BUSINESS FINANCE ESSENTIALS



Kevin Bracker, Fang Lin, Jennifer Pursley
Pittsburg State University

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Business Finance Essentials

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Detailed Licensing

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About the Authors

Kevin Bracker, Ph.D.



Dr. Kevin Bracker is a Professor of Finance in the Kelce College of Business at Pittsburg State University. He received a Ph.D. in Finance from the University of Kansas in December, 1995, with his doctoral research focusing on understanding and forecasting correlations across international equity markets. Kevin has published in a wide range of academic journals, contributing to the following literature: international equity markets, futures markets, prediction markets, bank risks, the impact of R & D on firm value, and financial education. He received the Kelce School of Business "Excellence in Research" award in 1999 and has participated at professional association conferences, presenting papers, serving as a reviewer, and chairing research presentation seminars. He has also served as a reviewer for several academic journals.

Kevin currently teaches business finance (traditional/online) and investments courses. He has received the "Outstanding Faculty Award" for the College of Business three times (2008, 2010 and 2012), has been nominated by students on several occasions for the University "Outstanding Faculty Award" and received the award (one of three recipients) in 2003. Kevin's passion as a professor is the opportunity to teach and interact with students in and beyond the traditional classroom. He has published journal articles with students, been a faculty advisor to the PSU Finance Club since arriving at the University in 1995, and served as a faculty mentor to the CFA Institute Research Challenge team starting in the fall of 2011. Kevin earned his Chartered Financial Analyst designation in 2003 and has sponsored several students for CFA Student Scholarships since that time.

Outside of his role as a professor, Kevin is married (Debbi Bracker) and has one daughter (Sarah Bracker). He stays active with a variety of outdoor activities including running, biking and backpacking. He has also been known to spend way too much time in the fall/winter watching NFL football and managing his fantasy football teams.

Fang Lin, Ph.D.



Dr. Fang Lin has been serving as an Assistant Teaching Professor of Finance at the University of Washington Bothell since Autumn 2022. Prior to joining UWB, he was an Associate Professor of Finance in the Kelce College of Business at Pittsburg State University. Professor Lin holds a Ph.D. degree in Finance from the University of Oklahoma, and a master's degree from the University of Nevada Las Vegas. His research interests are primarily in the area of empirical corporate finance, with a focus on corporate bond issuance, executive compensation, innovation, and energy markets. His articles have been published in journals such as the *Journal of Corporate Finance* and the *Energy Journal*. He also frequently presents his research at academic conferences.

While at PSU, Dr. Lin taught various courses including business finance, financial institutions and markets, risk management and insurance, investments, and seminar in financial management. He received the "Excellence in Teaching" award from the Kelce College of Business in 2017 and the "Outstanding Faculty Award" from at the university level in 2020. In his spare time, Dr. Lin enjoys travelling and watching sports, and he is becoming an avid runner.

Jennifer Pursley, MS



Jennifer Pursley is a Faculty Development Specialist in the Center for Teaching, Learning and Technology at Pittsburg State University. Jennifer completed a Master's of Science in Mathematics from Pittsburg State University in 2006 and a Master's of Science in Finance from the University of Kansas in 2008. She has over ten years of experience teaching Mathematics courses face-to-face, online and hybrid. In addition to Mathematics and Finance, Jennifer's professional interests include: Open Educational Resources, professional development, online course design, Quality Matters, accessibility, and general education.

Pittsburg State University

Pittsburg State University, known as Pitt State or PSU, is a public university with over 7,000 students located in Pittsburg, Kansas. PSU offers over 100 academic programs within the college of Arts and Sciences, Business, Education, and Technology. Pittsburg State University is not just your ordinary university. Many colleges can boast a small student to faculty ratio, a nicely sized

institution with qualified faculty. But the unique advantages of selecting Pitt State for your higher education are significant and include…

- Our esteemed Kelce College of Business, which has been continually accredited by the AACSB, as well as numerous top-shelf undergraduate and graduate programs in a variety of academic areas including pre-med, nursing, education, music, design, broadcasting, and much more.
- The Kansas Technology Center, which offers a number of internationally recognized technology programs.
- The Bicknell Family Center for the Arts is the region's premiere destination for the fine and performing arts. Designed and constructed by the world's most renowned theater architects, this $33 million facility features a 1,100-seat performance hall, a 250-seat theater, a 3,500 square-foot art gallery and state-of-the-art technology.
- Two new state-of-the-art centers for student health: the Student Recreation Center and the Student Health Center.
- Strong support from alumni and friends – Pitt State just successfully completed its 10-year, $120 million capital campaign for scholarships, programs and more.
- New apartment-style living for students in the modern Crimson Commons housing complex.
- More GTE Academic All-Americans than any other NCAA Division II institution this decade, as well as a well-known athletics program that brings students and community members together to cheer on the Gorillas!
- Reasonable, flat-rate tuition that extends well beyond the borders of Kansas. Our Gorilla Advantage program makes it possible for students in multiple counties surrounding Kansas to attend Pitt State at in-state rates. Qualified students who live outside of these areas, can take advantage of our new Gorilla Edge program, which allows students in Missouri, Oklahoma, Arkansas and Texas to attend Pitt State at a reduced rate.



Kelce College of Business

The Kelce College of Business at Pittsburg State University is among the nation's leading business schools for quality, high standards, and value. With a mission of offering a well-rounded, world-class education that engages students and prepares them for a future in the business world, the Gladys A. Kelce College of Business stands out as one of the premier business colleges in the country.

Kelce College of Business Accreditation, Rank and Recognition:

- Accredited by the AACSB
- Annually ranked among the Best Business Schools in the country by the Princeton Review
- Ranked among the top 5 Family Friendly business schools in the country
- In 2018, the *Accounting Degree Review* ranked the Kelce College #6 in the nation for programs offering degrees with forensic accounting.

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CHAPTER OVERVIEW

1: Introduction to Financial Management

Learning Objectives

After completing this chapter, students should be able to

- Define what is meant by finance and describe some of its primary areas
- Define and compare/contrast sole proprietorships, partnerships, and corporations
- Identify key advantages/disadvantages of the corporate form of ownership
- Define and identify key characteristics of stocks and bonds
- Define the primary goal of financial management and identify the three elements that impact achieving that goal
- Explain and apply the concept of risk aversion
- Explain how social responsibility and ethical behavior is consistent with maximizing shareholder wealth
- Define the concept of agency relationships and explain how they influence the goal of maximizing shareholder wealth

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1.1: What is Finance?

There are many different definitions of finance, but for the purposes of this course, we are going to define it as follows:

Finance refers to the process of allocating capital in order to optimize the risk-adjusted expected return on that capital.

This can apply to corporate finance where firms are allocating capital across various operations within the firm, making decisions which long-term projects they should undertake, developing dividend policy, planning how to raise funding, etc. It can also apply to banking where financial institutions evaluate who to lend money to and how much to charge in interest rates. It can apply to personal finance where individuals develop budgets to manage their spending and make investments to meet future goals, such as retirement.

There are several primary areas of finance. These include:

Commercial Banking/Financial Institutions

- Commercial banks, credit unions, insurance companies and countless other financial institutions are an important part of the financial landscape. These institutions deal with financial concerns such as risk management, time value of money, financial intermediation, providing short-term and long-term financing to individuals and businesses, payment processing, and many other activities critical to the financial environment.
- Banks and other similar financial institutions are among the primary employers in the field of finance.
- While we will deal with some issues that are of concern to these financial institutions (time value of money, risk/return analysis, types of financial instruments, etc.), this class will not be primarily focused on banking-related issues.

Investments

- One of the common images associated with finance is the stock market. The field of investments deals with stocks, bonds, options, mutual funds, futures, and many other financial instruments.
- Some of the key considerations in the field of investments include valuation analysis, risk/return analysis, diversification, and fit (by fit we mean that what may be a good investment for one individual may be a poor investment for someone else due to each person's unique set of investment objectives.)
- There are many career paths related to investments including stock analyst, fixed-income analyst, portfolio manager, trader, etc. These careers tend to be very competitive, demanding, and offer the potential for high income.

Personal Finance

- Personal finance deals with a variety of financial decisions made on the personal level. This includes areas such as retirement planning, insurance, personal budgeting (e.g. can I afford a new house or new car?), and any other financial decision that a person makes.
- While personal finance is not the primary topic of this course, it is an important issue for everyone AND overlaps with many of the main themes (time value of money, diversification, valuation analysis, etc.) that we will talk about in this class. Due to its importance and overlap with our primary focus, we will spend a fair amount of time this semester discussing personal finance issues.
- The most common career path associated with personal finance is the financial advisor/planner. A financial advisor works with individuals to help them achieve their personal financial goals. Financial planning is an expanding field and is consistently rated very high in job ranking evaluations due to its combination of potential income and job satisfaction.

Corporate Finance

- The terms Corporate Finance, Business Finance, and Managerial Finance are often used interchangeably and refer to the field of finance dealing with financial decision making from a business perspective.
- Primary topics for corporate finance deal with raising capital (issuing stocks, bonds, or other forms of financing), paying dividends, maximizing value for shareholders, evaluating potential long-term investments that the firm will undertake (e.g. building a new warehouse), and managing the firm's cash flows.
- Students with a strong background in accounting are often among the top candidates for jobs in the field of corporate finance.

This textbook will touch on several of these topics (interested students may find more information about potential finance-related careers at the Careers-in-Finance site), but our primary focus is going to be on Corporate Finance. In order to do this, we must start by defining the concept of the corporation (firm).

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1.2: Forms of Business Organization

There are three basic forms of business organizations – sole proprietorships, partnerships, and corporations. Our focus this semester will be on the corporation, but at this point we should introduce all three forms (in a simplified manner) to give the basic framework of each.

Sole Proprietorship

A sole proprietorship is a business organization where the owner is a single person and is solely responsible for control of the business. While the owner can hire employees (and managers), it is ultimately the owner that is in charge. One important characteristic of a sole proprietorship is that, from a legal and tax perspective, there is no real distinction between the owner and the business. The owner is liable (legally and financially) for the actions and liabilities of the business. Also, the income is only taxed once (as opposed to being taxed at both the business and personal level).

Partnership

A partnership is structured much like a sole proprietorship except that now there are multiple owners. Again, there is no distinction between the owners and the business as they are all liable (legally and financially) for the actions and liabilities of the business. Also, like in a sole proprietorship, the income is only taxed once. In practice, there are different types of partnerships (general vs. limited vs. limited liability). The general partnership is what is described above. A limited partnership involves at least one general partner to manage the company and take on the risk. The limited partners are passive investors. Finally, a limited liability partnership allows partners to limit their legal (limited to each partner's behavior) and financial liability (limited to the assets of the business) while still maintaining the tax structure of a general partnership. Note that specifics of partnership law vary by country and by state.

Corporation

A corporation is a firm owned by many individuals (stockholders) who in most cases have little input in operating the firm. A fundamental component of the corporate form of ownership is the separation of ownership from the process of managing the firm. The owners (stockholders) elect a board of directors who are responsible for hiring management and overseeing the direction of the firm's operations. Corporations account for the bulk of business activity in the US because most large firms are organized as corporations. Specifically, while approximately 17% of business tax returns were filed by corporations, they accounted for about 82% of total revenues by businesses and 62% of taxable income according to IRS SOI Tax Stats in 2015. Because most large firms are organized as corporations, accounting for the bulk of business activity, and corporations are more complex, we will focus on the corporation in our coverage of finance this semester.

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1.3: Advantages of Corporations

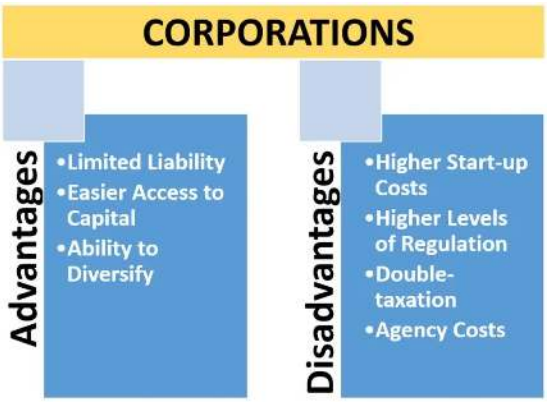


Figure 1.3.1: Advantages and disadvantages of corporations

Limited Liability

Due to the separation between business and the owners, stockholders are typically not liable for anything beyond their initial investment. When buying a share of stock and becoming an owner in a corporation, an individual can lose his entire initial investment if the company goes bankrupt, but nothing beyond that. Remember that this is not the case for sole proprietorships or general partnerships.

Easier access to capital

Corporations have access to the capital markets by issuing shares of stock or issuing bonds. This makes it easier to raise large sums of money for expansion or a multi-year, profitless startup that is anticipated to generate significant profits after the startup stage. Sole proprietorships and partnerships find it much more difficult to raise significant amounts of capital. Snap, Inc. (Snapchat) is an example of a limited liability corporation that recently became a publicly traded corporation via an Initial Public Offering, IPO. The Snap IPO was offered March of 2017 with an original price of $17 per share. Upon opening, demand for the popular IPO pushed the price to $24 per share (a 44% increase) giving the company a $32 billion dollar valuation. Despite several red flags investors continued to purchase Snap stock. The company had yet to see an operating profit, losing $500 million in 2016 and $372 million in 2015, and its net worth for 2016 was a mere $1.5 billion. Over the following few months the stock price gradually fell, trading significantly below its original offering price of $17 per share (all the way down to about $5 per share in Dec. 2018). As of January 2021, Snap is trading for around $50 per share, lost just over $1 billion in 2019 and is worth over $70 billion. See the current price of Snap.

Ability to Diversify Ownership

Corporations allow individuals to own multiple businesses without having expertise in all (or even any) of these businesses. This allows an investor (owner) to reduce her risk and take advantage of opportunities that would not be accessible without corporations. The chance of an investor owning multiple businesses in different industries as a sole proprietorship is minut (due to time, capital and expertise issues). Alternatively, it is easy for an individual to invest $5000 into a mutual fund and become a part owner of hundreds or thousands of different businesses.

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1.4: Disadvantages of Corporations

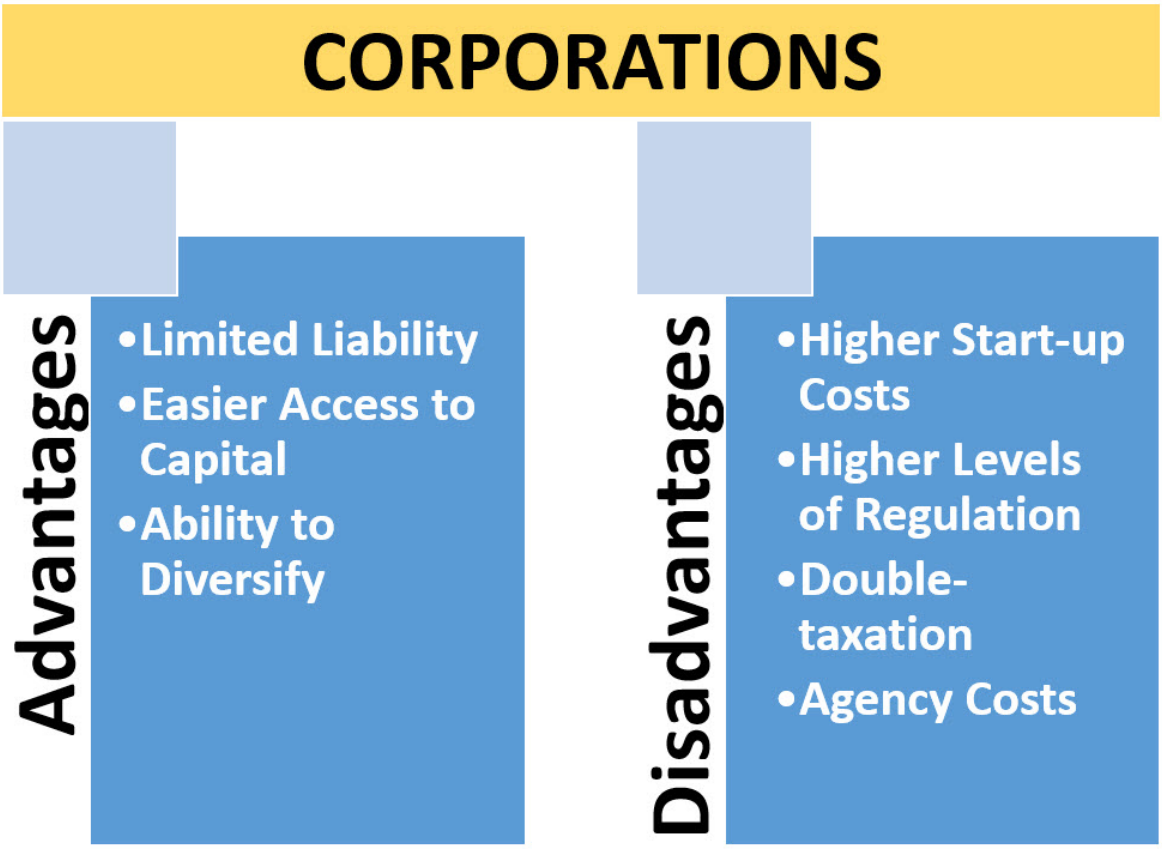


Figure 1.4.1: Advantages and disadvantages of corporations

Higher start-up costs and higher levels of regulation

Because there is a separation between the owners and the business, there are higher regulatory costs associated with keeping owners informed about business operations. Publicly traded corporations must follow SEC guidelines pertaining to registration and reporting (such as audited annual and quarterly reports) that are costly. According to a report by Protiviti in 2016, the average firm spent between $1,113,000 and $1,442,000 in internal compliance costs to comply with Sarbanes-Oxley regulations. This is just one of the regulatory costs associated with being a corporation. These expenses lower the profitability of the company, but may be necessary to protect shareholders.

Double-taxation

Because the owners and the business are treated as two separate entities under the corporate form of ownership, both are taxed. The business must pay corporate income taxes on any income it makes. When investors make money through dividends (a distribution of corporate profits to owners) or through capital gains (an increase in the value of a share of stock) these are taxable. The current tax code taxes dividend income and long-term capital gains at a lower rate than ordinary income which substantially reduces (but does not eliminate) the impact of double-taxation. Given the volatile nature of tax codes, the impact of double-taxation is likely to fluctuate over time.

Agency Costs

This topic will be discussed in more detail later, but essentially, it is the idea that the owners of the company are not handling the decision-making. Therefore, there is the potential for the decision-makers to run the firm more in their own self-interest rather than in the best interest of the owners (shareholders).

While our focus will be on the corporation, many of the same ideas apply to other types of business organizations (such as sole proprietorships, partnerships – limited or general, S corporations and limited liability companies) as well as personal financial decisions.

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1.5: Stocks vs. Bonds

The two primary sources of financing for corporations are stocks (equity) and bonds (debt). These are essential financial instruments that we will discuss in depth throughout the semester. Let us introduce the basic characteristics of these securities (a "security" is just a generic name for a financial instrument) now.

Stocks

Stocks are a form of ownership (equity) in a corporation. When you own a share of stock, you are actually a part-owner of the corporation. Large corporations have several million (or in some cases billion) shares outstanding, so when an individual owns 100 shares they own a very small fraction of the firm. For example, Exxon Mobil had 4.23 billion shares outstanding in January 2021, while Amazon had 501 million and Winnebago had 33.6 million at that time. As an owner, you are entitled to a piece of the company's profits (on a pro-rated basis equivalent to the percentage of ownership). The firm can choose to distribute those profits back to shareholders in the form of dividends or reinvest them back into the company. Sometimes firms will engage in buying back shares of their own stock as a substitute (or in addition to) dividends as a way to return profits to shareholders. We need to be careful because there are other reasons why firms may engage in buybacks, but while the COVID pandemic of 2020 saw companies cut dividends and buybacks, they were still quite strong. When firms reinvest the profits back into the company instead of paying them out as dividends, the value of the firm should increase (assuming the profits are reinvested wisely) which will result in capital gains. Thus, your return from owning stock can come from two sources — dividends and/or capital gains. Because the dividends and capital gains essentially represent your portion of the company's profit, they can fluctuate dramatically over time. Dividends represent the portion of the profit that is CURRENTLY being paid out while capital gains are dependent on investors' expectations of FUTURE profits.



Some companies expand rapidly and are extremely successful leading to high returns. Others struggle (or even go bankrupt) and lead to negative returns. As such, the returns associated with stock ownership are highly volatile and risky. Because investors are risk-averse (a concept we will introduce shortly), stocks must generate higher expected returns than safer investments (like bonds) in order to attract investor interest. Note that this does not mean that any individual stock (or stocks in general) WILL generate a higher return, only that its EXPECTED return will be higher.

A final issue associated with stocks is that there is no maturity date to stock ownership. When you buy a stock, you own it until you decide to sell or the company goes bankrupt. Theoretically, the timeline for this type of security is potentially infinite. However, in practice, we find that publicly traded companies have a much more finite lifespan of approximately 15 years. In the article, Where Do Firms Go When They Die the author discusses this relatively short lifespan. Note that this refers to the stock itself, not the investor's holding period which may be as short as a few seconds or as long as several decades.

Stock Summary

- Ownership (equity)
- Variable cash flow (return) stream — dividends and capital gains
- Higher risk and (on average) higher returns
- Potentially infinite time horizon

Bonds

Bonds are a form of debt. When you buy a bond, you are lending the issuer money (in addition to corporations, governments – federal, state local and international – also are large issuers of bonds). The loan is structured so that the bondholder (typically) receives a fixed interest payment (referred to as a coupon payment) every six-months until the bond matures. At maturity, the bondholder receives the last coupon payment and the par (or maturity) value. Unlike dividends (which firms can increase, decrease, or discontinue at their discretion), promised coupon payments on bonds must be made to bondholders on time or the company can be forced into bankruptcy. Bondholders are first in the priority of payments and must receive their promised payments before the

stockholders get anything. Due to this priority of claims, the fixed cash flow stream (coupon payments and maturity payment), and the fixed time horizon, bonds are considered lower risk than stocks. Given this lower risk, bonds will typically have lower expected returns (note – there can be exceptions where the bond of a firm that is exhibiting financial stress may be riskier and have a higher expected return than the stock of a large, stable company). Again, a lower EXPECTED return does not mean a lower return for any particular bond or for bonds in general in a particular year. In any given year, bonds can earn higher returns than stocks, but typically, over longer periods of times, stocks usually earn higher returns than bonds.

Interested students can compare historical returns for the S&P 500, 3-month Treasury bills and 10-year Treasury bonds on a data page by Aswath Damodaran. Since 1928, stocks (as measured by the S&P 500) have had annual returns that are about double that of 10-year Treasury bond (bonds issued by the US Federal Government). Alternatively, the volatility of annual returns over this same time-period has been almost three times as high for the S&P 500. Note that the higher return of stocks, significantly understates the benefit over this time period if one is not aware of the power of compounding. Specifically, $100 invested in stocks at the start of 1928 grew to $502,417 by the end of 2019. The same $100 invested in 10-year Treasury bonds over the same time grew to $8,013. In other words, while the average return was about twice as high for stocks (9.71% vs. 4.88%), the total wealth accumulation was over 62 times as high during this time frame.

Bond Summary

- Debt (loan)
- Fixed cash flow stream — coupon and maturity payments
- Lower risk and (on average) lower returns
- Fixed time horizon

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1.6: Goals of the Financial Manager

The goal of the Financial Manager is to Maximize the Shareholder Wealth (side note — sometimes this is referred to as Maximizing Firm Value since increasing the value of the firm increases shareholder wealth.)

In order to Maximize Shareholder Wealth, we must concentrate on

- The Magnitude of Expected Cash Flows
- The Timeliness of Expected Cash Flows
- The Riskiness of Expected Cash Flows

The above idea is a central theme that will underlie everything we do this semester!

Key Points regarding the Primary Goal of the Financial Manager

Note that in the 3 factors impacting firm value listed above we use cash flows NOT earnings (net income). While there are many similarities between earnings and cash flows, they are not the same. We should always focus our attention on cash flows instead of earnings. Cash flows are considered more important than earnings for three basic reasons:

- The accrual-based approach of net income accounting can distort the timing of when cash is received or spent. Time value of money recognizes that money spent today is more costly than the same money spread out over years. Therefore, something like depreciation may understate the financial cost of owning assets.
- Generally Accepted Accounting Principles (GAAP) or International Accounting Standards (IAS) allow corporations some flexibility in how they account for revenues and expenses. Firms that choose to aggressively apply GAAP/IAS may mislead shareholders by reporting artificially high earnings. Cash flows are harder to manipulate than net income (earnings).
- Cash is the life-blood of a business. Ultimately, it doesn't matter if the firm is profitable on an EARNINGS basis if it isn't generating enough cash to pay its employees, suppliers, creditors, etc. The firm needs to generate positive cash flows in order to maintain its operations.

The word Expected is a critical component of the three factors. While what has happened in the past is not irrelevant, the relevance is based on how it might impact future cash flows. Investors base their valuation decisions on the future of the firm. When analyzing stock price changes to information, it is always essential to consider what the new information is RELATIVE TO what expectations were. An analogy would be to compare two students in junior high. The first student normally gets As in her classes while the second student normally gets Cs. Both come home with several Bs on their report card. While both received the same grades, one will likely result in disappointment while the other will likely be celebrated. The difference is not the performance, but the performance relative to expectations. With stocks, new information causes investors to revise their expectations for future cash flows to the firm. If the new information is better than previously expected, investors revise cash flow forecasts upward (and the stock price goes up). If the new information is worse than previously expected, investors revise cash flow forecasts downward (and the stock price goes down).

The three key elements (magnitude, timeliness, and riskiness) are not individual goals. Everything else being equal, higher cash flows are preferred to lower cash flows, less risk is preferred to more risk, and earlier receipt (later payment) of cash flows is preferred to later receipt (earlier payment). However, things are rarely equal. Increasing the magnitude of cash flows usually means taking on higher risks. Less risk usually means lower expected cash flows. Thus, we need to keep the primary goal (maximize firm value) in mind and realize that the interaction of risk, magnitude, and timeliness are more important than any one separately.

The concept of maximizing firm value is not specific to finance. The purpose of marketing, internal accounting, personnel decisions, production, etc. is to maximize firm value. When an individual is hired in any field, the rationale for that decision is that the company plans for that person to directly or indirectly increase its value. If you are an employee of a corporation and are not adding value, what reason do the shareholders have to pay your salary?

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1.7: Risk Aversion



While the concept of risk aversion has been addressed briefly in the previous discussion of stocks and bonds, this is a topic worth exploing ring in more detail as it is a critical assumption underlying the analysis that will be covered as the semester unfolds. Risk aversion refers to the idea that investors don't like risk. All else equal, if two investments have the same expected return investors will choose the one with the least risk. However, risk aversion does not mean investors avoid risk at all costs…only that they need to be paid to take on extra risk. If investors were risk minimizers instead of merely risk averse, the stock market would not exist as investors would not take the risk associated with investing in stocks, regardless of the higher expected return. Investors will take on extra risk, assuming they receive ADEQUATE compensation for doing so.

Does adequate seem like a vague word? It should, because it is intentionally vague. The reason for this is because people have different levels of risk aversion depending on their personality, their age, their income, and several other factors. Some people are highly risk averse (needing significantly higher expected return to take on a little more risk) while others are only mildly risk averse (needing only slightly higher expected return to take on significantly more risk). To summarize:

- We will assume all investors are risk averse
- Risk aversion implies investors do not like risk
- If two investments have the same expected return, investors will choose the one with the least risk
- Risk aversion is NOT risk minimization, investors will take on more risk if they are adequately compensated for that risk
- The level of risk aversion varies from individual to individual

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1.8: Social Responsibility and Ethics

Social Responsibility

Social Responsibility refers to the concept that businesses should be actively concerned with the welfare of society. Examples may include establishing scholarship funds, contributing to the arts, or “matching” employee’s contributions to charities.

Ethics

Ethics refers to standards of conduct or moral behavior. Examples may include exceeding minimum safety requirements for employees, abiding by (or exceeding) regulations regarding environmental issues, honoring not just the letter, but the spirit of contracts or verbal agreements with customers and suppliers.

Social Responsibility and Ethics are NOT inconsistent with the maximization of firm value. While there is a cost to engaging in ethical and socially responsible behavior, there are often benefits in goodwill and public relations that may more than offset those costs. There is substantial evidence that engaging in Social Responsibility and Ethics is highly consistent with maximizing shareholder wealth. A study by Margolis, et al (2009), reviewed 251 other studies examining social responsibility and firm performance. They find a consistent pattern that social responsibility is correlated with firm performance. Specifically, the overall mean correlation is 0.13 (indicating a small, positive relationship). In addition, 28% of the studies reveal a statistically significant, positive relationship, 59% reveal no relationship, and only 2% suggest a statistically, negative relationship (with about 10% not reporting a sample size to make statistical significance impossible to measure). This implies that the overwhelming evidence suggests that corporations behaving in a manner consistent with social responsibility and ethical behavior are likely to either benefit financially or not experience any noticeable financial downside to doing so. In other words, companies that do the right thing will either generate additional financial rewards to shareholders or, at the worst, not cost their shareholders.

However, we must remember that while social responsibility is consistent with our primary goal (maximizing shareholder wealth) it is not the primary goal in and of itself. While it seems wrong to say that a corporation can spend too much money on trying to improve the welfare of society, keep in mind that the owners of the corporation are the stockholders. When a corporation writes a large check to a charitable organization, essentially the managers of the corporation are deciding where and how to spend the stockholders’ money. It would be fairer to let those stockholders decide how to allocate their money.

For an example of some firms that rate high in social responsibility and ethics, take a look at Business Ethics List of 100 Best Corporate Citizens.

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1.9: International Issues

One critical aspect to maximizing firm value is recognizing that business is global not national. Census for January 2021 shows there were 330 million people in the US and 7.7 billion people on the planet. Marketing solely to the US excludes over 95% of potential customers. While not every customer has equal purchasing power, it makes no sense to exclude 95% of your potential customers. From an economic standpoint, the majority of economic activity is also outside the US. According to Worldbank GDP Ranking, in 2019 the US had GDP of $21.4 trillion while global GDP was $87.8 trillion. This means that 76% of economic activity occurs outside the US (up from 70% in 2005). In addition to our customers, many of our competitors and/or suppliers may be based internationally. Therefore, if we ignore the global aspects of business, we are not maximizing firm value.

If we think of international business from the three aspects of maximizing shareholder wealth (magnitude, timeliness, and riskiness of expected cash flows), we can see that international business is likely to have a significant, positive impact on the magnitude of expected cash flows. The timeliness is likely to be slightly slower, but not nearly as significant. The riskiness can go either way. On one hand, international operations introduce new risk factors (political, cultural, exchange rate, etc.). On the other hand, sometimes international operations can help diversify away (a topic for a later chapter) some of our risk. How do we know that international business is an essential element to maximizing shareholder wealth? S&P Indices report, In most years the S&P 500 firms that report a breakdown of foreign revenues report between 40-50% of their revenues from foreign countries. Since these are among the largest firms in terms of market values, clearly foreign revenues are a key component of maximizing firm value.

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1.10: Agency Relationships

An Agency Relationship exists any time one or more people (the principals) hire another person (the agent) to perform a service and then delegates decision-making authority to that person. The central issue with agency relationships is potential conflict of interest between the principal and the agent or between two or more groups of principals.

Agency problems can cause difficulties in maximizing firm value. The major agency conflict we will focus on is between managers and stockholders (owners). Stockholders hire managers under the goal of maximizing firm value as doing so will maximize the wealth of shareholders. However, the manager may operate under the goal of maximizing his happiness instead of firm value. This may take the shape of overspending on perks (office decorations, company jets, etc.) or on limiting risk in order to protect job security, even at the expense of favorable risk-adjusted return opportunities. There are many ways to try to control for agency costs, including:

The Threat of Firing

While most people understand the threat of being fired, this is not an overwhelming threat to most top managers (although it is more credible for other employees of the firm). Many Chief Executive Officers (CEOs) get rich compensation packages (Golden Parachutes) even if they are forced out of their position. Also, there are some instances where the Board of Directors (the people responsible for hiring and paying the CEO) may be "friendly" to the CEO. In many cases, the CEO is also the Chairperson of the Board of Directors.

The article, The Top 20 CEOs With Even Bigger Golden Parachutes than Marissa Mayer's, list the CEOs who hold the largest Golden Parachutes in the S&P 500.

The Threat of Takeover<\h3>

If a firm is purchased by another firm, the acquiring firm may replace upper management. One reason for a takeover is that the management team is not maximizing firm value. If others feel that they could run the firm in such a way as to make it more valuable, they may buy the firm with the intention of bringing out this additional value. However, takeovers are not cheap. Most acquiring firms pay premiums of 20% to 50% to complete a takeover. For example, if the stock price before the takeover is $50, the takeover offer may be $70 per share. This leaves a lot of room for mismanagement. If a firm's assets are worth $60 per share under optimal conditions, but under current management are only valued at $50, management is not maximizing firm value. However, it may not be bad enough to justify a takeover. Also, many firms use defenses (Poison Pills) that make takeovers harder to execute. For example, there may be a clause in the debt agreements that all debt becomes due in the event of a takeover.

Influence of Large Shareholders

This is a relatively new form of Corporate Governance that is gaining prominence. Activist investors may pressure management to run a more efficient operation. If a shareholder with a large stake in the firm creates enough pressure on management and the board of directors, changes to the firm's strategies and/or operations may occur.

Compensation Packages

The best way to make managers interested in maximizing value is to pay them based on their stock performance. This is often accomplished through payment with stock options (the right to purchase shares at a fixed price even if the stock goes higher). Also, many CEOs own significant amounts of stock in the company they work for. Caution must be exercised that compensation is based on maximizing value and not other factors. For example, compensation based on the size of the company's assets may create incentives to make investments that increase assets without adding value. Also, compensation based on meeting sales targets may get met by selling items for a loss (which reduces firm value). Finally, stock options may be the most popular way of trying to align the interests of shareholders and managers but they also have some serious flaws. Specifically, the way many options packages are granted they reward short-term fluctuation in the price of the stock more than long-term value creation. There have also been issues related to the timing of option compensation that has acted more as a wealth transfer to executives rather than an incentive. Compensation packages must be carefully designed to align the interest of management with the objective of creating shareholder wealth in order to minimize agency conflicts.

Another agency conflict arises between the two principals, the stockholders and bondholders. Because of the difference in the way stockholders and bondholders are compensated, their attitudes towards a “worthwhile” investment may be different. This can lead to conflicts between which projects to undertake. Generally, bondholders prefer low-risk investments (as their potential return is limited) and stockholder prefer higher risk investments (assuming the higher risk is compensated by higher return).

The better we can control these agency problems, the better our chances of maximizing firm value. The term corporate governance is used to describe the policies that firms have in place to better align agency issues. Two studies that address this are Gompers, et al, 2003 and Cuñat, et al, 2010). These studies provide evidence that improving corporate governance results in higher shareholder wealth.

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1.11: Key Takeaways

Learning Objectives

Finance deals with the allocation of capital in order to optimize the risk-adjusted return earned on that capital. While the concept applies to both personal and business oriented decisions, the focus of this course will be first on corporations and secondarily on personal issues. The corporation is a form of business organization that separates out management from ownership and accounts for the bulk of business activity within the U.S. The primary objective of financial management within the corporation is to maximize shareholder wealth. This is accomplished by focusing on the magnitude, riskiness and timeliness of expected cash. Three larger issues that influence this goal are social responsibility and ethics, international business operations, and agency relationships.

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1.12: Exercises

Exercise 1.12.1

Define a corporation.

Answer

A corporation is a type of business organization that separates the management and ownership of the business. Ownership of the corporation is based on owning stock (or equity) in the firm. Owners have a right to the income that the business generates, a claim against the assets of the business (secondary to creditors), and then hire (through a board of directors) a management team to operate the business and make the strategic decisions. An example would be Ford. If you buy 100 shares of Ford, you are a part owner of the firm but you are not involved in the process of running the business. Because of this separation between ownership and management, there are some unique characteristics of a corporation.

Limited Liability – Owners' losses are limited to their initial investment. If you invest $1000 into Ford stock, that is the most you can lose. Even if the firm goes bankrupt and cannot pay all of its bills, your investment may become worthless but you will not owe additional money.

Double Taxation – Because the owners and the business are separated legally, they are separated in the eyes of the tax code as well. This means the business is taxed on its income (corporate income tax) and then owners are taxed on any profits they earn on their investments into the corporation (dividends and capital gains taxes).

There are several other forms of business organization (sole proprietorships, partnerships, etc.) and many other technical legal issues related to business organization but these are beyond the scope of our class. We will focus on the basic corporate form of organization for the purpose of this class.

Exercise 1.12.2

Explain the concepts of limited liability and double-taxation and how they relate to the corporate form of ownership.

Answer

The concepts of Limited Liability and Double Taxation are explained in the previous answer. In addition to understanding the concepts, it is important to understand their impact on investors and the corporation. Limited liability is critical due to the separation of ownership and decision-making. Not many investors would be willing to supply capital to the firm if they were not part of the decision-making process AND could be held liable for all of the firm's actions. Consider a situation where you invest in restaurant chain by buying 100 shares of stock for $20. You are investing $2000. Now imagine that this restaurant chain (without your knowledge or approval) used non-inspected meat that caused several deaths. With unlimited liability, it would be conceivable that you (as a passive investor) could lose everything and be forced into bankruptcy for actions that you had no influence on. If this were the legal environment, very few people would be willing to purchase shares of stock (becoming owners) in corporations. This would greatly restrict the amount of capital and make it harder for firms to raise the necessary money to build plants, develop new products, hire employees, etc. Limited liability is essential to creating an environment where investors are willing to the necessary capital to allow corporations to operate.

Double-taxation also impacts the ability of corporations to attract capital, although negatively. When investors purchase stocks and invest in ownership of a corporation, they are doing so in order to earn a profit. In investing, this profit is often referred to as a rate of return. The rate of return is what compensates the investor for both undertaking risk and for tying up the investor's money for a period of time. The investor is concerned with the rate of return after taxes as that is what will be left over for the investor to spend. Double-taxation lowers the after-tax rate of return and means investors must demand a higher before-tax rate of return. This makes it more expensive for firms to raise money and also means that some projects may no longer be worth pursuing. The more that firms must pay to raise money (referred to as the cost of capital), the less

productive the economy will be. This is why things like capital gains and dividend tax cuts are often thought to be something that can stimulate the economy.

? Exercise 1.12.3

One of the "disadvantages" of the corporate form of ownership is the higher regulatory cost. One of the large costs facing corporations is the cost of preparing and verifying financial statements. Who ultimately pays for this and does it benefit shareholders? Discuss.

Answer

Because of the separation between ownership and management in the corporate form of ownership, it is critical that the passive owners get the necessary information regarding the firm's financial performance in order to evaluate their investment. Without accurate and reliable information, the owners cannot make good decisions about which corporations to invest in. Also, unethical managers could use misinformation to take advantage of investors. If there were not audited financial statements, managers could exaggerate their performance in order to get more pay and other perks as shareholders would think that management was more productive than it actually was. This scenario occasionally occurs even with audited financial statements as some managers are able to commit fraud and trick the auditors. In the late-1990/early-2000 time period there were several instances of this occurring. These financial scandals severely eroded investor confidence and were one of the factors in stock prices plunging during 2001-2003. As a response, a series of enhanced financial reporting regulations called Sarbanes-Oxley were passed to improve the accuracy of information. While this has resulted in much better information for owners to use in evaluating investment decisions and which corporations to invest in, it is also quite costly for the corporations. As these higher costs lower profitability, ultimately it is the stockholders (owners) themselves that are paying for this better information. Is it worthwhile? There is much debate about that. It is clear that too little information is problematic, but spending too much on information can also be bad. If a firm losses too much of their profits in preparing the information, there may not be enough left over to make the investment worthwhile. Finding the balance is a challenging proposition.

? Exercise 1.12.4

What are the two primary instruments corporations issue to raise money? Explain the primary characteristics of each.

Answer

The two primary instruments corporations issue to raise money are stocks (equity) and bonds (debt). Stocks are an ownership interest in the firm and bonds are a structured loan made to the firm. (Note – there are many other forms of debt financing other than bonds {bank loans, leases, accounts payable, etc.} but bonds are a primary source of long-term debt financing for many corporations). When comparing stocks and bonds it is important to think of the primary characteristics of each.

Cash Flows Paid to Investors

Stocks pay a variable cash flow stream called dividends. Dividends can increase or decrease over time and firms are not required to pay them (many stocks currently pay no dividends). In addition to profiting from dividends, stockholders may also see a capital gain when the value of their stock goes up (or a capital loss if the value of the stock goes down). The change in the value of the stock will be related to the prospects of the business. In general, the more successful the business the greater the value of the stock since a share of stock represents a small ownership in the business.

Bonds make two primary payments to investors. First is the coupon payment. This is a fixed annual interest payment to bondholders. Unlike dividends, coupon payments do not increase or decrease over time and the firm must make promised payments or it can be forced into bankruptcy. The second form of cash flow paid to investors is the par value. At the end of the bonds life, the firm will pay the bondholders a par value (or sometimes called maturity value) to retire the bond. The coupon payment represents the interest and the par value represents the return of the borrowed money. (Side Note – the value of a bond can also fluctuate based on changes in market rates of interest as we will see later in the semester).

Lifespan

Stocks have an infinite time horizon. The ownership interests exists as long as the firm does. If the firm goes bankrupt or is purchased (takeover) by another firm, then the stock may cease to exist. However, the stock never matures. Your ownership interest generated by buying 100 shares of PepsiCo until (A) you sell it to someone else, (B) PepsiCo ceases to exist as a public company.
Bonds have a finite time horizon. A bond's maturity (for example 5 years) is set at the time the bond is issued and once that maturity is reached the bondholder is paid the par value and will no longer receive coupon interest payments.

Note that both stocks and bonds can be sold at any time in the financial markets, so purchasing a stock does not commit you to holding it forever and purchasing a bond does not commit you to holding it until maturity.

Control

Stockholders are not involved in running the firm or making strategic decisions for the firm. However, they have limited control through their election of the board of directors. The board of directors is in turn responsible for hiring, firing, and compensating management. For practical purposes, most stockholders have very little control of the firm.
Bondholders have no control over the firm as they are creditors rather than owners. However, bondholders will usually include provisions that protect their interests to some extent in the legal agreement created when the bonds were issued.

Risk

Stocks are riskier from the investors' perspective. Because dividends are variable, investors do not know what they will receive in terms of cash flows. Also, stockholders have a lower priority of claims than do bondholders. This means bondholders must be paid in full before stockholders get anything.
Bonds are less risky from the investors' perspective. The cash flows (coupon payments and par value) are known in advance and bondholders have a higher priority of claim than stockholders making it more likely they will receive most of their money back if things go wrong. As we will see later in the semester, long-term bonds are riskier than short-term bonds and some types of bonds are riskier than others based on who issued them.

Return

Risk and return are closely related. Since stocks are riskier, they typically offer investors higher rates of return than do bonds.

? Exercise 1.12.5

What is the goal of financial management? What 3 elements are essential to meeting this goal?

Answer

The goal of financial management is to maximize shareholder wealth (the value of the firm). Management accomplishes this goal by focusing on

The Magnitude of expected cash flows
The Timeliness of expected cash flows
The Riskiness of expected cash flows

There are a few important observations to remember with this.

In general, shareholder wealth is increased when the stock price increases so that maximizing shareholder wealth is the same thing as maximizing firm value. The value of the firm should be based on long-term value creation, not short-term stock price manipulation. Assuming the number of shares is held constant, increases in the stock price represent progress towards value maximization. Expectations mean that investors must be forward looking. The impact of what will happen over the next year is far more important than what has happened over the last year. Also, financial results need to be compared to what was expected to happen in order to be understood. The three elements of value maximization need to be considered as a whole, not independently. Our goal is not to minimize risk (doing so would mean never starting any new

projects), but to maximize the value of the firm (shareholder wealth). It is not to maximize cash flows (as that may entail too much risk), but to maximize firm value (shareholder wealth). It is not to get money into the firm as soon as possible (as many valuable projects may require several years to be generate value), but to maximize firm value (shareholder wealth). Only when we consider all three factors as a whole can we achieve our primary goal.

? Exercise 1.12.6

Why should we concentrate on Cash Flows instead of Earnings Per Share?

Answer

There are several reasons to focus on cash flows over earnings per share (or net income).

First, accounting earnings distort timeliness issues. In finance it is critical to recognize when cash flows are received or paid out as the value of those cash flows is dependent on when we receive them (it is better to get $1 today then the same $1 nine months from now).

Second, accounting earnings are easily distorted. There are several different ways to recognize various revenues and expenses (LIFO vs FIFO, depreciation, etc.). Changing the accounting method can change net income, but it doesn't affect value. Focusing on cash flows reduces this problem.

Third, it is possible to generate accounting profits and not have enough money to pay the bills. Firms need healthy cash flows in order to stay in business.

The vast majority of the time, earnings per share and cash flows will tell us the same thing. When they differ, we want to focus on the cash flows.

? Exercise 1.12.7

One of the key assumptions in finance is that people are risk averse. What do we mean by risk aversion? Does this seem to be a valid assumption? Explain.

Answer

Risk Aversion means that, everything else equal, investors prefer less risk. In order to get people to invest in riskier investments they need to anticipate higher rates of returns. A few important points on risk aversion:

Risk Aversion does not mean the same thing as risk minimization. A risk minimizer will always choose the lowest risk alternative. A risk-averse (NOTE: That is risk-averse, not risk-a**d**verse) individual may choose the higher risk alternative if he/she is receiving enough compensation to offset the higher risk.

The degree of risk aversion is very personal and varies based on a number of factors (age, wealth, income, personality, etc.). One individual may be willing to take a higher risk for a very small increase in anticipated return while another individual may require a significantly higher anticipated return to undertake the same risk.

Risk aversion is a valid assumption for most people despite a few common exceptions. While many people love to gamble (Las Vegas, lotteries, etc.) which typically has negative expected returns, this can be explained by two factors. First, most people consider this an entertainment expense rather than an investment. Second, most people gamble with small stakes. When evaluating investment decisions, most people exhibit risk-averse behavior.

? Exercise 1.12.8

Assume that for $1 you could buy a coin flip that would pay you $2 for heads and nothing for tails. If you are risk averse, should you take the coin flip? What if the coin flip cost you $0.90 instead of $1? What is the lowest price that YOU would take to accept the coin flip and why might this be different for others?

Answer

Half the time you flip the coin, you will get heads and get $2. The other half the time you will get tails and get $0. This means on average, you will get $1. Since you are paying $1 for the opportunity, your expected value is $0. On average, you won't make anything or lose anything on the flip. However, you are undertaking risk (since you could flip the coin, get tails and lose $1). A risk-averse person will not want to undertake risk without a payoff, so should not take the coin toss.

However, if you are able to buy the coin flip for only $0.90, you will be making an average profit of $0.10 every time you flip the coin. Since you are earning a profit, a risk-averse person might choose to undertake the coin flip. On the other hand, not all risk-averse people will. Some people will find the $0.10 profit high enough to take the risk while others (that are MORE risk-averse) will think $0.10 is not enough to take the risk. The amount of profit YOU need to earn in order to justify taking the risk is dependent on you as an individual. Different people will have different degrees of risk aversion.

? Exercise 1.12.9

How does globalization relate to the concept of maximizing firm value?

Answer

Globalization impacts firm value through both the magnitude of expected cash flows and the riskiness of expected cash flows. Globalization opens up more markets which can increase expected cash flows. This is because approximately only 5% of the global population and 25% of the global GDP belong to the US. That implies that 95% of our potential market in terms of customers and 75% of our potential market in terms of dollars lies outside the US.

Globalization also exposes firms to more risk factors (currency risk, political risk, cultural risk, etc.). In most cases, the benefits of the higher potential expected cash flows more than offset the negatives of the increased risk.

? Exercise 1.12.10

Explain what is meant by social responsibility and ethics? Discuss how these issues relate to the primary goal of the firm?

Answer

Social Responsibility – Being proactively concerned with the welfare of society
Ethics – A standard of conduct or moral behavior

Social responsibility and ethics are factors that help us achieve our goal of maximizing firm value over the long run. Ethics adds value through a concept known as "reputational capital." When employees, customers, suppliers, etc. feel that our firm is ethical and trustworthy, this will help us in many ways. For instance, a firm that has a reputation of treating its employees in a fair and respectful way will likely have an easier time recruiting and keeping high quality employees. Firms that treat suppliers in an unethical manner may find those suppliers unwilling to do business with them in the future. Social responsibility can help add value through both a marketing perspective as well as through employee relationships. Customers feel better about spending money with firms that have a positive image and employees feel better about working for companies with a positive image.

One note about social responsibility though is that it should not be the primary goal of the firm. For instance, a firm that donated 100% of their profits to a specific charity would be treating their stockholders in an unethical manner. The management of the firm is essentially allocating the stockholders' money. To the extent that social responsibility adds value, it is a win-win situation as both society and the shareholder benefit. However, spending too much on social responsibility (to the point that it lowers firm value) is merely a situation of management taking money from shareholders.

? Exercise 1.12.11

Define an agency relationship. What major agency problem do corporations encounter? What can be done to help minimize this problem?

Answer

An agency relationship exists when one party (the principle) hires another party (the agent) to perform a task and then grants that agent decision making authority. In the context of finance, the primary agency relationship exists between managers and stockholders. Stockholders are the principles and management is the agent. If both the principle and the agent have the same goal, the agency relationship is strong. If not, there is potential for an agency conflict. The corporate form of business organization introduces an agency conflict as stockholders want managers to maximize firm value and managers want to maximize their own happiness. Oftentimes these goals do not align. In order to align these goals, a compensation system needs to be designed that compensates management for engaging in value maximizing behavior. One tool for this is to make a significant portion of management compensation in the form of company stock. This makes managers into stockholders and helps align their goals.

? Exercise 1.12.12

One of the more controversial issues facing corporations today is the issue of executive compensation. Make an argument for the current state of executive compensation being okay and an argument in favor of regulation to reduce executive compensation. Base your arguments on the concept of shareholders and wealth maximization. After considering this would you be in favor of regulations?

Answer

Executive pay is a controversial issue as the level of executive pay has exploded over the past decades. In 2016, the average total compensation for CEOs of the S&P 500 firms was $13.1 million. This is 347 times the average compensation to production and nonsupervisory workers (instructor's note – notice that the comparison is not to all other employees, but to a specific subset of employees). The CEO of Alphabet topped the list with a total compensation of $100.6 million. A recent study by MSCI found that – "On a 10-year cumulative basis, total shareholder returns of those companies whose total summary pay (the level that must be disclosed in the summary tables of proxy statements) was below their sector median outperformed those companies where pay exceeded the sector median by as much as 39%." In other words, the greater the compensation to the CEO the LOWER the performance!

Some people will argue that the high level of executive compensation is merely a reflection of market forces. The job of CEO is demanding and consuming. A top quality hire may be able to make significant gains for shareholders and the number of qualified candidates is relatively small. No one is forcing firms to pay these high levels of compensation. If there are a billion shares of stock outstanding (Wal-Mart has approximately 3 billion shares as an example) and the CEO can make the value of each share increase by $0.50 a share more than the next most qualified person, he or she would be worth $500 million more to shareholders. For large firms, the value of the CEO can easily be in the hundreds of millions or more. Thus, maybe the large compensation packages are justified.

On the other hand, are executive salaries really operating on a free market? Do the boards of directors that are responsible for setting salaries and hiring executives really have the shareholders best interests at heart? For instance, let's say you were on the board of directors for XYZ corp. Might you be more willing to pay whatever it takes to get the person you want for the job (or retain the person currently in the job)? After all, you are not spending your money. Also, if you are currently an executive elsewhere or have the potential to be one in the future, isn't it in your best interest to push the market price of CEOs higher? Do you think it will be easier to work with the CEO (who is often interacting with and usually a member of the board) when the CEO is well compensated? There are several arguments that call into question whether or not the board of directors is ideally suited to determine optimal CEO salaries.

There are arguments that suggest CEO salaries are justifiably high and those that suggest that they are artificially high. You can make a rational argument for each side of the debate. I will not share my final opinion (although you may be able to infer it) as I don't want to artificially influence yours. However, I would encourage you to consider the arguments instead of making your decision solely based on emotion.

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CHAPTER OVERVIEW

2: Financial Statement Analysis

Learning Objectives

After completing this chapter, students should be able to

- Discuss the purpose and key issues associated with the income statement, balance sheet, and statement of cash flows
- Identify the three components of the statement of cash flows and interpret each of the three components
- Calculate and interpret key financial ratios
- Calculate and interpret a common size income statement and common size balance sheet
- Discuss and apply the concept of trend analysis, including both its strengths and weaknesses
- Discuss and apply the concept of comparative analysis, including both its strengths and weaknesses
- Identify key users of financial statement analysis
- Identify potential strengths and weaknesses for a firm, given financial statements for the firm and industry (or competitor)
- Discuss and interpret the many issues associated with financial statement analysis (such as seasonality, context, etc.)

2.1: Key Financial Statements
2.2: Financial Statements Analysis
2.3: Who Uses Financial Statement Analysis?
2.4: Putting it All Together
2.5: Key Takeaways
2.6: Exercises
2.7: Problems
2.8: References and Attributions

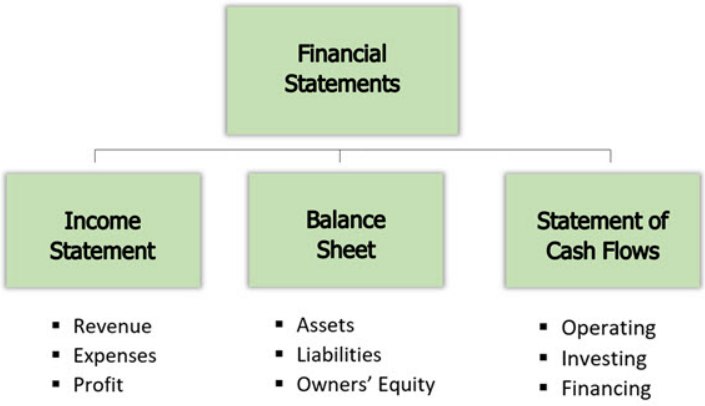
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2.1: Key Financial Statements

Key Financial Statements



There are three key financial statements that are important to investors, security analysts, management, and creditors. These are the INCOME STATEMENT, BALANCE SHEET, and STATEMENT OF CASH FLOWS. Note that there is a fourth financial statement (statement of retained earnings) that is provided in financial reports. However, the other three capture the majority of the information needed for financial statement analysis and are where we will focus our attention in this chapter. See the sample financial statements from Wal-Mart and Target in Appendix B. Note that these financial statements are compiled from Yahoo!Finance which attempts to fit financial statements to a (mostly) common template. In practice, financial analysts will use the financial statements provided directly from the company as part of the firm's 10-Q and 10-K reports required by the SEC. These official statements provide many additional details and notes that are not available from places that provide general financial information, but are essential to providing the context to make maximum use of the financial statements.



Income Statement

The income statement provides information on the company's revenues and expenses over a specific time period (usually annually or quarterly). These revenues and expenses are accounting-based and not necessarily reflective of cash flows generated. For example, when a long-term asset is purchased the cash is spent at that time. However, its expenses are recognized over time as depreciation instead of at the point of purchase. Also, the method chosen to account for inventory can cause discrepancies between net income and cash flows from operations. The cost of our inventory is recognized when it is sold not when it is paid for. While the income statement is not cash based, that does not imply that it is meaningless. It still provides a good picture of how well the company is doing, but we must recognize that net income is not cash.

Balance Sheet

The balance sheet provides a snapshot of the company's assets, liabilities, and owners' equity at a specific point in time. The company's assets must be financed by either debt (liabilities) or ownership interest (equity). Therefore, assets will always equal liabilities plus owners equity (A = L + OE). It is important to remember that the values reported on the balance sheet are "book values" and do not necessarily represent the market value of the asset or ownership interest for a variety of reasons:

- The value of brand names, patents and other intellectual property which are often quite valuable to a corporation are not typically recorded on the balance sheet.
- The book (balance sheet) value of assets is based on historical cost less accumulated depreciation. The real (market) value of the assets is based on the ability of the firm to generate cash flows from those assets.
- The market value of a firm may incorporate value from assets that are not actually on the balance sheet, but are anticipated to enhance the firm's ability to generate cash flows in the future. An example of this would be Tesla, which would likely lose significant market value if Elon Musk was not associated with the company.

Typically, investors are willing to pay more for the firm than the balance sheet tells us it is worth because the balance sheet tends to be a conservative estimate of the true value of the firm's assets (although sometimes the balance sheet will overstate the market value of the firm's shares). Also, remember that the balance sheet represents a point in time and may not be the same throughout the year. For example, a company like Wal-Mart may have relatively high inventory and low cash at the end of the 3rd quarter (start of Christmas shopping season) and relatively low inventory at the end of the fourth quarter (end of Christmas shopping season).

Statement of Cash Flows

The statement of cash flows attempts to reconcile the differences between net income according to Generally Accepted Accounting Principles (GAAP) and cash flows. Cash flows are broken down into three primary areas — Cash Flow from Operating Activities, Cash Flow from Investing Activities, and Cash Flow from Financing Activities.

Cash Flow from Operating Activities

This is the most critical component of the statement of cash flows. Cash flow from operating activities provides insights into how well the firm is doing at generating cash flows from its day-to-day operations before factoring in any capital investments or financing issues. This is done by starting with net income and then adjusting back to a cash-based version of income. For example, depreciation lowers net income, but is not a cash expense. Therefore, depreciation is added back in. If our accounts receivable declines, that means we've collected additional cash from sales (remember from accounting that revenue is recorded when the sale is made, not when the cash is collected). Therefore, a decline in accounts receivable indicates that our cash flow this period is higher than indicated by our net income. Ideally, we want to see this be positive and growing over time. The idea is that if a firm is going to survive as a going concern it needs to be able to generate positive cash flows from its basic business operations. In addition, investors like to see companies grow over time. As we will see in our chapter on stock valuation, the faster a company grows, all else equal, the more valuable it will be. Sometimes one (or both) of these conditions are not met. If so, it is incumbent on the analyst/management to understand why not and how it can be addressed. Operating cash flows can be negative due to short-term operating problems that are being addressed, due to economic/industry issues, or due to more significant operating problems. The impact on the firm will vary depending on how likely the negative operating cash flows are to be a short-term vs. a long-term issue. Growth, while less important, is also something that analysts/management want to address if it is stagnant or declining.

Cash Flow from Investing Activities

Again, it is important for firm's to operate as a going concern, which means that they need to invest in their business. This may be updating long-term assets that are getting worn out, spending money on new equipment to improve productivity, or spending money on expanding the business. These investments into long-term assets are commonly referred to as capital expenditures and are essential to a firm remaining competitive and successful. They are also a key element in the cash flow from investing activities segment of the statement of cash flows as they represent investment into the company. Because the firm is spending money on these investments, they will typically be negative (cash outflows). While we want cash flows overall to be positive, negative cash flows from investing activities are not a concern and instead are an essential part of a firm's long-term success. The reason for concern would be if a firm is underinvesting in its long-term assets or if it is spending too much on unproductive assets. These both can be difficult to identify in the short-run as there is often a lag between when investments are made and when the payoffs show up in the cash flow from operating activities section.

Cash Flow from Financing Activities

If a firm generates more cash flow from its operating activities than it spends on investing activities, it will have cash left over to return to investors (or add to cash balances). Alternatively, if a firm spends more cash flow on its investing activities than it generates from operating activities, it will need to raise additional cash from investors (or draw down cash balances). This is an area that can be as much about where a firm is in its growth cycle as it is about the firm's health. Typically, younger firms and/or rapidly growing firms need to spend a lot of cash on expanding the business and may not have enough operating cash flows to fund those investing activities. As such, it is common for them to be raising capital by issuing shares of stock or issuing debt and they are unlikely to be using much, if any, cash to pay dividends. This leads to positive cash flows from financing activities. Alternatively, more mature companies are likely to be generating more than enough cash from their operating activities to meet their investment demands. Therefore, they will have cash to pay dividends, buy back outstanding shares of stock, and/or pay back existing debt. This leads to negative cash flows from financing activities. All else equal, negative cash flows from financing

activities are a better sign of a company's health than positive cash flows from financing activities. However, as mentioned above, an analyst needs to consider where the firm is in its growth cycle before jumping to conclusions.

Sample Financial Statements

You can see examples of Garmin's Financial Statements within the 2019 Garmin Annual Report. Note the Financial Statements start on p. 64 (based on the bottom of the page). You can also see a slide show where Garmin discussed their 2020 3rd Quarter results with investors.

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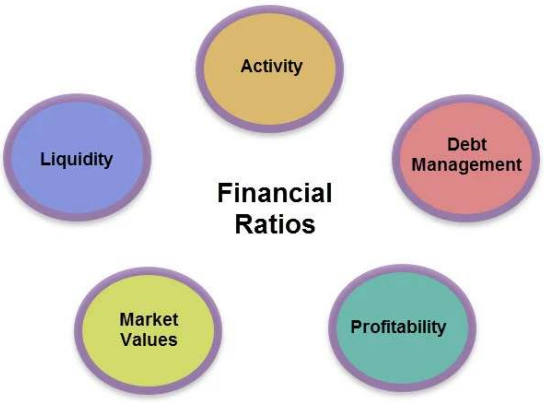
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2.2: Financial Statements Analysis

Financial Statements provide a wealth of information to many different users. There are many ways to analyze financial statements. These include ratio analysis and common size statements both of which can be analyzed through trend analysis or comparative analysis (we will go into more detail on trend analysis and comparative analysis in a little bit). While ratio analysis and common size statements provide an excellent way to analyze the information in the income statement and balance sheet, the statement of cash flows is best analyzed by breaking it down into its three primary components as discussed earlier.

Key Financial Ratios

There are a large variety of different financial ratios that attempt to evaluate different aspects of a company's health and performance. Some of these are specific to certain industries. For example, a popular ratio for brick-and-mortar retailers is sales-per-square-foot as it addresses how well the retailer is using its floor space to generate revenue. However, this same ratio would not make sense in evaluating the performance of a heavy equipment manufacturer like Caterpillar. Another challenge with ratios is that they can be calculated in different ways. For example, the Inventory Turnover ratio is sometimes calculated as Sales/Inventory and sometimes as Cost of Goods Sold/Inventory. To make things more complicated, sometimes the inventory level used as the denominator is defined as (beginning inventory + ending inventory)/2 and other times analysts will simply use ending inventory. Some ratios also go by different names. The Quick Ratio is sometimes referred to as the Acid Test Ratio or the Days Sales Outstanding Ratio is sometimes referred to as the Average Collection Ratio. This can make ratio analysis quite confusing for people who are just getting introduced to the topic. For the purposes of this class, we are going to focus on the following ratios which will be referred to and calculated as follows (using ending values for balance sheet items).



Liquidity Ratios

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

$$\text{Quick Ratio} = \frac{\text{Current Assets} - \text{Inventory}}{\text{Current Liabilities}}$$

Activity Ratios

$$\text{Inventory Turnover} = \frac{\text{Cost of Goods Sold}}{\text{Inventory}}$$

$$\text{Days Sales Outstanding} = \frac{\text{Accounts Receivable}}{\text{Sales }/365}$$

$$\text{Fixed Assets Turnover} = \frac{\text{Sales}}{\text{Net Property, Plant and Equipment}}$$

$$\text{Total Assets Turnover} = \frac{\text{Sales}}{\text{Total Assets}}$$

Debt Management Ratios

$$\text{Total Debt to Total Assets} = \frac{\text{Liabilities}}{\text{Assets}}$$

$$\text{Total Debt to Equity} = \frac{\text{Liabilities}}{\text{Owners}' \text{ Equity}}$$

$$\text{Times Interest Earned} = \frac{\text{EBIT}}{\text{Interest}}$$

Profitability Ratios

$$\text{Gross Profit Margin} = \frac{(\text{ Sales } - \text{ Cost of Goods Sold })}{\text{Sales}}$$

$$\text{Net Profit Margin} = \frac{\text{Net Income}}{\text{Sales}}$$

$$\text{Return on Assets} = \frac{\text{Net Income}}{\text{Total Assets}}$$

Return on Equity \(=\dfrac{\text { Net Income }}{\text { Owners' Equity }}\

Market Values

$$\text{Price/Earnings Ratio} = \frac{\text{Market Price per Share}}{\text{EPS}}$$

$$\text{Market/Book Ratio} = \frac{\text{Market Price per Share}}{\text{Book Value per Share}}$$

$$\text{Dividend Yield} = \frac{\text{Dividend per Share}}{\text{Market Price per Share}}$$

A couple of reminders. First, EPS refers to earnings per share and is simply (for the purposes of this class) net income divided by number of shares outstanding. Second, sales and revenues are used interchangeably in this class. Therefore, you can replace sales with revenues in any formula listed above. The goal of this class is not to make you an expert on ratio analysis, but to introduce it as a tool. This list of ratios will provide a strong foundation to build from if you delve further into ratio analysis.

One item that I want to stress is that interpreting ratios is as much of an art form as a science as there are always exceptions. Often, textbooks imply that once you calculate the ratios, you can easily identify a firm's strengths and/or weaknesses and take advantage of them and/or fix them. This is an illusion. Calculating the ratios is relatively simple. Interpreting the ratios requires context, understanding, and often experience. You need to understand where the numbers are coming from and why they are what they are (corporate strategy, company downturn, economic downturn, seasonality, etc.) in order to really make meaningful analysis. Explanation of Ratios, in the Appendix B, focuses on explaining and interpreting each of these ratios. However, even if you can adequately interpret the ratios, they are diagnostic more than prescriptive. We will discuss some of the challenges in applying ratio (and other forms of financial statement) analysis in a little bit.

Common Size Statements

In addition to ratios, we can also glean information from financial statements by comparing them from year to year or from firm to firm. However, we need to be careful. If our sales go up from year to year, most likely so will our costs. What becomes important then is not did costs go up, but how did they change relative to sales. Alternatively, our inventory may be down, but if all of our other assets are down as well, we may be starting to carry too much inventory. Our selling and administrative expenses (or accounts receivable) may appear relatively low to our competitors. However, if their firm is three times the size of ours, these expenses or receivables may still be too high. To fix these problems, we can develop common size income statements and common size balance sheets. A common size income statement takes each category in the income statement and divides by sales (expressing the item as a percentage of sales). A common size balance sheet divides each component of the balance sheet by total assets (expressing each item as a percentage of assets). This makes it easier to compare items from year to year (or across different size firms) and see how well the company is doing in each component.

Trend Analysis

The ratios presented above are close to meaningless by themselves. Looking at a single ratio in isolation is about as useful as a physician trying to perform a diagnosis simply by looking at your temperature. It is a piece of the puzzle, but without context and additional information it is not very meaningful. Also, common size statements offer little value without context. In order for them to become valuable for analysis, we must have something to compare them to. One technique is to view how these ratios and common size statements change over time. For example, is our ROA rising or falling from year to year? If it is rising, that indicates

we are doing a better job of generating profits from our assets. Alternatively, if our DSO ratio is rising, that indicates it is taking us longer to collect our credit sales. This may be a sign of a problem (note that I say “may” because it is also possible that we are intentionally offering more/better credit opportunities to customers in order to increase sales because our DSO was lower than optimal before). While we can do trend analysis with two years, it is better to have 3 to 5 years of ratios to analyze to truly spot trends. Too few years makes it hard to identify real trends as opposed to just normal year-to-year fluctuations. Alternatively, too many years may present a misleading picture as the company, industry, and economy has likely changed too much over the period to make comparisons meaningful. If you use quarterly data for trend analysis be careful of seasonality. It may not be appropriate to compare quarter two to quarter one, but instead only to quarter two of last year.

Potential Problems with Trend Analysis

One challenge with financial statement analysis is that many of the techniques we use help provide context for analysis, but they typically also have some flaws. Trend analysis is no different.

Seasonality

Due to seasonality in quarterly financial statements (and annual balance sheets), seasonality concerns may lead to distortions in trends. We must be aware of how seasonality can impact our ratios and common size statements before we can properly analyze trends.

Trend Changes

Trend analysis is designed to help us identify weaknesses and forecast future performance. The problem is trends can change suddenly. Often we can not identify changes in trends until after they have happened which can hinder our ability to use trends for predictions.

Fundamental Changes

Significant changes in firm strategy or industry dynamics may make comparisons to previous years less meaningful.

Comparative Analysis

Another way to make the ratios and common size statements meaningful is to compare them to industry averages or key competitors. For example, labor intensive industries may have high return on assets numbers while companies in capital (asset) intensive industries may have relatively low return on assets. Also, grocery stores are likely to have higher cost of goods sold values as a percentage of sales than software developers. If you are analyzing a software developer, it is important to compare it to others in the industry to determine if the numbers are “good” or “bad”. If our numbers compare favorably to the industry average that is a good sign, and numbers that compare unfavorably to the industry average indicate potential weaknesses. However, we must be careful here. Our goal is not to be average. If we are better than the industry average in an area, that does not mean we have no room for improvement and management should ignore that area.

Potential Problems with Comparative Analysis

Just like trend analysis, comparative analysis provides insights but also introduces some challenges. Some of these challenges are listed below.

Conglomerates

Some companies (such as Compass Minerals or Amazon.com) defy industry classification. Compass Minerals is both active in salt mining and plant nutrition which are two very different business lines. Amazon.com is a major retailer. However, they also offer streaming services, cloud computing, and are active in voice-related artificial intelligence. When a firm is involved in many different industries, comparative analysis can be misleading or extremely difficult to implement.

Concentrated Industry

Some companies (such as Facebook) dominate an industry to such a large extent that it can be misleading to compare them to the industry norm. It may also be hard to find a sample of direct, publicly-traded competitors to put together a good comparison.

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2.3: Who Uses Financial Statement Analysis?

Who uses financial statement analysis? The answer is many different groups of individuals and institutions who are concerned with identifying the health and performance of a company. This includes, but is not limited to the following groups:

Company Management

Managers need to evaluate a variety of ratios in order to properly manage their firm. They need to understand the liquidity situation, how well the company is doing at generating sales from their assets, what the debt picture is telling them, how profitable they are, and how investors are valuing their stock. As such, they need the big picture view provided by all the ratios, an evaluation of the statement of cash flows and common size statements.

Competitors

Like management of our own company, management of our competitors are going to need a big picture overview of our firm (as well as their other competitors) to evaluate their own strengths and weaknesses relative to their competition.

Long-term Lenders

While current and potential bondholders (and other long-term lenders) are going to evaluate many areas covered by financial statement analysis, there are certain areas that are more important and others that are less critical. For example, a current/potential bondholder is not likely to care much about the firm's PE ratio or inventory turnover ratio. On the other hand, debt management and liquidity ratios are going to be a big focus. Profitability ratios are somewhat in the middle. While long-term lenders prefer firms be profitable enough to have a margin of error in generating enough cash flows to meet their interest obligations and repay the principal, they are not really concerned with seeing profitability ratios be on the high end of the industry as they don't benefit from excess profits like stockholders do.

Short-term Creditors

Like long-term lenders, short-term creditors are focused on the firm's ability to repay its liabilities. However, they are less concerned with debt management ratios and more concerned with liquidity ratios. Whether the firm can meet their long-term obligations is less relevant as long as the firm can generate enough cash flows to meet their current obligations.

Stock Investors

Stock investors are going to have more of a big-picture focus than creditors. This is because the firm has to be generating sufficient cash flows, have significant and reliable profitability, meet its debt obligations (as stockholders come after bondholders in the priority of claims), and be able to purchase shares at a reasonable price.

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2.4: Putting it All Together

One of the big challenges in financial statement analysis is that there are many factors that do not "follow the rules" and there are exceptions to everything. For example, a common rule of thumb for the liquidity ratios is that we want to see the current ratio at 2.0 or higher and the quick (acid test) ratio at 1.0 or higher. If these numbers are too low, it could be a sign that the firm is suffering liquidity issues and may have problems meeting its current liability obligations.



Now, consider Wal-Mart. As of the Jan 31st, 2021 Annual Balance Sheet, Wal-Mart had a current ratio of 0.97 and a quick ratio of 0.49 (see financial ratios table in Financial Statement from Walmart and Target, in Appendix B. At first glance, it would appear that Wal-Mart is on the verge of bankruptcy as they will not be able to pay their current liabilities. However, does anyone really believe Wal-Mart is in a financial crisis? I didn't think so. Instead, they know that their inventory will turn over quickly and they have access to capital so they don't need to hold much in current assets (beyond their inventory). This is a strategy that allows them to earn higher rates of return. Another firm with slower inventory turnover, less favorable relationships with suppliers, or less access to capital may be in severe problems with the same (or even slightly higher) ratios. Also, consider that when liquidity ratios are too high, that can also be considered a problem as it indicates firms are being inefficient in allocating their resources (long-term assets generally offer higher returns than current assets). However, Facebook has a current (and quick since they don't have any inventory listed) ratio of over 5 at the end of their 2020 fiscal year. Does that imply that Facebook is not smart enough to properly allocate their capital or might there be other explanations for their high liquidity ratios? The key here is that it can be harder than it may seem to identify "good" or "bad" levels for ratios.

Another problem is identifying what a significant change is. For example, let's say that our Return on Equity is 14.3% and the industry average is 14.5%. We are below the industry average, but only by a very small amount. Obviously we'd like it to be higher, but is this a weak spot or is it an average spot? How much below the industry average do we need to be before we get concerned? Let's say that last year our Return on Equity was 14.0% and industry average last year was still 14.5%. Now we have increased our ROE (marginally), but it is still slightly below the industry average. Is it a strength (because it is improving), a weakness (because it is below the industry average), or neutral (because there was little change and we are close to the average). Again, how much different do the numbers need to be before we are concerned? These are judgment calls without clear answers.

Another issue is that while financial statement analysis might help us identify potential strengths and weaknesses, it doesn't tell us what to do about them. For example, let's say our net profit margin is rising and significantly higher than the industry average. This is good, but how does it help management? Can they ignore it and focus their attention elsewhere? If so, will it stay a strength? From an investor's perspective, does this make us want to buy the stock? Maybe it's a plus, but what if the stock price is high enough that it already captures this strength? Or is overvalued because of this? Ratio analysis should not be confused with stock valuation or an investment decision making tool, but instead a piece of the puzzle. Alternatively, what if our inventory turnover is significantly below the industry average and declining? We may know we have a problem, but we still have to figure out how to fix it. From an investor's perspective, is this a reason to avoid the stock or is it offset by other strengths? Again, ratios will not tell us by themselves whether or not a stock is a good or poor investment.

Another item to remember is that when we go through our financial statement analysis, we are typically not identifying problems/strengths, but POTENTIAL problems/strengths. Think of the process as flagging areas for further investigation. When you visit a doctor, she checks your vital stats and asks you about symptoms. This is where the doctor generates an initial diagnosis, but then usually a series of tests are done to confirm what is wrong. Financial statement analysis is the initial diagnosis stage. Once you identify areas of concern, then you need to dig deeper to see what is going on and why. Once you have this additional information, then you can decide if it needs fixed and if so, how to proceed.

I'll close with a comment that was raised earlier. In financial statement analysis, context is everything. We can't look at a single ratio in isolation. A company may have a great inventory turnover ratio, but not be doing so profitably or be having problems meeting their debt obligations. A firm may be seeing profitability rise, but slower than the industry average. A company may have abnormally high or low ratios (or items in common size statements) relative to the industry, but be pursuing a different strategy than the industry. For example, one firm may have a higher inventory turnover with lower profit margin while another may have a lower inventory turnover with a higher profit margin. Both strategies may be successful and allow the firms to differentiate their

target market. It does not mean one firm needs to increase their profit margin and the other needs to improve their inventory turnover. Because of the importance of context and other issues raised above, financial statement analysis is a useful, but very challenging, tool to apply.

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2.5: Key Takeaways

Key Takeaways

The income statement, balance sheet and statement of cash flows provide significant information which management and analysts can use to diagnose potential strengths and weaknesses of the firm. While the statement of cash flows provides significant information in its original format, the data from the income statement and balance sheet can provide additional insights through the use of financial ratios and common size statements. Despite the ability of financial statement analysis to provide insights into the firm's performance, it can be challenging to get the full benefits from this tool in a finance professional's kit. The reason for this challenge is that context is essential to interpreting the results of such analysis and that even with the appropriate context, it can be difficult to correctly diagnose opportunities and problems. Context can be provided by trend and comparative analysis along with understanding the dynamics of the firm and its environment.

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2.6: Exercises

Exercise 2.6.1

The income statement captures a company's performance over time while the balance sheet captures its status at a point in time. What does this mean?

Answer

The income statement captures all activity related to revenues and expenses over a particular time period. For instance, the quarterly income statement includes all revenue and expense items for that quarter. The beginning of the quarter is treated the same as the end of the quarter. The same applies for annual income statements. However, balance sheets represent a firm's assets, liabilities, and owners' equity at a particular point in time. The quarterly balance sheet only reflects the last day of that quarter and the annual balance sheet only reflects the last day of the year. As such, the balance sheet is more open to seasonality issues and short-term fluctuations. For instance, if the balance sheet is prepared 1 day prior to a large cash payment the cash account will appear artificially large. On the other hand, if it is prepared 1 day after the payment the cash account will appear artificially small.

Exercise 2.6.2

A company has $100 million in total assets and $40 million in equity. How much does it have in total liabilities?

Answer

The firm has $60 million in total liabilities.

A = L + OE
$100M = L + $40M
$60M = L

Exercise 2.6.3

How does depreciation create a difference between earnings and cash flows? Are there any other ways/reasons in which accounting earnings can be different from cash flows?

Answer

Depreciation is a noncash expense. While it lowers net income, the firm is not actually paying anything for depreciation so it has no impact on cash flows (ignoring taxes…when considering taxes, depreciation lowers net income but increases cash flows as less cash is paid in taxes). The cash flow impact of an asset purchase from a finance perspective occurs when the asset is purchased. Spreading the cost equally over the assets useful life ignores the time value of money and understates the true cost of the purchase. A few other issues that may create a difference between cash flows and earnings include (this is not a complete list) –

- Revenue recognition
- Inventory accounting method
- Prepaid expenses
- Accounts Payable/Receivable

Exercise 2.6.4

What types of people use ratio analysis? Who might be most interested in liquidity ratios? asset management ratios? debt management ratios? profitability ratios? market value ratios?

- Management

- Competitors
- Stockholders (and potential stockholders)
- Long-Term Creditors
- Short-Term Creditors

Answer

While many people use ratio analysis, the primary parties interested are

When analyzing **Asset Management Ratios**, the most interested parties are management, competitors, and stockholders. Again, management must be interested in all the ratios as they must manage all aspects of the firms operations. Competitors are interested as a gauge of their own performance. If our competition has a total asset turnover of 2.50 and ours is only 1.95 we must understand what they are doing to outperform us in this measure. By identifying our weaknesses, we can address them. Stockholders have some interest in that often asset management ratios impact a firm's ability to generate profits and increase firm value. Long-term and short-term creditors are typically not significantly concerned with these measures as they do not share in any "extra" profits the company generates. As long as the firm is able to meet interest and principle obligations, debt holders are happy.

Management, long-term creditors, short-term creditors, and stockholders are all focused on **Debt Management Ratios**. These ratios measure a firm's ability to meet their debt obligations, so creditors want to see these ratios strong in order to be confident of receiving their full interest and principle payments. Long-term creditors are probably more focused on this as short-term creditors hope to be repaid quickly enough that they are more concerned about the liquidity issues. Stockholders are concerned because if the firm is unable to meet its debt obligations it will be forced into bankruptcy and the stockholders will likely lose all of their investment.

Profitability Ratios are a concern primarily for management, competitors, and stockholders. Creditors, both LT and ST, do not participate in profits so their only concern with profitability ratios is if they are negative and threaten the ability of the firm to meet interest and principal payments. Like asset management ratios, competitors use profitability ratios as a method to gauge their strengths and weaknesses. Since stockholders "own" the business, the profits belong to them. Therefore, the stronger the profitability ratios, the happier the stockholders are.

Market Value Ratios are looked at by stockholders and management. These ratios measure how "cheap" or "expensive" the stock is. Management typically wants these ratios to be high as it is a sign that they are maximizing firm value. Potential stockholders typically want them low as that is an indication that the stock may be cheap (except for dividend yield). As a side note, market value ratios are often much more difficult to analyze than many people would like.

When analyzing **Liquidity Ratios**, the most interested parties are management and short-term creditors. Management needs to understand the firm's liquidity position in order to properly manage the firm. Short-term creditors typically do not care much about the long-term health of the firm, but only if they have enough liquid capital to meet the short-term obligations. Long-term creditors and stockholders would also be interested, but primarily only if the liquidity ratios were weak enough to damage the long-term health of the firm.

? Exercise 2.6.5

Company A has a ROA of 8% and a ROE of 12%. Company B has a ROA of 7% and an ROE of 15%. What does this tell us about the relative levels of debt financing between these two companies? Which company's approach is better?

Answer

The key to this question recognizing the role of the equation A = L + OE in these two ratios. Because all firms use some degree of liabilities (long-term debt, accounts payable, accruals, etc.), we know that Assets must be larger than Owners' Equity. The greater the amount of debt financing (liabilities), the greater the difference between Assets and Owners Equity will be. Also, since the difference between ROA and ROE is the denominator (ROA is NI/Assets while ROE is NI/OE), ROE will always be higher than ROE (for firms with positive NI). Finally, the greater the amount of debt financing (liabilities), the greater the difference between ROA and ROE will be.

When considering the above paragraph, we can now comment on the specific ROA and ROE numbers for Company A and B. Since Company B has a lower ROA and a higher ROE (relative to Company A), we know that Company B is using more leverage (debt financing) than Company A.

Neither approach is necessarily "better" or "worse" than the other. They are just different. Company B is using a more aggressive (riskier) strategy of financing. The higher level of debt increases the risk, but also means stockholders earn a greater return on their money when the company does well. However, if the company does poorly, the higher leverage (debt financing) will magnify the losses (as the interest must still be paid and the loss is spread over less shareholder capital). Thus, higher amounts of debt financing are riskier, but also increase the potential return. Which approach is better depends on the level of risk aversion for each shareholder.

? Exercise 2.6.6

Company A tends to have most of its sales in the fourth quarter and does a large percentage of sales on a credit basis. Company B also sells primarily on credit, but most of its sales come in the first and second quarter. An analyst looks at their DSO ratio from the annual balance sheet and income statement and notices that company A has a much higher DSO outstanding. The analyst concludes that Company A is doing a poor job of managing its accounts receivable. Is the analyst correct? Explain? Which company would likely have a higher inventory turnover ratio and why?

Answer

The DSO ratio does provide an indication of how long it is taking a firm to collect its credit sales. Thus, a high DSO ratio can be an indication of a problem in managing a firm's accounts receivables. However, one must be very careful in jumping to conclusions. First, DSO can be very industry dependent. Second, and the issue in this question, is that DSO uses both balance sheet and income statement values to calculate the ratio. As the Annual Income statement is not subject to seasonality while the Annual Balance Sheet is, there is the potential for seasonality issues to distort the ratio. Specifically, Company A has larger accounts receivable on their annual balance sheet due to the seasonal nature of their sales. This inflates their DSO ratio. Company B has had plenty of time to collect their accounts receivable. This is a prime example of why you need to consider seasonality when evaluating ratios.

If we think of the inventory turnover ratio, Company A should appear to be doing better. Specifically, they will have less inventory on hand at the end of the year (as their heavy sales season is winding down and they approach seasonally lower sales). Alternatively, Company B's inventory will be high to meet their seasonally high 1st and 2nd quarter sales that are right around the corner.

? Exercise 2.6.7

Which statements are subject to seasonality?

a. Quarterly Income Statement
b. Annual Income Statement
c. Quarterly Balance Sheet
d. Annual Balance Sheet

Answer

Subject to Seasonality – Quarterly Income Statement, Quarterly Balance Sheet, Annual Balance Sheet

Not Subject to Seasonality – Annual Income Statement

? Exercise 2.6.8

Company A has a Profit Margin of 3% while company B has a Profit Margin of 8%. This tells us that company B is outperforming company A. Is this statement true or false and explain your answer?

Answer

This is a FALSE statement. While it is true that everything else equal, a higher profit margin is better than a lower profit margin there is not enough information to make this a true statement. We are ignoring both trend analysis and comparative analysis, so we don't have the necessary context to evaluate the profit margin number. For instance company A could be in a low profit margin industry (such as banking or retail) while company B could be in a high profit margin industry (such as software or pharmaceuticals). Also, profit margin is only one ratio and to label one company as outperforming another based on a single ratio is shortsighted. We need to consider the larger picture before making such a statement. The purpose of this question is to illustrate that one ratio without context is close to meaningless.

? Exercise 2.6.9

What do we mean by trend analysis and comparative analysis? Why are these tools more useful than looking at the ratios for a single period in isolation?

Answer

Trend Analysis refers to looking at a firm's ratios over a period of 3-5 years to identify whether specific areas are strengthening or weakening. Comparative analysis refers to looking at a firm's ratios relative to other firms in the same industry to evaluate whether they are better or worse than industry averages. Trend/comparative analysis provides us some of the necessary context to properly interpret the ratios.

? Exercise 2.6.10

Identify at least one potential problem with trend analysis and one potential problem with comparative analysis.

Answer

Potential problems with trend analysis include

Trends can change abruptly	While it is important to identify trends, we should remember that these are past trends. Volatile business conditions can cause trends to stop or reverse unexpectedly.
Some patterns are not trends	If ROA increases from year 1 to year 2, this is not a trend but a one-year change. Often it is hard to distinguish between true strengthening/weakening trends and just random noise.
Past data may be irrelevant	Structural/strategic changes in firms may make comparisons to past years virtually meaningless.

Potential problems with comparative analysis include

Finding a comparison industry	Conglomerate companies such as General Electric are often involved in several industries making it hard to compare their ratios to an industry average.
Few competitors	Some large firms such as Microsoft dominate an industry to the extent that it is often hard to make comparisons to industry averages.

? Exercise 2.6.11

Why might a very low quick ratio be a cause for concern? How about a large quick ratio?

Answer

A very low quick ratio may be cause for concern because it could indicate liquidity concerns. A low level of cash and accounts receivable relative to our current liabilities could indicate that we will have a hard time paying those current liabilities when they are due. A very high quick ratio may be cause for concern because it indicates an inefficient allocation of resources. Cash and accounts receivable are not high return assets. We would likely be better off allocating our assets to areas with higher rates of return.

? Exercise 2.6.12

From the perspective of management, what is the primary objective of financial statement analysis? What are some difficulties management might encounter in doing a complete financial statement analysis? Re-examine these two questions from the perspective of the stockholder.

Answer

The primary objective of financial statement analysis from the perspective of management is to identify potential strengths and weaknesses of our firm relative to our competitors so we can take full advantage of our strengths and work on fixing our weaknesses.

There are several difficulties that management might encounter in conducting a complete financial statement analysis. Some are mentioned in the question on potential problems with trend analysis and comparative analysis above. Other problems include comparability of financial statements across firms in the industry due to different fiscal years and/or different accounting procedures. Also, the need to dig beyond the numbers is critical. For example, is a high ROE due to a well-run company or due to too much leverage that could cause significant problems if we hit a small rough patch? Another issue is that financial statement analysis may help us identify potential strengths and weaknesses. However, even after confirming them by digging deeper, the financial statement analysis often does not recommend HOW we can fix the weakness or exploit the strength.

The primary objective of financial statement analysis from the perspective or the stockholder is to identify companies to invest in (potential stockholders) or evaluate the companies the stockholder currently owns (current stockholders).

Stockholders face many of the same problems discussed above with management. However, an important challenge for stockholders is that they must not only analyze the company's financial health, but also evaluate how much they are paying for it. There may be situations where buying stock in a company with poor financial health is a good opportunity (the stock price is "cheap" enough and there is a chance for the company to rebound). There may also be situations where selling shares of stock in a company with strong financial health is good (the stock price is so expensive that the firm's success is already more than fully reflected in the stock price). Too often stockholders get caught up in what they are buying and don't think enough about how much they are paying for it.

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2.7: Problems

Problem 2.7.1

Using the Financial Statements for Joe's Gadgets in Appendix B, find the following ratios for both 2016 and 2017

a. Current ratio
b. Quick ratio (Acid Test)
c. Inventory Turnover Ratio
d. Days Sales Outstanding (Average Collection Period)
e. Fixed Assets Turnover
f. Total Assets Turnover
g. Total Debt to Total Assets (Debt Ratio)
h. Total Debt to Equity
i. Times Interest Earned
j. Gross Profit Margin
k. Net Profit Margin
l. Return on Assets
m. Return on Equity
n. Price Earnings Ratio
o. Market-to-Book Ratio
p. Dividend Yield

Answer

2016

CR = CA/CL = 7,000,000/4,500,000 = 1.56
QR = (CA – Inv)/CL = (7,000,000 – 2,000,000)/4,500,000 = 1.11
ITR = CGS/Inv = 6,000,000/2,000,000 = 3 times
DSO = AR/(Sales/365) = 2,000,000/(15,000,000/365) = 48.67 days
FAT = Sales/Fixed Asst = 15,000,000/10,000,000 = 1.5 times
TAT = Sales/Total Asst = 15,000,000/17,000,000 = 0.88 times
TD/TA = 10,000,000/17,000,000 = 58.8%
TD/OE = 10,000,000/7,000,000 = 142.86%
TIE = EBIT/Int = 4,000,000/1,000,000 = 4 times
GPM = (Sales – CGS)/Sales = (15,000,000 – 6,000,000)/15,000,000 = 60%
NPM = NI/Sales = 2,100,000/15,000,000 = 14.0%
ROA = NI/Asst = 2,100,000/17,000,000 = 12.4%
ROE = NI/OE = 2,100,000/7,000,000 = 30.0%
PE = Price/EPS = 25/1.05 = 23.81
M/B = Price/BV = 25/(7,000,000/2,000,000) = 7.14
DY = Div/Price = $0.50/$25 = 2.00%

2017

CR = CA/CL = 11,050,000/7,000,000 = 1.58
QR = (CA – Inv)/CL = (11,050,000 – 4,000,000)/7,000,000 = 1.01
ITR = CGS/Inv = 11,000,000/4,000,000 = 2.75 times
DSO = AR/(Sales/365) = 4,000,000/(20,000,000/365) = 73 days
FAT = Sales/Fixed Asst = 20,000,000/11,000,000 = 1.82 times
TAT = Sales/Total Asst = 20,000,000/22,050,000 = 0.91 times
TD/TA = 15,000,000/22,050,000 = 68.0%

TD/OE = 15,000,000/7,050,000 = 212.77%
TIE = EBIT/Int = 3,000,000/1,500,000 = 2 times
GPM = (Sales – CGS)/Sales = (20,000,000 – 11,000,000)/20,000,000 = 45%
NPM = NI/Sales = 1,050,000/20,000,000 = 5.25%
ROA = NI/Asst = 1,050,000/22,050,000 = 4.76%
ROE = NI/OE = 1,050,000/7,050,000 = 14.89%
PE = Price/EPS = 17.5/0.525 = 33.33
M/B = Price/BV = 17.5/(7,050,000/2,000,000) = 4.96
DY = Div/Price = $0.50/$17.50 = 2.86%

Problem 2.7.2

Using the Financial Statements for Joe's Gadgets in Appendix B, prepare common size income statements and balance sheets for 2016 & 2017.

Answer

Each item in the income statement is expressed as a percentage of sales (revenues) and each item in the balance sheet is presented as a percentage of total assets.

	2016	16CS	2017	17CS
Sales	15,000,000	100.0%	20,000,000	100.0%
CGS	6,000,000	40.0%	11,000,000	55.0%
S&A Exp.	3,000,000	20.0%	3,500,000	17.5%
Depreciation	2,000,000	13.3%	2,500,000	12.5%
EBIT	4,000,000	26.7%	3,000,000	15.0%
Interest	1,000,000	6.7%	1,500,000	7.5%
EBT	3,000,000	20.0%	1,500,000	7.5%
Taxes (30%)	900,000	6.0%	450,000	2.2%
Net Income	2,100,000	14.0%	1,050,000	5.2%
Num. of Shares	2,000,000		2,000,000	
EPS	$1.05		$0.525	
Div. per Share	$0.50		$0.50	
Stock Price	$25		$17.50	
Cash	3,000,000	17.6%	3,050,000	13.8%
A/R	2,000,000	11.8%	4,000,000	18.1%
Inv.	2,000,000	11.8%	4,000,000	18.1%
Cur. Assets	7,000,000	41.2%	11,050,000	50.1%
Net Prp, Plant & Equip	10,000,000	58.8%	11,000,000	49.9%
Total Assets	17,000,000	100%	22,050,000	100.0%
A/P	2,500,000	14.7%	3,500,000	15.9%
Accruals	1,500,000	8.8%	2,000,000	9.1%
Notes Payable	500,000	2.9%	1,500,000	6.8%
Cur Liabilities	4,500,000	26.5%	7,000,000	31.7%
Long-Term Debt	5,500,000	32.4%	8,000,000	36.3%
Total Libilities	10,000,000	58.8%	15,000,000	68.0%
Common Stock	1,000,000	5.9%	1,000,000	4.5%
Retained Earnings	6,000,000	35.3%	6,050,000	27.4%
Owners' Equity	7,000,000	41.2%	7,050,000	32.0%
Tot. Liab. & O.E.	17,000,000	100.0%	22,050,00	100.0%

Problem 2.7.3

Use the following industry average ratios for 2017 and your answers to Problem 1 and Problem 2 to highlight any strengths and weaknesses for Joe's Gadgets.

a. Current ratio 1.75
b. Quick ratio 1.00
c. Inventory Turnover Ratio 4.75
d. Days Sales Outstanding 50.0
e. Fixed Assets Turnover 1.30
f. Total Assets Turnover 0.50
g. Total Debt to Total Assets 0.55
h. Total Debt to Equity 1.22
i. Times Interest Earned 3.25
j. Gross Profit Margin 46.53%
k. Net Profit Margin 4.88%
l. Return on Assets 4.17%
m. Return on Equity 12.02%
n. Price Earnings Ratio 24.15
o. Market-to-Book Ratio 3.98
p. Dividend Yield 1.99%

Answer

To start the analysis of finding strengths and weaknesses, I started with the common size statements. The first thing that I noticed was the increase in Cost of Goods Sold from 40% of sales in 2015 to 55% of sales in 2017. This indicates that our production costs jumped significantly and will act to lower our net income. Selling and Administrative expenses dropped slightly from 20% of sales to 17.5% of sales. This is a strength, but is not a very large change so I don't place much emphasis on it. The declines in EBIT and Net Income as a % of sales are due to the increase in CGS, so do not need further analysis. Thus, from the Common Size Income statement, I focus on the increase in CGS as a significant weakness and would classify the decline in S&A Expenses as a small strength.

Next I proceed to the Common Size balance sheet. The first things I notice are the increases in accounts receivable and inventory as a % of total assets. This is a concern that needs more analysis before I declare it a weakness. Consider accounts receivable first. AR could increase due to higher sales levels. If 25% of my sales are done on credit and sales increase, my AR will automatically increase as well. This could result in AR being a bigger portion of my firm's assets and would not be seen as a negative. On the other hand, AR may be increasing because fewer customers are paying their bills on time. This could lead to more bad debt expense or higher collection costs. I can not tell which explanation is causing the increase in AR from the CS balance sheet, so I will make a note of it and look more at the issue as I move through my analysis. Like AR, inventory increases may or may not be a weakness. If sales increase, I will need more inventory on hand to handle the increase in sales which is likely to cause inventory to make up a larger portion of my firm's assets. Alternatively, if I am getting stuck with more out-of-date inventory it will also make up a larger portion of my firm's assets until I am forced to do a write down and take the loss. From the CS balance sheet I can't tell which scenario is taking place so this is also something to investigate further.

Net PPE shows a large drop in the CS Balance sheet, but that is primarily a result of the increase in current assets caused by the jump in AR and Inv which have already been discussed, so I will not pay much attention to the decline in Net PPE. Notes Payable shows a large jump, however that could just be a function of me financing some of my increase in current assets so again that is not something that would concern me too much. I would probably want to note it and make sure I find out the reason for the increase but it likely is not a strength/weakness. The jump in Total Liabilities as a % of total assets is something that might concern me. Higher levels of liabilities as a % of total assets indicates higher risk levels. The firm has a greater chance of serious financial problems is there is a slowdown. This is not necessarily bad as the higher debt

levels also have the chance to increase our profits if things go well, however it is something to note with a degree of caution due to the higher risk. Finally, the drop in OE is merely the flip side to the increase in TL, so needs no further analysis.

Next I move on to the ratio analysis. My liquidity ratios appear to be sound as both are stable from year to year and similar to the industry averages. Next is my Inv. Turnover Ratio. This, combined with the increase in inventory on the CS balance sheet indicates a problem. If my inventory increase was merely a result of increased sales, the inventory turnover ratio would hold steady or increase slightly. Instead it has decreased slightly and is noticeably lower than the industry average. This means that I am tying up more of my capital as inventory and probably ending up with older inventory that will need to be marked down and sold at a loss.

I also notice problems with my Days Sales Outstanding ratio. The significant jump in the DSO ratio tells me its taking me an about 24 days longer on average to collect each dollar in sales. Since this is also much higher than the industry average it means one of two things. Either I have a lot of customers that aren't paying on time and may end up with higher levels of bad debts or that I have to offer more favorable credit terms to my customers to keep sales from dropping. Both of these possibilities are bad, so my accounts receivable situation is a definite cause for concern.

Fixed Asset Turnover and Total Asset Turnover both look good. FAT is up and both are higher than the industry average. This is a sign that I am doing a good job overall of using my assets (especially my LT assets) to generate sales.

The debt management ratios are troublesome. My TD/TA and TD/OE ratios have increased by quite a bit and are higher than the industry averages. Also, my TIE ratio has dropped and is lower than the industry average. This means that our firm is using more debt financing and has less margin for error. If we experience an off year or two our firm is likely to run into severe financial problems and could face bankruptcy. On the other hand, if we have a couple of strong years, we will make higher returns for our shareholders due to the leverage provided by debt. This is not necessarily a strength/weakness but is a sign of high financial risk.

The profitability ratios are all showing an interesting pattern that ties back into my CGS observation from the CS income statement. My profitability (PM, ROA, ROE) is down due to the increase in CGS. However, all three ratios are consistent with the industry average. This might be an indication that the increase in CGS is more of an industry issue rather than firm specific. If a key input had a price increase, this is likely to impact all firms in the industry equally. For example, if grain prices jumped significantly both Kellogg's and General Mills may see a jump in their CGS and a decline in their profit margins. It doesn't indicate a management problem, but an industry issue. If my profitability ratios declined significantly AND were lower than the industry average I would be more concerned about company specific problems.

Finally we have the market value ratios which are difficult to interpret in this instance. The PE ratio has increased significantly as my stock price fell, but earnings fell faster. It is also higher than the industry average which indicates the stock is more expensive in terms of what investors pay for each dollar of earnings (possibly indicating that they believe the earnings drop is not permanent). The MV/BV ratio has decreased significantly which indicates the stock is cheaper. This is because book value is less sensitive to the recent earnings decline which lowered the stock price (making the stock cheaper relative to its book value). However, the stock is still slightly more expensive than the industry average. While our dividend yield increased and is higher than the industry average (which is good), there is a danger sign here. If earnings drop any further, we may have to cut our dividend which would cause the yield to drop.

To summarize, our financial statement analysis indicates

- The firm needs to address the CGS issue, but that it is probably an industry issue instead of a company specific problem. This doesn't mean we can ignore it, just that it will be more difficult to fix.
- The firm needs to get control of its credit policies and improve its collections process.
- The firm needs to get control of its inventory concerns The firm is doing a good job at generating sales from its LT Assets.
- The firm has a high degree of financial risk
- The firm does not appear to have any major liquidity constraints.
- The stock is relatively expensive relative to the industry average and the dividend yield (while attractive) should be viewed with caution as it may not be sustainable.

Problem 2.7.4

Firm A reports a Profit Margin of 5% and a Total Asset Turnover Ratio of 1.5. Their total asset level is $6,000,000. Assume there are 600,000 shares outstanding and the PE ratio is 13. Also, assume the Return on Equity is 14%. Based on this, calculate the MV/BV ratio. Hint 1: Use (Net Income)/(Shares Outstanding) to get Earnings Per Share. Hint 2: Think of how you can use data provided and ratio formulas to fill in missing values to ultimately get the MV/BV ratio – it will take several steps.

Answer

You know that you need the current stock price and the book value per share in order to get the MV/BV ratio. To get current stock price, you can use the PE ratio:

PE = Price/EPS ⇒ Price = (PE)×(EPS)

To get EPS, you need Net Income which you can get from the net profit margin:

Net Profit Margin = Net Income/Sales ⇒ Net Income = Net Profit Margin×Sales

You have the Profit Margin, so you need Sales. You can get Sales from the Total Asset Turnover Ratio:

Total Asset Turnover = Sales /Assets ⇒ Sales = TA Turnover×Assets

- Sales = (1.5)×($6,000,000) = $9,000,000
- Net Income = (0.05)×($9,000,000) = $450,000
- EPS = ($450,000)/(600,000 shares) = $0.75 per share
- Stock Price = (13)×(0.75) = $9.75

Now you need to solve for Book Value which is Owners' Equity per Share. We know the Return on Equity, so we can use that (along with Net Income) to get Owners' Equity:

ROE = Net Income/Owners Equity ⇒ Owners Equity = NI/ROE

- Owners' Equity = ($450,000)/(0.14) = $3,214,285.71
- Book Value = $3,214,285.71)/(600,000 shares) = $5.36 per share
- MV/BV = ($9.75)/($5.36) = 1.82

Our MV/BV ratio is 1.82. This is a tough problem as it not only tests your knowledge of ratios, but your problem solving skills. Don't worry if you didn't get it at first, but hopefully once you see the solution it makes sense.

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2.8: References and Attributions

Student Resources

Explanation of Ratios in Appendix B

Financial Statements from Walmart and Target in Appendix B

Guided Tutorial for Financial Statement Analysis in Appendix B

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CHAPTER OVERVIEW

3: Time Value of Money

> *Compound interest is the eighth wonder of the world. He who understands it, earns it … he who doesn't … pays it.*
> *– Albert Einstein*

Learning Objectives

After completing this chapter, students should be able to

- Explain the concepts of future value, present value, annuities, and discount rates
- Solve for the future value, present value, payment, interest rate or number of periods using the 5-key approach on a financial calculator
- Work with annual, semi-annual, quarterly, monthly, biweekly, weekly, or daily periods
- Solve for the present value of a perpetuity
- Solve for the present value or future value of an uneven cash flow stream
- Solve for the interest rate implied by an uneven cash flow stream
- Explain, calculate, and compare investments based on the effective annual rate
- Perform complex time value of money calculations (problems where multiple steps are required in order to reach the final solution)

3.1: The Power of Compound Interest
3.2: Future Value
3.3: Present Value
3.4: Annuities
3.5: Solving for PMT, I/YR, or N
3.6: Perpetuities
3.7: Uneven Cash Flow Streams
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3.1: The Power of Compound Interest

The quote at the start of the chapter is often attributed to Albert Einstein (despite some controversy as to the accuracy of that attribution). However, the validity of the statement itself has merit. Positive returns on investments over long periods of time are central to making money work for you as the power of compounding allows for geometric growth. Consider the following table (before long, you'll be able to verify these calculations) of someone saving $250 per month for various times at various rates of return. Note that an individual who is 25 would have about 40 years until a standard retirement at age 65 and, assuming their employer offers a 50% match on retirement savings plans such as a 401(k), a total contribution of $250 each month would only be $2000 per year out of pocket before taxes.

Table 3.1.1**: Future Value of $250 per month investment**

Years/Rate of Return	5%	10%	15%
1	$3,069.71	$3,141.39	$3,215.09
5	$17,001.52	$19,359.27	$22,143.63
10	$38,820.57	$51,211.24	$68,804.26
15	$66,822.24	$103,617.59	$167,126.69
20	$102,758.42	$189,842.21	$374,309.87
25	$148,877.43	$331,708.35	$810,882.40
30	$208,064.66	$565,121.98	$1,730,819.90
35	$284,023.11	$949,159.51	$3,669,295.04
40	$381,505.04	$1,581,019.90	$7,754,013.69
45	$506,609.32	$2,620,625.43	$16,361,256.65
50	$667,162.99	$4,331,097.70	$34,498,278.44

Take a moment to review the table above. Note that at 5 years out, the rate of return makes some difference, but not a dramatic difference. By 15 years out, an individual would have 2.5 times as much at the 15% rate of return as the 5% rate of return. By 30 years out, the 10% rate of return is 2.7 times as much as the 5% rate of return and the 15% rate of return has accumulated 8.3 times the wealth. By 40 years out, an individual has invested $120,000 into her retirement savings (40 years at $3000 per year – with the potential for some of that $120,000 coming from the employer). The power of compounding has generated about $261,500 at 5%, nearly $1.5 million at 10%, and over $7.5 million at 15%. This example illustrates how powerful time and return are as tools for building wealth. Now it is time to show you how to do these and other time value of money calculations.

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3.2: Future Value

When you put your money in a savings account (or invest it in some fashion), you earn a certain return (sometimes called interest) in order to compensate you. Because of this, a dollar today is not worth the same amount as a dollar sometime in the future. Since you earn money on the dollar invested (or saved) today, you will have more than a dollar at some later future point (making a dollar today worth more than the same dollar received later). The specific amount that you will have at the future date is referred to as a Future Value.

Consider if you had $100 today and were able to earn 12% per year by putting that money in a savings account at XYZ bank. How much would you have in one year? Two years? Three years? At first, you might think that you would have $112 in one year, $124 in two years and $136 in three years as you would earn $12 per year in interest. However, this is WRONG! It ignores the concept of compounding. After one year, you would indeed have $112. However, during the second year you earn 12% interest on the full $112 instead of only the $100 you started with. Therefore, you will earn $13.44 (=112×0.12) in interest in the second year and have $125.44 in two years. During the third year, you will earn $15.05 (=125.44×0.12) in interest and have $140.49 in three years. Therefore, the Future Value of $100 for three years at 12% is $140.49. In other words, $100 today is equivalent to $140.49 received three years from now assuming that you can earn 12% interest annually.

Solving for Future Value

We have three ways to solve for the FV: formula, financial table, and financial calculator.

Method 1: Using a Formula to Find the FV

The first is directly with a formula. Under this method, we use the following formula:

$$FV = PV(1+k)^n$$

where

FV is the future value (in year n) for which we are trying to solve
PV is the present value (how much we have today)
k is the rate of return we are earning (also referred to as the interest rate, required return, growth rate, or discount rate)
n is the number of years which we will be saving (or investing) the money.

Method 2: Using a Table to Find the FV

The second method is to use Financial Tables, in Appendix A. Financial tables are cumbersome and don't allow us as much flexibility as other methods, so they will not be covered in this text.

Method 3: Using a Financial Calculator to Find the FV

The third method (and the method focused on here) is to use the financial calculator or spreadsheet. Each financial calculator follows the same basic ideas, but the specifics are different for each brand of calculator. The steps below are for the HP10BII, TI-BAII+ and TI-83/84. If this is the first time using your financial calculator, see the detailed instructions Setting up Your Financial Calculator, in Appendix B. Please pause here to read that and set up your financial calculator before proceeding.

Calculator Steps to Compute FV:

HP10BII	TI-BAII+	TI-83/84
Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter PV Step 5: Press the FV key	Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter PV Step 5: Press the CPT key Step 6: Press the FV key	Go to APPS⇒Finance⇒ TVM_Solver Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter PV Step 5: Move to FV line and press the ALPHA SOLVE key

Note: The order of steps 1-4 is not important. The FV answer will appear as a negative number, ignore the negative sign for now. For the TI-83/84 calculators your P/Y and C/Y on the onscreen display should both be 1 for now.

✔ Example 3.2.1: Finding FV using

Find the Future Value of $350 invested for 25 years at 9.5% per year.

Solution

Step 1: 25 N
Step 2: 9.5 I/YR
Step 3: 350 PV
Step 4: 0 PMT
Step 5: FV⇒

You should get a solution of $3383.93.

In other words, if we invest $350 today and let it compound at 9.5% per year for 25 years, we will have $3383.93 at the end of the 25th year.

Technically, you will get a value of -3383.93. The negative sign is an important aspect of financial calculators. The calculator is looking for the solution that balances both parties of a transaction. Here, since the $350 starting value was positive, the calculator assumes that this amount is being received today. If an individual receives $350, that individual needs to pay back $3383.93. Positive values represent cash inflows and negative values represent cash outflows. In a problem like this, it is not essential. However, later in the chapter, we will introduce problems where the cash flow direction is essential. Specifically, whenever there are nonzero values for two or three of the cash flows (PV, PMT, and/or FV), cash flow direction matters. In those cases, figure out if the cash flow is coming to you (available at that moment to spend) or the cash flow is going away from you (set aside into a savings plan). If the cash flow is coming to you, it is positive. If it is going away from you, it is negative. If we applied that logic in this example, the $350 PV would actually be -350. However, this would not change the value of the FV other than to make it positive.

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3.3: Present Value

The flip side of Future Value is Present Value. Future value tells us how much a certain amount of money will be worth at some future date assuming a certain rate of return. However, what if we know how much we are supposed to get at some point in the future and want to know what it is worth to us today? Now we must find the Present Value. Assume we are offered an opportunity to receive $200 at the end of two years (call it investment A). How much is this opportunity worth to us today assuming we could earn 8% by placing our money in a savings account (that has risk similar to investment A)? To answer this, we must ask how much we would need to place in a savings account today in order to have $200 at the end of the two years.

$$\begin{aligned} FV &= PV(1+k)^n \\ 200 &= PV(1.08)^2 \\ \frac{200}{(1.08)^2} &= PV \\ \$171.47 &= PV \end{aligned}$$

If we had $171.47 today and placed it in a savings account earning 8%, we would have $200 in two years (the same as through investment A). Assuming that investment A had the same degree of risk as our savings account, then we would buy investment A if it was available for less than $171.47 and put our money in the savings account if investment A cost more than $171.47. We could say that the present value of investment A is $171.47.

Solving for Present Value

We have three ways to solve for the PV: formula, financial table, and financial calculator.

Method 1: Using a Formula to Find the PV

The first is directly with a formula. Under this method, we use the following formula:

$$PV = \frac{FV}{(1+k)^n}$$

where

FV is the future value (in year n) that we plan to receive
PV is the present value (how much it is worth to us today)
k is the rate of return we can earn elsewhere (also referred to as the compound rate, required return, or discount rate)
n is the number of years which we will have to wait before receiving the money.

Method 2: Using a Table to Find the PV

The second method is to use financial tables and will not be covered in this text.

Method 3: Using a Financial Calculator to Find the PV

The third method is to use the financial calculator (or spreadsheet). Each financial calculator follows the same basic ideas, but the specifics are different for each brand of calculator. The steps below are for the HP10BII, TI-BAII+ and TI-83/84.

Calculator Steps to Compute PV

HP10BII	TI-BAII+	TI-83/84
Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter FV Step 5: Press the PV key	Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter FV Step 5: Press the CPT key Step 6: Press the PV key	Go to APPS⇒Finance⇒ TVM_Solver Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter FV Step 5: Move to PV line and press the ALPHA SOLVE key

Note: The order of steps 1-4 is not important. The PV answer will appear as a negative number, ignore the negative sign for now.

✔ Example 3.3.2: Finding PV Using the Financial Calculator

Find the Present Value of $5000 received 15 years from today with a 9.5% discount rate.

Solution

Step 1: 15 N
Step 2: 9.5 I/YR
Step 3: 0 PMT
Step 4: 5000 FV
Step 5: PV⇒

You should get a solution of $1281.62

In other words, if we are offered the opportunity to receive $5000 at the end of 15 years that is equivalent to receiving $1281.62 today.

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3.4: Annuities

The examples previously discussed are for situations where we have a specific amount today and want to know what it is worth at some point in the future (FV) or when we plan to receive a certain amount at some point in the future and want to know what it is worth today (PV). These are referred to as lump sum situations because there is only one cash flow that we are discounting or compounding.



An annuity is different in that with an annuity we have the same exact amount being received (or paid) at the end of each period over a number of periods. For example, if we win the lottery that is usually paid in equal installments over a twenty-five year period. A $1,000,000 jackpot would be paid at $40,000 per year for twenty-five years. This is said to be an annuity. (Technically the lottery is an "annuity due" because the first payment is paid today, or the beginning of the period, as opposed to the end of the period).

Timelines: Let us pause here for a moment to introduce an important tool used in time value of money – timelines. Timelines provide an aid that helps us better visualize what the cash flow stream looks like. Consider an annuity that pays $2000 per year for 4 years with an 8% discount rate. We can illustrate this on a timeline as follows:

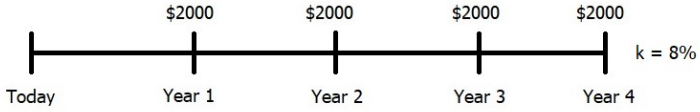


Figure 3.4.1: Annuity timeline

Note that the hashmarks represent the end of the time increment and the space between the hashmarks represent the time increment itself. In other words, the year 1 hashmark represents the end of year 1 where the annuity makes its first $2000 payment. Some students find timelines very helpful and use them for most time value of money problems while others use them less frequently. However, when we get to the section on complex time value of money problems later in this chapter, most students will find timelines quite beneficial.

Solving for Present Value of an Annuity

We have three ways to solve for the PV of an annuity: formula, financial table, and financial calculator.

Method 1: Using a Formula to Find the PV of an Annuity

The first is directly with a formula. Under this method, we use the following formula:

$$PVA = PMT\left(\frac{1-\frac{1}{(1+k)^n}}{k}\right)$$

where

PVA is the present value of the anticipated cash flow stream (annuity)
PMT is the annuity payment (how much we receive or save each period)
k is the rate of return we can earn elsewhere (also referred to as the compound rate, required return, or discount rate)
n is the number of periods which we will have to wait before receiving the money.

Method 2: Using a Table to Find the PV of an Annuity

The second method is to use financial tables and will not be covered in this text.

Method 3: Using a Financial Calculator to Find the PV of an Annuity

The third method is to use the financial calculator (or spreadsheet) which is what we will focus on. Let's walk through an example with the financial calculator. An investment that pays $100 at the end of each year for 4 years is an annuity (note that a clue for annuities is to look for the word "each' or "every" to indicate that the same cash flow is being repeated

multiple times). If we wanted to know what that investment is worth to us today and we had a 10% discount rate, we would be finding the present value of that annuity.

Calculator Steps to Compute PV of an Annuity

HP10BII	TI-BAII+	TI-83/84
Step 1: 4 N Step 2: 10 I/YR Step 3: 100 PMT Step 4: 0 FV Step 5: PV⇒	Step 1: 4 N Step 2: 10 I/YR Step 3: 100 PMT Step 4: 0 FV Step 5: Press the CPT key Step 6: Press the PV key	Go to APPS⇒Finance⇒ TVM_Solver Step 1: 4 N Step 2: 10 I/YR Step 3: 100 PMT Step 4: 0 FV Step 5: Move to PV line and press the ALPHA SOLVE key

Note: The order of steps 1-4 is not important. The PV answer will appear as a negative number, ignore the negative sign for now.

You should get a solution of $316.99

Solving for Future Value of an Annuity

As with the other TVM calculations we have encountered, there are 3 basic methods to solve for the FV of an annuity: formula, financial table, and financial calculator.

Method 1: Using a Formula to Find the FV of an Annuity

The first is directly with a formula. Under this method, we use the following formula:

$$FVA = PMT\left(\frac{(1+k)^n - 1}{k}\right) \tag{3.4.1}$$

where

FVA is the future value that our cash flow stream will grow to at the end of n periods
PMT is the annuity payment (how much we receive or save each period)
k is the rate of return we can earn elsewhere (also referred to as the compound rate, required return, or discount rate)
n is the number of periods which we will have to wait before receiving the money.

Method 2: Using a Table to Find the FV of an Annuity

The second method is to use financial tables. These tables are included in Appendix A and will not be covered in this text.

Method 3: Using a Financial Calculator to Find the FV of an Annuity

The third method is the financial calculator (or spreadsheet) approach. Let's walk through an example using the financial calculator to solve for the future value of an annuity. We want to save $1000 per year (at the end of each year) for 10 years at 12%. How much will this be worth at the end of the 10th year?

Calculator Steps to Compute FV of an Annuity

HP10BII	TI-BAII+	TI-83/84
Step 1: 10 N Step 2: 12 I/YR Step 3: 1000 PMT Step 4: 0 PV Step 5: FV	Step 1: 10 N Step 2: 12 I/YR Step 3: 1000 PMT Step 4: 0 PV Step 5: Press the CPT key Step 6: Press the FV key	Go to APPS⇒Finance⇒ TVM_Solver Step 1: 10 N Step 2: 12 I/YR Step 3: 1000 PMT Step 4: 0 PV Step 5: Move to FV line and press the ALPHA SOLVE key

Note: The order of steps 1-4 is not important. The FV answer will appear as a negative number, ignore the negative sign for now.

You should get a solution of $17,548.74

Note: Ordinary annuities (both present value and future value) assume that cash flows will arrive at the end of each period. Occasionally, you might encounter an annuity due (which means that cash flows arrive at the BEGINNING of each period). It is easy to adjust for this when using a financial calculator by changing the calculator from END of period cash flows to BEGINNING of period cash flows. This process is described in Setting up Your Financial Calculator in Appendix B (for the TI-83/84, it is just part of the onscreen display in the TVM_Solver).

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3.5: Solving for PMT, I/YR, or N

Sometimes you may need to find something other than the present value or future value. For instance, you may want to know how much you have to save per year to reach a certain future value (or how much you must earn as a rate of return or how many years it will take). If you are using a financial calculator, these are relatively easy. For example, assume you have $2000 saved already and want to save another $5000 per year to accumulate $80,000 after 10 years. What rate of return must you earn?

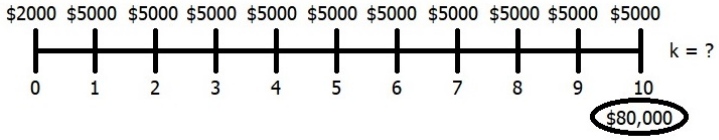


Figure 3.5.2: Rate of return needed to eary a fixed amount

Calculator Steps for the Solution

HP10BII	TI-BAII+	TI-83/84
Step 1: 10 N Step 2: 80000 FV Step 3: -5000 PMT Step 4: -2000 PV Step 5: I/YR	Step 1: 10 N Step 2: 80000 FV Step 3: -5000 PMT Step 4: -2000 PV Step 5: Press the CPT key Step 6: Press the I/YR key	Go to APPS⇒Finance⇒ TVM_Solver Step 1: 10 N Step 2: 80000 FV Step 3: -5000 PMT Step 4: -2000 PV Step 5: Move to I% line and press the ALPHA SOLVE key

Solution = 8.83%

Reminder: Either the PMT must be negative and the FV positive or the PMT positive and the FV negative. It doesn't matter which way you do it, but one must be negative and the other positive.

Solving for N and PMT is done along similar lines.

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3.6: Perpetuities

A Perpetuity is an annuity that lasts forever. While it is difficult to imagine a situation where an individual could buy a cash flow stream that will pay a fixed amount per year through infinity, perpetuities can be useful tools when dealing with long, constant cash flow streams. Consider someone wanting to fund a scholarship or plan for retirement where she is not sure how long she'll live. A perpetuity can provide a reasonable approximation in either of those situations.

How much would a perpetuity of $100 be worth assuming a discount rate of 10%? Remember this is $100 per year forever. It would seem that this would be worth an infinite amount. However, consider what would happen if you had $1000 today and could put it in the bank to earn 10% interest. You would receive $100 per year and never touch the principal. You would essentially be buying a $100 perpetuity (assuming the bank didn't change the interest rate). Therefore, a perpetuity has a finite value. The formula for finding the present value of a perpetuity is as follows:

$$PV = \frac{PMT}{k}$$

Note: When using this formula, always plug in k as a decimal so that 10% is 0.10

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3.7: Uneven Cash Flow Streams

Sometimes you will encounter a situation where you have more than one payment, but it is not the same each year. Remember that an annuity requires the payment to be the same each year. If you have multiple cash flows, but they are not the same, you have an uneven cash flow stream. In order to solve a problem like this, treat it as a series of single cash flows (or possibly a series of smaller annuities).

Net Present Value of an Uneven Cash Flow Stream

Consider the following example: you have an investment project that will pay the following cash flows:

Year 1 $1000
Year 2 $500
Year 3 $2000
Year 4 $2000

The discount rate is 15%. Find the Present Value.

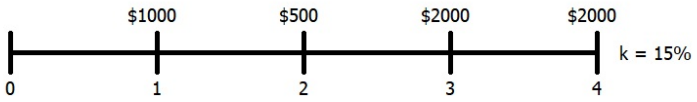


Figure 3.7.3: Net present value with a set discount rate

Calculator Steps to Compute PV of an Uneven Cash Flow Stream

HP10BII	TI-BAII+	TI-83/84
Step 1: Clear All Step 2: 0 CFj Step 3: 1000 CFj Step 4: 500 CFj Step 5: 2000 CFj Step 6: 2 Nj Step 7: 15 I/YR Step 8: NPV	Step 1: CF CLR Work Step 2: 0 Enter ↓ Step 3: 1000 Enter ↓↓ Step 4: 500 Enter ↓↓ Step 5: 2000 Enter ↓ Step 6: 2 Enter Step 7: NPV 15 Enter ↓ Step 8: CPT	Go to APPS⇒Finance⇒ Step 1: Select npv(Step 2: Enter the given information in the following format: npv(InterestRate, CF0, {CF Stream}, {CF Frequencies} npv(15,0,{1000,500,2000},{1,1,2} Step 3: Press the SOLVE key

Solution $3706.18

Note for HP10BII+: The Nj key is used to tell the calculator the number of times that the same cash flow will be received consecutively. If the cash flow only occurs once (in a row) then we do not need to use the Nj key. However, when we have the same cash flow multiple times in a row (such as the $2000 for two years), we can use the Nj key to tell the calculator that this $2000 will occur in two consecutive years.

Note for TI-BAII+: The F screen that appears after you enter a cash flow and down arrow is used to tell the calculator the number of times we have that same cash flow consecutively. If the cash flow only occurs once (in a row) then we do not F screen and just down arrow past it. However, when we have the same cash flow multiple times in a row (such as the 2000 for two years), we use

the F screen to tell this to the calculator. The calculator does not have a F screen after the initial cash flow, so we do not need the double down arrow after entering the initial CF.

The above calculator methods are referred to as your Cash Flow Register or Cash Flow Worksheet. It is essential that you always clear all/clear work before entering any cash flows. If you do not do this you will be adding cash flows to a previous problem instead of starting a new problem. The TI-83/84 does not utilize this type of register and does not need to be cleared.

Future Value of an Uneven Cash Flow Stream

The NPV function gives you the present value. You may alternatively want to know how much you will have at the END of the time period (solve for the future value). If this is the case, you start by solving for the NPV. Once you have that, use the 5-key approach to bring that present value forward to the end of the time horizon. For example, if we wanted to know what the above cash flow stream was worth at the END of the fourth year, we would start by solving for the NPV and get the same $3706.18 we calculated earlier. Then, we would go to our 5-key and solve for the future value as follows:

Step 1: 4 N
Step 2: 15 I/YR
Step 3: 3706.18 PV
Step 4: 0 PMT
Step 5: Solve for FV⇒$6482.13

When calculating the PV of an uneven cash flow stream, it should always be less than the sum of the cash flows. When calculating the FV of an uneven cash flow stream, it should always be more than the sum of the cash flows. Also, many financial calculators allow you to solve directly for the future value of an uneven cash flow stream. To see if yours does this, consult your user manual or ask your instructor.

Finding the discount rate of an Uneven Cash Flow Stream

We can also find the discount rate (I/Y) if we have uneven cash flows. Consider the following example: We have an investment project that will pay the following cash flows:

Year 1 $1000
Year 2 $500
Year 3 $2000

If the present value of this investment is $3000, what is the discount rate?

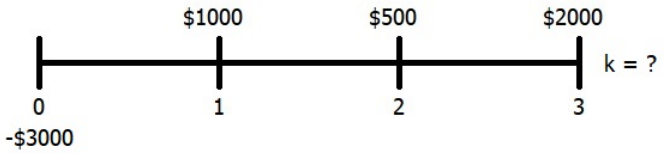


Figure 3.7.4: Finding the discount rate with an uneven cash flow stream

Calculator Steps to Compute I/Y of an Uneven Cash Flow Stream

HP10BII	TI-BAII+	TI-83/84
Step 1: Clear All Step 2: -3000 CFj Step 3: 1000 CFj Step 4: 500 CFj Step 5: 2000 CFj Step 6: IRR/YR⇒	Step 1: CF CLR Work Step 2: -3000 Enter ↓ Step 3: 1000 Enter ↓↓ Step 4: 500 Enter ↓↓ Step 5: 2000 Enter Step 6: IRR Step 7: CPT	Go to APPS⇒Finance⇒ Step 1: Select irr(Step 2: Enter the given information in the following format: irr(CF0,{CF Stream},{CF Frequencies}. irr(-3000,{1000,500, 2000},{1,1,1} Step 3: Press the SOLVE key

Solution 7.06%

Note for HP10BII+: The IRR/YR is not the same key as you used for the I/YR, but it serves a similar role — finding the discount rate (or rate of return) for a cash flow stream. The difference is that they I/YR key only works with single cash flows or annuities while the IRR/YR key works with uneven cash flows.

Note for TI-BAII+: The IRR is not the same key as you used for the I/Y, but it serves a similar role — finding the discount rate (or rate of return) for a cash flow stream. The difference is that the I/Y key only works with single cash flows or annuities while the IRR key works with uneven cash flows.

CF0 will always be negative when calculating IRR. If you end up with an error message when calculating the IRR, one of the first things you should do is make sure that your CF0 was a negative value.

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3.8: Non-Annual Compounding

The more frequently interest is compounded, the greater the effective yield on our savings. Many banks use non-annual compounding periods (monthly, daily, etc). In order to make comparisons, we must find the effective annual yield. This tells us how much we are earning on an annual basis.

Using a Formula to Find the Effective Annual Yield

The formula for effective annual yield is as follows:

$$k_{eff} = \left(1 + \frac{k_{nom}}{m}\right)^{m} - 1$$

where

k_{eff} is the effective annual yield
k_{nom} is the nominal or stated yield
m is the number of compounding periods per year

For example, what is the effective interest rate of 8% compounded daily?

$$k_{eff} = \left(1 + \frac{0.08}{365}\right)^{365} - 1$$

Note: Be careful not to round when you take .08/365 or you will end up with significant error after compounding it 365 times.

Using a Calculator to Find the Effective Annual Yield

As an alternative, you could use your financial calculator to find the effective interest rate. Again, using 8% compounded daily.

Calculator Steps to Find the Effective Annual Yield

HP10BII	TI-BAII+	TI-83/84
Step 1: 365 SHIFT P/YR Step 2: 8 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I Conv I Conv is the shift of the 2 key Step 2: 8 Enter ↓↓ Step 3: 365 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF(Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(8,365) Step 3: Press SOLVE

Solution 8.33%.

Note for HP-10BII+: You have changed your payments per year when doing this calculation. If you go back to another TVM problem, be sure to reset your payments per year to one.

✔ Example 3.8.3: Solve a Problem Involving Non-Annual Compounding

We could also look at non-annual compounding with loans or investments. For example, consider a mortgage loan. You are borrowing $80,000 at an 8% rate with monthly payments for 30 years (note that non-annual annuities and lump sums work best with calculators), what is your monthly payment?

Solution

Step 1: Convert your calculator to monthly payments by entering 12 P/YR
Step 2: -80000 PV
Step 3: 8 I/YR
Step 4: 360 N (30 years at 12 months per year)

Step 5: 0 FV
Step 6: PMT

Solution = $587.01 per month

Be VERY careful if you change your payments per year to change it back to 1 P/YR when you are done. Also, each calculator is slightly different in how it sets the periods per year. Be sure to review the Setting up Your Financial Calculator in Appendix B for calculator specific instructions.

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3.9: Return to Future Value Tables

Remember the table of future values that we used to start the chapter? We said that the value of $250 set aside every month for 40 years at 10% would be $1,581,019.90. We also suggested that by the end of this chapter, you would be able to do that calculation on your own. Well, now you can.

Step 1: Convert your calculator to monthly payments by entering 12 P/YR
Step 2: 0 PV
Step 3: 10 I/YR
Step 4: 480 N (40 years at 12 months per year)
Step 5: 250 PMT
Step 6: FV

Solution = $1,581,019.90

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3.10: Complex Time Value of Money Problems

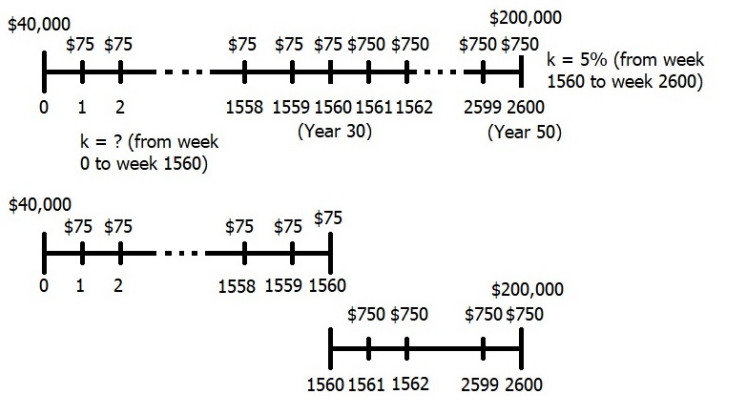
Everything above this point completes your "Time Value of Money Toolbox." All the examples to this point have been straight-forward situations. However, sometimes we have what we refer to as complex time value of money problems where there are multiple issues that need addressed within one problem. One of the most common examples of this would be a retirement problem where you have X dollars available today, want to be able to withdraw a certain cash flow stream at retirement throughout your retirement years and want to find out how much you need to save each month until retirement between now and the day you retire to achieve your goal. In order to solve a problem like this, you need to visualize (a time line is very helpful) what information you have and what you are missing (that you need to solve for). You will often need to break this down into multiple steps.

✔ Example 3.10.4: Solve a Complex Time Value of Money Problem

Consider a situation where you are saving for retirement. You currently have $40,000 saved and would like to save an additional $75 per week for the next 30 years. You estimate that when you retire (30 years from today), you want to be able to withdraw $750 each week for the next 20 years and have $200,000 left over at the end of the 20-year retirement period. Assuming you earn 5% during retirement, what rate of return must you earn during the next 30 years to meet your goal?

Solution

One way to approach this is to start with a timeline. Note that each period is one week and there are 52 weeks per year. This means that we will have 1560 periods until retirement (1560 = 30×52) and another 1040 periods until the end of retirement (1040 = 20×52). This provides a total of 2600 periods for the entire 50 year time (2600 = 1560 + 1040). Once we've created the timeline, we can split it into two timelines. Timeline one will begin today and go to retirement (period 1560) and timeline 2 will begin at retirement (also period 1560) and go to the end of the retirement time frame (period 2600). Here, the timelines help us visualize the information that we know and what we need to find out (specifically our rate of return we must earn over the first 30 years).



Now we can start the calculations. To start, you need to figure out how much you will require at the end of the 30 years. This is the amount you want to have when you retire.

Step 1: Solve for how much you need at retirement.

Set your calculator to 52 periods per year to reflect weekly withdraws during retirement

Set your N to 1040 (52 periods per year for 20 years = 1040 weekly periods)

Set your PMT to 750 (to reflect the weekly withdraw)

Set your FV to 200,000 (to reflect the amount left over)

Set your I/YR to 5 (for your rate of return during retirement)

Solve for PV ⇒$566,527.38

Note – your PMT and FV need to be the same sign. You can make them both positive or both negative, but they are both flowing in the same direction so must be the same sign.

Step 2: Now that you know how much you need when you retire ($566,527.38), you can calculate what rate of return you need to earn over the next 30 years to get there.

Keep your calculator set to 52 periods per year as you are making weekly contributions

Set your N to 1560 (52 periods per year for 30 years = 1560 weekly periods)

Set your PV to -40,000 (to reflect the initial $40,000 contribution)

Set your PMT to -75 (to reflect your weekly $75 contribution)

Set your FV to 566,527.38 (to reflect how much you need at retirement)

Solve for I/YR ⇒5.98%

Note – your PV and PMT both need to be the same sign. Again, you can make them positive or negative, but they are both flowing in the same direction. The FV needs to be the opposite sign. The easiest way to think of this is that you are giving up the $40,000 today and the $75 per week in order to get back the $566,527.38 30 years from today.

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3.11: Key Takeaways

Key Takeaways

Time value of money is one of the most powerful and most important concepts in finance. It essentially is as simple as recognizing that because we can earn a return on our money, the value of money changes depending on when it is received or spent. One dollar today is worth more than one dollar received next year. The value of the dollar initially is referred to as a present value while the value of the dollar at a later point in time is referred to as the future value. Compound interest implies that money will grow exponentially over time instead of linearly. This means that relatively small increases in rates of return or time horizons have more power to increase wealth. After completing this chapter, you should be comfortable performing many calculations to see exactly how time value of money can work for you.

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3.12: Exercises

Exercise 3.12.1

Explain why $1 received today is worth more than $1 received one year from today.

Answer

$1 received today is worth more than $1 received one year today because as soon as we have the money we can start making it work for us earning a positive rate of return. If I earn 5% interest, then having the $1 today means I get an extra 5 cents. The earlier I get the money, the more time I have to make it work in my favor.

Exercise 3.12.2

What do we mean when we refer to an annuity? How is an annuity different from an annuity due?

Answer

An annuity refers to an equal periodic cash flow stream. While the equal cash flows arrive at the END of each period for an annuity, they arrive at the BEGINNING of each period for an annuity due.

Exercise 3.12.3

What is the relationship between present value and future value?

Answer

Present Value and Future values are just flip sides of the same coin. Present value tells us what the cash flow is worth to us today while future value tells us what the cash flow will grow to over time. Once we have one, we can find the other.

Exercise 3.12.4

How do we determine the appropriate discount rate to use when finding present value?

Answer

The appropriate discount rate to use when finding present value is the rate of return we can earn on other investments of similar risk. The idea of present value is that it tells us how much a future cash flow is worth to us today. The value of this future cash flow is exactly equal to what we would have to invest today to duplicate it. However, we need to control for risk. Riskier cash flows should be discounted at a higher rate because they are worth less to us. Note that the appropriate discount may change over time as market rates of interest change over time. This will play a large part in our valuation chapters starting with Chapter 6 on bond valuation.

Exercise 3.12.5

Why is compounding on a monthly basis better for us than compounding on an annual basis?

Answer

Compounding on a monthly basis is better than annual because it allows us to start earning interest on interest sooner. Not only does the principle work for us, but so does the interest.

Reminder for calculation exercises: When using the 5-key approach with the TI-BAII+ , you must press CPT and then what you want to solve – for instance in Problem 1a, your last step would be CPT FV. With the HP, you just

press what you want to solve – for instance in Problem 1a, your last step would be FV. With the TI-83/84 move the cursor to highlight the variable you want to find and then press SOLVE.

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3.13: Problems

Problem 3.13.1

Determine the answer to each of the following questions.

a. Find the Future Value of $2500 invested today at 11% for 10 years.
b. Find the Future Value of $2500 invested today at 11% for 30 years.
c. Find the Present Value of $6000 received 10 years from today if the discount rate is 5%.
d. Find the Present Value of $6000 received 10 years from today if the discount rate is 10%.
e. Find the Future Value of $3000 per year (at the end of each year) invested at 6% for 30 years.
f. Find the Future Value of $3000 per year (at the end of each year) invested at 12% for 30 years.
g. Find the Present Value of $4000 per year (at the end of each year) if the discount rate is 15% for 20 years.
h. Find the Present Value of $4000 per year (at the end of each year) if the discount rate is 15% for 40 years.

Answer

Part 1a

Step 1: 10 N
Step 2: 11 I/Y
Step 3: 2500 PV
Step 4: 0 PMT
Step 5: FV⇒ $7,098.55

Part 1b

Step 1: 30 N
Step 2: 11 I/Y
Step 3: 2500 PV
Step 4: 0 PMT
Step 5: FV⇒ $57,230.74

Part 1c

Step 1: 10 N
Step 2: 5 I/Y
Step 3: 6000 FV
Step 4: 0 PMT
Step 5: PV⇒ $3,683.48

Part 1d

Step 1: 10 N
Step 2: 10 I/Y
Step 3: 6000 FV
Step 4: 0 PMT
Step 5: PV⇒ $2,313.26

Part 1e

Step 1: 30 N
Step 2: 6 I/Y
Step 3: 0 PV
Step 4: 3000 PMT
Step 5: FV⇒ $237,174.56

Part 1f

Step 1: 30 N
Step 2: 12 I/Y
Step 3: 0 PV
Step 4: 3000 PMT
Step 5: FV⇒ $723,998.05

Part 1g

Step 1: 20 N
Step 2: 15 I/Y
Step 3: 4000 PMT
Step 4: 0 FV
Step 5: PV⇒ $25,037.33

Part 1h

Step 1: 40 N
Step 2: 15 I/Y
Step 3: 4000 PMT
Step 4: 0 FV
Step 5: PV⇒ $26,567.11

? Problem 3.13.2

Find the interest rates implied by each of the following:

a. You borrow $1500 today and promise to repay the loan by making a single payment of $2114.00 in 5 years.
b. You invest $500 today and receive a promise of receiving back $193.50 for each of the next 4 years.

Answer

Part 2a

Step 1: 5 N
Step 2: 2114 FV
Step 3: -1500 PV
Step 4: 0 PMT
Step 5: I/Y ⇒ 7.10%

Part 2b

Step 1: 4 N
Step 2: 0 FV
Step 3: -500 PV
Step 4: 193.50 PMT
Step 5: I/Y ⇒ 20.10%

? Problem 3.13.3

If $2000 is invested today at a 12% nominal interest rate, how much will it be worth in 15 years if interest is compounded

a. Annually
b. Quarterly

c. Monthly
d. Daily (365-days per year)

Answer

Part 3a

Step 1: 15 N
Step 2: 12 I/Y
Step 3: 2000 PV
Step 4: 0 PMT
Step 5: FV⇒ $10,947.13

Part 3b

Step 1: Set P/YR to 4
Step 2: 60 N
Step 3: 12 I/Y
Step 4: 2000 PV
Step 5: 0 PMT
Step 6: FV⇒ $11,783.21

Part 3c

Step 1: Set P/YR to 12
Step 2: 180 N
Step 3: 12 I/Y
Step 4: 2000 PV
Step 5: 0 PMT
Step 6: FV⇒ $11,991.60

Part 3d

Step 1: Set P/YR to 365
Step 2: 5475 N
Step 3: 12 I/Y
Step 4: 2000 PV
Step 5: 0 PMT
Step 6: FV⇒ $12,095.72
Remember to Set P/YR back to 1.

Problem 3.13.4

How long will it take your money to triple given the following interest rates?

a. 5%
b. 10%
c. 15%

Answer

Part 4a

Step 1: 3 FV
Step 2: 5 I/Y
Step 3: -1 PV

Step 4: 0 PMT
Step 5: N⇒ 22.52 years

Part 4b

Step 1: 3 FV
Step 2: 10 I/Y
Step 3: -1 PV
Step 4: 0 PMT
Step 5: N⇒ 11.53 years

Part 4c

Step 1: 3 FV
Step 2: 15 I/Y
Step 3: -1 PV
Step 4: 0 PMT
Step 5: N⇒ 7.86 years

? Problem 3.13.5

After graduating from college you make it big — all because of your success in business finance. You decide to endow a scholarship for needy finance students that will provide $5000 per year indefinitely, beginning 1 year from now. How much must be deposited today to fund the scholarship under the following conditions.

a. The interest rate is 10%
b. The interest rate is 10% and the first payment is made 6 years from today instead of 1 year from today.

Answer

Part 5a

PV=PMT/k
PV=$5000/.10
PV=$50,000

Part 5b

Now, the first payment is in year 6, so when we solve for the perpetuity we get the amount we need to have at the end of year 5 ⇒ $50,000. In order to find out how much we need to invest now to have $50,000 at the end of year 5, we solve for PV

Step 1: 5 N
Step 2: 10 I/Y
Step 3: 50000 FV
Step 4: 0 PMT
Step 5: PV⇒ $31,046.07

? Problem 3.13.6

Find the present value of the following cash flow stream if the discount rate is 12%:

Years 1-10 $4000 per year
Years 11-15 $6000 per year
Years 16-20 $8000 per year

Answer

Solution: $34,833.37. Calculator steps are below.

HP10BII+	TI-BAII+	TI-83/84
Step 1: Clear All Step 2: 0 CFj Step 3: 4000 CFj Step 4: 10 Nj Step 5: 6000 CFj Step 6: 5 Nj Step 7: 8000 CFj Step 8: 5 Nj Step 9: 12 I/YR Step 10: NPV	Step 1: CF CLR Work Step 2: 0 Enter ↓ Step 3: 4000 Enter ↓ Step 4: 10 Enter ↓ Step 5: 6000 Enter ↓ Step 6: 5 Enter ↓ Step 7: 8000 Enter ↓ Step 8: 5 Enter Step 9: NPV 12 Enter ↓Step 10: CPT	Go to APPS⇒Finance⇒ Step 1: Select npv(Step 2: Enter the given information in the following format: npv(InterestRate, CF0, {CF Stream}, {CF Frequencies} npv(12,0,{4000,6000,8000},{10,5,5} Step 3: Press the SOLVE key

Problem 3.13.7

Add exercises text here.

Answer

Solution: $77,129.07. Calculator steps are below.

HP10BII+	TI-BAII+	TI-83/84
Step 1: Clear All Step 2: 0 CFj Step 3: 3000 CFj Step 4: 5 Nj Step 5: 7500 CFj Step 6: 9000 CFj Step 7: 9 Nj Step 8: 12,000 CFj Step 9: 15 Nj Step 10: 8.75 I/YR Step 11: NPV	Step 1: CF CLR Work Step 2: 0 Enter ↓ Step 3: 3000 Enter ↓ Step 4: 5 Enter ↓ Step 5: 7500 Enter ↓↓ Step 6: 9000 Enter ↓ Step 7: 9 Enter ↓ Step 8: 12,000 Enter ↓ Step 9: 15 Enter Step 10: NPV 8.75 Enter ↓ Step 11: CPT	Go to APPS⇒Finance⇒ Step 1: Select npv(Step 2: Enter the given information in the following format: npv(InterestRate, CF0, {CF Stream}, {CF Frequencies} npv(8.75,0,{3000,7500,9000,12000}, {5,1,9,15} Step 3: Press the SOLVE key

Second, solve for FV using 5-key approach:

Step 1: 30 N
Step 2: 8.75 I/Y
Step 3: 77,129.07 PV
Step 4: 0 PMT
Step 5: FV⇒ $955,203.85

Problem 3.13.8

Find the value of the following cash flow stream at the end of year 30 if the rate of return is 8.75%:

Years 1-5 $3000 per year
Year 6 $7500
Years 7-15 $9000 per year
Years 16-30 $12,000 per year

Answer

Part 8a

k_{eff}=9.00%

Part 8b

Solution: 9.31%

Formula: $k_{eff}=[1+(.09/4)]^4-1=9.31\%$ or
Calculator:

HP10BII+	TI-BAII+	TI-83/84
Step 1: 4 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I Conv Step 2: 9 Enter ↓↓ Step 3: 4 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF(Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(9,4) Step 3: Press SOLVE

Part 8c

Solution: 9.38%

Formula: $k_{eff}=[1+(.09/12)]^{12}-1=9.38\%$ or
Calculator:

HP10BII+	TI-BAII+	TI-83/84
Step 1: 12 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I Conv Step 2: 9 Enter ↓↓ Step 3: 12 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF(Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(9,12) Step 3: Press SOLVE

Part 8d

Solution: 9.42%

Formula: $k_{eff}=[1+(.09/365)]^{365}-1=9.42\%$ or
Calculator:

HP10BII+	TI-BAII+	TI-83/84
Step 1: 365 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I ConvI Step 2: 9 Enter ↓↓ Step 3: 365 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF(Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(9,365) Step 3: Press SOLVE

Note: If you are using the HP, be sure to set P/YR back to 1 after finishing 8d.

Problem 3.13.9

Your firm has a retirement plan that matches all contributions on a one-to-two basis. That is, if you contribute $3000 per year, the company will add $1500 to make it $4500. The firm guarantees a 9% return on your investment. Alternatively, you can "do-it-yourself" and you think you can earn 12% on your money by doing it this way. The first contribution will be made 1 year from today. At that time, and every year thereafter, you will put $3000 into the retirement account. If you want to retire in 25 years, which way are you better off?

Answer

Company Plan	Do-it-Yourself Plan
Step 1: 25 N Step 2: 9 I/Y Step 3: 0 PV Step 4: 4500 PMT Step 5: FV⇒ $381,154.03	Step 1: 25 N Step 2: 12 I/Y Step 3: 0 PV Step 4: 3000 PMT Step 5: FV⇒ $400,001.61

Problem 3.13.10

Jen is planning for retirement. She plans to work for 32 more years. She currently has $15,000 saved and, for the next 15 years, she can save $6,000 at the end of each year. Fifteen years from now, she wants to buy a weekend vacation home that she estimates will require her to withdraw $100,000. How much will she have to save in years 16 through 32 so that she has exactly $750,000 saved when she retires? Assume she can earn 9% throughout the 32-year period.

Answer

Step 1 ⇒ How much will Jen have saved immediately before purchasing vacation home?

15 N
9 I/Y
-15000 PV
-6000 PMT
FV⇒ $230,802.73

Note that I made both the 15,000 and the 6000 negative. That is because Jen's 15,000 that she has already saved is equivalent to a cash outflow (set aside today so it can compound) and the $6000 she is saving at the end of each year are also effectively outflows (set aside so they can compound until 15 years from now). After 15 years, we will have $230,802.73 available for us to withdraw (equivalent to a cash inflow). While I made the $15,000 and $6000 negative, you could also leave them both positive…just make sure the both are the same sign.

Step 2 ⇒ How much will Jen have immediately after withdrawing $100,000 for the purchase of a vacation home?

$230,802.73 – $100,000 = $130,802.73

Step 3 ⇒ How much will Jen have to save at the end of each year for the remaining years (17) to accumulate $750,000?

17 N
9 I/Y
-130,802.73 PV
750,000 FV
PMT ⇒ $4,974.72

Note that it is 17 years (not 16) as we have the initial 15 + the subsequent 17 to give us 32 years (the full time horizon). Also, note that the PV needs to be negative (we are setting aside the 130,802.73 at the start of the last 17 years) and the FV positive (so we can get $750,000 at the end of our time horizon). While I didn't put a negative sign in front of it, you should

note that your PMT is also negative as you are giving up the $4974.72 per year (along with the $130,802.73) in order to get the $750,000 at the end.

Problem 3.13.11

You are a recent college graduate and want to start saving for retirement. You plan to save $2000 per year for the next 15 years. After that you will stop contributing and just allow your savings to accumulate for another 20 years. Your twin brother would rather wait awhile before he starts saving. He is not going to put away anything for the next ten years, then he will start making contributions at the end of each year for the final 25 years. You both anticipate earning a 9.5% rate of return on your investments. How much must your brother put away at the end of each year to have the same amount of money for retirement as you?

Answer

Step 1 ⇒ How much will you have at the end of year 15?

15 N
9.5 I/Y
0 PV
2000 PMT
FV ⇒ 61,080.46

Step 2 ⇒ How much will this $61,080.46 grow to over the remaining 20 years?

20 N
9.5 I/Y
61,080.46 PV
0 PMT
FV 375,132.49

Step 3 ⇒ Since your brother will save nothing for the first 10 years, he will start at the end of year 10 with nothing and have 25 years to accumulate $375,132.49. How much must he save each year to accomplish this?

25 N
9.5 I/Y
0 PV
375,132.49 FV
PMT ⇒ $4,111.22

Problem 3.13.12

You are considering purchasing a new home. The house you are looking at costs $120,000 and you plan to make a 10% down payment. You checked with a bank and they have two mortgage loan options for you. The first is a 15-year mortgage at 6.25%. The second is a 30-year mortgage at 6.50%.

a. What are your monthly payments for each loan?
b. What is the total you will pay over the life of the loan for each loan?
c. After one year you get a job transfer and have to sell the house. What is the payoff value of your remaining loan balance (hint: find PV of remaining payments)?
d. Over the first year, how much did you pay in principal and how much did you pay in interest?

Answer

Part 12a

15-Year Mortgage	30-Year Mortgage
Set P/YR to 12 Step 1: 180 N Step 2: 6.25 I/Y Step 3: 108,000 PV Step 4: 0 FV Step 5: PMT ⇒ $926.02	Set P/YR to 12 Step 1: 360 N Step 2: 6.5 I/Y Step 3: 108,000 PV Step 4: 0 FV Step 5: PMT ⇒ $682.63

Part 12b

15-Year Mortgage ⇒ $926.02×180 = $166,683.60
30-Year Mortgage ⇒ $682.63×360 = $245,746.80

Part 12c

15-Year Mortgage	30-Year Mortgage
Set P/YR to 12 Step 1: 168 N Step 2: 6.25 I/Y Step 3: 926.02 PMT Step 4: 0 FV Step 5: PV ⇒ $103,511.02	Set P/YR to 12 Step 1: 348 N Step 2: 6.5 I/Y Step 3: 682.63 PMT Step 4: 0 FV Step 5: PV ⇒ $106,792.31

Part 12d

15-Year Mortgage

Total First Year Payments (15-Year) = $926.02×12 = $11,112.24
Principal Paid (15-Year) = $108,000 – $103,511.02 = $4488.98
Interest Paid (15-Year) = $11,112.24 – $4488.98 = $6623.26

30-Year Mortgage

Total First Year Payments (30-Year) = $682.63×12 = $8191.56
Principal Paid (30-Year) = $108,000 – $106,792.31 = $1207.69
Interest Paid (30-Year) = $8191.56 – $1207.69 = $6983.87

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3.14: References and Attributions

Student Resources

Table: Future Value of $250 per month investment, in Appendix B

Financial Tables, in Appendix A

Setting up Your Financial Calculator, in Appendix B

TVM 5-Key Approach Guided Tutorial with HP10BII+, in Appendix B

TVM 5-Key Approach Guided Tutorial with TI-BAII+, in Appendix B

TVM 5-Key Approach Guided Tutorial with TI-83 or TI-84, in Appendix B

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CHAPTER OVERVIEW

4: Valuation and Bond Analysis

Learning Objectives

After completing this chapter, students should be able to

- Define valuation and identify the three steps in the valuation process
- Apply the three-step valuation process to bonds
- Calculate the value of a bond given the coupon rate, required return, and time to maturity of the bond
- Identify the three primary relationships between bond prices and interest rates
- Explain the concept of the yield-to-maturity and calculate the yield-to-maturity for a bond given the bond's price, coupon rate and time to maturity
- Explain the concept of a call provision
- Calculate the yield-to-call for a bond given the bond's price, coupon rate and time until first call date
- Identify which is more relevant to an investor regarding the coupon rate, yield-to-maturity, and yield-to-call
- Define key bond terms

4.1: Valuation Concepts
4.2: Three-Step Valuation Process
4.3: Bond Pricing
4.4: Bond Prices and Interest Rates
4.5: Yield-to-Maturity (YTM)
4.6: Call Provisions
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4.1: Valuation Concepts

Valuation Definition – The value of any financial asset/security is equal to the present value of all cash flows which that asset/security will generate over its lifetime discounted back to today at an appropriate discount rate.

A financial security refers to an instrument such as a stock or bond that represents a financial claim against assets. The primary difference among different assets/securities (such as stocks vs. bonds vs. corporate projects) is that each asset/security will have a different cash flow stream and a different discount rate depending on the riskiness of that cash flow stream. For example, as was covered in Chapter One, bonds typically have a fixed cash flow stream over a finite time horizon while stocks typically have a variable cash flow stream over a potentially infinite time horizon. Stocks also tend to be riskier than bonds, which results in investors demanding higher rates of return to compensate for the additional risk. While financial securities may have different characteristics, the concept of valuation is essentially the same regardless of the specific security.

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4.2: Three-Step Valuation Process

While the definition above is more conceptual, we can easily turn it into an applied process to value all stocks, bonds, or other investment opportunities. The process is as follows:

1. Forecast all cash flows which that asset/security is expected to generate over its lifetime.
2. Determine an appropriate discount rate
3. Solve for the present value of the expected cash flows in step one given the discount rate from step two.

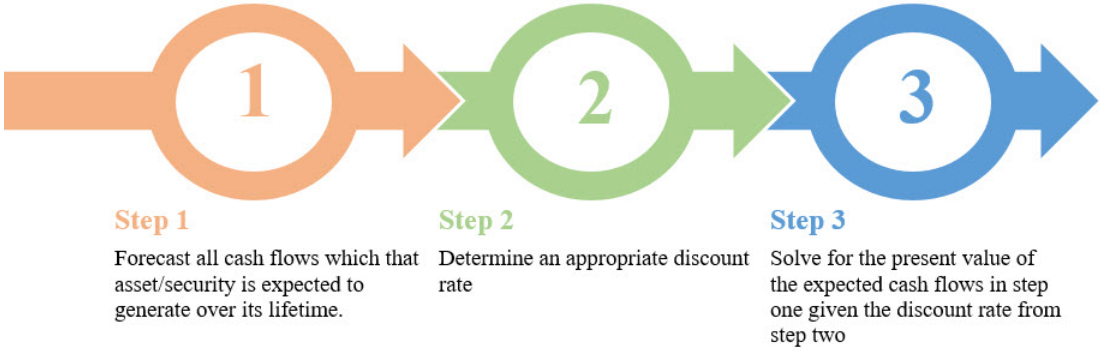


Figure 4.2.1: Three step valuation process

What changes as we deal with different stocks, bonds, and other investment opportunities is not the process, but how we apply the process. For instance, estimating the cash flows for bonds is simple as the cash flow is generally fixed in size and covers a specific, finite time. On the other hand, estimating the cash flow stream for stocks is trickier because the cash flows are usually variable and potentially infinite. As stocks tend to be riskier than bonds, a higher discount is usually applied. Finally, solving for PV is a straightforward application of the 5-key approach for bonds while it typically involves formulas and/or the cash-flow worksheet for stocks.

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4.3: Bond Pricing

As stated above, the value of a bond is equal to the present value of the cash flows that the particular bond will pay. Bonds pay cash flows in two different ways. First, bonds pay a coupon payment. Typically, every six months the bondholder receives a coupon payment determined by the stated coupon rate. When bonds are issued, they state the coupon rate which typically (in this class we will assume always) remains fixed over the life of the bond. This is the percentage of par value that the bondholder will receive in annual interest payments (while technically different bonds may have different par values, most corporate bonds have a standard par value of $1000 which we will use as the standard for this class…**always assume the par value is $1000 unless specifically stated otherwise**). To calculate the amount the bondholder will receive every six months, just take the annual payment and divide by two. In addition to the coupon payment, at the end of the bonds life the bondholder will receive the par value ($1000). Sometimes this par value is referred to as maturity value or face value. Thus, to find the price (or value) of a bond (B0), we want to find the present value of the coupon payments and the par value.

> Consider the following example which we will walk through using the financial calculator. I want to purchase a bond that pays a 6% coupon and want to earn an 8% return on my investment. The bond has 20 years remaining until maturity. The first thing I need to do is figure out what my coupon payment is going to be.
> Annual Coupon ⇒ 0.06*$1000 = $60
> Semi-Annual (every 6 months) Coupon ⇒ $60/2 = $30

This tells me that I am going to receive an interest payment of $30 twice per year for each of the next 20 years **plus** at the end of the 20th year, I will receive $1000. This is my cash flow stream which must be discounted back to today at the 8% required return that I want to receive.

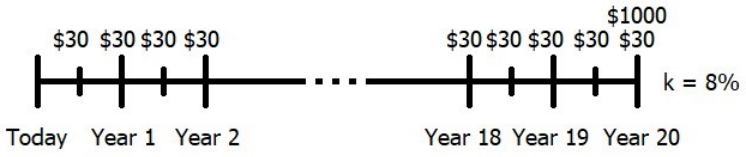


Figure 4.3.1: Example of bond pricing

Because I am receiving 2 coupon payments each year, I must be careful to set my calculator to 2 periods per year (and remember that now N represents the number of periods – 40 – instead of the number of years – 20.) This is done as follows:

Financial Calculator:

> 2 P/Y
> 40 N
> 8 I/YR
> 30 PMT
> 1000 FV
> Compute PV ⇒ $802.07

In other words, if we require an 8% return on this bond we would be willing to pay no more than $802.07 to purchase it today.

Note that the PMT and the FV are both positive. They could also both be negative. The key is to recognize that they should both be the same sign. Why is this? From the perspective of the bondholder, we will RECEIVE both an annual cash flow (the coupon payment ⇒ PMT) and a single cash flow at maturity (the par value ⇒ FV). Since we receive these, they should be positive. If we took the perspective of the bond ISSUER, both of these would be payments and thus be negative. The key is that both the PMT and the FV are flowing in the same direction and thus must have the same sign

One thing that can be confusing with bonds is that there are two “rates” that are mentioned in bond pricing. The first is the coupon rate and the second is the discount rate. Note that the discount rate can take on many names — market rate of interest, interest rate, rate of return, required return and yield-to-maturity — they all mean the same thing. In order to avoid confusion, try to think of the coupon rate as a cash flow rather than a rate. The coupon rate tells us what our yearly payment will be. It is not a rate of return and

it doesn't change over time. The discount rate (market rate of interest, interest rate, rate of return, required return, and/or yield-to-maturity) tells us what rate of return we want to earn on our investment in this bond. It can (and will) change over time — sometimes increasing and sometimes decreasing — depending on market conditions.

In practice, determining the discount rate is one of the most challenging aspects for a bond investor. It primarily depends on the perceived risk of the bond and the expected inflation rate that is anticipated over the life of the bond. Note that while there are ways to approximate both of these components, they both have a subjective aspect to them. Neither the actual risk of the bond nor the realized inflation rate that will occur over the life of the bond are known today. Therefore, these values are based on educated guesses from an individual's perspective. The market's yield-to-maturity (a measure we will discuss shortly) provides the consensus opinion of what the appropriate required return should be.

If the bond price is trading for more than its par value (bond price is greater than $1000), the bond is said to be trading for a **premium**. Alternatively, if the bond price is trading for less than its par value (bond price is less than $1000), the bond is said to be trading for a **discount**.

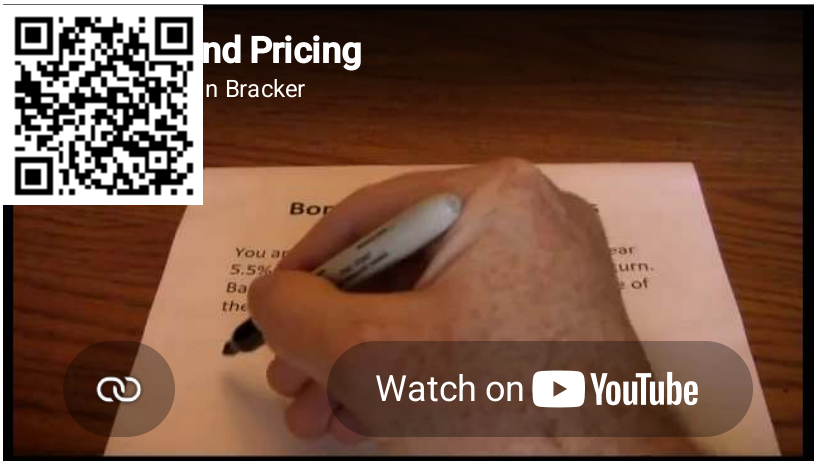
The premium or discount will diminish over time as the bond approaches maturity. This is because at maturity, the bond will be worth the $1000 par value. Therefore, assuming required returns (market rates of interest) stay constant until maturity, the bond price will follow the pattern in the graph below. In practice, the lines will not be as smooth as required returns (market rates of interest) tend to fluctuate over time.



Figure 4.3.2:Price of Bond Selling at Discount vs. Premium over Time

Source of Graph: Bogleheads

Video Bond Pricing



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4.4: Bond Prices and Interest Rates

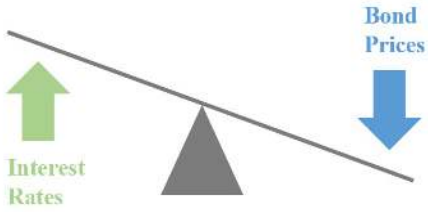


Figure 4.4.1: Relationship between bond pricing and interest rates

As market rates of interest rise, bond prices will fall. Alternatively as market rates of interest fall, bond prices will rise. **Bond prices and the market rate of interest are inversely related**. This is because the cash flow stream you receive from the bond is fixed. As market rates of interest go up, you are discounting that fixed cash flow stream back at a higher rate which makes it less valuable. As market rates of interest go down, you are discounting that fixed cash flow stream back at a lower rate which makes it more valuable. The market rate of interest is the rate of interest available on similar risk securities purchased today. Also, we can think of the Yield-to-Maturity (more on this in a minute) as the market rate of interest. Keep in mind when we say interest rates went up or down, we are talking about the YTM, NOT the coupon rate. The coupon rate does not change.

This relationship is stronger for bonds with a longer time until maturity. Therefore, a 20-year bond will have a higher premium than a similar 3-year bond after interest rates have declined. The rationale for this relates again to the time value of money. A bond with a greater time to maturity will have a longer fixed cash flow stream which means it will be affected to a greater degree by changes in interest rates. As a side note, this is a little bit of a simplification. The sensitivity to interest rates is technically affected by a combination of time to maturity and the coupon rate (duration), but that is beyond the scope of this class. For our purposes, it will suffice to know that the greater the time to maturity, the more sensitive the bond is to changes in interest rates.

This relationship is also stronger for bonds with lower coupon rates. Everything else being equal, the lower the coupon rate of a bond the more sensitive it will be (in terms of percentage changes in the bond price) to interest rate changes. Therefore, a 15-year 4% coupon bond will see a greater percentage price increase if interest rates decline than a similar 15-year 10% coupon bond.

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4.5: Yield-to-Maturity (YTM)

The YTM represents the EXPECTED return on the bond if it was purchased at the current price AND held until maturity. We can also use the YTM to tell us what the current required return is for the market. We solve for this by using the same approach we used to solve for interest rates (or discount rates, rates of return, growth rates) in Chapter Three (Time Value of Money) — by solving for the I/Y with the 5-key approach on our financial calculator. We know the bond price (provides PV), coupon rate (provides PMT), number of years until maturity (provides N), and maturity (par) value (provides FV of $1000). The only thing we don't know is the I/Y (which is the yield to maturity). In order to get the YTM, we are solving for the rate of return that makes the PV of cash flows (coupon payments and par value) equal to the current bond price (B0).

Again, let's work through a brief example: Assume that I am considering buying a bond that pays a 7.5% coupon and can purchase this bond for $1095. If this bond has 10 years remaining until maturity, what is my YTM? Again, the first step is to find the coupon payment.

Annual coupon ⇒0.075*$1000 = $75
Semi-Annual (every 6 months) Coupon ⇒ $75/2 = $37.50

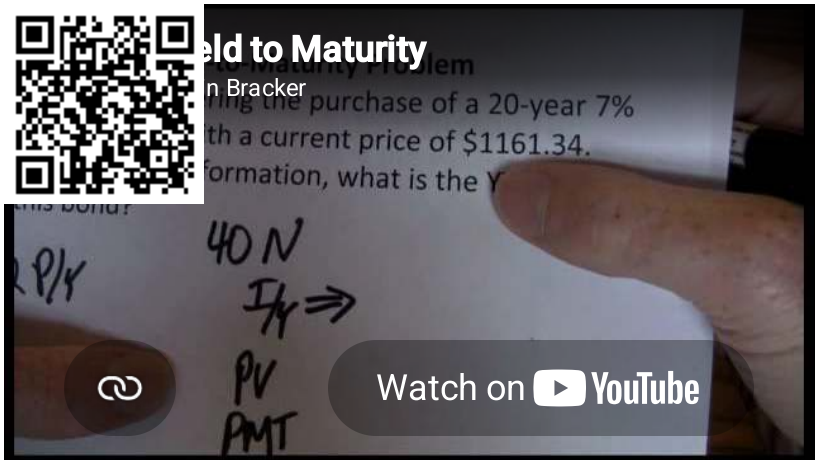
Now I know that I can buy this bond for $1095 today and in return I will receive cash flows of $37.50 twice per year for each of the next 10 years PLUS $1000 at the end of the 10th year. Remember, we are trying to find the discount rate where the PV of the cash flows is equal to $1095.

Financial Calculator:

2 P/Y
20 N
-1095 PV
37.50 PMT
1000 FV
Compute I/YR ⇒ 6.21%

Two quick notes on the YTM calculation. First, the PMT and FV must both be the same sign and opposite of the PV. This is because the bondholder will receive both the coupon payment (PMT) and the par value (FV) as a result of paying the current price for the bond (PV). Second, if the bond is trading at a premium, the YTM will be less than the coupon rate. Alternatively, if the bond is trading at a discount, the YTM will be greater than the coupon rate.

Video Yield-to-Maturity



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4.6: Call Provisions

A Call Provision is a provision included in the bond indenture that gives the company that issued the bond the right, at their discretion, to purchase (call) the bond back from investors before it matures for a pre-set price. Usually the call provision does not start immediately, but becomes effective after a 5-10 year time period. Also, the pre-set price is typically (but not always) a small premium to the $1000 maturity value.

To calculate the Yield-to-Call (YTC) we approach the problem in a similar manner as the YTM, except for two differences. First, the number of years until the first call date is used as opposed to the number of years until maturity. Second, the call price (which usually includes a small premium over par value) is used instead of the maturity value.

For example, consider a bond with 20 years to maturity that has a current price of $925, a coupon rate of 5.5%, and is callable in 5 years at $1050. Find the YTC for this bond. To do this, follow the same procedure outlined above for calculating the YTM, but now the FV is $1050 instead of $1000 and the number of years is 5 (the 20 years to maturity is irrelevant in calculating the yield-to-call).

Financial Calculator:

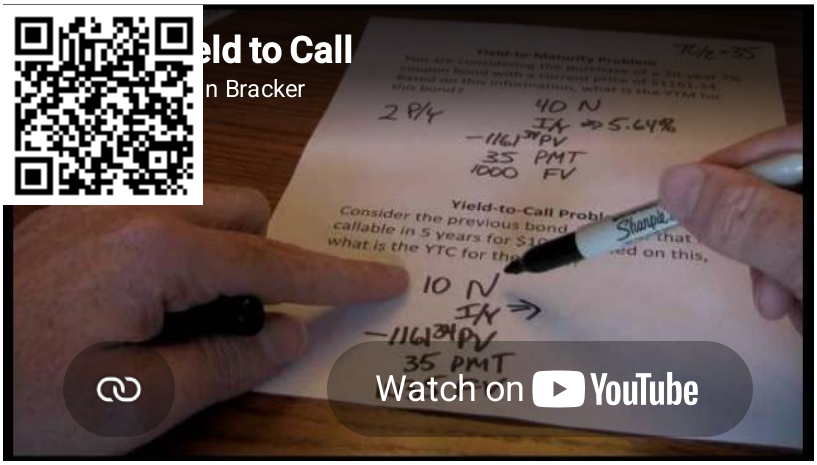
2 P/Y
10 N
-925 PV
27.50 PMT
1050 FV
Compute I/YR ⇒ 8.19%

As with the YTM calculation, the PMT and FV should be the same sign and the opposite of the PV sign when solving for the YTC.

At this point, there may be some confusion as to why there are potentially three different “rates” associated with a bond. There is the coupon rate, the yield-to-maturity, and (if the bond has a call provision) the yield-to-call. From an investor’s perspective, how do we know which of these rates to focus on? First, remember the discussion from earlier in the chapter regarding the coupon rate and the discount rate. We said that the discount rate (yield-to-maturity or market rate of interest) was the correct “rate”. The reason for this is that the coupon rate does not reflect a rate of return, but tells you how much you will receive for the annuity stream portion of the bond. A 6% coupon bond may offer an investor a greater rate of return than an 8% coupon bond if he can buy the 6% coupon bond cheap enough relative to the price of the 8% coupon bond. His return depends not only on what cash flows he receives, but on how much he paid for them. The YTM incorporates not only the coupon payments, but also the price he paid to receive them and how long he anticipates receiving them. It therefore provides more information and is more meaningful.

What about the YTM vs. the YTC? Here, we need to remember that the investor doesn’t decide whether or not to call the bond, the issuer does. Assume that you are borrowing money and are paying an interest rate (YTM) of 8.5%. Alternatively, if you pay the loan off early (even if you need to borrow money to do so) and it lowers your effective rate of interest to 6%, would you want to do so? Certainly. This is why people refinance their mortgage when interest rates decline. Since the issuer makes the decision on whether or not to call the bond, the issuer will only do so if it is to the issuer’s advantage. Note that people don’t rush out to refinance their mortgages when interest rates are rising. Therefore, if the YTC is less than the YTM, the bond is more likely to be called (to save the issuer interest expense). This means that the investor is more likely to receive the YTC. On the other hand, if the YTC is higher than the YTM, the bond is not likely to be called. This means that the investor is more likely to receive the YTM. In other words, the lower of the two rates (YTC or YTM) is the one that the investor is more likely to receive and therefore is the more meaningful rate of return.

Video Yield-to-Call



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4.7: Zero Coupon Bonds

A Call Provision is a provision included in the bond indenture that gives the company that issued the bond the right, at their discretion, to purchase (call) the bond back from investors before it matures for a pre-set price. Usually the call provision does not start immediately, but becomes effective after a 5-10 year time period. Also, the pre-set price is typically (but not always) a small premium to the $1000 maturity value.

To calculate the Yield-to-Call (YTC) we approach the problem in a similar manner as the YTM, except for two differences. First, the number of years until the first call date is used as opposed to the number of years until maturity. Second, the call price (which usually includes a small premium over par value) is used instead of the maturity value.

For example, consider a bond with 20 years to maturity that has a current price of $925, a coupon rate of 5.5%, and is callable in 5 years at $1050. Find the YTC for this bond. To do this, follow the same procedure outlined above for calculating the YTM, but now the FV is $1050 instead of $1000 and the number of years is 5 (the 20 years to maturity is irrelevant in calculating the yield-to-call).

Financial Calculator:

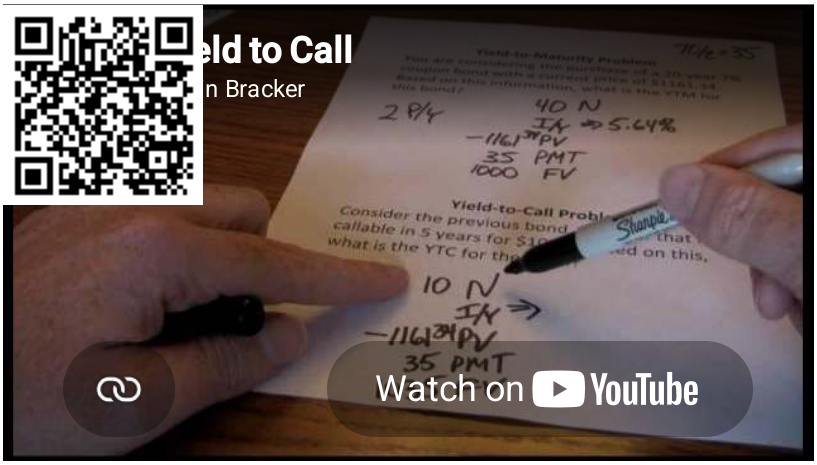
2 P/Y
10 N
-925 PV
27.50 PMT
1050 FV
Compute I/YR ⇒ 8.19%

As with the YTM calculation, the PMT and FV should be the same sign and the opposite of the PV sign when solving for the YTC.

At this point, there may be some confusion as to why there are potentially three different “rates” associated with a bond. There is the coupon rate, the yield-to-maturity, and (if the bond has a call provision) the yield-to-call. From an investor’s perspective, how do we know which of these rates to focus on? First, remember the discussion from earlier in the chapter regarding the coupon rate and the discount rate. We said that the discount rate (yield-to-maturity or market rate of interest) was the correct “rate”. The reason for this is that the coupon rate does not reflect a rate of return, but tells you how much you will receive for the annuity stream portion of the bond. A 6% coupon bond may offer an investor a greater rate of return than an 8% coupon bond if he can buy the 6% coupon bond cheap enough relative to the price of the 8% coupon bond. His return depends not only on what cash flows he receives, but on how much he paid for them. The YTM incorporates not only the coupon payments, but also the price he paid to receive them and how long he anticipates receiving them. It therefore provides more information and is more meaningful.

What about the YTM vs. the YTC? Here, we need to remember that the investor doesn’t decide whether or not to call the bond, the issuer does. Assume that you are borrowing money and are paying an interest rate (YTM) of 8.5%. Alternatively, if you pay the loan off early (even if you need to borrow money to do so) and it lowers your effective rate of interest to 6%, would you want to do so? Certainly. This is why people refinance their mortgage when interest rates decline. Since the issuer makes the decision on whether or not to call the bond, the issuer will only do so if it is to the issuer’s advantage. Note that people don’t rush out to refinance their mortgages when interest rates are rising. Therefore, if the YTC is less than the YTM, the bond is more likely to be called (to save the issuer interest expense). This means that the investor is more likely to receive the YTC. On the other hand, if the YTC is higher than the YTM, the bond is not likely to be called. This means that the investor is more likely to receive the YTM. In other words, the lower of the two rates (YTC or YTM) is the one that the investor is more likely to receive and therefore is the more meaningful rate of return.

Video Yield-to-Call



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4.8: Bond Ratings and Default Risk

One of the big factors impacting the required return associated with bonds is the default risk associated with the bond. Bond default does not imply that the bondholder will lose her entire investment. Instead, it means that the bond issuer cannot meet the specific terms associated with paying the bond coupon payments and/or principal. At this point, bondholders can force the firm into bankruptcy proceedings or reach a mutual settlement with the firm accepting a restructured payment plan.

The default risk associated with a bond varies dramatically based on the specific issuer. Bonds issued by the US Treasury are often assumed to be free of default risk (or have extremely little default risk). Alternatively, bonds issued by corporations depend on the financial stability of the firm that issued the bond. Since many individual bondholders lack the resources to carefully evaluate the financial stability of each issuer, there are bond ratings agencies (such as Standard and Poor's, Moody's, and Fitch) that provide bond ratings to investors. These bond ratings are essentially grades that indicate the potential default risk associated with the bond. While each rating agency uses slightly different processes and grading systems, essentially a AAA-rating is considered the gold-standard and a rating of C or D indicates a company either already in default or likely to be there soon. The following links take you to an overview of the rating definitions for the three big ratings agencies:

- Moody's Ratings Brief Explanation
- Standard and Poor's Ratings
- Fitch's Ratings

Table 4.8.1: **Standard and Poor's Bond Rating Scale**

Ratings	Explanations
AAA	Extremely strong capacity to meet financial commitments. Highest Rating.
AA	Very strong capacity to meet financial commitments.
A	Strong capacity to meet financial commitments, but somewhat susceptible to adverse economic conditions and changes in circumstances.
BBB	Adequate capacity to meet financial commitments, but more subject to adverse economic conditions.
BB	Less vulnerable in the near-term but faces major ongoing uncertainties to adverse business, financial and economic conditions.
B	More vulnerable to adverse business, financial and economic conditions but currently has the capacity to meet financial commitments.
CCC	Currently vulnerable and dependent on favorable business, financial and economic conditions to meet financial commitments.
CC	Currently highly vulnerable.
C	Currently highly vulnerable obligations and other defined circumstances.
D	Payment default on financial commitments.

Ratings from 'AA' to 'CCC' may be modified by the addition of a plus (+) or minus (-) sign to show relative standing within the major rating categories.
Shaded portions of the tables indicates "junk bond" status
Source – Standard and Poor's Credit Ratings Definitions & FAQs

Because default risk is one of the main sources of risk associated with bonds (along with the price risk associated with changes in interest rates), the required return of a bond is highly dependent on the bond rating. All else equal, the lower the bond rating, the greater the default risk. As investors are risk averse, higher default risk implies higher required returns. Since bond prices are inversely related to the required return, improvements in bond ratings will cause prices to rise and drops in bond ratings will cause bond prices to fall. Also, bonds with lower bond ratings (more default risk) will have higher expected returns. This does not make these bonds better or worse investments. Instead, these bonds (sometimes referred to as junk bonds) just have a different risk-return profile than investment grade bonds. The single B vs. double B rating grade is the general distinction between investment grade bonds vs. junk (or high-yield) bonds. However, even within each category there will be variation in expected returns associated with these bonds. The following chart shows historically how the spread between AAA vs. BBB bond yields have fluctuated over time. As you can see, the AAA is always less than the BBB, but the spread between the two yields varies significantly through the years.

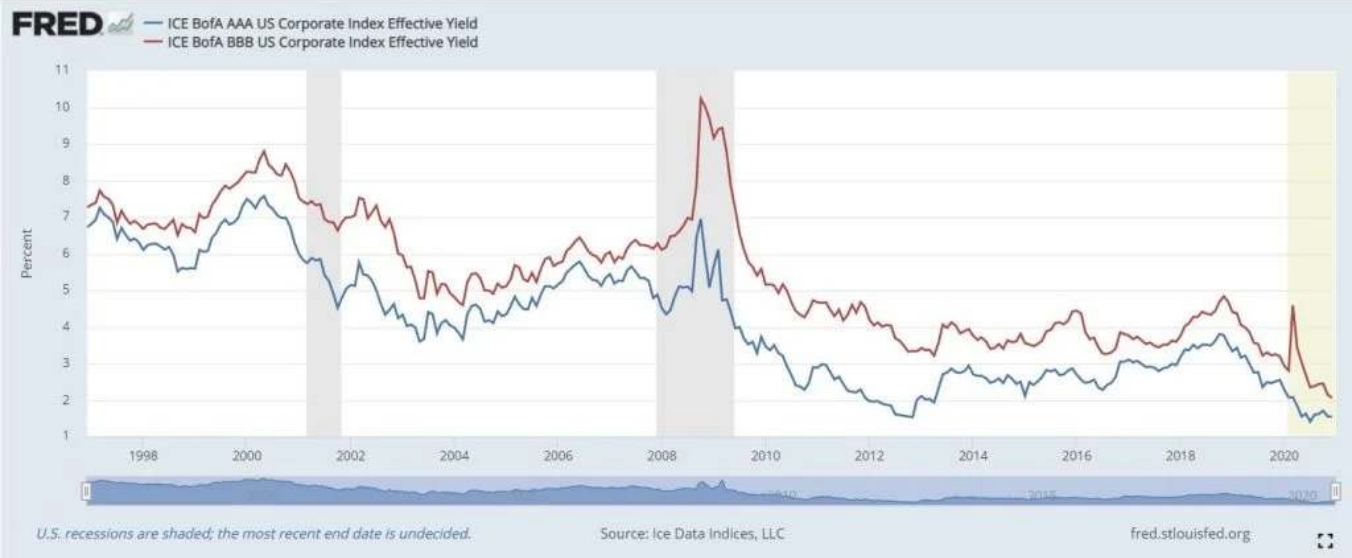


Figure 4.8.1: **Historical Yields for AAA and BBB Bonds**

Source of BBB Graph: Fred
Source of AAA Graph: Fred

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4.9: Key Takeaways

Key Takeaways

Valuation is a fundamental concept in finance that is based on the present value of the future cash flows which a security will generate. Because of their structure, a fixed cash flow stream over a finite time horizon, bonds provide a reasonably straightforward security in which to initially apply valuation analysis. As demonstrated above, the value of a bond moves inversely to the market rate of interest so that as interest rates fall, bond prices rise and vice-versa. Also, given the current price of a bond, the expected return of that bond, either the yield-to-maturity or yield-to-call, can be calculated. The required return on bonds is a primarily a function of anticipated inflation over the life of the bond and the risk of the bond. The primary risk factor is default risk which is approximated through bond ratings.

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4.10: Exercises

Exercise 4.10.1

What is the three step approach for security valuation and how do I apply it to bond pricing?

Answer

The three step approach for security valuation is:

Step 1: Forecast all expected cash flows associated with that security over its lifetime
Step 2: Choose an appropriate discount rate
Step 3: Solve for the PV

When applying this to bond valuation, we start with step 1. The cash flows associated with a bond are (A) the coupon payments and (B) the par value. The coupon payments are an annuity, paid twice each year. The annual coupon payments are calculated by taking the coupon rate times the par value (which we assume is always $1000). Therefore, a 5% coupon bond will pay $50 coupon payments annually as 5% of $1000 is $50. Since coupon payments are made semi-annually, this will generate a $25 coupon payment every six months. The par value is a single cash flow ($1000) paid at maturity.

Next, we must choose an appropriate discount rate. In class, this will be a given. However, it is an important step in practice. The riskier the bond, the higher the discount rate that you must use. Also, as expected inflation increases you will want to increase the discount rate. A common practice is to estimate the discount rate by starting with the interest rate (yield) on Treasury bonds of similar maturity and then adding in a risk premium to reflect how much riskier the bond you are valuing is relative to the Treasury bond.

Finally, we solve for PV. This step is easy with bonds. Convert your calculator to 2 Periods per Year. N represents the number of periods (years*2) the bond has remaining until maturity. I/Y represents the discount rate we estimated in step 2. PMT is the coupon payment we calculated in step 1. FV is the par value ($1000). Once we enter these four values into our financial calculator, we then solve for PV.

Exercise 4.10.2

What is the relationship between market rates of interest and bond prices?

Answer

Market rates of interest and bond prices have an inverse relationship. When market rates of interest increase, bond prices decline. When market rates of interest decrease, bond prices go up. The reason for this is that the cash flow stream associated with the bond does not change and the market rate of interest represents the discount rate. So, if we discount the same cash flow stream at a higher rate of interest it will be worth less while if we discount it at a lower rate of interest it will be worth more.

Exercise 4.10.3

How does the length of time until maturity for a bond impact the relationship between market rates of interest and bond prices?

Answer

The longer the time to maturity, the more sensitive the bond price will be to changes in the market rate of interest. Long-term bond prices will increase by a greater amount when interest rates go down and will fall by a greater amount when interest rates go up.

? Exercise 4.10.4

If a bond will pay me $1000 upon maturity, why would I ever be willing to pay a premium to purchase it today

Answer

I would be willing to pay a premium for a bond if the cash flow stream that it generates is higher than I can get elsewhere. For instance, if the current market rate of interest is 7%, that implies that newly issued bonds will be paying 7% coupon payments. If I can find a bond with a 9% coupon rate, I will receive an extra $20 per year in coupon payments. If that coupon stream will last for 10 years, then the premium that I am willing to pay is the present value of $20 per year for 10 years.

? Exercise 4.10.5

What is a call provision?

Answer

A call provision is a feature in the bond indenture that allows the issuing party to repurchase the bond for a preset price prior to maturity. For instance, a firm may issue a 20-year 8% coupon bond that is callable in 5 years for $1040. Then, if interest rates have declined significantly after five years the firm will find it cheaper to call back the bond rather than to continue paying interest payments for the next 15 years. If they still need additional financing, the will be able to issue new bonds with a lower interest rate. On the other hand, if interest rates go up, the firm will decide not to call back the bond as it would cost them more to refinance it. If they no longer needed the financing, they could buy the bonds back in the open market for less than the call price (since bond prices decline when rates go up.)

Note that, everything else equal, call provisions are good for the issuer but bad for the investor. That is because if interest rates go down, the company is likely to call the bond and the investor won't get the full benefit of declining interest rates. On the other hand, if interest rates go up the company is not likely to call which leaves the investor feeling the full downside of increasing interest rates. Because of this, the only way to get investors to buy callable bonds is to pay them slightly more. Therefore, callable bonds will typically offer investors a slightly higher yield in order to offset the call risk.

? Exercise 4.10.6

What is more relevant to an investor

a. Yield-to-Maturity or Coupon Rate?
b. Yield-to-Maturity or Yield-to-Call?

Answer

a. The Yield-to-Maturity (YTM) is more relevant to an investor than the coupon rate. The coupon rate determines the coupon payments, so it tells us what the cash flow stream looks like, but doesn't take into account what we pay for it. For instance, which would you rather buy…a 3-year 5% coupon bond or a 3-year 10% coupon bond? At first glance, the 10% coupon bond seems better because we will get $100 per year in coupon payments instead of $50. However, how much are we paying for these bonds? What if the 5% bond is selling for $700 and the 10% bond is selling for $1300? We will get a much higher rate of return on the 5% bond making it a better purchase (assuming similar risk levels). Thus, the YTM provides a better measure of what we will earn on a bond because it takes into account more information. Not only does it consider coupon payment, but how much we are paying today and how long we will receive the coupon payment. Another simple way to look at this question is if the coupon rate was a more relevant measure, no one would ever buy a zero coupon bond.

b. Sometimes the Yield-to-Maturity (YTM) is more relevant than the Yield-to-Call (YTC) and sometimes the YTC is more relevant than the YTM. It depends on the situation. To understand this, we first must remember what the numbers represent. We defined the YTM as the expected rate of return we would earn on the bond if we bought it today and held it until

maturity and the YTC as the expected rate of return if we bought it today and it got called at the first call date. Those definitions come from the viewpoint of the bondholder. However, someone has to pay the bondholder those rates of return and it is the issuer. Therefore, the bondholders expected rate of return is the issuers expected cost. Now, remember who makes the call decision – the issuer. Since the issuer would prefer to face a lower cost, it will likely call the bonds back if the YTC is less than the YTM. Alternatively, if the YTM is less than the YTC, the issuer will not want to call the bond back early. Thus, the investor is likely to receive whichever is lower between the YTM and YTC and that means whichever one is lower is the more relevant number.

? Exercise 4.10.7

Why are bond ratings important?

Answer

Bond ratings are important because they provide a measure of the default risk associated with investing in bonds. The worse the bond rating, the greater the default risk. Everything else being equal, investors will demand higher returns (YTMs) for bonds with bad bond ratings. From a firm's perspective, that means a bad bond rating is going to translate into paying more to raise additional debt financing. One important point to remember about bond ratings though is that they only measure DEFAULT risk, and not total risk. There are several other risk factors associated with bonds (such as interest rate risk and liquidity risk) that also must be considered when evaluating the total risk of a particular bond.

? Exercise 4.10.8

Which bond should have a higher YTM:

- A 20-year bond with a AA rating, or a 20-year bond with a BB rating?
- A 30-year bond with an A rating or a 5-year bond with a BB rating?

Answer

a. A 20-year bond with a BB rating should have a higher YTM than a 20-year bond with a AA rating. The reason for this is that the lower bond rating indicates more default risk. Since the bonds have the same time to maturity, the primary risk differential is default risk. The greater the risk, the higher the YTM should be.

b. There is not enough information to answer this question. The problem is we are changing two important factors – time to maturity and bond rating. The YTM will depend on inflationary expectations (over the 5-year and 30-year periods respectively), maturity risk, and default risk.

? Exercise 4.10.9

Because junk bonds have a higher probability of default than investment-grade bonds, they are a poor investment tool and we should expect to earn lower rates of return on them. True or False? Explain.

Answer

FALSE. While it is true that junk bonds have a higher probability of default than investment grade bonds, that does not mean that they are a poor investment or that we should expect low rates of return. The higher probability of default means that they are riskier. Riskier investments should offer higher expected returns to compensate investors for the additional risk (if they were riskier and offered lower expected returns, no one would purchase them). This higher expected returns may make them good investments for some people. Whether or not junk bonds are a good investment depends on the individual. For people with low risk tolerances, junk bonds are likely to be a poor investment (although there could even be some situations where they make sense as part of the overall portfolio for someone with a low risk tolerance as long as they are a very small portion). For people with greater risk tolerance the risk-return tradeoff may be attractive. However, they should always offer higher expected returns than investment grade bonds. Note that higher expected returns do not mean that an

investor will earn a higher return. Instead, it means that ON AVERAGE junk bonds will offer higher returns, but that there will be periods where most junk bonds earn low (or negative) returns and in virtually all periods there will be some junk bonds that see large negative returns.

? Exercise 4.10.10

Which is more sensitive to a change in interest rates, a zero-coupon bond or a 10% coupon bond? Why might this be?

Answer

The zero-coupon bond will be more sensitive to changes in interest rates than the 10% coupon bond (in terms of % differences). The reason for this is that the coupon payments start returning some of our investment quicker, so the bond's value is not impacted as much by changes in interest rates. For instance, part of the value of the 10% bond is the $100 in coupon payments during the first year ($50 every ½ year). Since, it is only one year away, its present value will not be changed much by changing the discount rate. However, the zero coupon bond has no coupon payments (the entire cash flow will not be received until maturity which is several years out), so its value will be impacted significantly by changes in the interest rate. Consider the following two bonds.

Bond A – 10% coupon bond with 10-years remaining and a 10% market rate of interest
Bond B – Zero-coupon bond with 10-years remaining and a 10% market rate of interest

Calculate the percentage increase in the bond prices if the market rate of interest drops to 8%.

Bond A starting value (at 10%): $1000.00
Bond A new value (at 8%): $1135.90
Percent Increase: 13.59%

Bond B starting value (at 10%): $376.89
Bond B new value (at 8%): $456.39
Percent Increase: 21.09%

Calculation for Bond Values

Starting Value 10% coupon bond at 10% ⇒ No calculation needed, when coupon rate and market rate of interest are the same, the bond price will always be par value ($1000).

New Value 10% coupon bond at 8%
Step 1: 2 P/Y
Step 2: 20 N
Step 3: 8 I/Y
Step 4: 1000 FV
Step 5: 50 PMT
Step 6: PV⇒ $1,135.90

Starting Value zero coupon bond at 10%
Step 1: 2 P/Y
Step 2: 20 N
Step 3: 10 I/Y
Step 4: 1000 FV
Step 5: 0 PMT
Step 6: PV⇒ $376.89

New Value zero coupon bond at 8%
Step 1: 2 P/Y
Step 2: 20 N
Step 3: 8 I/Y

Step 4: 1000 FV
Step 5: 0 PMT
Step 6: PV⇒ $456.39

? Exercise 4.10.11

Would you ever pay more than $1000 to buy a $1000 non-convertible zero coupon bond? Explain.

Answer

No. A non-convertible zero-coupon bond will only pay par value at maturity. There will be no other payments. Therefore, a $1000 par value zero-coupon, non-convertible bond will pay exactly $1000 at maturity. Let's say the bond matures in 4 years. There is never a good reason to pay more than $1000 today to receive $1000 four years later. Even if the market rate of interest was zero, it would make more sense to just hold onto our money rather than pay more than $1000 today to receive $1000 at a later date.

Reminder: For all bond exercises, your calculator should be set to 2 P/Y to reflect semi-annual coupon payments. Also, the payment is equal to the annual coupon divided by 2.

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4.11: Problems

Problem 4.11.1

Find the price for a 7.5% coupon bond under the following conditions.

a. 30 years to maturity, required return is 9%
b. 30 years to maturity, required return is 7.5%
c. 30 years to maturity, required return is 6%
d. 10 years to maturity, required return is 9%
e. 10 years to maturity, required return is 7.5%
f. 10 years to maturity, required return is 6%
g. 2 years to maturity, required return is 9%
h. 2 years to maturity, required return is 7.5%
i. 2 years to maturity, required return is 6%

Answer

Part 1a

Step 1: 60 N
Step 2: 9 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $845.21

Part 1b

Step 1: 60 N
Step 2: 7.5 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,000.00

Part 1c

Step 1: 60 N
Step 2: 6 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,207.57

Part 1d

Step 1: 20 N
Step 2: 9 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $902.44

Part 1e

Step 1: 20 N
Step 2: 7.5 I/Y
Step 3: 1000 FV

Step 4: 37.50 PMT
Step 5: PV⇒ $1,000.00

Part 1f

Step 1: 20 N
Step 2: 6 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,111.58

Part 1g

Step 1: 4 N
Step 2: 9 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $973.09

Part 1h

Step 1: 4 N
Step 2: 7.5 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,000.00

Part 1i

Step 1: 4 N
Step 2: 6 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,027.88

? Problem 4.11.2

The current price of a 4.25% coupon bond with 10 years to maturity is $918.23, what is the YTM?

Answer

Step 1: 20 N
Step 2: -918.23 PV
Step 3: 1000 FV
Step 4: 21.25 PMT
Step 5: I/Y⇒ 5.31%

? Problem 4.11.3

The current price of a 9.75% coupon bond with 20 years to maturity is $1318, what is the YTM? If the bond contains a call provision that allows the company to call the bond for $1050 7-years from now, what is the YTC? Based on the available information, is this bond likely to be called?

Answer

Yield to Maturity

Step 1: 40 N
Step 2: -1318 PV
Step 3: 1000 FV
Step 4: 48.75 PMT
Step 5: I/Y⇒ 6.81%

Yield to Call

Step 1: 14 N
Step 2: -1318 PV
Step 3: 1050 FV
Step 4: 48.75 PMT
Step 5: I/Y⇒ 4.93%

Since the YTC is less than the YTM, this bond is likely to be called based on information available today. Note that the interest rate environment may change before the call date arrives in 7 years which may cause the YTC and YTM to change. Therefore, we are not saying the bond WILL be called, only that it is LIKELY to be called. An investor should buy this bond only if he or she is happy with the 4.89% rate of return that would be earned if the bond was called in 7 years.

Problem 4.11.4

Find the price of a 20-year zero coupon bond if the required return on such a bond was 12%? What if the required return was 10%

Answer

NOTE – Even though zero coupons don't pay a semi-annual coupon payment (they actually pay no coupon payment) we are using the semi-annual convention – 2 P/Y – to keep consistent with regular coupon bond valuation.

Price with a 12% required return

Step 1: 40 N
Step 2: 12 I/Y
Step 3: 1000 FV
Step 4: 0 PMT
Step 5: PV ⇒ $97.22

Price with a 10% required return

Step 1: 40 N
Step 2: 10 I/Y
Step 3: 1000 FV
Step 4: 0 PMT
Step 5: PV ⇒ $142.05

Problem 4.11.5

Ten years ago you purchased a 30-year 9% coupon bond. At that time, the market rate of interest was 6.5%. Today, you sell the bond (the current market rate of interest is 10.5%).

a. How much did you pay for the bond when you purchased it 10 years ago?
b. How much can you sell the bond for today?
c. What rate of return did you earn on your investment over the 10-year period that you held the bond?

Answer

Part 5a

It is important to recognize that the value of the bond is the present value of remaining cash flows. At the time of purchase, the bond had 30 years until maturity and this is when we purchased it. This means the value at the time it was purchased should be based on the 30 years until maturity (60 semi-annual periods).

Step 1: 60 N
Step 2: 6.5 I/Y
Step 3: 1000 FV
Step 4: 45 PMT
Step 5: PV ⇒ $1,328.17

Part 5b

Since you purchased the bond 10 years ago when it had 30 years to maturity, there are now 20 years (40 semi-annual periods) remaining until maturity.

Step 1: 40 N
Step 2: 10.5 I/Y
Step 3: 1000 FV
Step 4: 45 PMT
Step 5: PV ⇒ $875.59

Part 5c

Now, it is no longer a bond pricing problem, but a time value of money problem. You paid $1328.17 ten years (20 periods) ago, you received $45 twice per year in coupon payments, and today you sold the bond for $875.59 ⇒ Solve for your return.

Step 1: 20 N
Step 2: -1328.17 PV
Step 3: 875.59 FV
Step 4: 45 PMT
Step 5: I/Y ⇒ 3.97%

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4.12: References and Attributions

Student Resources

Bond Ratings Scales in Appendix B

Videos

Bond Pricing

Yield-to-Maturity

Yield-to-Call

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CHAPTER OVERVIEW

5: Stocks and Stock Valuation

Learning Objectives

After completing this chapter, students should be able to

- compare and contrast the application of the three-step valuation process to stocks relative to the application to bonds
- define preferred stock
- calculate the value of a stock based on the present value of dividends using the no-growth model, constant-growth model, and non-constant-growth model
- define the concept of market efficiency
- differentiate and identify situations which violate/support weak-form, strong-form, and semi-strong-form market efficiency
- explain the rationale and implications behind market efficiency
- define par value, book value and market value as these terms relate to common stock and identify the relative importance of each
- identify the rights and privileges associated with ownership of common stock
- discuss how the valuation of stock in practice is more complicated and imprecise than textbook models.

5.1: Stock Valuation
5.2: Market Efficiency
5.3: Par Value vs. Book Value vs. Market Value
5.4: Rights and Privileges of Common Stockholders
5.5: Stock Valuation in a Non-Textbook World
5.6: Key Takeaways
5.7: Exercises
5.8: Problems
5.9: References and Attributions

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5.1: Stock Valuation

When we developed the formula to price bonds, it was a straight-forward application of the time value of money concepts. The bond produces a series of simple cash flows – fixed interest payments twice per year and a maturity value of $1000 at the end of the bond's fixed life span. However, stocks have no expiration or maturity date. Therefore (at least theoretically) the cash flow (dividend) stream extends into infinity. Also, the dividends are MUCH more difficult to project than are the interest payments as dividends can increase, decrease or be stopped entirely (although corporations are reluctant to lower or stop dividends unless absolutely necessary for their survival). Therefore, stocks require a slightly different application of the time value of money concept.

While it is not likely that any person will hold a stock forever (unless that person has discovered the secret of immortality), the valuation process using an infinite cash flow stream remains appropriate. If I buy a stock today based on the present value of the expected cash flows and only plan to hold the stock for three years, why am I concerned with the dividends that will be paid after year three? The answer is simple. If I plan to sell the stock after the three years, I'm going to have to find a buyer. How much will that buyer pay me? According to our framework, the buyer will pay the present value (at the time she buys the stock) of the expected cash flow stream. Therefore, what the buyer will be willing to pay me depends upon the expected dividends from years 4 and on. Since those later dividends will affect the price at which I can sell the stock, I must factor them into my analysis. By finding the present value of ALL expected cash flows (dividends) that the stock will pay, my holding period becomes irrelevant. Whether I want to hold the stock for one day or twenty years, it is worth the same to me.

Stock valuation based on the dividend discount model typically takes one of three forms depending on what pattern we expect the dividends to follow. These three model variations are (1) the no-growth case, (2) the constant-growth case, and (3) the non-constant-growth (or supernormal-growth) case. There are a couple of other variations, but these three provide a solid foundation. Remember, all three methods do the same thing — forecast a cash flow stream (dividends) that will be paid to stockholders and then discount that cash flow stream back to the present to see what the stock is worth today.

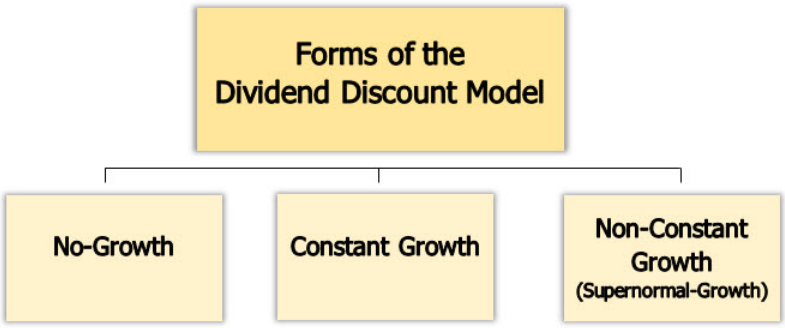


Figure 5.1.1: Discount dividend models for no growth, constant growth and supernormal growth

In all models below, we assume that the current dividend has just been paid (immediately before we buy the stock) and our first dividend received will be one year from today. We also assume that dividends are paid annually instead of quarterly or semi-annually. These assumptions make the application of time value of money simpler. While they may not be realistic, they do not greatly alter the results and therefore are worthwhile simplifications.

No Growth

If we have a stock with no growth in its dividends over time, the infinity issue is solved with a perpetuity. The stockholder will receive the same dividend every year (an annuity) that lasts forever. This is the perpetuity concept that was introduced in the Time Value of Money chapter. The most common example of a no growth stock is a PREFERRED STOCK.

Preferred Stock is somewhat of a hybrid between a common stock and a bond. Preferred stock typically has (a) no voting rights, (b) an infinite maturity, (c) pays dividends as a percentage of par value, and (d) falls between bonds and common stock in the priority of claims. Preferred pays a dividend (which unlike interest can be skipped if the firm needs to preserve capital in hard times), which creates more risk than bonds. However, these dividends are fixed and must be paid before dividends on common, which creates less risk than common. Many firms do not issue preferred stock.

A preferred stock typically pays a fixed dividend (a percentage of its par value), that does not change over time. However, there are some instances where a common stock at least approximates the no-growth pattern.

According to the no-growth model, to find the value of the stock, we just take the current dividend and divide by the required return (remember, it's just a perpetuity — an infinite annuity — since the stock has no maturity date and the dividend is not expected to increase or decrease in value). This is written below

$$P_0 = \frac{D_1}{k}$$

where

P_0 represents the current value (price today)
k represents the required return and
D_1 represents the dividend

Note: While we designate next year's dividend in the formula, this is just to be consistent with the later models. Since there is no growth, all the dividends are the same regardless of which year we are referring to.

Example 5.1.1

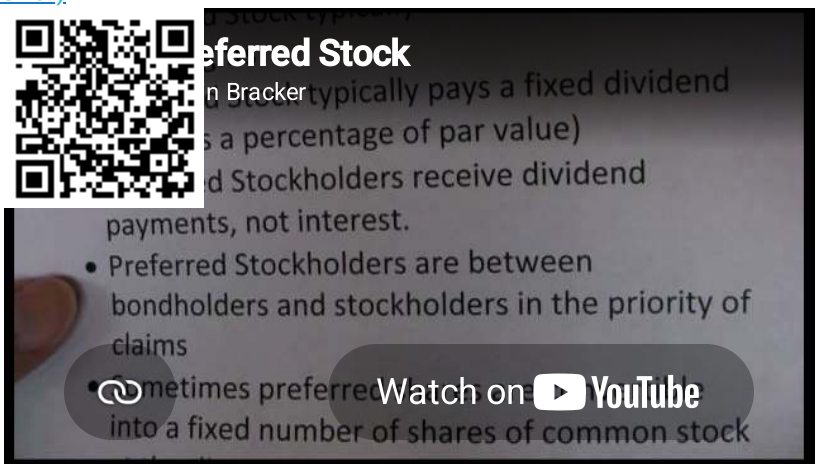
Preferred Stock Valuation Using the No Growth Model

Consider the following example with a preferred stock. Assuming that a preferred stock has a par value of $75, pays a 10% dividend and you have an 8% required return, what is this stock worth to you?

Solution

$$P_0 = \frac{D_1}{k} = \frac{\text{ParValue} * \text{DividendRate}}{k} = \frac{\$75 * 0.10}{0.08} = \frac{\$7.50}{0.08} = \$93.75$$

Video Preferred (No Growth)



Constant Growth

While it is possible for a common stock to have a constant dividend over time, it is not likely. Companies tend to grow and expand, which usually results in dividends growing over time. However, if dividends don't remain constant we can no longer use a perpetuity formula. Also, since the dividend stream doesn't end, we can't use the standard time value of money process. Luckily, as long as the growth rate remains constant over time and is less than the required return, there is a simple formula we can use to find the present value.

$$P_0 = \frac{D_1}{(k-g)}$$

or

$$P_0 = \frac{D_0(1+g)}{(k-g)}$$

where

g is the growth rate in dividends
P_0 represents the current value (price today)
k represent the required return and
D_0 and D_1 represent the dividend paid today (D_0) or the forecasted dividend next year (D_1) respectively

Note: $D_0(1 + g)$ and D_1 are the same thing. They both represent the forecasted dividend next year. The only difference is that sometimes you will be given the current dividend and sometime you will be given the forecasted dividend next year. Since the present value formula needs the forecasted dividend next year, $D_0(1 + g)$ just gives us that value based on the current dividend and the dividend growth rate.

Example 5.1.2

Common Stock Valuation Using the Constant Growth Model

For a quick example, consider a stock that just paid a dividend (D_0) of $5.00 per share with dividends growing at a constant 4% per year. If my required return is 13%, what is the stock worth to me?

Solution

$$P_0 = \frac{D_0(1+g)}{(k-g)} \tag{5.1.1}$$

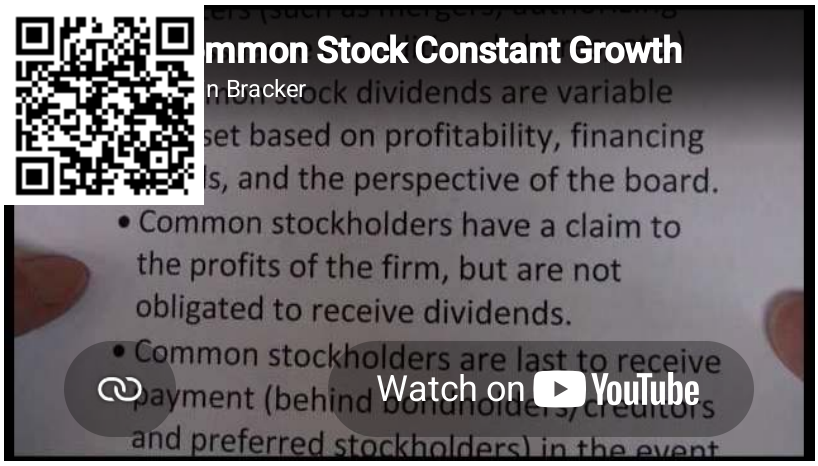
$$P_0 = \frac{\$5.00(1+.04)}{(.13-.04)} \tag{5.1.2}$$

$$P_0 = \frac{\$5.20}{.09} \tag{5.1.3}$$

$$P_0 = \$57.78 \tag{5.1.4}$$

Three points on this model. First, while it may not look like the present value formulas that we did in Chapter Three, that is all it is. The constant-growth model is not magical; it's just a special case of present value and could be used to find the present value of any cash flow stream that is growing at a constant rate. Second, growth rates rarely remain constant over time. However if growth rates are relatively stable, this can be a close approximation. Third, this model only works when the required return exceeds the growth rate. This is not usually critical as it is impossible to maintain a growth rate higher than the required return indefinitely, but if you try applying this model when the growth rate exceeds the required return, you will get a negative value – which does not make sense as stock prices will not fall below $0.00 due to the limited liability concept introduced in Chapter One.

Video Constant Growth



Supernormal (Non-Constant) Growth

This is where things get a little tricky. However, it is the most common situation. The solution is not a simple formula, but instead a three-step process.

The 3-step solution

- Step 1 – Forecast the dividends during the non-constant growth period up to the first year at which dividends grow at a constant rate.
- Step 2 – Once a constant growth rate is reached, use the constant growth pricing model to forecast the stock price. This stock price represents the PV of all dividends beyond the non-constant growth period.
- Step 3 – Discount the cash flows (dividends found in step one and price found in step two) back to year zero at the appropriate discount rate. This is the current value of the stock.

Example 5.1.3

Common Stock Valuation Using the Supernormal Growth Model

This is a tricky one, so again, let's do an example. Consider a firm that just paid a dividend of $2.60. They plan to increase dividends by 5% in year one, 10% in year two, 20% in year three, 20% in year four, and then 3% per year thereafter. You feel that a 16% required return is appropriate. What is this stock worth to you?

Solution

Step 1 — Forecast the Dividends

D_1 = $2.60*(1.05) = $2.73

D_2 = $2.73*(1.10) = $3.00

D_3 = $3.00*(1.20) = $3.60

D_4 = $3.60*(1.20) = $4.32

D_5 = $4.32*(1.03) = $4.45

Note: We stop in year five because that is the first year of constant growth. There is no need to forecast dividends any further since once they are growing at a constant rate (in the timeline below, you can see that after year 4, all dividends are growing at 3% per year through infinity), we can apply the Constant Growth Model discussed above which leads to Step 2.

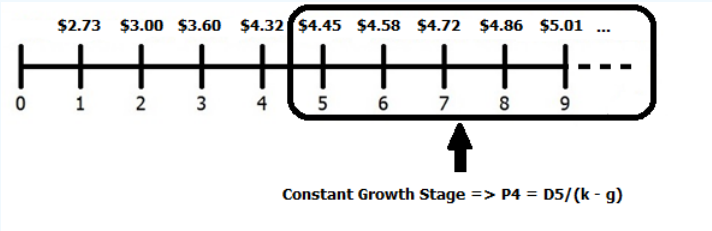


Figure 5.1.2

Step 2 — Use the Constant-Growth Model to Forecast Price

$$P_4 = \frac{\$4.45}{.16 - .03} = \$34.23$$

Note: Be careful here as this is a confusing, but critical detail. When we apply the constant-growth model we use next year's dividend to get this year's price. Since we are using year five's dividend, the first dividend of the constant-growth stage, it will tell us the price in year four – not year five. **This price represents the present value of all dividends paid from year five and beyond as of year four.**

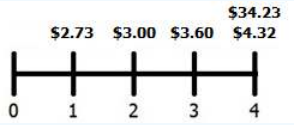


Figure 5.1.3

Step 3 — Discount Cash Flows Back to Today

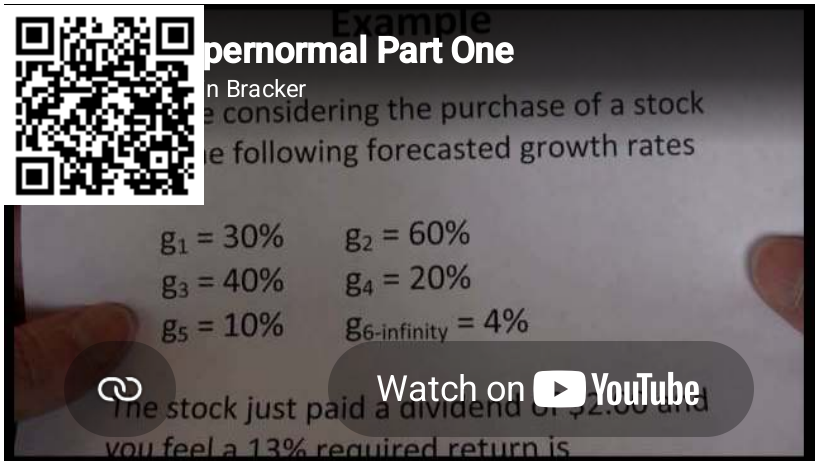
Use your financial calculator to find the net present value of the cash flows.

Calculator Steps to Compute NPV of the Uneven Cash Flow Stream:

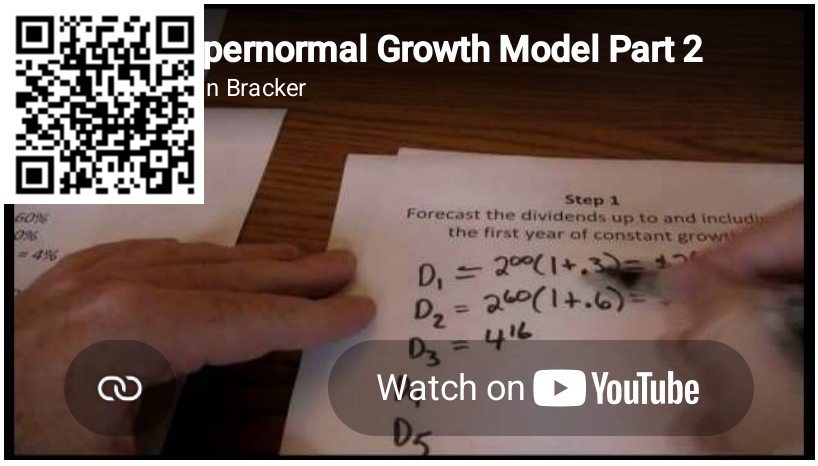
HP10BII	TI-BAII+	TI-83/84
Step 1: 2nd Clear All Step 2: 0 CFj Step 3: 2.73 CFj Step 4: 3.00 CFj Step 5: 3.60 CFj Step 6: 38.55 CFj Step 7: 16 I/YR Step 8: 2nd NPV ⇒ $28.18	Step 1: CF 2nd CLR Work Step 2: 0 ENTER ↓ Step 3: 2.73 ENTER ↓↓ Step 4: 3.00 ENTER ↓↓ Step 5: 3.60 ENTER ↓↓ Step 6: 38.55 ENTER Step 7: NPV 16 ENTER Step 8: CPT ⇒ $28.18	Go to APPS⇒Finance⇒ Step 1: Select npv(Step 2: Enter the given information npv(16,0,{2.73,3.00,3.60, 38.55} *Note that we do not need to put in the CF frequencies as they are all 1 Step 3: Press the SOLVE key

Note: A couple of comments here. First, the year four cash flow ($38.55) represents both the year four dividend and the price in year four. If you try to enter them separately, the calculator will think the dividend comes in year four and the price in year five, giving you the wrong answer. Second, you may be wondering what happened to the year five dividend. The answer is that it is included in the year four price. To include it again would be double-counting. Remember what the year four price represents — the present value (as of year four) of all dividends paid in years five and beyond. Third, as with the first two models, this is just another application of time value of money, specifically present value. We forecast the cash flows and then discount them back to today.

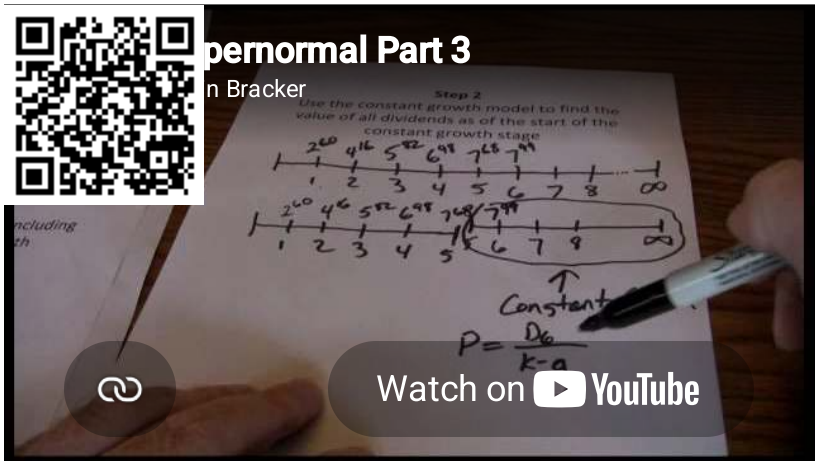
Video [Supernormal Growth Part 1]



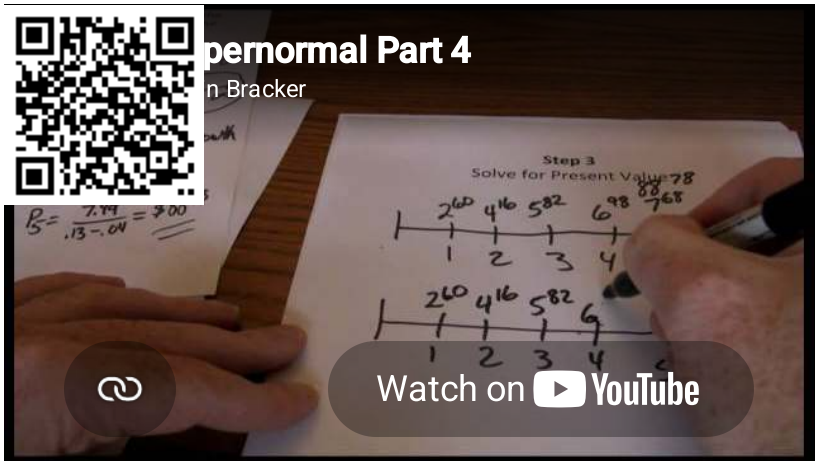
Video [Supernormal Growth Part Two]



Video [Supernormal Growth Part Three]



Video [Supernormal Growth Part Four]



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5.2: Market Efficiency

Markets are said to be efficient when prices of stocks accurately represent all currently available information. This means that we cannot determine which stocks are “good” and which are “bad”. All stocks are properly valued given what is known today. If they turn out to be “good” or “bad” in the future, it is due to information that has yet to be revealed. There are three types of market efficiency that are based on what is considered “current” information.

Weak Form Efficiency – Markets are efficient based on past price data

Semi-Strong Form Efficiency – Markets are efficient based on all publicly available information

Strong Form Efficiency – Markets are efficient based on all public and private information

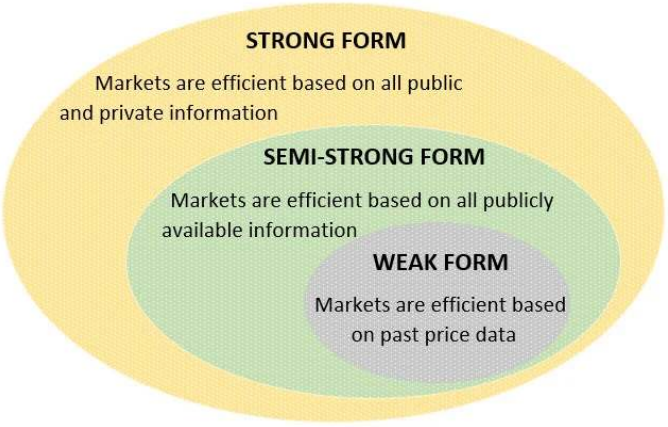


Figure 5.2.1: Forms of the efficient market hypothesis.

For a more thorough analysis of market efficiency, see the Efficient Markets Hypothesis Handout in Appendix B.

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5.3: Par Value vs. Book Value vs. Market Value

Par Value

The face value of each share of stock is stated on the stock's charter. The only time this is a meaningful number is when the stock is initially sold for less than par value (which almost never happens). In this case, shareholders are liable for the difference in the event of bankruptcy. In today's markets, newly issued common stocks often are issued with either no par value or a par value of $0.01. For example, a recent IPO by food delivery company Blue Apron had a par value of $0.0001 per share. Note that this discussion is focused on common stock. Par value for preferred stock is very different as the dividend is often based on par value for preferred.

Book Value

$$\text{Book Value} = \frac{\text{Book Value of Assets} - \text{Book Value of Liabilities}}{\text{Number of Outstanding Shares}}$$

This tells us how much each share is worth on an accounting basis. The book value tends to understate the true value of a stock because the balance sheet focuses on historical value and (in most cases) omits the value of intangible assets (such as brand names, intellectual property, etc.) Also, historical value (purchase price less accumulated depreciation) does not factor in either the magnitude or riskiness of the expected cash flows those assets may generate.

Market Value

This is the most important measure of share value. It is the price at which you can buy or sell a share of stock. To get the market value of a stock at any time, you can use one of the many free stock quote services found online. One that we use frequently is Yahoo! Finance. When you look up a stock quote, you will need to use a ticker symbol. However, just start typing the name of the company in the quote box and (assuming it is a publicly traded company) the ticker symbol will show up on a list below. This is the value that we as managers are trying to maximize.

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5.4: Rights and Privileges of Common Stockholders

Common stockholders have a right to the residual income of the firm. This means that any income generated beyond what is required to pay preferred dividends belongs to the common stockholders. This income may be distributed to common stockholders in the form of dividends or it may be reinvested in the firm.

Stockholders control the firm through the election of the board of directors and some other key corporate issues. However, this control is often limited through diverse ownership, institutional ownership, staggered boards (where only certain board members are elected each period), and dual-class shares where shares typically held by the public have limited voting rights.

Stockholders have the right to obtain information from management about the firm's operations. This information is usually present on the Investor Relations page of a firm's corporate web page. For example, see the Investor Relations page for Amazon.

Common stockholders can usually lose no more than the value of their investment, because they have no liability for the debts incurred by the firm beyond the value of the stock that they own. This is related to the limited liability aspect of corporations raised in Chapter One.

Common stockholder may transfer ownership of shares to other investors in the secondary market. These transfers are done at the current market price which is constantly changing.

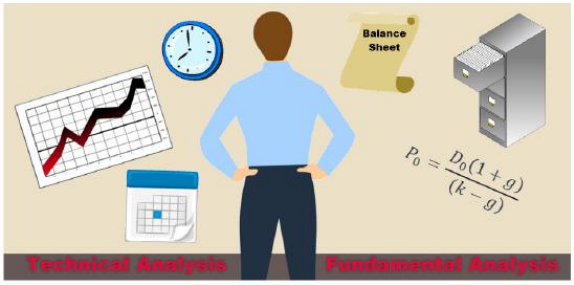
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5.5: Stock Valuation in a Non-Textbook World

There are more ideas, books, magazine/internet articles on stock valuation than you could read in a year if that was all you did. The two primary camps are fundamental analysis and technical analysis (although we have even seen stories about people making investment decisions based on planetary alignments – seriously!). Fundamental analysis deals with things like we are focusing on here and in other parts of this class. Looking at the company, industry, and economy to evaluate the company's ability to generate cash flows and its risk levels to determine what a fair price would be to pay to buy a piece of that company. If the current market price is below that fair price, the stock is a "buy". If the current market price is above that fair price, the stock is a "sell". Many investors will use financial statement analysis, evaluate industry competitiveness, regulations faced by the company/industry, economic analysis, Price-Earnings ratios, and valuation models like illustrated in this class (although using a concept called free cash flows instead of dividends) to determine the fair value. This will include reading annual reports, listening to conference calls, evaluating how the firm is doing with new/existing products, looking at supply-chain cost issues, etc. to evaluate the company.

Technical analysis, on the other hand, attempts to evaluate supply/demand issues by looking at the stock price "action". Specifically, technical analysts look at things like stock charts (graphs of the recent stock price) to look for trends, lines of support or resistance, patterns that might predict future movement, etc. They will also incorporate trading volume and other factors that try to gauge whether "smart" investors are accumulating or selling shares. If you get into technical analysis you will encounter things like candlestick charts, Fibonacci numbers, moving averages, and other terms.



Which is the correct approach – fundamental or technical analysis? The answer depends on who you ask. However, we much prefer fundamental analysis as it has a better theoretical foundation for determining what a stock should be worth. However, it is important to remember the concept of market efficiency. Regardless of which approach you use, you should not expect easy riches to suddenly materialize. There are a lot of smart people constantly looking for undervalued stocks to buy and overvalued stocks to sell. In order to beat these other investors, you need (a) the ability to process information better than them, (b) the ability to process information faster than them, (c) access to information that they do not have – and remember it is illegal to trade on information that is not publicly available, or (d) to be lucky. The purpose of this chapter is NOT to make you a multi-millionaire stock trader (if it were that easy we would all be retired on our private islands). Instead it is to make you aware of the basic ideas behind stock valuation so that (a) you have a foundation to understand business news with respect to stock prices, (b) you understand what makes stock prices go up/down, (c) you can talk to a financial advisor and have an understanding of what he/she is talking about, and (d) if you are interested in investment analysis, you have a starting point to investigate further. Remember, any book, TV ad, Internet posting, etc. that offers you the secret to easy wealth from the stock market has a 99.999% chance of being a lie/scam.

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5.6: Key Takeaways

Key Takeaways

The US stock market represents a total market capitalization as of 2020 of over $36 trillion and is about 86% larger than the US GDP. Prices for individual stocks range from relatively small (you can buy a share of Blue Apron for about $6.00 as of Janury 2021) to very large (a single share of Berkshire Hathaway Class A costs over $343,000 as of the same date). Since stocks represent an ownership claim on corporations, how do investors determine the fair value for each share? The answer is that stocks, like other financial securities, generate cash flows for their owners over time. Thus, the fair value of a share of stock is simply the present value of all expected cash flows that the stock will generate over its lifetime, discounted back to today at the appropriate risk-adjusted discount rate. What make this difficult is that the expected cash flows are not known and the lifetime is potentially infinite. Therefore, investors need to make assumptions about future growth rates and apply them to valuation models to determine prices. It is essential to note that the true underlying value of a stock is unknowable, and these models only provide approximations that are as accurate as our underlying assumptions. According to the Efficient Markets Hypothesis, the best estimate of the true value of a stock is that stock's current market price. This is due to the current market price being the consensus of all individual attempts to determine the correct value.

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5.7: Exercises

Exercise 5.7.1

How does the application of the three-step valuation process differ for stocks vs. bonds?

Answer

The three-step valuation process for stocks differs from bonds due to the differences in the structure of the cash flow stream. Conceptually, the process is different. However, the cash flow stream for stocks (dividends) has a variable, infinite time horizon which makes forecasting all expected cash flows impossible to do without some simplifying assumptions.

When forecasting dividends, we use one of three assumptions. First, we can assume that dividends exhibit no growth over time. The dividend will remain the same forever. Second, we can assume dividends grow at a constant rate over time. Third, we can assume dividends will grow at a non-constant rate for a specific number of years and then a constant rate after that. The assumption that we make about the dividend stream will determine how we solve for present value in step three of the 3-step valuation method.

The process of choosing an appropriate discount rate is similar (at least until we introduce the Security Market Line in Ch. 8). We need to determine the riskiness of the security and then select a discount rate based on the rate of return we can earn on other similar risk investments. One item of note is that the discount rate for stocks will tend to be higher than the discount rate for bonds due to the fact that stocks (on average) are riskier than bonds.With bonds, solving for PV was simply to use the 5-key approach to find PV.

With stocks, we need to either use a formula (for dividend assumptions one and two) or a process involving the CF worksheet (for dividend assumption three). The formula for the no-growth model is:

$P_0=D/k$

The formula for the constant growth model is:

$P_0=D_1/(k-g)$

Exercise 5.7.2

Explain the difference between par value, book value, and market value for a common stock. Which is most important and why?

Answer

Par value is the value stated on the stock certificate and is essentially a meaningless number. This reflects the minimum amount of capital that must be supplied by stockholders to meet the limited liability characteristic of stock ownership. If the stock is originally issued for less than par value, the stockholders are liable for the difference in the event of bankruptcy. However, in practice, most firms set par value for common stock so low (often $0.01 per share or less) that it is no practical meaning.

Book value represents the accounting value of each share of stock based on the balance sheet. Book value per share can be found by solving for one of the following two equations (note – both equations are identical since A = L + OE):

BV = (A – L)/(number of common shares outstanding) or
BV = (OE)/(number of common shares outstanding)

Book value tends to understate the true value of the firm because of the historical cost bias and the omission of most intangible assets.

Market value represents the “true” (sometimes called “economic” or “financial”) value of the share of stock. This is the price at which investors are willing to buy and sell shares.

No one individual determines market value, instead it is set by the equilibrium price in the financial markets (in other words, the price at which both buyers and sellers agree that they are getting their best price). Market value changes constantly based on new information. Any information that causes investors to change their perception on the magnitude, riskiness, or timeliness of expected cash flows will result in changes in the market value. When you look at a stock quote in the Wall Street Journal or online, this represents the market value.

Market value is the most important measure of value for a common stock because it reflects the current price at which people are willing to buy/sell the stock.

? Exercise 5.7.3

What rights are granted to stockholders? Explain each.

Answer

The right to information – Stockholders have a right to know what is going on in the firm. At a minimum, firms must prepare quarterly and annual audited financial statements that are made available to the stockholders and have annual meetings which stockholders can attend. Most firms make significant information available on their company web page in an investor relations section. Most of the information made available is detailed financial performance information and general firm strategy information.

Limited Liability – Stockholders can lose no more than their initial investment in common stock. This is a function of the separation of ownership and decision making within the corporate form of ownership. Since the stockholders are not making the management decisions, they are not liable for the results. The stock price can fall to zero and the investor can lose their entire investment made in the stock, but the investor can not be required to supply more money beyond that to meet creditor obligations.

The right to "control" – Stockholders get voting rights. These voting rights allow them to elect the board of directors who are responsible for hiring and compensating management as well as approving major strategic decisions. Stockholders also have voting rights on a limited set of corporate decisions such as authorizing additional shares of stock to be created and issued. However, for most practical purposes, the average stockholder has no real control over corporate activities. The way that board of director votes are handled are designed to keep current boards in place and unless there is a very significant amount of shareholder dissatisfaction their will not be any board shakeups. Also, shareholders do not vote or influence day-to-day corporate decisions or even larger corporate strategies. Finally, some firms issue dual-class shares where the public holds non-voting shares or shares with drastically diluted voting rights while the firm founders hold the shares with voting or super-voting rights.

The right to transfer – Stockholders can sell their shares in the open market whenever they choose. Thus, most stockholders will "vote with their feet" when they don't like the way a company is running its business. Since they know their ability to influence company policy through voting rights is minimal at best, simply selling shares is often the best strategy. However, selling stock does not have to be due to dissatisfaction with the way the company is doing business. Shareholders may sell for many reasons including diversifying their holdings, taking profits, raising cash, cutting losses, etc. However, this ability to sell shares whenever one wants is critical to the success of corporate form of ownership as it creates liquidity which is necessary to get people to buy stock.

The right to residual income – this is the most important right associated with common stock and is the principle reason why people invest in common stock. When you buy common stock you are buying ownership into the company and with that ownership comes a right to your proportion of the profits. Residual income refers to income left over after preferred stockholders are paid. It is important to note that the right to residual income is NOT the same as the right to dividends. Firms can choose to pay out the residual income to investors in the form of dividends or they can reinvest into the firm. If the residual income is invested wisely, this will result in even more profits for stockholders later on. However, if it is invested poorly, it may all be lost before the stockholders receive any in dividends. Ultimately, if you bought every share of stock outstanding, you would own all of the firm's profits and would be able to decide for yourself whether to pay dividends or reinvest in the firm.

? Exercise 5.7.4

According to the stock pricing models we use in class, will I pay more for a stock that I plan to hold for 5 years than I will for a stock that I plan to hold for 2 years?

Answer

The holding period of a stock is irrelevant to determining its value. The value is based on the present value of all future dividends. The reason holding period is irrelevant is that when I sell the stock, I will be able to sell it for all the future dividends at that point. Whether I actually receive the dividends or sell the stock for the value of those dividends doesn't matter. Another way to look at this is with the constant growth pricing model $\Rightarrow P_0 = (D_1)/(k - g)$. Note that no where in that model do you plug in your holding period. Since it is not part of the formula, it can't have an influence on the price of the stock.

? Exercise 5.7.5

In the Non-Constant (Supernormal) Growth model, we assume that dividends will grow at a constant rate forever after the non-constant growth period. Is this realistic? If not, why do we do so?

Answer

No, it is not a realistic assumption. Dividends will grow at varying rates over time depending on the success of the firm and the new products it introduces. However, we know that our predictive ability is limited. How fast is Wal-Mart going to grow 16 years from now? How about 17 years? Since we know that there is no way to make precise forecasts, we assume that after a certain time, the firm will grow at approximately the same rate as the economy (or maybe a bit slower) and use this as our constant growth rate. This allows us to use what information we can to forecast growth rates (and dividends) as far as we can and then approximate the rest with a constant growth assumption. Is it 100% accurate? No. Is it more reasonable than trying to forecast year- by-year growth rates for the next 1000 years? Definitely!

? Exercise 5.7.6

What is meant by market efficiency? What are the three types of market efficiency?

Answer

Market efficiency refers to the concept that all relevant information that influences a firm's value is already reflected into its stock prices. As new information comes out, the stock price will respond immediately to reflect that new information. There are no "undervalued" stocks to buy that will earn us higher than a fair, risk-adjusted rate of return and there are no "overvalued" stocks that we should sell. Instead (assuming market efficiency is valid), the best that we can do is own a diversified portfolio of stocks and expect to earn a fair, risk-adjusted rate of return.

The three types of market efficiency are weak form, semi-strong form, and strong form and the difference between the three is based on the definition of "relevant information."

1. Weak Form Market Efficiency assumes all information related to past price data is already reflected in the current market price. Whether the stock is in an "uptrend" or "downtrend" is merely coincidence and doesn't tell us anything about the future direction of the stock. If the stock increased in value for the past three days or decreased in value for the past three days, it is equally likely to increase or decrease the next day. Stock prices have no "memory." If markets are weak-form efficient, technical analysis (a process of trying to identify stocks to buy or sell based primarily on charts and other forms of past price trends) is not going to work. A chart of a stock's past price information is meaningless in helping us identify its future price information.
2. Semi-strong Form Market Efficiency assumes all publicly available information is already reflected in the current market price. This means that there can be no "edge" gained from evaluating a firm's financial statements or trying to project its future cash flows based on economic, demographic, or firm specific factors that might influence the success

(or lack of success) in a firm's product line. Reading the Wall Street Journal, Business Week, financial statements, etc. will not allow you to identify which stocks to buy or sell. This process of trying to value stocks based on projecting future cash flows is referred to as fundamental analysis. If markets are semi-strong form efficient, fundamental analysis will not serve as a worthwhile tool for picking stocks other than to find a risk level that you are comfortable with. While new "fundamental" information will influence stock prices, it is only the "surprise" portion that will drive the stock price up or down. For instance, if a company was expected to report earnings of $1.00 per share and a 15% growth rate from the previous year and instead reported earnings of $0.90 per share and a 10% growth rate from the previous year, this would be a negative surprise (even though both earnings and growth were positive) and would cause the stock price to decline. However, the decline would be so immediate that you would not be able to respond to the news and sell before the price declined.

3. Strong Form Market Efficiency assumes all information, public or private, is already reflected in the current market price. Based on this, not even having access to inside information would allow you to identify good/bad stocks ahead of time.

? Exercise 5.7.7

I carefully analyze the WSJ and other sources of publicly available financial information (annual reports, CNBC, Business Week, etc.). Over the past 10 years, I have earned a 13% average annual rate of return (without facing higher than average risk levels), while the overall stock market has earned a 9.5% average annual rate of return. Is this evidence in favor of or against semi-strong form market efficiency?

Answer

This would be evidence AGAINST semi-strong form market efficiency. If markets were semi-strong form efficient, the only way I would be able to earn a higher rate of return than the market with publicly available information would be if I (A) only (or primarily) invested in high risk stocks or (B) was lucky. Since the statement says that I've not faced higher than average risks, (A) is not valid. Also, since this is over a 10-year time horizon, it is not likely just luck (although that is still a possibility). Finally, I've done this using publicly available information. Therefore, this would be evidence AGAINST semi-strong form market efficiency.

? Exercise 5.7.8

Why are efficient markets considered a good thing?

Answer

There are a couple of reasons why we would like to see markets be efficient. First, is that if markets were NOT efficient, then it would be difficult for management to know if they were maximizing firm value. If stock prices reflect all available information and management engages in value maximizing activities, the stock price should go up. If markets were not efficient, there would be no predictable relationship between management activities and stock price response so it would be hard for management to maximize value. As a side note, this is a very important issue. The more efficient markets are, the more focus management will place on long-term value maximization instead of short-term manipulation and accounting gimmickry. This is because investors will see through the manipulation and not "reward" management's trickery. Instead, management that operates with a clear, long-term strategy will see higher stock prices.

A second reason has to do with a concept called allocational efficiency. Allocational efficiency means money flows to the "right" places (right ⇒ productive). Thus, if scientists are working for a cure for a major disease and have a real shot at producing it, markets will recognize this as a profitable opportunity and fund it. While it may seem cold-hearted to define the "correct" places to spend capital as those that produce the best risk-adjusted returns, it actually is just society "voting" on what is the best use of their dollars (as that spending is what produces profits). We may not individually agree with those decisions, but it is a much better system for allocating capital than any other.

Exercise 5.7.9

Why might we expect markets to be efficient? Why might we expect markets to NOT be efficient?

Answer

We expect markets to be efficient for the same reason we don't expect to find $20 bills laying all over the hallways. People do not like to leave money on the table. There are a large number of extremely intelligent individuals with large budgets for information and information processing power constantly looking for opportunities to make money in the financial markets. As soon as they find those opportunities, the take advantage of them (pick up the $20 bills). As such, we should not expect to see any unexploited opportunities. The profit motive creates a strong incentive to drive markets towards efficiency.

On the other hand, if people do not see the $20 bills laying in the hallway, they will not pick them up. Despite the apparent precision of our stock valuation models, predicting prices is not a precise process. Given all the uncertainties involved in estimating growth rates, future cash flows, and discount rates it is hard to place 100% confidence in our final results. Let's say we found the stock value was $50 and the current stock price was $49. This means we get a free $1 for every share we buy. Theoretically we would keep buying as much stock as possible until the stock price increased to $50. However, how much are you willing to commit to your $50 forecast being right?

Another argument against market efficiency (also related to us not "seeing" the opportunities) is that there may be behavioral biases built in to human nature that prevent us from being able to "pick up the free money." For instance, we tend to over-react to news and place too much weight on new evidence in some cases and in others we tend to under-react and place to much weight on our previous views. For instance, if Apple reports a bad quarter, we are apt to dismiss it as we "know" Apple is a good investment in the long-run. How do we know this? Because we rely on the past performance. On the other hand, when the Internet boom was underway in the late 1990's, we over-reacted to how that was going to make EVERY company related to the Internet profitable. We also do not process information very well and can easily be tricked by the way the information is presented. This is referred to as framing. The exact same information can be presented in two different ways and we will interpret it differently each time. How do these behavioral biases relate to market efficiency? Well, one way is that individuals tend to sell their winners too soon and hold their losers too long. The way the tax code is written, there is an advantage to hold on to winning stocks longer and to sell losing stocks quicker…however, there is strong evidence that people do the opposite which costs them money.

There are reasons why we should expect markets to be efficient and reasons why we should expect them to NOT be efficient, so which is it? Ask 100 different finance professors and you'll probably get 50 different answers ranging from markets are 100% efficient to markets are not even close to efficient. My view is that market inefficiencies exist, but taking advantage of them is not easy. For most individual investors (and institutional investors as well), attempting to "outperform the market" is not only a waste of time, but a costly waste of time. However, there are a few people that have both the ability and effort to earn higher than risk-adjusted rates of return. It requires two factors. One, being extremely intelligent (you have to outthink everyone else that is searching for those $20 bills on the ground so that you can either "see" them more easily or grab them quicker). Two, you must be committed. Keep in mind that the more trading you do to outperform the market, the harder it is. That is because transaction costs (brokerage commissions, taxes, other costs) add up with each trade.

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5.8: Problems

Problem 5.8.1

You have a preferred stock with an $80 par value. The stock has a required return of 7% and the dividend is 6% of par value. How much should you pay for this stock?

Answer

P_0 = D/k = (Dividend Rate * Par Value)/k
P_0 = (0.06×$80)/.07
P_0 = $4.80/.07
P_0 = $68.57

Problem 5.8.2

Stock A has an expected dividend (D_1) of $3.50. The growth rate in dividends (g) is 4% and the required return is 13%. What is the price of this stock?

Answer

$P_0 = D_1/(k - g)$
P_0 = 3.50/(0.13 – 0.04)
P_0 = $38.89

Problem 5.8.3

Stock C just paid a dividend (D_0) of $2. The required return is 12%. Find the price of the stock when the growth rates are

a. 0%
b. 5%
c. 10%
d. 15%,
e. Does your answer seem reasonable? Explain.

Answer

Part 3a

P_0 = D/k
P_0 = 2.00/0.12
P_0 = $16.67

Part 3b

$P_0 = D_1/(k - g)$
P_0 = (2.00×1.05)/(0.12 – 0.05)
P_0 = 2.10/0.07
P_0 = $30.00

Part 3c

$P_0 = D_1/(k - g)$
P_0 = (2.00×1.10)/(0.12 – 0.10)

$P_0 = 2.20/0.02$
$P_0 = \$110.00$

Part 3d

$P_0 = D_1/(k - g)$
$P_0 = (2.00 \times 1.15)/(0.12 - 0.15)$
$P_0 = 2.30/-0.03$
$P_0 = -\$76.67$

Part 3e

No, the answer to part 4 does not make sense. As we can see from part 1-3, increases in the growth rate make the stock more valuable. Also, due to the limited liability feature of corporations, the lowest value a stock can take is \$0.00. Therefore, it makes no sense to say that as growth increases from 10% to 15%, the stock price not only declines, it turns negative. The problem is that the formula we developed for solving for the present value of dividends when the growth rate is constant only works if the required return is greater than the growth rate (k>g). If that does not hold, the formula is no longer solving for present value, but instead is generating a meaningless number.

While this may appear to be a significant flaw at first glance, it really isn't as bad as it seems. Remember that the model assumes that the growth rate will continue not for a short time, but forever. How likely is it for a company to grow at 15% forever? Since the overall economy only grows at about a 3-4% annual rate, this company would overtake the world before too long. When companies exhibit extremely high growth rates, we know that their growth must decline over time because of (A) they will have no new areas of growth after the control their entire market or (B) new competition will enter the market. Consider Wal-Mart. It is unreasonable to assume they will grow at the same rate over the next 20 years as they have over the past 20 because they don't have as many untapped markets to expand into. When companies exhibit high growth rates, we must use the non-constant dividend growth model.

? Problem 5.8.4

Price a supernormal (nonconstant) growth stock with the following information:

Current Dividend (D_0) is \$3.00
growth rate year 1 is 35%
growth rate year 2 is 25%
growth rate year 3 is 20%
growth rate years 4 through infinity is 10%
required return is 18%

Answer

Step 1 – Forecast all dividends up to and including the first year of constant growth

$D_1 = 3.00 \times (1.35) = \$4.05$
$D_2 = 4.05 \times (1.25) = \$5.06$
$D_3 = 5.06 \times (1.20) = \$6.07$
$D_4 = 6.07 \times (1.10) = \$6.68$

Step 2 – Solve for the value of all dividends during the constant growth stage

$P_3 = D_4/(k - g) = 6.68/(0.18 - 0.10) = \$83.50$

Step 3 – Solve for PV

$CF_0 = 0$
$CF_1 = 4.05$
$CF_2 = 5.06$
$CF_3 = 89.57 \Leftarrow \$6.07 + \$83.50$

I = 18
NPV = P_0 = $61.58

Problem 5.8.5

Price a supernormal (nonconstant) growth stock with the following information:

Current Dividend (D_0) is $1.50
growth rate year 1 is -10%
growth rate year 2 is 0%
growth rates years 3-4 are 20%
growth rate year 5 is 150%
growth rate years 6 through infinity is 3%
required return is 15%

Answer

Step 1 – Forecast all dividends up to and including the first year of constant growth

D_1 = 1.50*(0.90) = $1.35
D_2 = 1.35*(1.00) = $1.35
D_3 = 1.35*(1.20) = $1.62
D_4 = 1.62*(1.20) = $1.94
D_5 = 1.94*(2.50) = $4.85
D_6 = 4.85*(1.03) = $5.00

Step 2 – Solve for the value of all dividends during the constant growth stage

$P_5 = D_6/(k - g)$ = 5.00/(0.15 – 0.03) = $41.67

Step 3 – Solve for PV

CF_0 = 0
CF_1 = 1.35
CF_2 = 1.35
CF_3 = 1.62
CF_4 = 1.94
CF_5 = 46.52 ⇐ $4.85 + $41.67
I = 15
NPV = P_0 = $27.50

Problem 5.8.6

If you planned to sell the stock described in Problem 5 immediately after the year 3 dividend was paid, how much would you expect to receive? (Assume the required returns and growth rates remain unchanged)

Answer

The key for this problem is to remember the concept that the value of the stock is equal to the present value of the remaining cash flows. The cash flows are the same as the ones we forecasted to solve for problem 5, except that we have moved through the first three years and the first three dividends are no longer associated with the stock. The person buying the stock is going to receive all of the dividends from year 4 on (but remember that since we are in year three, the year 4 dividend is only 1 year out).

CF_0 = 0
CF_1 = 1.94
CF_2 = 46.52

I = 15

NPV = P_3 = $36.86

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5.9: References and Attributions

Student Resources

Efficient Markets Hypothesis in Appendix B

Sample of Stock Information in Appendix B

Guided Tutorial for Stock Valuation in Appendix B

Videos

Preferred (No Growth)
Constant Growth
Supernormal Growth Part One
Supernormal Growth Part Two
Supernormal Growth Part Three
Supernormal Growth Part Four

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CHAPTER OVERVIEW

6: The Financial System and Interest Rates

Learning Objectives

After completing this chapter, students should be able to

- Diagram the financial system
- Discuss the components of the financial system and how they are connected
- Explain the role of the financial markets
- Explain the role of the financial intermediaries
- Differentiate between money and capital markets
- Differentiate between primary and secondary markets as well as explain the importance of each
- Explain the individual components that determine the rate of interest for a particular security
  - Real Rate of Interest
  - Inflation Premium
  - Default Risk Premium
  - Maturity Risk Premium
  - Liquidity Risk Premium
  - Special Characteristics Premium
- Explain the concept of a yield curve
- Explain the functions of the Federal Reserve System

6.1: Financial System
6.2: Components of the Financial System
6.3: Key Market Distinctions
6.4: More on Financial Markets
6.5: Determinants of Interest Rates
6.6: Further Discussion of Interest Rate Determinants
6.7: The Yield Curve
6.8: The Federal Reserve System
6.9: Key Takeaways
6.10: Exercises
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6.1: Financial System

The financial system refers to the complex of markets and institutions which help move capital (or cash) from suppliers of capital to demanders of capital, see diagram.

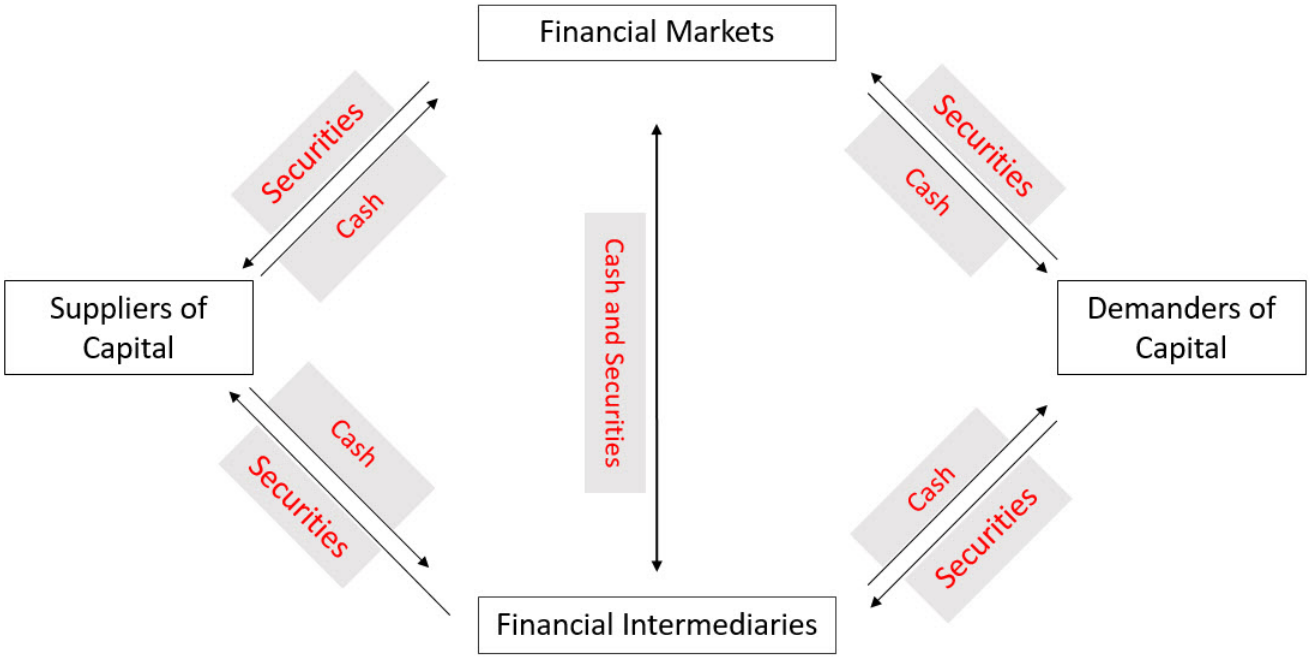


Figure 6.1.1: The financial system

As you can see, capital (cash) flows from suppliers of capital to demanders of capital in several different routes. It can flow through the financial markets (for example, when an investor buys a stock or a bond) or through a financial intermediary (for example, when someone deposits their money in a savings/checking account at the bank). Securities flow from demanders of capital to suppliers of capital (in exchange for cash). For instance, in the example of an investor buying a stock or bond, the investor that is selling the stock is exchanging a security for capital through the financial markets. When you borrow money from the bank to purchase a new car you are exchanging a security (the loan agreement) for cash (to pay the car dealer). Capital and securities also flow both ways between financial intermediaries and financial markets (for instance, banks buy and sell Treasury bonds — sending capital to the financial markets in exchange for securities when buying and sending securities in exchange for capital when selling.

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6.2: Components of the Financial System

Suppliers of Capital

Suppliers of Capital refer to those people/institutions that have extra income during the current time period that they are not using on current consumption. Instead of doing nothing with that extra income (or stuffing it in the mattress), they are going to put that extra money (referred to as capital) into the financial system so that they can earn a rate of return on their capital. Suppliers of capital can refer to individuals, businesses or governments. For example, when an individual is saving for retirement that person is acting as a supplier of capital (with the money that they are investing into their retirement fund.)

Demanders of Capital

Demanders of Capital refer to those people/institutions that need extra capital in order to meet their planned spending for the period. This could be

- An individual that is borrowing money for a new car
- A firm that is issuing bonds to expand production
- A firm that is issuing stock to expand production
- A local government issuing bonds to improve the area schools
- The federal government issuing bonds to finance government spending programs
- An individual selling off previous investments to fund their retirement
- Etc.

As you can see from the examples, demanders of capital include individuals, businesses, and governments. Also, it is important to note than many people will act as both suppliers of capital and demanders of capital during the same period. For instance, if I am saving $100 a month into a savings account to pay for a down payment on a house in a couple years and at the same time borrow money to buy a new car, I am both a supplier of capital in the first instance and a demander of capital in the second instance.

Financial Markets

Financial Markets help to bring together suppliers and demanders of capital in a more efficient manner if these suppliers and demanders of capital meet certain characteristics with respect to the financial securities that are being traded. Financial markets work most efficiently if the following characteristics are met:

- The number of identical (homogeneous) financial securities are large
- There are a large number of potential buyers (suppliers of capital) and sellers (demanders of capital) for a particular security.

Let’s explain this a little bit. Consider a security like IBM common stock. One share of IBM common stock is identical the next (this is referred to as being homogeneous) and there are over 900 Million shares outstanding (as of May 15, 2018). There are also a large number of potential buyers and sellers. In a situation like this, it doesn’t matter who we buy from or which shares we buy, so a financial market works well. Since we don’t have to investigate the particular seller or the specific shares they are selling, we can just place an order with a broker to buy 100 shares of IBM stock and they will buy them quickly in the marketplace.

Examples of financial markets may include

Stock Markets: NYSE (New York Stock Exchange) and NASDAQ (National Association of Securities Dealers Automated Quotations)
Bond Markets
Currency Markets
Derivative Markets



Figure 6.2.1: New York Stock Exchange

Financial Intermediaries

Financial Intermediaries (Institutions) act to process transactions between suppliers of capital and demanders of capital in which the financial markets are not efficient. For instance, if I as an individual want to borrow money for a new car, this is not an optimal transaction for a financial market. The number of identical financial securities (my car loan) is one. My personal credit and income characteristics are important, so the supplier of capital will not want to lend me money without investigating these issues. Also, these characteristics are different than the next person that wants to take out a car loan. Because of this, the marketplace approach that works well with stocks and bonds does not work well for transactions in which:

- The number of identical financial securities is small
- The personal characteristics of the buyer (supplier of capital) or the seller (demander of capital) are important to determining the value of the security.
- The supplier or demander of capital needs an additional service other than merely the transfer of cash ⇔ securities.

In these situations, financial intermediaries specialize in efficiently analyzing the information necessary to conduct transactions between suppliers and demanders of capital. In addition, they often issue a different security to the supplier of capital than was issued by the demander of capital. For instance, consider the car loan. The bank gets capital to make car loans from depositors. Depositors (suppliers of capital) put cash into the bank in exchange for checking accounts, savings accounts, and certificates of deposit. The bank pools this capital and lends it back out to the demanders of capital (the person taking out the car loan). By specializing in acquiring deposits, structuring different securities to meet the needs of suppliers of capital vs. demanders of capital, and in evaluating credit risks, the bank moves money from suppliers of capital to demanders of capital more efficiently than a marketplace would for these smaller, individualized transactions.

Examples of financial intermediaries may include

Credit Unions
Commercial Banks
Mutual Funds

Life Insurance Companies
Credit Card Companies

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6.3: Key Market Distinctions

There are several different classification schemes which are applied to financial markets which are discussed below. It is important to note that these are merely classification schemes and do not represent specific, physical marketplaces. For instance, there is not a national “capital market” where all capital market securities trade. Instead the term “capital market” merely seeks to characterize a particular type of security. Also, specific securities may trade on multiple types of financial markets. For instance, IBM common stock is a capital market security that trades on the secondary market at an organized exchange (the NYSE). There are also additional market designations, but the ones listed below represent the principle classifications of market types.

Money Markets vs. Capital Markets

Money Markets include all markets in which securities with 1-year or less remaining until maturity trade. Two examples here would be Treasury Bills and Commercial Paper. Both of these are short-term debt securities issued by the federal government (T-Bills) or corporations (Commercial Paper). Another example of a money market security would be Repurchase Agreements.

Capital Markets include all markets in which securities with more than 1-year remaining until maturity. Some examples here would be stock markets, Treasury bond markets, and corporate bond markets.

Primary Markets vs. Secondary Markets

Primary Markets are markets in which the security is sold for the first time. The security changes hands from the corporation (or government) that issues the security to the investor that purchases the security. The issuing body receives the capital. An example here would be the IPO (Initial Public Offering) market in which a firm issues shares of stock for the first time. Another example may include the US Treasury issuing 5-year Treasury Notes. The US Treasury receives the capital from this transaction and the purchaser of the security gets the security. It should be noted that a security can only trade in the primary market one time. Any trade of the security after it is issued will take place in the secondary market.

Secondary Markets are markets in which the security is sold between investors. The firm that originally issued the stock or bond is not involved in the transaction and receives no money. The NYSE is an example of a secondary market. For example, consider the 5-year Treasury Note discussed above. When that security is issued, it is issued in the primary market. However let’s assume that, after holding it for one year, the original purchaser decides to sell the security. This transaction will take place in the secondary market. The secondary market accounts for the bulk of trading activity in the financial markets.

Primary markets are essential for raising money. Since this is where securities are issued, corporations and governments use the primary market to raise capital for their investments. Without a strong primary market, the ability of firms to raise money to pursue long-range business goals would be significantly damaged. Secondary markets are essential for providing liquidity and valuation information. Let’s first consider liquidity. Liquidity (as will be discussed later) refers to the ability to sell an asset quickly and for fair market value. Investors like liquidity. Without active secondary markets, there would not be any liquidity (if you purchased shares of stock issued by a corporation, you would have a hard time selling it later when you wanted to convert it into cash). Without liquidity, people would stop buying securities on the primary market (would you want to buy stock in a company if there was no active secondary market to sell it in later?). Therefore, secondary markets are necessary to keep primary markets viable. Another role of secondary markets is to provide valuation information. We can see the value of a particular stock by the price at which people are willing to buy/sell. Without an active secondary market, we would have much less information about the value of stocks and bonds.

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6.4: More on Financial Markets

There are several different financial markets that exist in the United States (and several more that exist globally). Some financial markets trade stocks, others trade bonds, and still others trade different financial securities or assets (currencies, options, futures, etc.) Some of these markets have formal structures (such as the New York Stock Exchange or Nasdaq) while others are set up as a network of dealers (currencies and many bonds trade this way). In order to trade securities (stocks, bonds, derivatives), you need a broker. There are several different brokerage firms that offer a wide range of services. Some brokerage firms are referred to as full-service brokers that offer a complete range of trading services and financial advice. Typically these brokers also have the highest commission rates on trades. There are also electronic brokers (such as E*Trade or TD Ameritrade) which are structured for online trading. If you are interested in trading currencies or futures contracts, there are brokers that specialize in these types of securities. When you place your order with a broker, they then send that order to the financial markets where it is matched with someone taking the other side (for instance, if you are selling 100 shares of Wal-Mart someone else likely has an order with their broker to buy them).

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6.5: Determinants of Interest Rates

$$k = k^* + IP + DRP + LRP + MRP + SCP \tag{6.5.1}$$

$$krf = k^* + IP \tag{6.5.2}$$

where

k* = The real risk-free rate of interest
krf = The risk-free rate of interest
IP = The inflation premium
DRP = The default risk premium
LRP = The liquidity risk premium
MRP = The maturity risk premium
SCP = The special characteristics premium

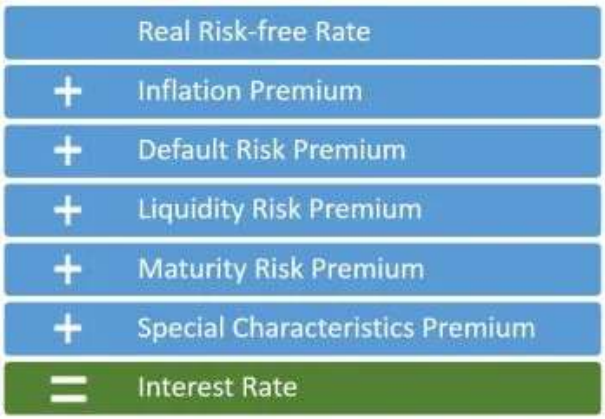


Figure 6.5.1: Determinants of Interest Rates

Real Risk-Free Rate of Interest

The Real Risk-Free Rate of Interest should represent the amount of compensation that investors feel is necessary to forego consumption today and instead save/invest that capital. This is typically a small amount in the range of 1% to 3% per year. This is sometimes referred to as the “PURE RATE”. The pure rate (real risk-free rate) will fluctuate over time, but at any point in time should be approximately the same across all securities.

Inflation Premium

The Inflation Premium is a percentage above the real risk-free rate of interest that allows the investor/saver to compensate for any loss in purchasing power due to inflation. For example, if I were to earn a 5% rate of return on an investment and in the same time inflation was 10%, then I have really just lost 5% of my wealth. If I want to earn a real return of 3% when inflation is 10%, I need to get at least 13%. One other thing to keep in mind regarding the inflation premium is that it is based on the expected average annual rate of inflation over the length of the investment. For example, the 3-month Treasury Bill has an inflation premium based on the expected ANNUALIZED rate of inflation over the next 3-months, while the 30-year Treasury Bond has an inflation premium based on the expected AVERAGE ANNUAL inflation rate over the next 30-years. While 3 months is a relatively short time, in periods of rising prices, the expected ANNUALIZED can be quite high. Also, since we are looking at AVERAGE ANNUAL inflation not cumulative inflation, the inflation premium on longer term bonds can sometimes be relatively small. For securities with approximately the same time to maturity, the inflation premium should be the same across these securities.

Default Risk Premium

The Default Risk Premium compensates investors for the risk of a borrower defaulting on their loan. For Treasury securities this is usually estimated to be zero as the possibility of default by the US Treasury is nil. For Municipal Bonds and Corporate Bonds the default premium can be relatively small or large depending on the creditworthiness of the issuer. There is a strong relationship between default premiums and bond ratings. The weaker the bond rating, the higher the default risk premium.

Liquidity Risk Premium

The Liquidity Risk Premium compensates investors for the difficulty of turning their investments into cash on a timely basis for close to fair market value. The more liquid an asset is, the more valuable, other things being equal, it is to an investor. If investors are not able to quickly convert their investment to cash without selling the asset for a steep discount, they will demand compensation for tying up their capital. Treasury securities are very liquid. Corporate Bonds and Municipal Bonds are much less liquid and there is a lot of variance among the liquidity of various securities.

Maturity Risk Premium

The Maturity Risk Premium recognizes that longer-term securities are more risky than shorter-term securities. Remember from Chapter Four that long-term bonds fluctuate more in value when interest rates rise than short-term bonds. This makes them riskier. As investors are risk averse, they will demand a premium for investing in longer-term securities.

Special Characteristics Premium

The Special Characteristics Premium accounts for any special features that may be attractive or unattractive to investors. For example, the bond may be issued by an international firm and interest paid in a foreign currency. This introduces currency risk and may require a slightly higher rate in order to attract investors. There could be a call provision. As discussed in Chapter Four, a call provision limits the investors upside potential when interest rates go down, but doesn't help the investor if interest rates increase. This "Heads I Don't Win, Tails I lose" feature makes investors demand a higher premium to invest in callable bonds. Convertible Bonds typically carry a negative premium as it allows investors to participate in the gains from stock increases while providing the greater security of a bond. Any other special features can result in positive or negative special characteristic premiums depending on whether or not investors find the feature to be a bonus or a detriment.

Each security will have different interest rates based on the above factors. The real risk-free rate of interest should be similar across various securities, however the various other factors will fluctuate based on the issuer, time to maturity, and size of issue, etc.

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6.6: Further Discussion of Interest Rate Determinants

Consider a Treasury Note with two years remaining to maturity vs. a 20-year, callable bond issued by a small firm with a BB bond-rating. The corporate bond should have a higher interest rate (bond yield) due to a larger maturity premium, larger default risk premium, larger liquidity premium, and larger special characteristics premium. The real rate of interest should be essentially the same on both bonds. The inflation premium will likely be different (as the expected annual rate of inflation over the next 2 years is likely to be different than that of the next 20 years), but it is not clear which bond will have the higher inflation premium as that depends on the particular economic environment and investors' expectations regarding inflation over these two time periods.

Another thing to consider when discussing the differences in yields on these two bonds in terms of the various premiums is that the exact size of the various premiums is likely to fluctuate over time. For instance, in periods of economic turmoil, default risk premiums tend to increase (as corporate bankruptcies are more likely). In periods where interest rates are highly volatile, we might see maturity risk premiums increase as well. The premiums give us a framework for explaining why different bonds have different yields. Also, if we have enough bonds, we can estimate what the various premiums are in the current economic environment. However, we should keep in mind that in a real world environment, these premiums do fluctuate and are only ballpark estimates instead of exact values that we can look up and plug into the formula.

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6.7: The Yield Curve

The Yield Curve refers to a graph of interest rates on securities with different times to maturity. The Yield Curve is designed to illustrate the difference between long-term and short-term interest rates. From our discussion above on determinants of interest rates, we know that the two factors that are likely to be different on bonds with different maturities are the maturity premium and the inflation premium. The longer the time to maturity, the greater the maturity premium will be. The inflation premium will depend on inflation expectations. The normal shape of the yield curve is upward sloping (due to the maturity premium). If we see a steep upward slope (more than a 1-2% yield difference between short-term and long-term bonds), that indicates that investors anticipate rising inflation (and, in turn, interest rates) in the future. If we see a flat or declining yield curve, that indicates that investors anticipate declining inflation (and interest rates) in the future. Since inflation typically slows in a recession, a downward sloping yield curve is an indicator of a potential recession. However, we must be careful. The economy is very complex and depends on hundreds of different influences. While a downward sloping yield curve is an indicator of a potential recession it does not mean there WILL be a recession – only that a recession is more likely than it would be if we had an upward sloping yield curve.

Another thing to stress on the yield curve is that things like the default risk and liquidity risk should be held as constant as possible along the yield curve. In other words, you would want to draw a yield curve entirely with Treasury bonds or entirely with BB-rated corporate bonds, but not with a mix of these bonds.

To view the current yield curve, see the following link:

Vanguard Funds Bond Yield Chart

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6.8: The Federal Reserve System



Figure 6.8.1: Hallway of Federal Reserve Bank of San Francisco

The Federal Reserve System (the Fed) is the central bank of the United States. It was created in 1913, following a series of banking crises that led to the desire for some central control on the stability of the banking sector. Since then the Fed has evolved into one of the most powerful economic body in the world. Today the major goals of the Federal Reserve System include full employment, stable prices, and moderate long-term interest rates.

Functions of the Federal Reserve System

Managing the nation's money supply through Conducting Monetary Policy is one of the primary responsibilities of the Fed. There are three main tools of monetary policy: open market operations, the discount rate, and the reserve requirements.

Open market operations is the most commonly used tool, in which the Fed purchases and sells U.S. government and federal agency securities, such as Treasury bills. As a recent example of using open market operations to implement expansionary monetary policy, the Federal Reserve purchased unprecedented amount of Treasury securities following the 2008 financial crisis to stimulate the U.S. economy. As a result, the Fed's holdings of Treasury notes increased dramatically during the following years.

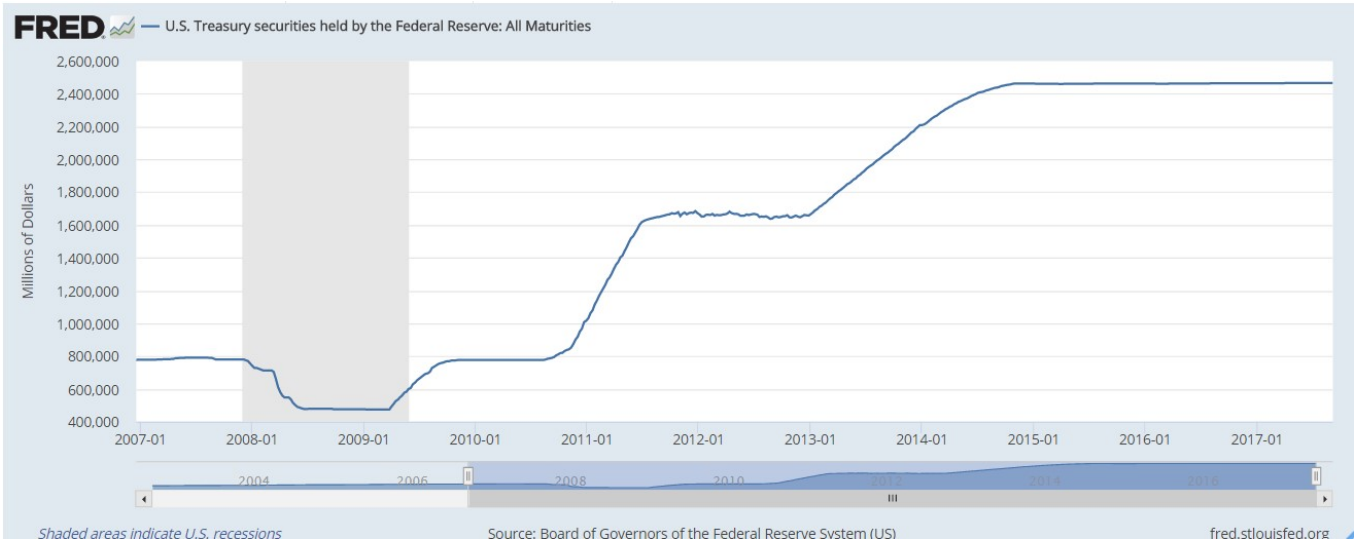


Figure 6.8.2: US Treasury securities held by the Federal Reserve Source: https://fred.stlouisfed.org/series/TREAST

As an alternative approach to manage money supply, the Fed can simply change the discount rate it charges on the loans made to commercial banks. By lowering the discount rate, commercial banks would find the loans from the Fed more affordable and hence borrow more, which leads to an increase in money supply to the economy. A third alternative is to change the reserve requirement. Each commercial bank is required to hold some proportion of assets from being invested in such assets as loans and mortgages. When the Fed lowers the required reserve ratio, commercial banks free up additional capital which can be potentially made into loans and mortgages.

The Federal Reserve supervises and regulates the activities of banks and other financial institutions. To effectively implement its supervisory and regulatory function, the Federal Reserve System is divided into 12 districts. Each district has one main Federal Reserve Bank which examines the activities of member banks located in their own district. The figure below shows the geographic boundaries of the 12 districts.

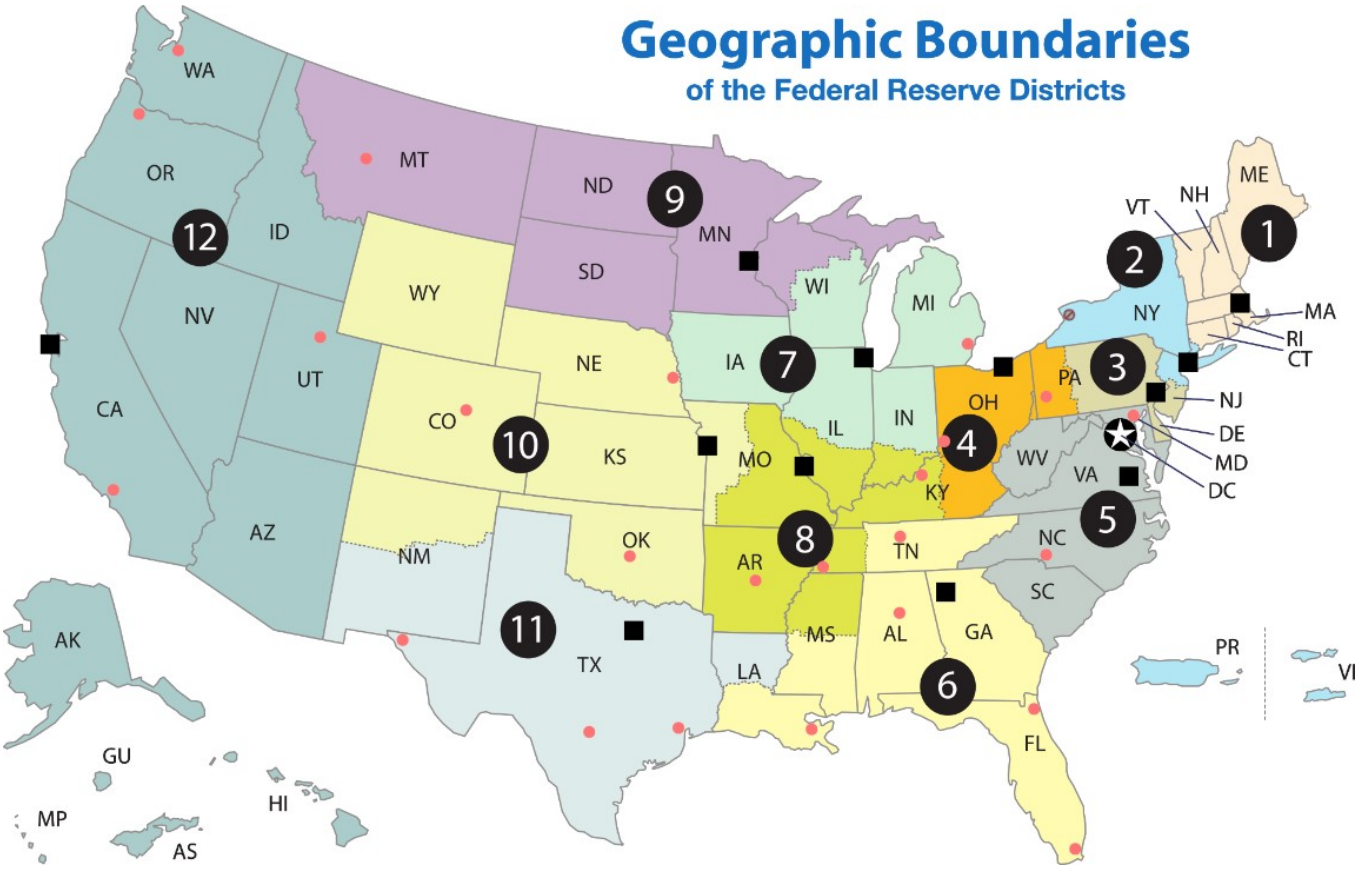


Figure 6.8.3: Geographic boundaries of the Federal Reserve Districts Source: https://en.Wikipedia.org/wiki/Federal_Reserve_System

Other functions of the Federal Reserve include:

- Collecting and replacing damaged currency from circulation.
- Check clearing. The Fed transfers funds from one bank to another as checks clear through the system.
- Serving as the commercial bank for the U.S. Department of Treasury.
- Providing research in the banking sector and economy as a whole.

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6.9: Key Takeaways

Key Takeaways

One of the fundamental components of a strong economy is a strong financial system. The financial system serves to bring together those that need to raise capital (demanders of capital) with those that have excess capital they would like to invest (suppliers of capital) in an efficient manner through either the financial markets or financial intermediaries. We can segment securities raised through financial markets and intermediaries as money market (short-term) vs. capital market (intermediate to long-term) securities. We can also segment activities as primary market transactions (where firms and governments raise capital) vs. secondary market transactions (where securities are traded amongst investors after they've been issued). The cost of raising capital is largely a function of a real rate of return to compensate investors for forgoing current consumption, an inflation premium to allow them to keep pace with anticipated inflation over the life of the security, and an assortment of risk premiums to compensate for the risk of their investments. One of the key actors in the financial system for the United States, as both a regulator and a participant, is the Federal Reserve. The Federal Reserve supervises and regulates the banking system, sets monetary policy for the United States, clears checks, and provides research in addition to other roles.

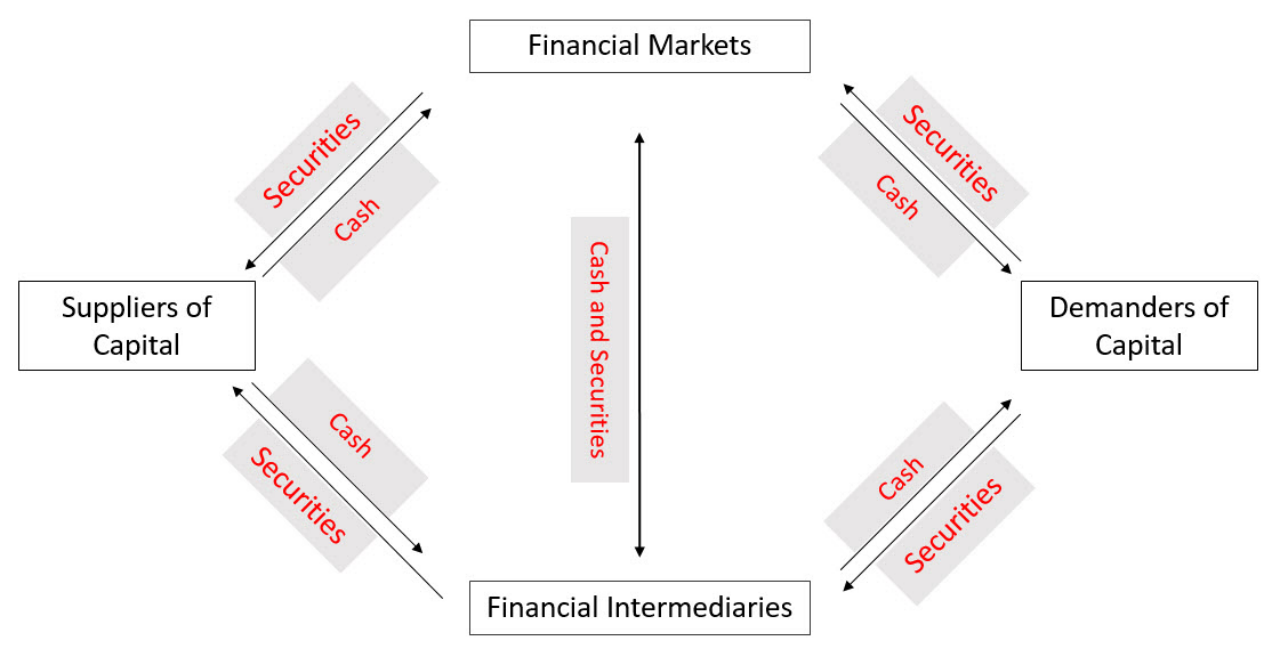
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6.10: Exercises

Exercise 6.10.1

Diagram and fully label the financial system and the flows of capital (cash) and securities through the system.

Answer



Exercise 6.10.2

What is a "Supplier of Capital"? Give an example of where you or someone you know has been a supplier of capital within the past year.

Answer

A supplier of capital refers to an individual, business, or government that has excess capital at a point in time that they would like to invest. The investment period could be as short as overnight or it could be several years. A couple of examples where I have acted as a supplier of capital in the past year would include investments into my retirement account and deposits into a checking account at my bank.

Exercise 6.10.3

What is a "Demander of Capital"? Give an example of where you or someone you know has been a demander of capital within the past year.

Answer

A demander of capital refers to an individual, business, or government that needs additional capital at a point in time. It also includes situations where an individual uses previous capital (acquired as a supplier of capital) for a purchase (or purchases) in this time period. The period for using that capital could be as short as overnight or it could be several years. A couple of examples where I have acted as a demander of capital in the past year would include credit card purchases and obtaining a loan for the purchase of a van.

Exercise 6.10.4

Is it possible to be both a supplier of capital and a demander of capital within the same time period? Explain.

Answer

Yes, most of us will act as both suppliers and demanders of capital within a given time period. If you make a deposit into a checking account (supplier of capital) and, within the same period, use a credit card (demander of capital) you are engaging in both activities. If you add money to a retirement plan at work (supplier of capital) and borrow money to purchase a home (demander of capital) you are engaging in both activities. You can probably think of several different situations from your own experience where you operated on both sides of the system within a given time period.

Exercise 6.10.5

Explain how the financial system makes both suppliers of capital and demanders of capital better off.

Answer

First, imagine a situation where there was no financial system in place. If you wanted to borrow money to purchase a new home, you would have to approach friends and family, take out a classified ad, or set up a web page asking to borrow money. Now imagine if you were doing this as a large business needing to raise $50 million for a new production facility. Or consider the flip side. You are working and earning a good salary. You want to set aside some money for retirement. Without a financial system, you can go dig holes in the back yard and start burying your extra money in jars. Or you could go around to local businesses asking if they wanted to borrow money from you or let you invest in their business. Or possibly even hang out at car dealerships seeing if someone needed a loan to buy a new car. Obviously none of these are very attractive options.

Having an efficient financial system in place allows you to approach a financial intermediary (such as a bank) when you need to obtain a loan. It allows you to pool purchases on a credit card (and if you pay your cards off on time without carrying a balance, you can earn rewards such as cash back). It allows you to become a part owner in attractive businesses by purchasing shares of stock or set aside money for retirement through a mutual fund. Essentially, by having a system in place that allows convenient trading of securities (the financial markets) and processing of transactions that require special structuring or credit evaluation (financial intermediaries), both suppliers and demanders of capital benefit. The reduced costs of finding someone to take the other have of the transaction and the specialization of financial institutions mean that suppliers of capital receive higher effective returns on their investments while at the same time demanders of capital are able to raise money at lower effective rates. This win-win situation is caused by the huge reduction in transaction costs (monetary costs and time costs) along with the availability of far more opportunities provided by financial markets and financial intermediaries.

Exercise 6.10.6

Explain why stocks are better suited for financial markets than financial intermediaries.

Answer

Stocks are what we refer to as homogeneous securities. What that means is that one share of stock in Google is the same as the next. It doesn't matter which share I buy or who I buy it from. This homogeneity is one of the primary reasons why financial markets are efficient for stock transactions. I do not need to evaluate the quality of the particular share of stock I'm receiving or the creditworthiness of the person selling it to me. All I need to know is (A) what company am I buying stock in, (B) how many shares do I want to buy, and (C) how much am I willing to pay.

The second important characteristic of stocks is that most publicly traded stocks have several million (in some cases billions) of shares outstanding and many different people (both individuals and institutions) willing to buy/sell those shares

at any given time. That means that by having a central location (either a physical location or even a network) where buyers and sellers are brought together, I can find someone willing to take the other side of my transaction very quickly.

When we have homogeneous securities and a large number of potential buyers and sellers, we have ideal conditions for financial markets. Give the potential buyers and sellers access to each other and they will collectively determine the optimal pricing.

? Exercise 6.10.7

Explain why auto loans are better suited for financial intermediaries than financial markets.

Answer

An auto loan is a very specialized security. The borrower (demander of capital) is seeking a loan (typically in the $10,000 – $25,000 range). The appropriate rate of return is dependent on the specific borrower (what is his credit history, employment history, income, other debts, etc.). Remember that one of the characteristics of securities that work well in financial markets is their homogeneity (it doesn't matter who I am buying the security from). Also, important to financial markets is that there are many buyers and sellers of the identical security. However, since each auto loan is individualized, neither of these characteristics are present. As a supplier of capital, you would need to run a complete credit background on the borrower and prepare a binding, legal note (the document backing the loan) for repayment. As most of us do not engage in these activities on a regular basis, the cost of doing so would eat up most of the return. However, for a financial institution that makes several similar loans each day, the process of credit checks and documentation are relatively low-cost items. Specialization allows the financial institutions to process these loans at a low cost (and diversify some of the risk by holding many different auto loans) so that they can lend the money at a relatively low rate. If the financial intermediary is a bank, it gets the necessary capital from the many depositors at the bank.

? Exercise 6.10.8

Explain how the security that the demander of capital exchanges for capital with a financial intermediary can be different than the security received by the supplier of capital.

Answer

This was partially discussed in the above question. Consider a bank. Banks obtain capital from hundreds (thousands or even hundreds of thousands depending on the size of the bank) of depositors. These people have checking accounts, savings accounts, certificates of deposits, etc. at the bank. The bank then takes all of this money on deposit and lends it out in the form of business loans, personal loans, mortgage loans, etc. They may also use the money to purchase Treasury bonds. By pooling capital in a financial intermediary, the bank is able to provide securities to the suppliers of capital that have a very different risk/return profile than the securities issued by the demanders of capital. This process helps increase the amount of money available in the financial system and allows both suppliers and demanders to benefit by better matching their needs.

Another example would be mutual funds. Many people invest in stocks and bonds through mutual funds. The mutual fund acts as a financial intermediary. As a supplier of capital, I send money to the mutual fund to invest in stocks and/or bonds. The mutual fund issues me shares of its portfolio. It then pools my money with thousands of other investors and goes into the financial markets to buy stocks and bonds from demanders of capital. The advantage to me as a supplier of capital is I get better diversification, the ability to invest less capital, and professional investment management to pick the stocks and bonds. Without the mutual fund as the financial intermediary, I would have to evaluate each stock and/or bond in my portfolio myself and have enough money to purchase enough different stocks/bonds to be diversified.

? Exercise 6.10.9

Give an example of a transaction that goes from the supplier of capital to the financial intermediary to the financial markets to the demander of capital.

Answer

The mutual fund example above meets this criteria. Another would be a life insurance company. When you purchase life insurance, the insurance company pools the premiums paid by you and the thousands of other customers. Instead of just holding onto this money and waiting to pay our benefits, the insurance company invests those premiums in stocks and bonds purchased in the financial markets. Because the insurance company is able to earn a return on these premiums paid in while they are waiting to pay out benefits, it lowers the cost of the insurance for customers. Many life insurance policies combine the life insurance with an investment policy so that the supplier of capital is buying life insurance and saving for retirement at the same time. (Note – this is not necessarily the best way to save money for retirement for everyone).

? Exercise 6.10.10

Give an example of a money market security and a capital market security.

Answer

Money market securities refer to securities that mature in one year or less. These include Treasury Bills (short-term "bonds" issued by the US Federal Government), Commercial Paper (short-term "bonds" issued by corporations), Re-purchase Agreements, and several other types of short-term securities.

Capital market securities refer to securities that mature in more than one year. These include Treasury Notes ("bonds" issued by the US Federal Government that mature in 2-10 years), Treasury Bonds (bonds issued by the US Federal Government that mature in 11-30 years) , Corporate Notes and Bonds, Preferred Stock, Common Stock and many other securities.

? Exercise 6.10.11

Explain how a company can raise money in the financial markets through a primary market transaction.

Answer

The primary markets are where firms (or governments) issue securities to raise capital. For instance, Initial Public Offerings (IPOs) refer to situations where a corporation "goes public". When a firm has an IPO, it is selling its stock to the public for the first time (prior to this, the corporation was typically owned by the founders and venture capitalists). In the IPO, the firm works with investment bankers to set the initial price and find investors that want to buy the shares. It is common for a firm to have more interested buyers than shares available. When this happens, the investors that were able to participate in the IPO often can sell their shares in the secondary markets later in that same day for 10%-100% more than they paid in the IPO. Consider the Snap (parent company of Snapchat) IPO from 2017. On March 2nd, 2017, Snap became a publicly traded company through an IPO. The stock was issued through the IPO at $17. Because the demand for the stock was so high on the IPO, not everyone that wanted to buy at the initial offering price of $17 could buy. When shares started trading in the secondary market, the price was $24 (about 40% above the IPO price). By the end of the day, the stock closed at $24.48 after trading as high as $26.05 during the day. Note that the increase in price beyond the IPO price of $17 was a return to the investors in the IPO and did not raise any additional capital for LinkedIn. LinkedIn's capital raised was based on the $17 IPO price.

Another type of primary market activity is referred to as a secondary (or "seasoned equity") offering. The secondary offering is NOT TO BE CONFUSED with the secondary market. A secondary ("seasoned equity") offering refers to a company that already is publicly traded, but issues additional shares of stock to raise money. Typically when firms issue additional shares in a secondary offering, the price of the stock will fall by a small amount (1-3%).

A third type of primary market activity occurs when corporations and/or governments issue new bonds. The US Treasury auctions new bonds on a regular basis where investors engage in an auction process to determine the price that they are willing to pay the US Treasury for these bonds. Corporations and State/Local governments will typically use investment bankers to help them price and sell their bonds in the primary markets instead of the auction process used by the Treasury.

Exercise 6.10.12

Explain how a company benefits from a secondary market transaction if it is not directly involved in the transaction.

Answer

There are multiple ways in which the secondary market benefits firms. First, without an active secondary market, the primary market would be much more limited. When investors buy stocks and bonds from the issuers in the primary market, the investors want to have the option to resell those stocks and bonds later on in the secondary markets. If there was no secondary market, many investors would be less willing to participate in the primary markets. Would you want to buy a 30-year Treasury bond if you knew there was no convenient way to sell it before maturity? How about buying stock in a new company? Without the liquidity provided by the secondary market, very few firms would be able to find investors to purchase primary market transactions. Even those that were able to still find investors in the primary markets would likely need to pay those investors much higher rates of return.

The second way the secondary markets benefit firms is through information. When bonds are actively traded in the secondary markets, we get information about what investors are demanding for interest rates. When stocks are actively traded in the secondary market, firms get information about the health of their company and their competitors (a falling stock price indicates perceived problems while a rising stock price indicates perceived strength).

Secondary markets also provide sources of acquisitions (allowing companies to grow), ways to reduce agency costs (through stock-based compensation) and many other benefits.

Exercise 6.10.13

Given the following information, calculate the interest rate on each of the securities in parts 13a-13d.

- Current Real Risk-Free Rate of Interest ⇒ 2%
- Liquidity Premium on Treasury Bonds ⇒ 0%
- Liquidity Premium on Bond C ⇒ 0.1%
- Liquidity Premium on Bond D ⇒ 0.2%
- Average Annualized Inflation Rate Expected over

  2 years ⇒ 3.0%
  5 years ⇒ 3.5%
  15 years ⇒ 2.5%
  20 years ⇒ 2.5%

- Default Risk Premium

  Treasury Bonds ⇒ 0.0%
  AA Corporate Bonds ⇒ 0.3%
  BB Corporate Bonds ⇒ 1.2%

- Special Characteristics Premiums

  Call Provision 0.6%
  Convertible Provision -0.8%

- Maturity Premiums

  2 years ⇒ 0.0%
  5 years ⇒ 0.15%
  15 years ⇒ 0.5%
  20 years ⇒ 0.6%

a. 2-year Treasury Note (bond)
b. 20-year Treasury Bond

c. 5-year AA callable, corporate bond and
d. 15-year BB convertible, corporate bond

Answer

Part 13a

$k = k_{rf} + IP + DRP + LP + MRP + SCP$
$k = 2\% + 3\% + 0\% + 0\% + 0\% + 0\% = 5\%$

Part 13b

$k = k_{rf} + IP + DRP + LP + MRP + SCP$
$k = 2\% + 2.5\% + 0\% + 0\% + 0.6\% + 0\% = 5.1\%$

Part 13c

$k = k_{rf} + IP + DRP + LP + MRP + SCP$
$k = 2\% + 3.5\% + 0.3\% + 0.1\% + 0.15\% + 0.6\% = 6.65\%$

Part 13d

$k = k_{rf} + IP + DRP + LP + MRP + SCP$
$k = 2\% + 2.5\% + 1.2\% + 0.2\% + 0.5\% + -0.8\% = 5.60\%$

? Exercise 6.10.14

a. Draw a yield curve based on the following bond yields:

3-Month Treasury Bill ⇒ 3.5%
1-Year Treasury Bill ⇒ 4.0%
2-Year Treasury Note ⇒ 4.2%
5-Year Treasury Note ⇒ 4.7%
10-Year Treasury Note ⇒ 5.0%
20-Year Treasury Bond ⇒ 5.1%
30-Year Treasury Bond ⇒ 5.2%

b. Draw a yield curve based on the following bond yields:

3-Month Treasury Bill ⇒ 6.5%
1-Year Treasury Bill ⇒ 7.0%
2-Year Treasury Note ⇒ 7.0%
5-Year Treasury Note ⇒ 6.2%
10-Year Treasury Note ⇒ 6.0%
20-Year Treasury Bond ⇒ 5.7%
30-Year Treasury Bond ⇒ 5.7%

c. Draw a yield curve based on the following bond yields:

3-Month BB-rated Corp. Bond ⇒ 8.0%
1-Year BB-rated Corp. Bond ⇒ 8.6%
2-Year BB-rated Corp. Bond ⇒ 8.7%
5-Year BB-rated Corp. Bond ⇒ 7.9%
10-Year BB-rated Corp. Bond ⇒ 7.6%
20-Year BB-rated Corp. Bond ⇒ 7.3%
30-Year BB-rated Corp. Bond ⇒ 7.4%

d. What are the different yield curves in Exercise a and Exerciseb telling us about inflation expectations in each situation?

e. Assume that the yield curves in Exercise b and Exercise c both represent the same point in time. What information can we get about the differences in these two yield curves?

Answer

Part 14a



Part 14b



Part 14c



Part 14d

In Yield Curve A, we have an upward-sloping yield curve (longer-term securities offer higher returns). The differences in yields are based on two factors – the inflation premium and the maturity premium. We know longer-term bonds are riskier and have a higher maturity premium. This is likely accounting for some of the upward slope. However, it is also likely that inflation expectations are slightly higher over the long-term than the short-term.

In Yield Curve B, we have a downward-sloping yield curve. As the maturity premium should increase with longer-term securities, the only way for a long-term bond to offer a lower yield than a shorter-term bond is if inflation expectations are higher for the short-term bonds. This typically will occur when the economy is expected to enter an economic slowdown in the near future.

Part 14e

Yield Curve B is based on Treasury bonds while Yield Curve C is based on BB-rated corporate bonds. Since the yield curves are taken at the same point in time, the inflation premiums should be the same in both curves. This means that the difference (the higher yields at every level in Yield Curve C) are based on the higher levels of default risk premium associated with BB-rated bonds and (to a lesser extent) the slightly higher liquidity premium on the corporate bonds (Treasury bonds tend to be more liquid than corporate bonds).

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CHAPTER OVERVIEW

7: Risk Analysis

Learning Objectives

After completing this chapter, students should be able to

- Define the concept of risk and explain how both the probability and magnitude of outcomes impact the degree of risk.
- Identify sources of risk and differentiate between general economic risk factors and firm specific risk factors.
- Explain the concepts of probability distributions, expected return and standard deviation for a single security.
- Calculate and interpret the expected return and standard deviation of a single security given a probability distribution.
- Explain the concept of correlation.
- Explain the concept of expected return and standard deviation for portfolios.
- Calculate and interpret the expected return and standard deviation for two-stock portfolios.
- Explain/diagram the concept and implications of portfolio diversification.
- Differentiate between firm-specific (diversifiable) risk, market (non-diversifiable) risk, and total risk.
- Identify when each risk type of risk measurement is appropriate.
- Calculate and interpret beta.
- Explain, calculate, and interpret the Capital Asset Pricing Model and Security Market Line.
- Identify potential concerns regarding the viability of the Capital Asset Pricing Model and the Security Market Line

7.1: What is Risk?
7.2: Expected Return and Standard Deviation of a Single Security
7.3: Interpreting Expected Return and Standard Deviation
7.4: Expected Return and Standard Deviation of a Portfolio
7.5: Diversifiable and Non-Diversifiable Risk
7.6: Beta
7.7: How do we Interpret Beta?
7.8: Standard Deviation vs. Beta
7.9: Beta and Required Return- Capital Asset Pricing Model (CAPM)
7.10: Important Implications of the CAPM/SML
7.11: Empirical Findings of the SML
7.12: Key Takeaways
7.13: Exercises
7.14: Problems
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7.1: What is Risk?

Risk refers to the possibility of an unfavorable event occurring. The higher the risk, the greater the probability of an unfavorable event or the more unfavorable the event could be. The interaction of the probability of the unfavorable event and the degree of negativity associated with the event is critical to determining the risk. For instance, imagine that you are going to participate in a coin flip. It will cost you $1.00 to participate. If you flip a head, you get $1.01. If you flip a tail you get $0.99. Even though there is a fairly high probability of the unfavorable event (50% chance of tails), the outcome is so minor (you lose $0.01) that this would be a low-risk event. Now, consider a slightly different coin flip. This time, instead of flipping the coin once, you will flip it 3 times. If you get 3 heads, you receive $10,000. If you flip 3 tails, you owe $10,000. Anything else you get your $1.00 back. Even though the probability of the bad outcome is much smaller (there is only a 12.5% chance of flipping 3 straight tails), this is a much riskier event due to the bad outcome being substantially worse. However, most people do not consider flying a commercial airliner to be a high risk event (even though the worst case scenario is obviously quite severe) because of the extremely low probability of a fatal crash (less than 1 in 10 million). It is not just the probability or just the degree of unfavorable outcome, but the combination of the two that matter for rational risk analysis.

In finance terms, our “unfavorable event” refers to earning less than expected. Any time we have a chance to earn less than expected on an investment opportunity we are exposed to risk. Note that this is a more strict definition than defining risk as the possibility of losing money. We want to be careful to think of risk as the possibility of earning less than expected instead of being the possibility of losing money.

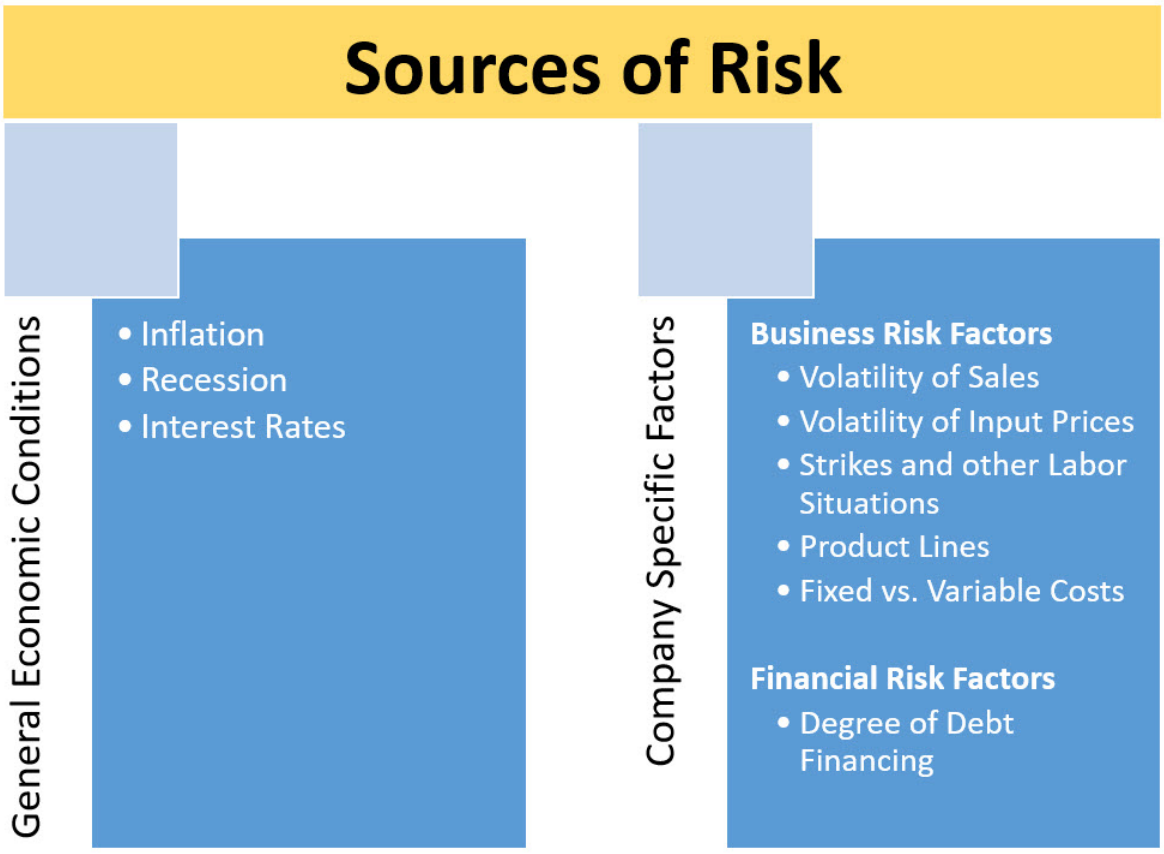


Figure 7.1.1: Broad categories of sources of risk

Note that the above list is a sample of broad factors and not a specific list. For example, consider what happens when we have a large increase in oil and gasoline prices. One immediate impact is inflation. The higher energy prices are, by definition, inflation in energy, but it goes beyond that. Now it costs more for firms to distribute their products to suppliers which is likely to cause the inflation to spill over to other areas. As we search for alternative energy sources (like ethanol), we may see corn prices rising. Since corn is used to feed cattle, this could lead to an increase in beef costs as well. Also, if consumers are now spending more to fill up

their gas tanks and more to buy a variety of food products, there would be less money available to spend on entertainment and other goods/services. This could lead to a recessionary environment (could, not will, because there are always so many influences on the economy that this is just one of many factors impacting economic growth). The point here is not the specific impacts of higher oil/gasoline prices, but that many economic risk factors may have more complex interactions than are apparent at the surface.

One other thought on risk to keep in mind as we move through this chapter. Throughout the chapter, we will be treating risk and potential returns as largely objective and measurable. However, in practice, one of the biggest challenges of risk management is trying to figure out what bad outcomes are and how likely they are. As, John Kenneth Galbraith, one of the great economists of the 20th century once wrote – "There are two kinds of forecasters: those who don't know, and those who don't know they don't know." In practice, the results of our models are only as good as the inputs we put into them.

Diversification

Diversification refers to the concept that by holding a number of different securities (ideally not just stocks) from a spectrum of industries, we can negate the impact of company specific factors on our returns. We will come back to this issue (one of the most important concepts in finance) in more detail later in this chapter.

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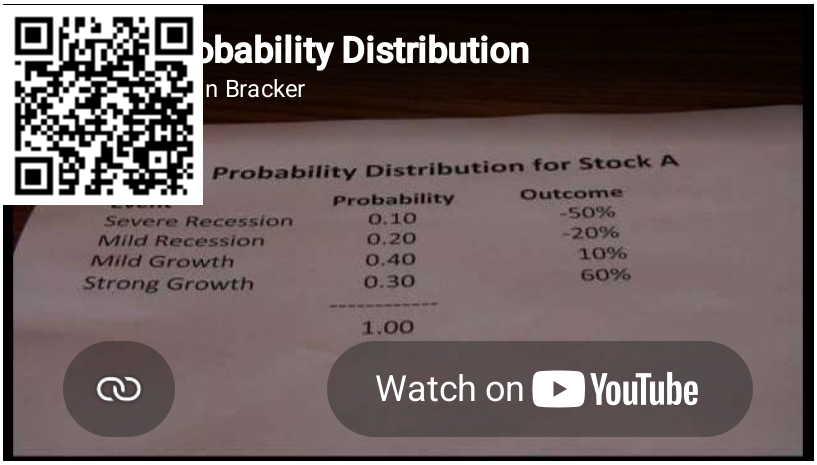
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7.2: Expected Return and Standard Deviation of a Single Security

Expected Return

The expected return of a security is based on the probability distribution of returns. Before we get into the details of the expected return, let's briefly introduce the concept of a probability distribution. A probability distribution is a representation of possible outcomes (states of nature) that may occur and the likelihood (probability) of each outcome. If you think of a coin flip, the probability distribution has two possible outcomes (heads or tails) and each outcome has a 50% chance of occurring (technically, this is not true as even in a "fair" coin flip, the side that starts up has about a 51% chance of occurring). When dealing with financial securities, the number of possible outcomes is nearly infinite and it is not possible to know the exact outcomes or probabilities of those outcomes. Therefore, we are really only approximating the true probability distribution.

Video Probability Distribution



Specifically, the expected return is the probability of a specific state of nature occurring times the return under that state of nature summed across all possible states of nature. In formula terms, it is

$$\bar{k} = \sum_{i=1}^{n} P_i k_i$$

or

$$\bar{k} = P_1 k_1 + P_2 k_2 + ... + P_n k_n$$

where

$\bar{k}$ represents the expected return of the stock
P_i represents the probability of the ith possible outcome (state of nature)
k_i represents the return under the ith outcome (state of nature)
P_n represents the probability of the nth possible outcome (state of nature) k_n represents the return under the nth outcome (state of nature)

Don't worry if the formula and definition seem intimidating, the process is relatively simple. Consider the following example. After researching Stock A we have determined that there are 3 possible outcomes for the next year (3 states of nature). The first possibility is the economy enters a recession causing the stock to have a return of -15%. The probability of this occurring is 20%. The second possibility is that the economy goes smoothly, but does not experience rapid growth causing the stock to rise and offer a 10% return. The probability of this occurring is 50%. The third possibility is that the economy booms, causing the stock to provide a 35% rate of return. The probability of the economy booming is 30% (note that the probabilities must sum to 1.0 and the states of nature should be mutually exclusive).

State of Nature	Probability	Return
Recession	0.20	-15%
Normal	0.50	10%
Boom	0.30	35%

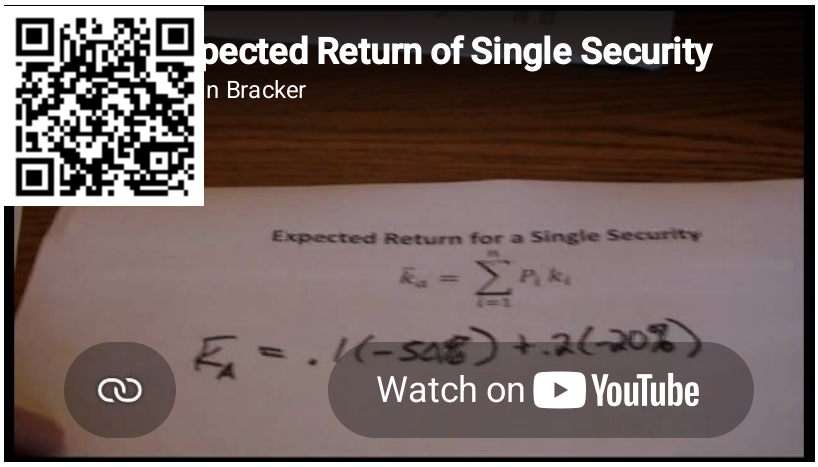
What is the expected rate of return?

$$\bar{k} = (.20)(-15\%) + (.50)(10\%) + (.30)(35\%)$$

$$\bar{k} = -3\% + 5\% + 10.5\%$$

$$\bar{k} = 12.5\%$$

Video Expected Return of a Single Security



Standard Deviation

The standard deviation measures the variability of possible returns and is represented by the lower-case Greek symbol sigma. The smaller the standard deviation, the more likely we are going to earn something "close" to our expected return. The greater the standard deviation, the greater the chance that we may earn something far more (good) or far less (bad) than our expected return. The formula for this is (remember that $\bar{k}$is our symbol for expected return):

$$\sigma = \sqrt{\sum_{i=1}^{n} P_i \left(k_i - \bar{k}\right)^2}$$

or

$$\sigma = \sqrt{P_1 \left(k_1 - \bar{k}\right)^2 + P_2 \left(k_2 - \bar{k}\right)^2 + ... + P_n \left(k_n - \bar{k}\right)^2}$$

where

sigma (σ) represents the standard deviation
P_i represents the probability of the ith outcome (state of nature)
k_i represents the return under the ith outcome (state of nature)
$\bar{k}$ represent the expected return for the stock
P_n represents the probability of the nth outcome (state of nature)
k_n represents the return under the nth outcome (state of nature)

Calculation Notes:

It is easy to get confused with decimals and percents. The best way to do these calculations is to always leave the weights as decimals and the returns as a regular number. For instance, if you have a probability of 0.10 and a return of 15%, you would put the probability into your calculator as 0.10 and the return as 15.

Be careful with your order of operations.

1. Do $\left(\mathrm{k}_1 - \bar{k}\right)$ first
2. Then square that
3. Then multiply by P_1
4. Repeat for all n states of nature
5. Add them up
6. Finally, take the square root

Consider our previous example. What is the standard deviation for stock A?

$$\sigma = \sqrt{0.2(-15 - 12.5)^2 + 0.5(10 - 12.5)^2 + 0.3(35 - 12.5)^2}$$

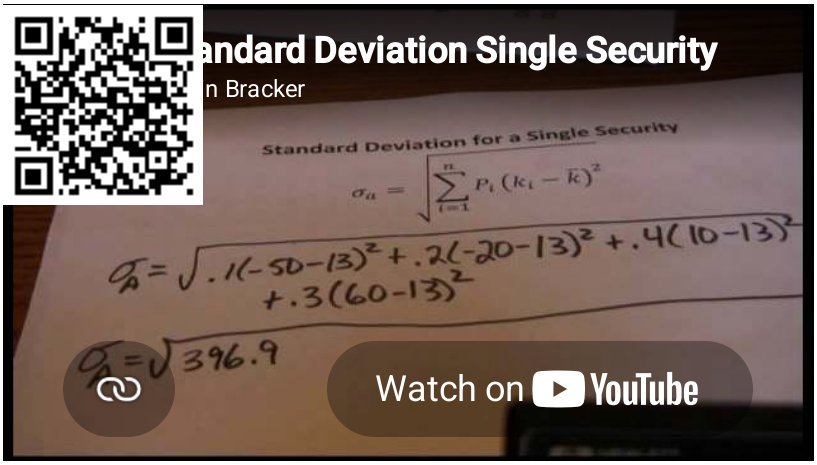
$$\sigma = \sqrt{0.2(756.25) + 0.5(6.25) + 0.3(506.25)}$$

$$\sigma = \sqrt{151.25 + 3.13 + 151.88}$$

$$\sigma = \sqrt{306.25}$$

$$\sigma = 17.50\%$$

Video [Standard Deviation of a Single Security]



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7.3: Interpreting Expected Return and Standard Deviation

Expected return gives us an idea of how much we will make on the investment. Remember that it is **not** how much we **will** make, but how much we would make **on average** if we could repeat the holding period an infinite number of times. Think of a situation where you are asked to pick a number between 1 and 10. If you select the correct number you get $100 and if not you get nothing. Any one time that you try this, you will either receive $100 (if you are lucky) or $0. However, if you could repeat the exercise 100,000 times, you would find that you would make almost exactly $10 per time. It is critical to know expected values when selecting investments. For instance, if someone offered you the opportunity to do this exercise for $9 per pick and you could pick as often as you wanted, it would be an excellent opportunity. Alternatively, if you were offered the same thing for $11, you would (hopefully) walk away. However, it is just as important to understand that the expected return is only an average return and not the return you **will** receive in any particular instance. This example also illustrates why it is so important to focus on the process and not the result. If you had the opportunity to play this game once for a cost of $2 and you lost, it still was a smart decision to play and you should do it again if you got the chance. If you had the opportunity to play this game once for a cost of $20 and you won, it was still a bad decision to play and you should pass if offered the opportunity to try again.

Now consider a similar exercise — pick a number between 1 and 5. If you select the correct number, you get $50 and if not you get nothing. The expected value for this exercise is the same as the previous exercise ($10). So, imagine that you are offered the opportunity to participate in either one (pick from 10 numbers or pick from 5 numbers) for $8. You can only play once. Most people will now choose to pick from 5 numbers. Why? Because it has less risk (a lower standard deviation) and offers the same expected return. This is the concept of risk aversion. As a side note, if you still picked the 10-number game it is likely because the stakes are small (the entertainment value of the gamble outweighs the financial aspect). As the stakes increase, the vast majority of people will choose the 5-number game.

Moving away from our example, let's put this in finance terms. Consider two stocks. Stock A has an expected return of 10% and a standard deviation of 25%. Stock B has an expected return of 10% and a standard deviation of 30%. Which should you choose and why? (Answer to follow …think about it first)

Now consider two other stocks. Stock C has an expected return of 7% and a standard deviation of 20%. Stock D has an expected return of 9% and a standard deviation of 28%. Which should you choose and why? (Again, spend some time thinking before reading the next paragraph).

In the first example, you should choose stock A and so should everyone else. Stock B offers us no additional compensation (expected return) to entice us to take the higher risk (standard deviation). Therefore, it is irrational in a risk-averse framework to invest in stock B. In the second example, you could choose stock C or stock D and someone else may make the same choice or the opposite choice. Here, the choice is based on your individual level of risk aversion. Stock D is riskier, but it also compensates us for that risk with a higher expected return. Is the compensation enough? That depends on the individual. For those that are less risk-averse, they require less additional compensation to take on the extra risk so they will likely take stock D. For those that are more risk averse, they will take stock C because the extra compensation is not enough for them to take the extra risk. Take a few moments and try to think of what factors impact **your** level of risk aversion. Typically we find that age, personality, number of dependents, wealth, income, variability of income, past life experiences, and other factors all combine to influence one's level of risk aversion. One last thought — remember that taking stock D does not mean you will earn a higher return, just that you will earn a higher return **on average**. If you always earned a higher return from stock D, then it wouldn't be riskier. Visually, you can think of it along the lines of the diagram below. At low levels of risk the range of returns will be close to the expected return. At high levels of risk, the range of returns will be higher. The expected return increases with risk, but so to does the range of potential returns.

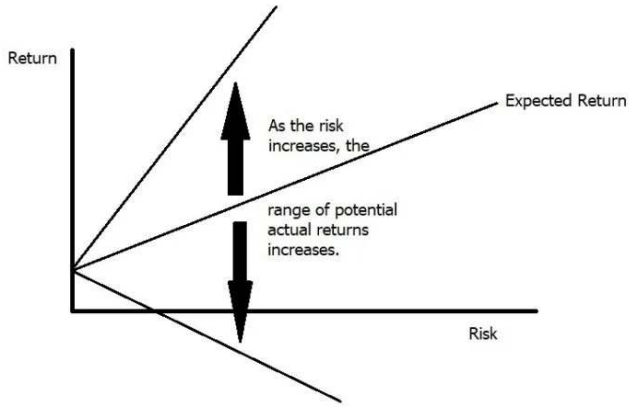


Figure \(\PageIndex{2}: **Range of Potential Actual Returns**

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7.4: Expected Return and Standard Deviation of a Portfolio

Expected Return

The expected return for a portfolio is simply the weighted average of each stock held in the portfolio. The formula here is

$$\overline{k_p} = \sum_{i=1}^{n} W_i \bar{k}_i$$

or

$$\overline{k_p} = W_1\overline{k_1} + W_2\overline{k_2} + ... + W_n\overline{k_n}$$

where

$\overline{k_p}$ represents the expected return for the portfolio
W_1 represents the weight (proportion of portfolio) of stock 1
$\overline{k_1}$ represents the expected return for stock 1
W_n represents the weight (proportion of portfolio) of stock n
$\overline{k_n}$ represents the expected return for stock n

Again, let's consider an example. What is the expected return of a portfolio made up of 60\% Stock A and 40\% Stock B when the expected return for Stock A is 10\% and the expected return for Stock B is 20\%?

$$\overline{k_p} = (.60)(10\%) + (.40)(20\%)$$

$$\overline{k_p} = 6\% + 8\%$$

$$\overline{k_r} = 14\% v$$

Video [Expected Return of a Two-Stock Portfolio]



Standard Deviation

The standard deviation of a portfolio becomes more complicated. It depends not only on the standard deviation and weightings of each stock, but also on the correlation between pairs of stocks.

Correlation

The correlation between a pair of stocks measures how closely the returns for each stock are related. A negative correlation means that the price of one stock tends to fall while the other rises (prices/returns are inversely related). A positive correlation means that the price of one stock tends to rise while the other rises (prices/returns are positively related). Correlations can range from -1.0 to 1.0. Correlations for real-world variables are almost never at the extremes (perfect positive correlation, no correlation, or perfect negative correlation).

See the Observed Betas, Correlations, and Standard Deviations Table in Appendix B for some standard deviations and correlations from actual companies over the past five years.

Observations from the Table

- The last two rows/columns are for an aggregate US bond fund and the S&P 500 ETF. The purpose of these is to provide a proxy for the US bond market and the US stock market.
- The vast majority (65 of 66) of correlations between pairs of stocks are positive. This is because all stocks are impacted by general economic factors.
- The average correlation across pairs is a low, positive value (0.31 in our sample). While general economic factors cause a tendency for stock to move together, firm-specific factors push correlations towards zero.
- Stocks in similar industries tend to have higher correlations than the average stock (0.50 vs. 0.31).
- Each stock has a positive correlation with the overall stock market.
- The stock and bond market have a negative (although essentially zero) correlation during this time-period.
- The bond market has a much lower standard deviation than the stock market, but also generated much lower returns during this time-period.
- Most individual stocks have a standard deviation that is higher than the overall stock market. This is because the stock market represents a diversified portfolio which has eliminated most of the firm-specific risk. The exception is Pepsi in our sample which is essentially the same standard deviation.
- The historical annualized returns are not the same as the expected returns. It is unrealistic to expect 30%+ annual returns for Deere, Boston Beer or Amazon going forward (which is not the same as saying that these stocks can't generate those returns). Also, it is unreasonable to expect people to buy stock in Molson Coors and Exxon with the anticipation of losing nearly 12% or 8% each year.
- While standard deviations will vary depending on overall market conditions, large cap stocks over this 5-year window had standard deviations of approximately 15-42%. Note that the standard deviations will be bigger or smaller depending on both the stock and the time period and that Boston Beer's 42.5% is noticeably larger than the next closest company.

Standard Deviation for a two-stock Portfolio

In order to calculate the standard deviation of a two-stock portfolio, we will use the following formula:

$$\sigma_p = \sqrt{W_1^2\sigma_1^2 + W_2^2\sigma_2^2 + 2W_1W_2\sigma_1\sigma_2\,\text{corr}_{1,2}}$$

where

σ_p represents the standard deviation of the portfolio
W_1 represents the weight (proportion of portfolio) of stock 1
σ_1 represent the standard deviation of stock 1
W_2 represents the weight (proportion of portfolio) of stock 2
σ_2 represent the standard deviation of stock 2
corr $_{1,2}$ represents the correlation between the returns of stocks 1 and 2

Again, let's work through an example. Consider a two-stock portfolio in which 60\% of your money is invested in stock A and 40% of your money is invested in stock B. Stock A has a standard deviation of 50% and stock B has a standard deviation of 70%. The correlation between the returns for stock A and stock B are 0.30 . You want to find the standard deviation of this portfolio.

$$\sigma_p = \sqrt{(0.6)^2(50)^2 + (0.4)^2(70)^2 + 2(0.6)(0.4)(50)(70)(0.3)}$$

$$\sigma_p = \sqrt{(0.36)(2500) + (0.16)(4900) + (504)}$$

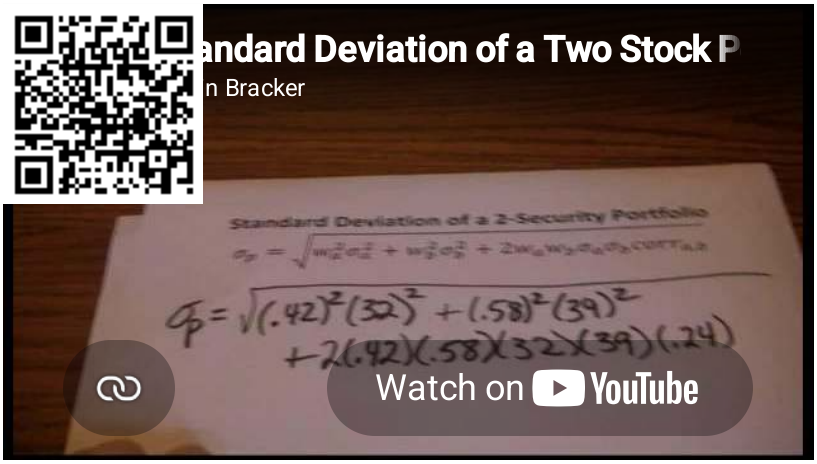
$$\sigma_p = \sqrt{900 + 784 + 504}$$

$$\sigma_p = \sqrt{2188}$$

$$\sigma_p = 46.78\%$$

Note that in this example, the standard deviation of the portfolio is less than the standard deviation of either stock separately. This illustrates the concept of diversification. As long as the correlation is less than 1.0 (which it will be for any two stocks), the risk of the portfolio is less than the weighted average risk of the two securities which make up the portfolio (and sometimes — like here — even less than the lowest risk stock in the portfolio). While we will not cover the process of calculating the expected return and standard deviation for larger portfolios in this class, in practice, most portfolios hold far more securities.

Video Standard Deviation of a Two-Stock Portfolio



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7.5: Diversifiable and Non-Diversifiable Risk

Remember earlier we discussed the possibility of lowering our firm-specific risk by holding a number of stocks from a wide range of industries? This concept of diversification allows us to greatly reduce our risk by holding a portfolio. Diversifiable risk refers to risk factors that are isolated towards one particular firm or industry.

For example, if a drug manufacturer gets hit with a lawsuit related to one of the drugs it produces, that is likely to have an isolated impact. It will not have any effect on the stock prices of auto manufacturers, grocery retailers, banks, etc. Once we have enough stocks in our portfolio, bad news for any one of them will have a small impact on our overall portfolio as long as that bad news is contained to that one firm (in other words, as long as it comes from a diversifiable risk factor). By holding approximately 25-50 stocks, we can eliminate a large portion of our diversifiable risk. (Statman, 1987) While a portfolio of 10 stocks has much less risk than a portfolio of 5 stocks, a portfolio of 100 stocks offers very little risk reduction compared to a much smaller 50-stock portfolio (assuming our stocks are from a variety of different industries and have other differing characteristics).



Does this mean that we have eliminated all of our risk when we hold a 50-stock (or even 500-stock) portfolio? No, we are still subject to general economic risk that affects all securities. This leftover risk is referred to as Non-diversifiable risk (or market/systematic risk). Examples of non-diversifiable risks include political events (such as wars), energy price shocks, changes in interest rates, recessions, etc. Any risk factor that impacts virtually all stocks is referred to as a non-diversifiable risk factor because it will impact our portfolio regardless of how well we have diversified our investments. Another name for non-diversifiable risk is “market risk” because these sources of risk tend to affect the entire market as opposed to an individual security or industry. Note: Market risk does not refer to risk impacting a specific industry. Instead it refers to risk impacting the broad economy (most stocks). If a risk factor only impacts one or two industries without carrying over to the broader market it is classified as firm-specific.

The following graph does a good job of illustrating the concept of diversification and firm-specific vs. market risk.

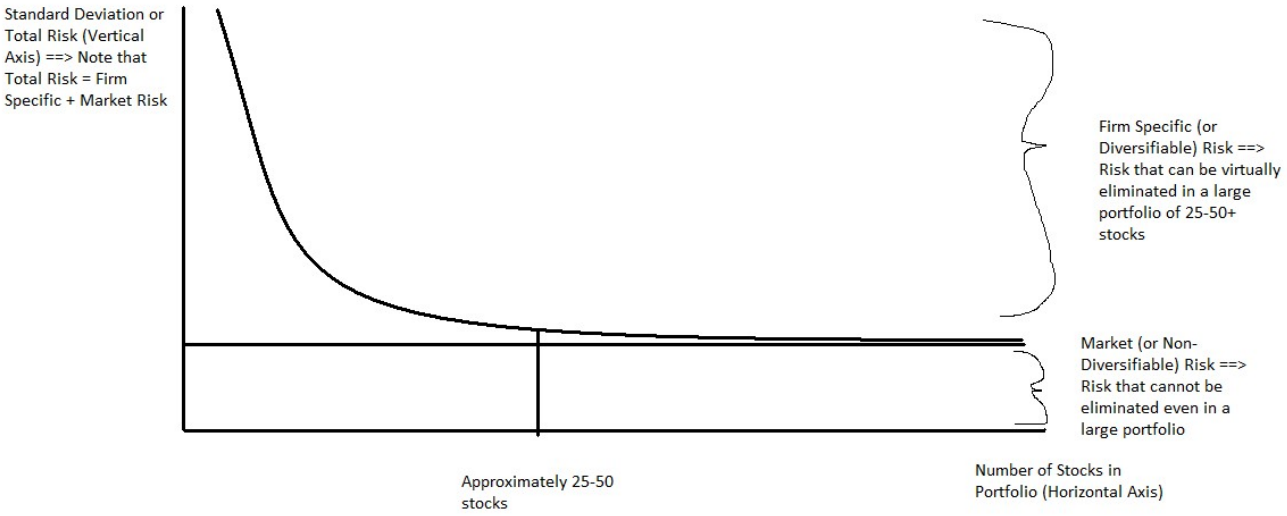
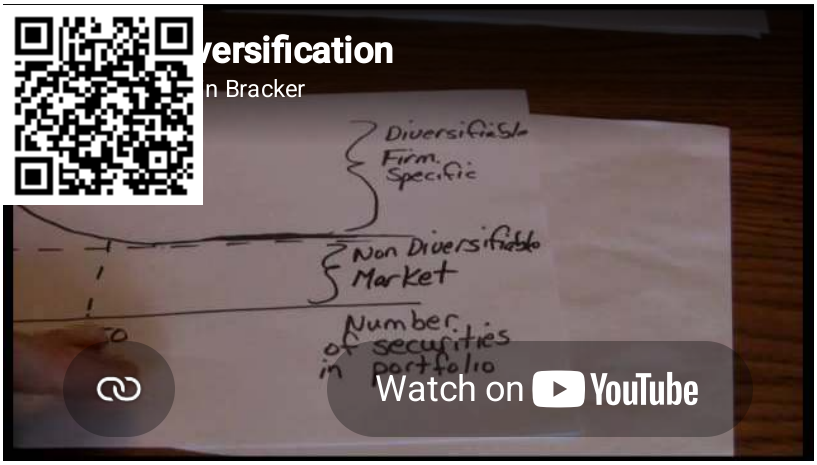


Figure 7.5.1: Firm-specific Risk vs. Market Risk

Given the relative ease with which investors can virtually eliminate their firm-specific (diversifiable) risk, for most investors the level of non-diversifiable (market) risk associated with an investment becomes more important. It is important to note that while market risk impacts all stocks, it does not impact all stocks equally. Therefore, we need to a tool to measure how sensitive a stock is to the overall market. This tool is known as BETA. Standard deviation measures total risk (diversifiable risk + market risk) for a

security, while beta measures the degree of market (non-diversifiable) risk. We won't introduce a risk measurement for diversifiable risk.

Video Diversification



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7.6: Beta

In addition to serving as a measure of market risk, Beta tells us how a particular stock moves in relation to the rest of the stock market as a whole.

$$\beta_A = \frac{(\sigma_A)\,(\text{corr}_{A,MKT})}{\sigma_{MKT}}$$

where

β_A represents the Beta of Stock A
σ_A represents the standard deviation of stock A
corr $_{A,MKT}$ represents the correlation between stock A and the overall market σ_{MKT} represents the standard deviation of the overall market

Consider the following example. Stock A has a standard deviation of 60% while the overall stock market has a standard deviation of 25%. Assuming that the correlation between Stock A and the overall market is 0.30 , what is the beta of Stock A?

$$\text{Beta } = [(60)(.30)]/(25) = 18/25 = .72$$

What is the Market?

The market refers to a portfolio of all investment assets (stocks, bonds, gold , art, etc.). However, in more practical terms, the market usually refers to the stock market and can be measured by a market index (such as the S&P 500 or Dow Jones Industrial Average).

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7.7: How do we Interpret Beta?

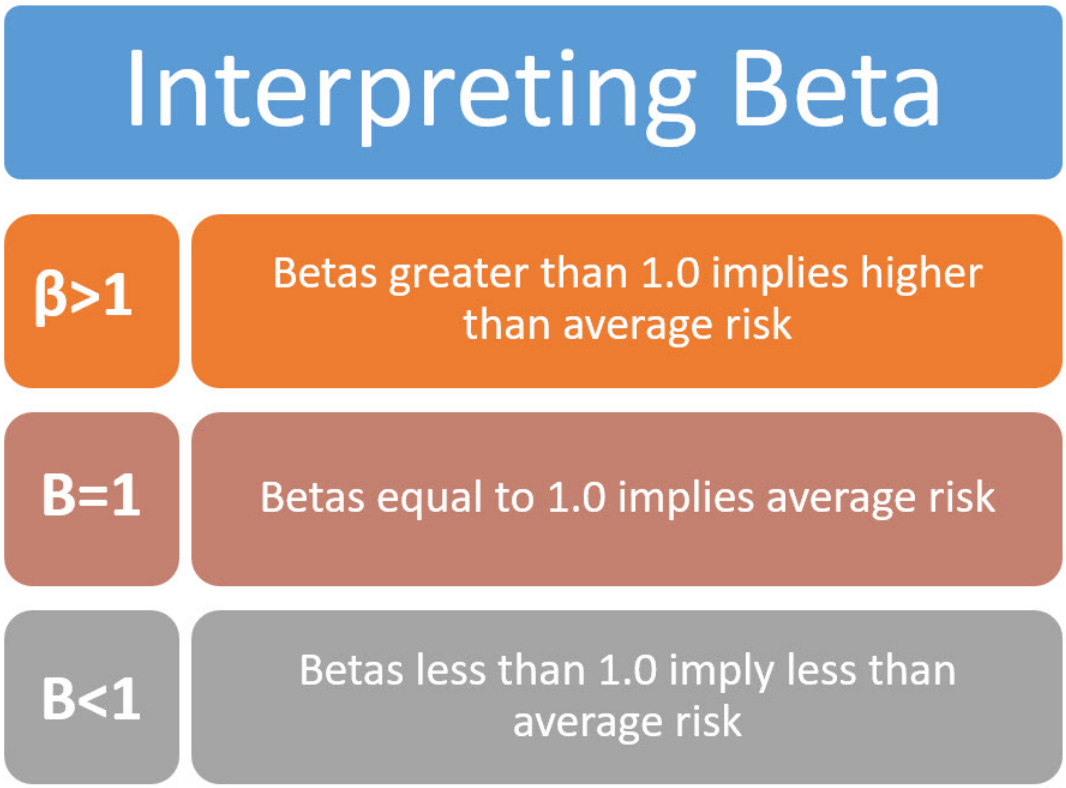


Figure 7.7.1: Beta helps evaluate risk

Most betas range between 0.35 and 1.8 (there are many outside this range, but the majority of stocks fall in this range – review Observed Correlations, Returns, Standard Deviations and Betas Table in Appendix B and note that all the stocks other than Wal-Mart fall in this window.)

Go back to our example where we calculated the beta for stock A. By itself, stock A is much riskier than the overall market as determined by its standard deviation. However, when we consider it as part of an overall portfolio its risk is much lower (less than average) due to the fact that it has a relatively low correlation to the overall market. The riskiness of stock A depends on whether we plan to use it as a stand alone investment or as part of a portfolio.

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7.8: Standard Deviation vs. Beta

At this point, we have introduced two risk measurements. The first is standard deviation and the second is beta. In some cases, these two risk measurements will tell a different story. For instance, stock A may have a standard deviation of 30% and a beta of 0.8 while stock B may have a standard deviation of 25% and a beta of 1.3. Which stock is riskier? The answer is depends on the specific situation. Because each risk measurement is measuring a different type of risk (standard deviation measures total risk while beta measures market risk), we need to think of situations where each is appropriate.

Single Security and/or Poorly Diversified Portfolio

If you are going to place your entire investment into a single security or a poorly diversified portfolio, then standard deviation is the appropriate risk measurement. In this situation, you have not diversified away the majority of the firm-specific risk, so you need to include it in your analysis. Standard deviation does this because it includes both sources (market and firm-specific) of risk.

Adding a Security to a Well-Diversified Portfolio

If you own a well-diversified portfolio and you are planning to add a single security to that portfolio, then the firm-specific risk of the security you are adding is not relevant. The reason it is not relevant is because it will be one of many stocks in the large portfolio and the firm-specific risk will be diversified away. What matters is how that stock moves with the overall market. Since we measure this market risk with beta, our appropriate risk measurement here is beta.

Choosing Between 2 (or more) Well-Diversified Portfolios

If you are choosing between two or more portfolios that are each well-diversified, then you can use either standard deviation or beta as your risk measurement. The reason for this is that at this point, the firm-specific risk is already diversified away so that your total risk and market risk should be essentially the same. Thus, whichever portfolio has the higher standard deviation should also have the higher beta (if not, you know the portfolios are not well-diversified).

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7.9: Beta and Required Return- Capital Asset Pricing Model (CAPM)

During the mid-1960's and early-1970's some finance professors developed the Capital Asset Pricing Model (CAPM). (Sharpe, 1964; Lintner, 1965; Black, 1972) One of the key components of this model is the Security Market Line (SML) which states that the required rate of return for a stock is dependent on the beta of that stock. While technically, the SML is a subset of the larger model (CAPM), in practice the two terms are typically used interchangeably. Thus, think of them as the same basic model. Specifically, the SML states that

$$k_A = k_{RF} + \beta_A \left(\overline{k_m} - k_{RF}\right)$$

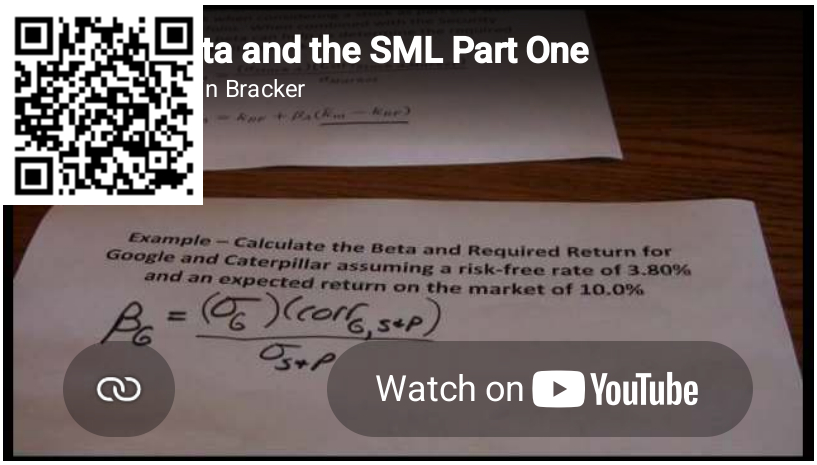
where

k_A is the required return for stock A,
k_{RF} is the risk-free rate of interest (often approximated by the yield on 10 -year Treasury bond),
β_A is the beta for stock A,
$\overline{k_m}$ is the expected return on the market (often approximated by the S\&P 500)

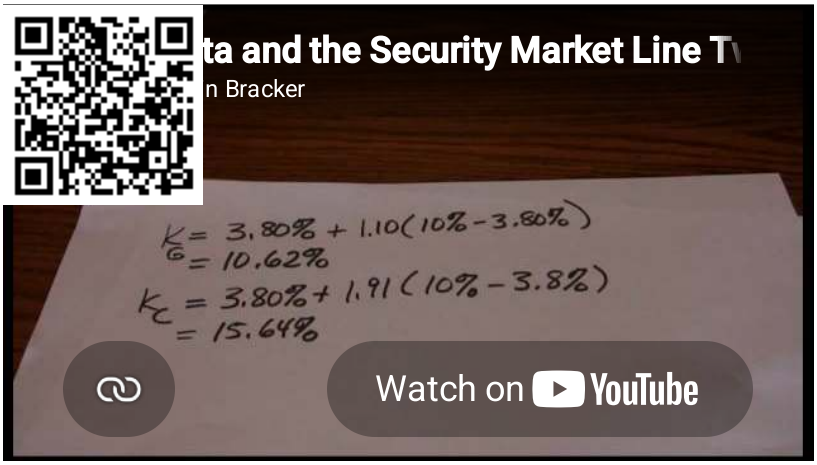
Let's calculate the required return for a particular stock. Stock B has a beta of 1.4. The expected return on the market is 11% and the Treasury bond rate is 5%. Based on this, we can calculate the required return for stock B as follows

$$k = 5\% + (1.4)(11\% - 5\%)$$
$$k = 5\% + (1.4)(6\%)$$
$$k = 5\% + 8.4\%$$
$$k = 13.4\%$$

Video Beta and the SML Part One



Video Beta and the SML Part Two



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7.10: Important Implications of the CAPM/SML

- According to the SML, high beta stocks should, on average, earn higher returns than low beta stocks.
- According to the SML, the only factor that should cause consistent differences in returns across stocks is beta.
- When interest rates rise, required returns should increase and (all else equal) cause stock prices to decline.
- When investors become more risk-averse, the risk premium $(\bar{k_m} - k_{RF})$ should increase which will increase required returns and (all else equal) cause stock prices to decline.

Under equilibrium conditions, the required return should equal the expected return. Let's consider this for a minute. In our example above, we estimated that the required return for stock B should be 13.4%. What would happen if the expected return $\hat{k}$ for this stock was 16% ?

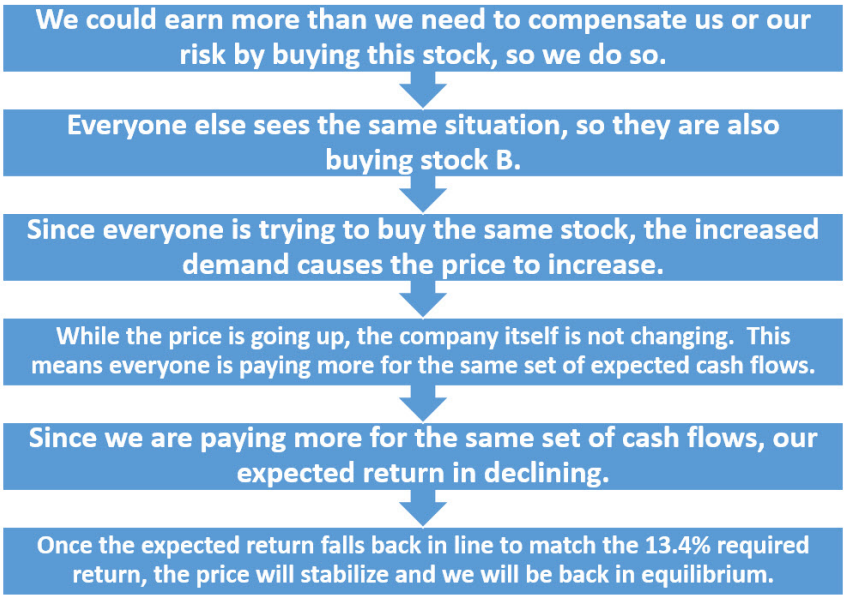


Figure 7.10.1: Flow chart

For practice in understanding this concept, think through what would happen if the required return was 13.4% and the expected return was 9%. Also, think about what types of things may push us out of equilibrium and why this is relevant for explaining stock price movements.

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7.11: Empirical Findings of the SML

While the CAPM/SML met with a lot of early success and became the standard for estimating required returns in the field of finance very quickly, it ran into problems in the 1990's and is deemed less reliable at the moment. (Fama and French, 1992) There have been some alternative models (Fama-French 3-Factor model, Carhart 4-Factor model, Fama-French 5-Factor model, and the q-Factor model) introduced since then, however there has not been a new standard-bearer to take its place. As of right now, the SML is still commonly used in practice, however there is growing focus on the alternatives. My view is that it is critical for you to know and understand the basic premise of the CAPM and SML (that role of market risk in explaining returns) but also to be aware of some of the problems (listed below).

- While market returns play a major role in explaining returns of individual stocks, Beta doesn't do a very good job of explaining future returns. In other words, after controlling for other factors, it is not clear that high beta stocks actually outperform.
- Small firms seem to earn higher returns than can be explained by beta.
- Firms with a low market-to-book ratio (MV/BV) tend to earn higher returns than can be explained by beta.
- Firms that have been top performers in the past 6-12 months tend to earn higher returns in the following 6-12 months than can be explained by beta.

Again, the above flaws do not mean that the CAPM/SML are useless. They provide a simplified framework for understanding how market risk relates to returns. However, recognize that they are not perfect models and the process of understanding stock returns is more complex than the SML indicates. As our knowledge increases, better models will likely evolve.

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7.12: Key Takeaways

Learning Objectives

The relationship between risk and return is an essential element of financial analysis. Because investors tend to behave in a risk-averse manner, we anticipate that higher risk investments should have higher expected returns. In this chapter, we formalize that analysis by introducing measures of risk (standard deviation and beta) and expected return. Standard deviation captures the dispersion of possible returns (total risk) and is best used when evaluating individual investments in isolation or poorly diversified portfolios. Beta captures the risk of securities relative to the overall market (market risk) and is best used when evaluating individual investments within a portfolio. A portfolio represents a collection of securities held together and is an essential tool for diversifying away firm-specific risk. The lower the correlation between a pair of securities, the more potential diversification benefits there are. This is reminiscent of the “don’t put all your eggs in one basket” cliché. While diversification can virtually eliminate the impact of firm-specific risk, it cannot eliminate market risk. Therefore, investors should be compensated for the degree of market risk that they are exposed to in their investments. The Security Market Line (SML) formalizes the risk-return tradeoff with respect to beta, the risk-free rate, and the market risk premium. It hypothesizes that higher beta stocks should generate higher returns and beta should be the only factor that systematically differentiates returns. Unfortunately, the SML has not held up well to empirical testing which has led to the introduction of newer attempts to formalize the relationship between risk and return. While the specific nature of risk and return is not finalized, it is safe to say that, in general, higher risk should be rewarded with higher expected returns. However, it is important to remember that expected returns are not the same as realized returns due to the nature of risk.

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7.13: Exercises

Exercise 7.13.1

What is Risk? What two factors are important in determining the degree of risk?

Answer

In Finance terms, risk refers to the possibility of earning less than expected on a particular investment over a given time period. For instance, if I make an investment an anticipate earning a 5% rate of return over the next year, I am exposed to risk if there is any chance that I earn less than that 5%. The two factors that determine the degree of risk are (A) the extent to which I can earn less than expected and (B) the likelihood that I will earn less than expected. For instance, if my expected return is 5% and the worst possible outcome is that I earn 4%, there is not a lot of risk involved. On the other hand, if there is a chance that I will lose 60%, my risk is much higher. Also, if I will make 5% 99.5% of the time and lose 50% only 0.5% of the time, my risk is also not very great because the chance of a bad outcome is very small. A high risk investment means that there is both a significant chance of earning less than expected and the amount less that I can earn is relatively large.

Exercise 7.13.2

"As long as we can't lose any money, we have a risk-free investment." Discuss this comment.

Answer

This is a false comment. You can avoid losing money and still earn less than expected. Very small rates of return over long periods of time are still "bad" outcomes and the chance of that happening means you are exposed to risk even if you can't lose money.

Exercise 7.13.3

Both investing and gambling can be defined as "undertaking risk in order to earn a profit." Explain how these two activities are different and why society generally takes a more favorable view of investing compared to gambling.

Answer

While both activities use risk in an attempt to earn a profit, there are several important differences. First, the risk-return profile is different. Most forms of gambling have a negative expected return (the "house edge"). Even games where you might argue that some people have a positive expected return (sports betting, poker, etc.), the average individual will lose money due to the fixed cost of paying the gambling institution offering the wager. On the other hand, investing typically offers a positive rate of return. While stocks and bonds have both had periods of negative returns, the long-run rate of return on both is significantly positive.

Another difference is that investing provides capital to a variety of businesses. Without stock and bond markets, there would be far fewer jobs and product innovation as the stock and bond markets provide the capital for businesses to operate. Gambling on the other hand tends to transfer wealth instead of create it.

Note that the above discussion does not imply that gambling is wrong and investing is right. Instead, the point is to illustrate that the combination of positive expected returns to investors and providing capital to businesses makes investing a net positive to society while gambling tends to transfer wealth from gamblers to gambling institutions and is thus neutral in creating wealth.

Exercise 7.13.4

Explain the concept of correlation? If two securities have a high positive correlation what does that mean? Give an example of two securities that might be highly correlated. If two securities have a low positive correlation what does that mean? Give an example of two securities that might have a low positive correlation. If two securities are negatively correlated what does that mean? Give an example of two securities that might be negatively correlated?

Answer

Correlation measures the extent to which two variables (returns) move together. If two securities have a high positive correlation (say somewhere between 0.5 and 0.99) that means that they have a strong tendency to move in the same direction. When one security increases in value, it is likely that the other will as well. When one decreases in value, it is likely that the other will as well. However, since the correlation is less than 1.0, the will not ALWAYS move in the same direction. Two securities with high positive correlations could be any two securities in the same industry. Industry pressures will lead the securities to move in a similar direction most of the time. However, firm specific factors will keep the correlation less than 1.0.

If two securities have a low positive correlation (0.01 to 0.49) that means that they have a weak tendency to move in the same direction. While they move in the same direction (up or down) more frequently than not, it is not uncommon for one to be up while the other is down. Two securities with low positive correlations could be any two companies without a specific connection (for instance, Amazon and Exxon). Both will be exposed to the same general economic factors (leading to a positive correlation), but the different industry and firm specific issues will keep the correlations low. In general, most stocks should have low positive correlations.

If two securities have a negative correlation, that means that they tend to move in opposite directions (the closer to -1.0, the stronger the inverse relationship). Due to general economic factors, few stocks will have negative correlations (at least as an expectation). One possible example might be oil producers and trucking firms. Since an increase in oil prices will improve the value of assets and profits for the oil firms and lower profits for trucking firms, we might see negative correlations. However, the ability of trucking firms to pass along higher prices and periods with low oil price volatility will mean that even here we may not see that significant of an inverse relationship.

Exercise 7.13.5

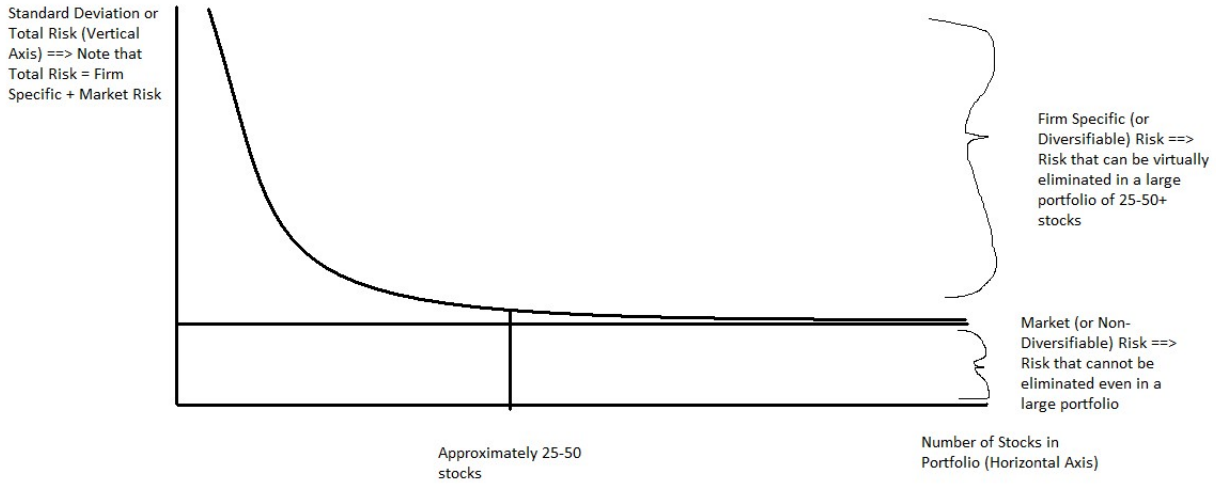
What is diversifiable risk? What is market or non-diversifiable risk? Give an example of each.

Answer

Diversifiable (Firm Specific) risk is risk that can be virtually eliminated by holding a large portfolio of securities from a variety of industries. An example of a diversifiable risk would be the success or failure of a new product introduction by a firm. For instance, if Ford’s new auto line is poorly received and results in a bad year or two for the automaker, this will not impact the other stocks in my portfolio. Thus, as long as I own several other stocks in a variety of industries, my overall portfolio will not be hurt much by Ford’s problems.

Non-Diversifiable (Market or General Economic) risk is risk that can NOT be eliminated by holding a large portfolio of securities from a variety of industries. An example of a non-diversifiable risk would be a sudden surge in inflation. This would result in most stocks declining and I couldn’t eliminate this risk regardless of how many stocks were in my portfolio.

The diagram below indicates how we can diversify away most of our firm specific risk in a large portfolio (25-50+ stocks), but market risk remains.



? Exercise 7.13.6

Standard deviation measures what kind of risk? When is this important? When is it not important?

Answer

Standard Deviation measures total risk. Total risk is both firm specific and market risk combined. Standard deviation is important when I am considering putting all of my money into a single security or a non-diversified portfolio. The reason total risk needs to be considered in these situations is that we have not diversified away our firm-specific risk so that it is still relevant. On the other hand, if we are adding a security to a well- diversified portfolio, the standard deviation of that stock is not important. Because we own a well-diversified portfolio, the firm specific risk of the stock will be unimportant and we only need to focus on the market risk.

? Exercise 7.13.7

Beta measures what kind of risk? When is this important? When is it not important?

Answer

Beta is a measure of market risk. While every firm has market risk and it can not be eliminated in a portfolio, some firms are more sensitive to market (general economic) factors than others. Therefore, the market risk of some stocks will be higher than the market risk of others. A portfolio of stocks with high market risk can still be diversified (so that firm specific issues are not relevant) and yet increase at a rate faster than the market or decrease at a rate faster than the market. When we are adding a security to a well-diversified portfolio, we no longer need to be concerned about firm-specific risk, but only about market risk and how it will affect our portfolio's sensitivity to general economic/market forces. When we are considering investing all of our money into a single stock, beta is not relevant because we need to focus on the total risk instead of just the market risk factors.

? Exercise 7.13.8

Explain why we can use either beta or standard deviation when comparing two well-diversified portfolios. Is this true for any two portfolios?

Answer

When we are comparing two well-diversified portfolios, either beta or standard deviation will work. That is because since both portfolios have essentially zero firm-specific risk, the total risk of the portfolio will effectively equal the market risk of the portfolio. Whichever portfolio has more market risk (higher beta) will also have more total risk (higher standard deviation).

The table below illustrates when we should focus on standard deviation (σ) as a measure of risk and when we should focus on beta (β) as a the appropriate measure of risk.

	Evaluating the risk of a single security in isolation or comparing two poorly diversified portfolios	Evaluating the risk of a security to add to a well-diversified portfolio	Comparing the risk level of two well-diversified portfolios
σ	X		X
β		X	X

? Exercise 7.13.9

If I had a stock with a beta of 1.25 and I thought the stock market was going to climb by 10% over the next 2 months, how much should I expect my stock to move? How about if I thought the stock market was going to drop by 5%? What would happen under each of the previous two cases if my beta was 0.6 instead of 1.25?

Answer

The stock should increase by 12.5% ⇒ (1.25×10%). While in reality it will likely increase by either more or less than 12.5%, my best guess today would be for an increase of 12.5%. If it increased by more than 12.5%, it would be because firm specific factors turned out positive and if it increased by less than 12.5% (or dropped), it would be because firm specific factor turned out to be negative. The 12.5% is based on the firm's sensitivity to market factors. If I thought the stock market was going to decline by 5%, I would expect my stock to decrease in value by 6.25% ⇒ (1.25×-5%). For a stock with a beta of 0.6, it should increase by 6% if the market climbs by 10% and fall by 3% if the market declines by 5%.

? Exercise 7.13.10

According to the SML, if we purchase only securities with a high beta, we should (on average) earn higher returns. True or False? Explain your answer.

Answer

True. High beta stocks imply higher than average risk. Higher than average risk implies higher than average expected returns. We can also see this by looking at the security market line. If we have a beta of more than one, the required return will be greater than the expected return on the market. Note that this relationship is based on expected returns and not actual returns. The nature of risk is that sometimes we will lose money and with high risk we may lose a lot. While our expected returns are greater than the average return on the market, our realized returns may be higher or lower. Over long periods of time with well diversified portfolios, we should earn higher than average returns if beta is a good measurement of risk.

? Exercise 7.13.11

Stock A has an expected return of 10% and stock B has an expected return of 20%. This means that if we buy stock B, we will be wealthier at the end of the year than if we bought stock A. True or False and explain.

Answer

False. Expected return does not mean realized return. While ON AVERAGE, we would make more money from stock B over the course of the next year, we don't get to repeat next year 10,000 times to reach our average. Instead, we only get one shot. Its possible that stock B will earn quite a bit less than its expected return and stock A will earn quite a bit more.

? Exercise 7.13.12

Due to a recent news announcement, the expected return on XYZ Corp. just went from 13% to 18%. Assuming that the stock was in equilibrium prior to the announcement and the announcement did not affect the required return, explain what will happen to XYZ's stock price (and expected return) in the immediate future to bring the stock back into equilibrium. How long should this process take?

Answer

In equilibrium, expected return should equal required return. If this is not true, the price will adjust until we move back into equilibrium. In this example, the expected return moves to 18%, while the required return stays at 13%. This means investors anticipate earning an 18% return on average while a 13% return is enough to compensate them for the risk they are taking. Since they can earn 5% more than they need to compensate them for the risk, they will buy the stock. As a large number of investors start buying the stock, the price will increase. Since the expected cash flows associated with the stock are not changing, the higher price means that there will be a lower expected return (see a more detailed explanation of this below). The price will continue to go up until the expected return falls to 13%. At that point, there is no reason for people to keep buying the stock and pushing up the price because they are only earning the required return. At this new price, the stock is worth buying, but at any higher price it would not be. Thus, we are back in equilibrium.

This process should happen instantaneously if markets are efficient. People will see the discrepancy between expected return and required return and start buying immediately. With everyone wanting to buy at the same time, the price will respond immediately.

A lot of people struggle with the idea that an increasing price leads to a lower expected return. At first glance, it seems counter-intuitive as if we see the stock price going up we might think that it is a "good" stock and expect it to continue to go up more in the future. However, if you think of a stock as the present value of all expected cash flows AND we increase the price while holding cash flows constant, you can see that you are paying more for the same set of cash flows. Since you are paying more for the same set of cash flows, you should expect to get a lower rate of return on your investment.

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7.14: Problems

Problem 7.14.1

Find the expected return and standard deviation of each stock.

Stock A

Probability	Return
0.20	-30%
0.40	15%
0.40	30%

Stock B

Probability	Return
0.30	-5%
0.40	10%
0.30	20%

If you were going to put all of you money into one of these two stocks, which should you pick?

Answer

Exp Ret $A = 0.20(-30\%) + 0.40(15\%) + 0.40(30\%) = -6\% + 6\% + 12\% = 12\%$

Exp Ret $B = 0.30(-5\%) + 0.40(10\%) + 0.30(20\%) = -1.5\% + 4\% + 6\% = 8.5\%$

St. Dev. A $= \sqrt{0.20(-30\% - 12\%)^2 + 0.40(15\% - 12\%)^2 + 0.40(30\% - 12\%)^2}$\$

St. Dev. $A = \sqrt{352.8 + 3.6 + 129.6}$

St. Dev. $A = 22.05\%$

St. Dev. B $= \sqrt{0.30(-5\% - 8.5\%)^2 + 0.40(10\% - 8.5\%)^2 + 0.30(20\% - 8.5\%)^2}$

St. Dev. $B = \sqrt{54.68 + 0.90 + 39.68}$

St. Dev. $B = 9.76\%$

If you are going to put all of your money into one stock, you could choose either one. People that are more risk-averse will choose stock B while people that are less riskaverse will choose stock A. Note that both choices are consistent with risk aversion because the stock with the higher risk (stock A) also has a higher expected return.

Problem 7.14.2

a. Find the expected return and standard deviation of each stock

Probability	Return of Stock C	Return of Stock D
0.30	-10%	25%
0.50	15%	10%
0.20	40%	0%

b. Calculate the expected return and standard deviation of a portfolio made up of 50% stock C and 50% stock D if the correlation is -0.75.

c. Would you prefer to put your money in stock C, stock D or the 50/50 portfolio? Explain.

Answer

Part a

Exp Ret C $= 0.30(-10\%)+ 0.50(15\%)+ 0.20(40\%)= -3\%+ 7.5\%+ 8\%= 12.5\%$

Exp Ret D $= 0.30(25\%)+ 0.50(10\%)+ 0.20(0\%)= 7.5\%+ 5\%+ 0\%= 12.5\%$

St. Dev. $C = \sqrt{0.30(-10\% - 12.5\%)^2 + 0.50(15\% - 12.5\%)^2 + 0.20(40\% - 12.5\%)^2}$

St. Dev. $C= \sqrt{151.88 + 3.13 + 151.25}$

St. Dev. $C= 17.50\%$

St. Dev. D $= \sqrt{0.30(25\% - 12.5\%)^2 + 0.50(10\% - 12.5\%)^2 + 0.20(0\% - 12.5\%)^2}$

St. Dev. $D= \sqrt{46.88 + 3.13 + 31.25}$

St. Dev. $D= 9.01\%$

Part b

Exp Ret Port $= 0.5(12.5\%)+ 0.5(12.5\%)= 12.5\%$

St. Dev. Port $= \sqrt{(0.5)^2(17.5\%)^2 + (0.5)^2(9.01\%)^2 + 2(0.5)(0.5)(17.5\%)(9.01\%)(-.75)}$

St. Dev. Port $= \sqrt{76.56 + 20.30 + -59.13}$

St. Dev. Port $= 6.14\%$

Part c

We should choose the portfolio because all three choices have the same expected return, but the portfolio has the lowest risk. All risk-averse investors will choose the portfolio over either stock individually in this situation.

? Problem 7.14.3

Assume you had two stocks. Stock A had an expected return of 20% and a standard deviation of 25%. Stock B had an expected return of 15% and a standard deviation of 20%. You want to create a portfolio made up of 65% stock A and 35% stock B. Find the expected return and standard deviation of this portfolio under the following conditions.

a. Correlation between stock A and B is 1.0
b. Correlation between stock A and B is 0.5
c. Correlation between stock A and B is 0.0
d. Correlation between stock A and B is -0.5
e. Correlation between stock A and B is -1.0

Answer

Part a

Exp Ret Port $= 0.65(20\%)+ 0.35(15\%)= 18.25\%$

St. Dev. Port $= \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(1.0)}$

St. Dev. Port $= \sqrt{264.06 + 49 + 227.5}$

St. Dev. Port $= 23.25\%$

Part b

Exp Ret Port $= 0.65(20\%)+ 0.35(15\%)= 18.25\%$

St. Dev. Port $= \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(0.5)}$

St. Dev. Port $= \sqrt{264.06 + 49 + 113.75}$

St. Dev. Port $= 20.66\%$

Part c

Exp Ret Port $= 0.65(20\%) + 0.35(15\%) = 18.25\%$

St. Dev. Port $= \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(0)}$

St. Dev. Port $= \sqrt{264.06 + 49 + 0}$

St. Dev. Port $= 17.69\%$

Part d

Exp Ret Port $= 0.65(20\%) + 0.35(15\%) = 18.25\%$

St. Dev. Port $= \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(-0.5)}$

St. Dev. Port $= \sqrt{264.06 + 49 + -113.75}$

St. Dev. Port $= 14.12\%$

Part e

Exp Ret Port $= 0.65(20\%) + 0.35(15\%) = 18.25\%$

St. Dev. Port $= \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(-1.0)}$

St. Dev. Port $= \sqrt{264.06 + 49 + -227.5}$

St. Dev. Port $= 9.25\%$

Note that the expected return is not a function of the correlation while the standard deviation declines as the correlation drops. This is the "free lunch" of diversification - as long as we invest in securities with a correlation of less than one, we will lower our risk (st. deviation will be less than the weighted average of each stock's st. deviation) without lowering our expected return (the exp. return will be the weighted average of each stock's expected return).

? Problem 7.14.4

The stock of Ralph's Restaurants has a standard deviation of 70% and has a correlation with the market of 0.40. The expected return for the market is 13% and it has a standard deviation of 20%. Currently the risk-free rate of return is 5%.

a. What is the beta for Ralph's Restaurants?
b. What is the required return for Ralph's Restaurants?
c. What is the expected return for Ralph's restaurants in equilibrium?

Answer

Part a

$Beta = \frac{(70)(0.40)}{20} = 1.40$

Part b

Req. Return $= 5\% + 1.40(13\% - 5\%) = 5\% + 11.2\% = 16.2\%$

Part c

In equilibrium, expected return equals required return. Since the required return is 16.2%, the expected return should be 16.2% as well.

Problem 7.14.5

We are purchasing a stock that just paid a dividend (D_0) of \$1.50. The growth rate in dividends for this stock is 4% and it has a beta of 1.3. The expected return on the market is 12% and the current Treasury rate is 7%. How much should we pay for this stock?

Answer

First, we know that the stock price should be found by using the following formula

$$P_0 = D_1/(k-g)$$

Now, we need to find each of the three inputs. g is given at 4%.

$$\begin{aligned} &\mathrm{D}_1 = \mathrm{D}_0(1+\mathrm{g}), \mathrm{so}_1 = 1.50(1.04) = \$1.56. \\ &k = k_{rf} + \beta\left(\overline{k_m} - k_{rf}\right) \\ &k = 7\% + 1.3(12\% - 7\%) \\ &k = 13.5\% \end{aligned}$$

Once we get all the inputs, we plug them back into the pricing model

$$P_0 = 1.56/(.135 - .04) = \$16.42.$$

The most we should pay for the stock today is $\$16.42$.

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Student Resources

Observed Correlations, Returns, Standard Deviations and Betas Table in Appendix B

Risk and Return Guided Tutorial in Appendix B

Videos

Probability Distribution

Expected Return of a Single Security

Standard Deviation of a Single Security

Expected Return of a Two-Stock Portfolio

Standard Deviation of a Two-Stock Portfolio

Diversification

Beta and the SML Part One

Beta and the SML Part Two

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CHAPTER OVERVIEW

8: Introduction to Capital Budgeting

Learning Objectives

After completing this chapter, students should be able to

- Identify what a capital budgeting project is, provide an example, and discuss why the capital budgeting process is essential to maximizing shareholder wealth
- Explain the difference between independent and mutually exclusive projects
- Identify and explain the relevance of the four key capital budgeting criteria
- Identify whether or not each of the criteria is met by each of the three decision techniques introduced in class (Payback Period, Internal Rate of Return, and Net Present Value)
- Calculate and conceptually explain the concepts of Payback Period (PP), Internal Rate of Return (IRR), and Net Present Value (NPV)
- Adjust for risk differences under PP, IRR, and NPV
- Evaluate independent and/or mutually exclusive projects using each of the three decision techniques in isolation and as a whole
- Explain the flaws and relevance of the PP
- Explain the flaws and relevance of the IRR
- Explain why NPV is the best model
- Explain the concepts of the size problem, reinvestment rate problem, and crossover problem as well as identifying when these problems might be present
- Explain the concept of the NPV profile
- Discuss the survey results of how these methods are applied in practice.

8.1: What is Capital Budgeting?
8.2: Mutually Exclusive vs. Independent Projects
8.3: Capital Budgeting Decision Criteria
8.4: Capital Budgeting Process
8.5: Capital Budgeting Decision Techniques
8.6: Capital Budgeting in Practice
8.7: Key Takeaways
8.8: Exercises
8.9: Problems
8.10: References and Attributions

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8.1: What is Capital Budgeting?

Capital budgeting is the process of deciding which long-term projects the firm should undertake.
Examples may include:

- The decision to purchase a new printing press.
- The decision to build a new warehouse.
- The decision to open or establish a second location on the other side of town.
- The decision to update an airline fleet.

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8.2: Mutually Exclusive vs. Independent Projects

Mutually Exclusive Projects

Mutually exclusive projects are any set of projects in which choosing one makes the other projects no longer possible. For example, we are considering upgrading our printing press and have the choice of two alternatives. The first is a low-cost model that will need replaced in 3-years and the second is a more expensive model that will need replaced in 5-years. We can only choose one of these options, so they are mutually exclusive. When we have mutually exclusive projects, our decision rule needs to not only decide if a project is good or bad, but needs to be able to rank which project is the best.

Independent Projects

Independent (sometimes called stand-alone) projects are any set of projects in which choosing one has no impact on our decision to choose another project from that set. For example, McBurger Inc. may have the following capital budgeting projects to consider. The first is a new deep frying system for their french fries. The second is a new order placement system for the drive-thru. McBurger could choose to take the new deep fryer or the new order placement, or it could choose both. Taking one project does not influence the other, so they are independent. When we have independent projects, our decision rule does not need to rank which project is the best, but merely identify if the project is good or bad.

Many decisions made by the firm are neither independent nor mutually exclusive, but are instead interdependent. In this case, the decision to take one project impacts our decision to take another, but they are not mutually exclusive. For example, VideogamesPlus may decide to introduce a new video game machine along with some games for the new system. The two projects are not independent (the game machine will sell better with more games available) nor mutually exclusive (producing the games does not preclude producing the game machine). However, they are interdependent in that each project will perform better if both are produced. Some interdependent projects are compliments (like the example above) in which the cash flows from both projects taken together are greater than the cash flows from each project on a standalone basis. Other interdependent projects are substitutes in which the cash flows from both projects taken together are less than the cash flows from each project on a standalone basis. While we will not be evaluating interdependent projects in this class, the procedure is to look at each project individually as well as in combination.

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8.3: Capital Budgeting Decision Criteria

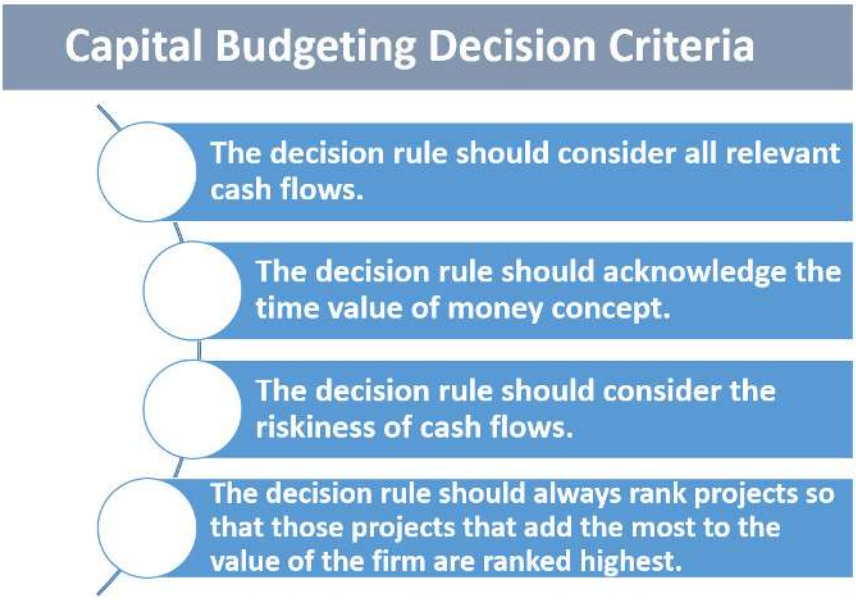


Figure 8.3.1: Decision tree for capital budgeting

Whatever capital budgeting decision rule we undertake should meet the following criteria:

The decision rule should consider all relevant cash flows

Some decision rules (such as the Payback Period) stop considering cash flows after a certain cutoff point. This may result in us making a poor decision, especially when trying to choose between two or more mutually exclusive projects. We also should note that it is important to be careful about evaluating relevant cash flows. For instance, consider your decision to attend college as a capital budgeting decision. It is easy to underestimate the cost if you do not acknowledge that you could be earning income during the time you spend in class and on homework. This is an opportunity cost and is just as important as actual dollars spent.

The decision rule should acknowledge the time value of money concept

Since capital budgeting projects are long-term investments, the cash flows which they generate are likely to take place years into the future. If a firm spends $1000 today and receives back $100 per year over the next 10 years, they have not broken even. Instead, the project has caused a significant reduction in firm value. This is because the present value of $100 per year for 10 years is worth far less than the $1000 spent today.

The decision rule should consider the riskiness of cash flows

As we have discussed since chapter one, investors are risk averse. Therefore, the riskier the projects that the firm invests in, the higher the rate of return they must earn to satisfy stockholders. If we don't adequately address risk in the capital budgeting process, we will find firms over investing in high risk projects and under investing in low risk projects.

The decision rule should always rank projects so that those projects that add the most to the value of the firm are ranked highest

This is something to be careful about. All decision rules will rank projects in some manner. However, if we are going to focus on maximizing shareholder wealth, then we want to rank projects based on how they add value to the firm. The more value the project generates, the more wealth is generated for our shareholders.

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8.4: Capital Budgeting Process

It is reasonable to argue that capital budgeting is the most important factor in maximizing shareholder wealth. Good capital budgeting decisions can generate hundreds of millions (or even billions) of dollars for shareholders as often a successful project lays the foundation for many more on top of the original. Poor capital budgeting decisions can destroy wealth almost as quickly (especially if the firm does not recognize failure quickly enough and continues to throw good money after bad). While we will focus only on a small portion of the process (making the decision), it is worthwhile to look at the process as a whole.

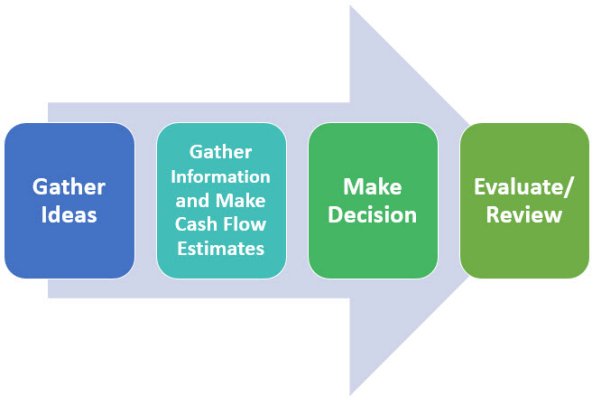


Figure 8.4.1: Capital budgeting process

Generating ideas

The process starts by generating potential ideas for capital budgeting projects. These may be projects to improving existing processes within the firm (such as updating current manufacturing equipment or introducing new software to streamline our distribution) or it could be developing new product lines.

Gathering information and making cash flow estimates

A challenging and critical component to capital budgeting is the process of trying to forecast the relevant cash flows. This typically involves input from many areas of the firm (marketing may estimate sales levels and pricing of a new product, accounting may help with cost estimates, operations will discuss feasibility and labor demands, etc.). Here we must estimate how much it will cost us to initially purchase and implement new equipment, the life span of the project, the marginal revenue it will generate each year, the marginal costs associated with the project each year, etc. While there is a lot of subjectivity and forecasting involved here, the better we do at getting things right in this stage, the better our results will be. If this stage is done poorly, the rest of our analysis will not be very useful (garbage in, garbage out).

Make decision

This is where we focus our attention for this class. Given what we know about the cash flow estimates above, we evaluate whether or not the project will help us add value for shareholders. If yes, we pursue the project. If not, we reject it.

Evaluate/review

This is an important (and difficult) part of any decision-making process …evaluating the results. What makes this difficult is we need to avoid falling into the “Results Oriented Thinking” trap. For instance, consider a project that has a 25% chance of making $50 million and a 75% chance of losing $10 million. On average, we will make $5 million for taking the project (it is a good project). However, if we lose $10 million, does that mean we shouldn’t have invested? No! Taking the project is a good decision with a bad outcome. Unfortunately in practice this is harder to evaluate as it is hard to distinguish between bad forecasts and bad outcomes. Therefore, in evaluation we should evaluate the process for biases (do we tend to underestimate risk or overestimate projected revenues) instead of just focusing on the outcome itself.

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8.5: Capital Budgeting Decision Techniques

There are three capital budgeting techniques:

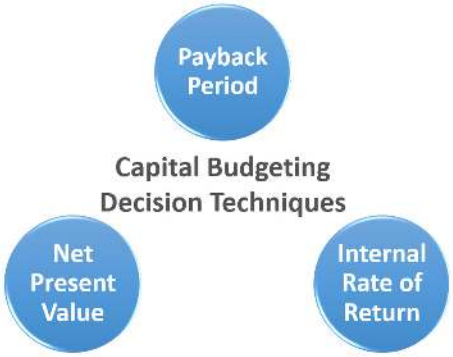


Figure 8.5.1: The three key metrics for capital budgeting decisions are NPV, Payback period and internal rate of return

Note: There are many other additional capital budgeting decision techniques as well, but these are the primary models. Also, be careful about confusing concepts in this chapter as we have introduced (A) four key capital budgeting **criteria**, (B) a four-part capital budgeting **process**, and (C) three capital budgeting decision **techniques**. Oftentimes we will see students mix these up on tests or homework.

A capital budgeting criteria refers to a specific issue we would like the capital budgeting decision process to factor into the decision. For example, the decision rule should consider all relevant cash flows is a criteria.

A capital budgeting process is the set of procedures we want to follow throughout the analysis of a potential capital budgeting process. For example, generating ideas is part of the process.

A capital budgeting technique refers to the way we evaluate whether or not the capital budgeting project being evaluated should be accepted or not. For example, net present value is a technique.

Payback Period

The Payback Period measures the amount of time it would take to earn back the initial investment in the project. Management then decides how long they are willing to wait to recover their investment (critical acceptance level — T) and compares the calculated payback period to the critical acceptance level.

The decision rule for independent projects is to accept all projects that have a payback period less than the critical acceptance level (T). For mutually exclusive projects, the project with the lowest payback period would be chosen (assuming it is below the critical acceptance level)

For example, let's assume that Jim's Printing is considering the purchase of a new printing press. The press will cost $2000 to produce and will generate cash flows of $900 per year for 3 years. What is the payback period for this press? If Jim's assigns a critical acceptance level of 2.0 years, should they accept the project?

- In year one, we earn back $900 and have $1100 of our initial investment to recover
- In year two, we earn back another $900 and still have $200 of our initial investment to recover
- In year three, we will earn more than our initial investment and therefore we know that the payback period is more than two years, but less than three years
- Since we will pay off our initial investment between the 2nd and 3rd year, we divide the amount remaining to be paid off at the start of the 3rd year ($200) by what we will receive in the 3rd year ($900) and find out that it will take us two full years plus 2/9ths (0.22) of the 3rd year to recover our initial investment.
- Therefore, our payback period is 2 + 0.22 years (2.22 years).

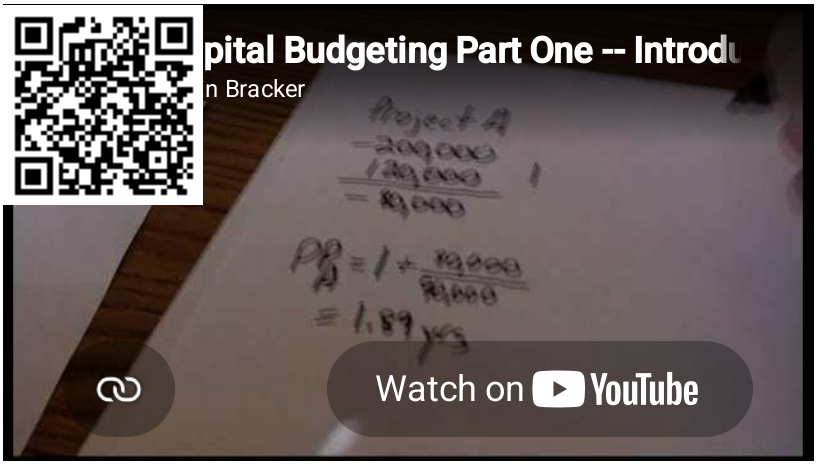
Since the Payback Period = 2.22 years which is greater than 2.0 years (our T), we should reject the project.

How well does the payback period meet our 4 criteria? Very poorly. It ignores the time value of money and it may not consider all relevant cash flows (ignoring all cash flows that are after the payback period). Also, the decision rule is arbitrary – what is an

acceptable payback period? It also ranks by time instead of shareholder wealth. Because of these flaws, the payback period does not always pick the best project. Despite this, many corporations still calculate the payback period (although usually not as the primary decision tool). Does this mean corporations are stupid? Probably not. What are some situations that you can think of in which the payback period may provide critical information in making a capital budgeting decision? Think about this for a minute before reading further.

There are two primary situations when payback period can be helpful. The first is when the distant cash flows are highly uncertain. For instance, we may project a 6-year life span for the project and find out after two years that the technology behind it has become obsolete and the project must end prematurely. In a situation like this, it would be extremely helpful to have had the entire project paid back by the end of the second year. That way even if we didn't make as much as planned, we at least recovered our investment. The second situation where Payback Period is extremely helpful is when our firm is facing significant financial problems. Consider a highly profitable long-term investment that has very low cash flows in the first couple years and high cash flows in the later years. Can we afford to undertake such an investment if we are having financial problems? Probably not, there is too much of a chance that we will end up bankrupt and out of business before we can get to the part of the project with the high cash flows. For firms suffering from financial distress, projects having a quick payback are important.

Video Capital Budgeting Part One -Introduction and Payback Period



Internal Rate of Return

The Internal Rate of Return calculates the average annualized rate of return that we can earn over the lifetime of the project.
The acceptance rule for independent projects is to accept all projects where the IRR is above the required return (hurdle rate) for those projects. If projects are mutually exclusive, accept the one with the highest IRR (assuming it is above the hurdle rate).
Let's look at the IRR of our printing press example

CLEAR WORKSHEET
CF0 = -2000
CF1 = 900
CF2 = 900
CF3 = 900
SOLVE FOR IRR AND GET 16.65%

This is the process we used in Chapter Three Time Value of Money to find the discount rate. Here is a quick review for each calculator:

Calculator Steps to Compute IRR

HP10BII+	TI-BAII+	TI-83/84
Step 1: SHIFT C ALL Step 2: -2000 CFj Step 3: 900 CFj Step 4: 3 SHIFT Nj Step 5: SHIFT IRR/YR	Step 1: CF 2nd CLR Work Step 2: -2000 Enter ↓ Step 3: 900 Enter ↓ Step 4: 3 Enter Step 5: IRR Step 6: CPT	Go to APPS⇒Finance⇒ Step 1: Select irr(Step 2: Enter the given information in the following format: irr(CF0,{CF Stream},{CF Frequencies} irr(-2000,{900,900, 900},{1,1,1} Step 3: ALPHA SOLVE

Should we accept the project? Let's assume that the project had a required return of 10%. Given this information, we would accept the project because the IRR is greater than the required return (or hurdle rate). This means that we are earning more than we need to compensate us for the risk we are assuming when we undertake the project.

How well does the IRR meet our 4 criteria? Very well if projects are independent. If projects are mutually exclusive, not so well. IRR incorporates the time value of money and considers all relevant cash flows. We can adjust for risk by adjusting our hurdle rate (the minimum acceptable rate of return for the project). If projects are independent (and there is no crossover problem – see below), the IRR will always make the right decision. However when projects are mutually exclusive, it will not always rank the projects correctly (again, see below). Despite this flaw, is used quite frequently as a capital budgeting techniques (although few firms use it in isolation).

Video Capital Budgeting Part Two -Calculating Internal Rate of Return



Crossover (Multiple IRR) Problem

If cash flows for a project crossover more than once (go from negative in one period to positive in the next or vice-versa) then the IRR will have more than one mathematically valid solution. For projects with a crossover problem, the IRR cannot be used. For instance, consider a project with the following cash flow stream:

CF0 = -$100
CF1 = $180
CF2 = $0
CF3 = $0
CF4 = $0
CF5 = $0

CF6 = $0
CF7 = -$100

The project has two IRR's (4.9% and 76.7%). With two solutions, it is unclear whether to accept or reject the project, so we use NPV analysis instead. IRR is unreliable in this situation.

Size Problem and Reinvestment Rate Problem

If projects are mutually exclusive, the IRR can provide invalid rankings due to two problems. First, if the projects are of different sizes (the size problem). Second, if the timing of cash flows is vastly different (one project has cash flows come in evenly throughout the payback period and the other generates low cash flows early on and high cash flows near the end – or other such differences). This is referred to as the reinvestment rate problem. I will explain each of these in detail below, however, it is important to note that these two problems are only relevant when dealing with mutually exclusive projects. If we are dealing with independent projects, they may still impact the rankings but they will not cause us to make an incorrect accept/reject decision.

Size Problem

The issue with the size problem is related to IRR's focus on rate of return instead of value generation in terms of dollars. Consider a situation where you had the choice of two projects. Project A cost $1 today and would return $2 at the end of 1 year. Project B cost $1000 and will return $1500 at the end of 1 year. The first project has a 100% IRR while the second project only has a 50% IRR. At first glance, it appears that Project A is twice as good. However, if you could only take one of these two projects, which would be better? Clearly Project B is a better choice in that you will make $500 beyond your initial investment. If you took Project A, while you earned a higher return you would only make enough profit to visit the $1 menu at your local fast-food chain. When we can only choose one of the available projects, it is not important to identify which project generates the highest rate of return, but instead which project generates the most value. A high rate of return on a small investment is not likely to be as valuable as a moderate rate of return on a large investment. We can recognize the potential for a size problem in evaluating capital budgeting projects by looking at the initial investment. If initial investment sizes are very close, we likely will not encounter a size problem. If initial investments are vastly different, we need to be aware of the size problem and use NPV if dealing with mutually exclusive projects.

Reinvestment Rate Problem

The reinvestment rate problem is not as intuitive as the size problem. The reinvestment rate problem is a function of the process by which the IRR is generated mathematically. In order to calculate the IRR, the calculator assumes that all cash flows received throughout the projects life will be reinvested at the IRR. For instance, let's assume that you have the following project

CF0 = -$1000
CF1 = $800
CF2 = $400
CF3 = $300

This gives us an IRR of 29.02% (in other words, we are expecting to earn an average rate of return of 29.02% per year over the next three years on our $1000 investment that we are making today). However, in order for this IRR to be realized, we will need to take the $800 that is generated at the end of year one and reinvest it somewhere for the remaining two years at 29.02%. Is this realistic? Well, how many investments do you know that pay nearly 30% rates of return? Probably not too many. As such, our average return is biased upwards (as we will likely earn much less than the 29% needed on reinvested cash flows). This bias will be greater for projects that are front loaded. The term front loaded refers to projects with higher cash flows early in the project life. The bias is greater here because the faulty reinvestment rate assumption has longer to impact our final answer. The bias is smaller for projects that are back loaded (cash flows coming in primarily later in the project life). Because of this difference in bias, front loaded projects are likely to have an artificially higher IRR than back loaded projects, which can potentially cause us to rank them incorrectly. If we are evaluating mutually exclusive projects with different timing (front loaded vs. back loaded), then we should be careful of the reinvestment rate problem and choose NPV as our decision tool.

Two last comments on the reinvestment rate problem. First, as with the size problem, it is only important when evaluating mutually exclusive projects. It will not distort accept/reject decisions for independent projects. Second, there is a process called Modified

Internal Rate of Return (MIRR) that can be used to correct this issue. However, it is beyond the scope of this class and we will not be covering it.

Net Present Value

The Net Present Value measures the value added by investing in the project. Specifically, the NPV is equal to the present value of all cash flows less the initial investment.

The decision rule for independent projects is to accept all projects with a positive NPV. For mutually exclusive projects, accept the project with the highest positive NPV.

Let's consider the printing press example above, what is its NPV (assume the required return on the project is 10%, just like when we did the IRR analysis)?

CLEAR WORKSHEET
CF0 = -2000
CF1 = 900
CF2 = 900
CF3 = 900
I/YR = 10
SOLVE FOR NPV AND GET $238.17

Calculator Steps to Compute NPV

HP10BII+	**TI-BAII+**	**TI-83/84**
Step 1: SHIFT C ALL Step 2: -2000 CFj Step 3: 900 CFj Step 4: 3 SHIFT Nj Step 5: 10 I/YR Step 6: SHIFT NPV	Step 1: CF 2nd CLR Work Step 2: -2000 Enter ↓ Step 3: 900 Enter ↓ Step 4: 3 Enter Step 5: NPV 10 Enter ↓ Step 6: CPT	Go to APPS⇒Finance⇒ Step 1: Select npv(Step 2: Enter the given information in the following format: npv(Rate,CF0,{CF Stream},{CF Frequencies} npv(10,-2000,{900,900, 900},{1,1,1} Step 3: ALPHA SOLVE

Video [Capital Budgeting Part Three -Calculating Net Present Value]

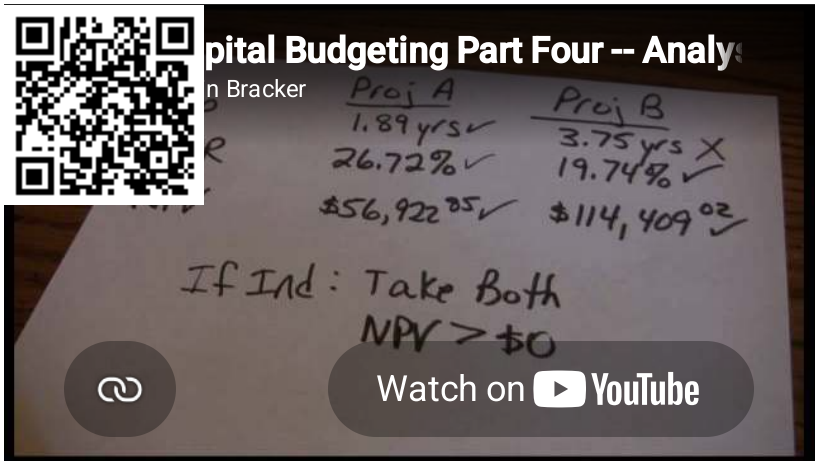


How well does the NPV meet our 4 criteria? Perfectly. The NPV directly addresses the time value of money. It also considers all relevant cash flows. The riskiness of cash flows can be acknowledged by using a higher discount rate for high-risk projects and a lower discount rate for low-risk projects. The decision rule for NPV will always provide the correct decision. NPV is used by almost all firms as a key capital budgeting decision tool.

Capital Budgeting Decision Rule

When evaluating projects always use NPV as the decision maker. Even if PP and IRR conflict with your NPV analysis, go with the project with the highest NPV.

Video [Capital Budgeting Part Four -Analysis of Decision]



NPV Profile

Required Rate of Return	NPV
0%	$700.00
5%	$450.92
10%	$238.17
15%	$54.90
20%	($104.17)
25%	($243.20)

NPV profile is a graph that shows the relationship between a project's NPV and the required return on the project. To draw the NPV profile, we first need the project's NPV at a number of different discount rates. Let's stick with the example above, which requires an initial investment of $2,000 and generates $900 per year for the next three years. Instead of using a single required rate of return of 10%, I allow the rate to change within a range, say from 0% to 25%. For each discount rate, I would record the corresponding NPV value. The table to the right shows some of the results.

Next, we plot these values to create the NPV profile. Make sure to plot discount rates on the x-axis and NPV on the y-axis. For the project in this example, NPV declines as discount rate increases.

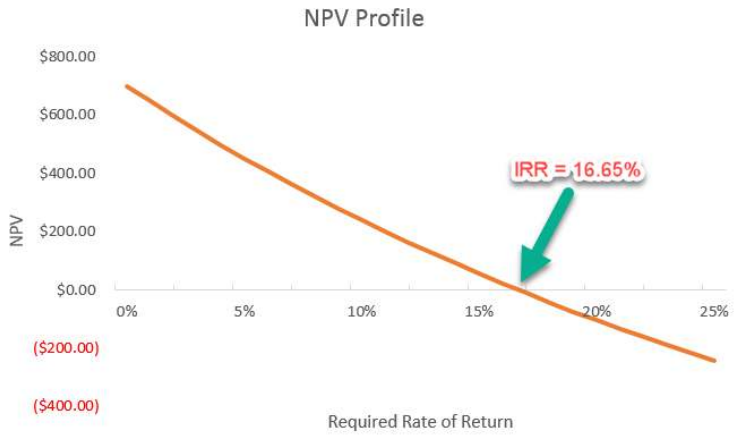


Figure 8.5.2: NPV profile for determining capital decisions

One unique feature about the NPV profile is that it visualizes how IRR is related to NPV. Recall that the IRR of this project is 16.65%, and that is the exact discount rate at which the profile line crosses the horizontal axis. In other words, IRR is in fact the discount rate that makes the project NPV to equal zero.

Now consider two mutually exclusive projects. Project A and Project B require the same initial investment at time 0, but their cash flows in the following years differ.

Year	**Project A**	**Project B**	**Incremental Cash Flow** $\Delta CF = CF_A - CF_B$
0	-$500	-$500	$0
1	$50	$300	-$250
2	$300	$250	$50
3	$400	$150	$250

The figure below shows two NPV profiles – one for A and one for B – and the following are worth noting:

When the discount rate increases, the NPVs from both projects decline.

Each project has only one fixed IRR. The IRR of Project A is lower than that of Project B, no matter what the discount rate is.

The two profiles crosses at a discount rate of 10.50%, which is considered as the crossover rate of the two projects. When the actual cost of capital is lower than the crossover rate, Project A should be taken because it has a higher NPV; when the actual cost of capital exceeds the crossover rate and as long as the NPV is positive, Project B should be accepted.

To find the crossover rate, I first need to compute the incremental cash flows as the difference in the two projects cash flows (see the last column of the table above), and then calculate the IRR based on the incremental cash flows.

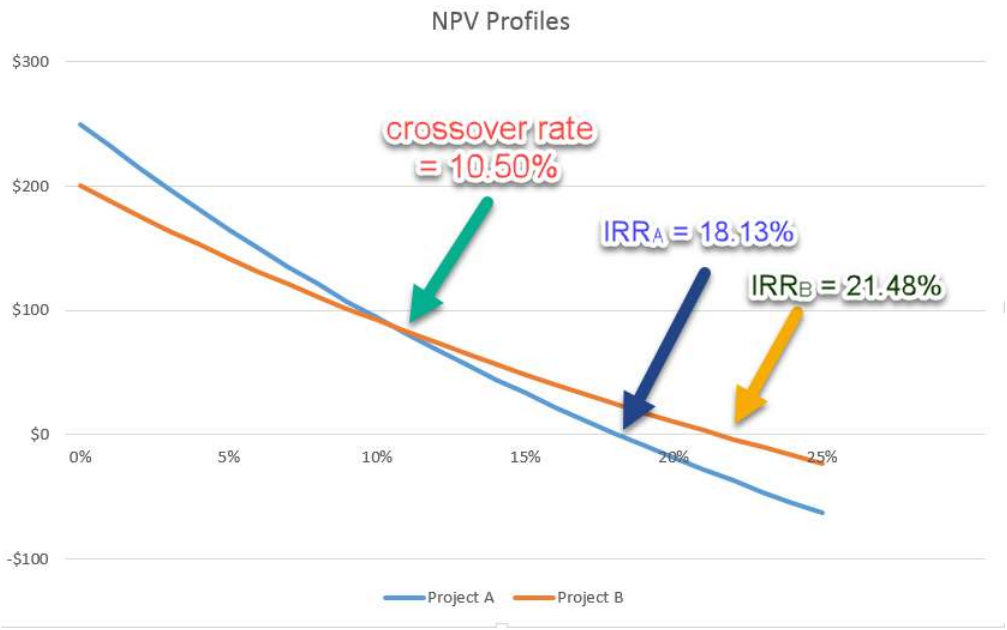


Figure 8.5.3: Copy and Paste Caption here. (Copyright; author via source)

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8.6: Capital Budgeting in Practice

While the data is starting to get dated, the most recent survey of capital budgeting techniques used in practice was conducted in 1999 and published in 2002 (Ryan and Ryan, 2002). This survey was based on Fortune 1000 firms and received 205 usable responses. Key findings include:

- 85.1% of respondents use NPV either always or often
- 76.8% of respondents use IRR either always or often
- 52.6% of respondents use PP either always or often

This tells us that not only is NPV the preferred choice from a theoretical perspective, it is also the preferred choice of firms in practice. However, equally important is the concept that many firms rely on multiple techniques rather than merely choosing one when evaluating capital budgeting decisions. Even though there are flaws with IRR and PP (which have been discussed above), they are still used in practice. Possible reasons for this include that the marginal cost of performing the additional calculations is small and there may be reasons where the benefits of communicating the results or factoring in the concerns of financial distress possibilities make it worthwhile to include IRR and PP in the analysis, even if they are not a primary decision tool.

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8.7: Key Takeaways

Key Takeaways

Capital budgeting refers to the practice of evaluating long-term investments that firms undertake, such as building a new warehouse, opening a new production facility, developing a new product, or replacing existing equipment. Since the firm is really just a collection of all its past and future capital budgeting projects, this is one of the key components associated with maximizing shareholder wealth. Capital budgeting projects can be thought of as independent projects (where we want to accept all good projects) or mutually exclusive projects (where we can only take one from the set so must choose the best project). When evaluating capital budgeting projects, we need to make sure that we consider all the relevant cash flows the project is expected to generate, acknowledge time value of money, control for the riskiness of the expected cash flows and choose the project that adds the most to firm value. While there are many different techniques for evaluating capital budgeting projects, the three most common are Payback Period, Internal Rate of Return, and Net Present Value. Of these three methods, all are used in practice by a significant percentage of firms. However, only NPV (which is used most frequently) meets all four of the criteria we designate as critical in choosing projects. Therefore, when making decisions, NPV should be our primary decision tool.

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8.8: Exercises

Exercise 8.8.1

What are the four capital budgeting decision criteria?

Answer

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Exercise 8.8.2

Identify 4 flaws of the payback period? Given these flaws, why should you know the payback period method?

Answer

Add texts here. Do not delete this text first.

Exercise 8.8.3

With independent projects that do not suffer from the crossover (multiple IRR) problem, will the IRR and NPV always give the same accept reject decision? Explain.

Answer

Add texts here. Do not delete this text first.

Exercise 8.8.4

What are 3 potential problems with the IRR? Given these flaws, why should you know the IRR method?

Answer

Add texts here. Do not delete this text first.

Exercise 8.8.5

How can we account for risk under each of the three methods (PP, IRR, NPV)?

Answer

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Exercise 8.8.6

Consider a situation where a firm carefully performs capital budgeting analysis and selects a project with a high, positive NPV. Three years later, the project is terminated early and the company has lost significant money on the project. Does this mean that their capital budgeting process is flawed? Explain.

Answer

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8.9: Problems

Problem 8.9.1

Calculate the PP, NPV, and IRR of the following projects (assuming a 14% required return and critical acceptance level <T> of 3 years)

Cash Flow	Project A	Project B	Project C	Project D
CF_0	-$1,000,000	-$1,000,000	-$500,000	-$500,000
CF_1	400,000	150,000	200,000	75,000
CF_2	400,000	100,000	250,000	50,000
CF_3	225,000	550,000	150,000	225,000
CF_4	200,000	775,000	100,000	387,500

Which project(s) should we accept if they are independent? Mutually Exclusive?

Answer

PP_A = 2.89 years
PP_B = 3.26 years
PP_C = 2.33 years
PP_D = 3.39 years

IRR_A = 9.99%
IRR_B = 15.40%
IRR_C = 17.07%
IRR_D = 12.94%

NPV_A = -$71,051
NPV_B = $38,622
NPV_C = $28,259
NPV_D = -$14,437

If Independent

Choose Projects B and C as both have positive NPVs. While the PP exceeds T for project B, unless the company has significant financial problems and/or is severely concerned about the project lasting the four years. NPV is the best decision rule, so when the decision rules give conflicting results, go with NPV.

If Mutually Exclusive

Choose Project B as it has the highest NPV. The higher IRR for project C is irrelevant and is caused by the different sizes of the projects. Again, when there are conflicts among the rules always follow NPV.

Problem 8.9.2

In the problem above, identify a pair of projects that could suffer from the size problem, but not a reinvestment rate problem. Next, identify a pair of projects that could suffer from the reinvestment rate problem, but not the size problem.

Answer

We identify the size problem by looking for different initial investments. Projects AC, AD, BC, and BD all are pairs with different initial investments. However, we also want to find a pair of projects without the reinvestment rate problem. Since

A and C are both frontloaded while B and D are both backloaded, they should not suffer from the reinvestment rate problem. Therefore, you could select either AC or BD as an answer for a pair of projects that could suffer from the size problem, but not the reinvestment rate problem.

When looking for pairs of projects that might suffer from the reinvestment rate problem, we have AB, AD, BC, and CD. However, we also want to find a pair of projects without the size problem. Since both AB and CD have the same initial investments, they will not suffer from the size problem. Therefore, you could select either AB or CD as an answer for a pair of projects that could suffer from the reinvestment rate problem, but not the size problem.

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8.10: References and Attributions

Videos

Capital Budgeting Part One -Introduction and Payback Period

Capital Budgeting Part Two-Calculating Internal Rate of Return

Capital Budgeting Part Three -Calculating Net Present Value

Capital Budgeting Part Four -Analysis of Decision

References

Ryan, P. A., & Ryan, G. P. (2002). Capital budgeting practices of the fortune 1000: How have things changed? Journal of Business and Management, 8(4), 355-364.

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CHAPTER OVERVIEW

9: Mutual Funds, IRAs and 401(k) Plans

Learning Objectives

- After completing this chapter, students should be able to
- Define mutual funds
- Identify advantages of mutual funds
- Identify key types (objectives) of mutual funds
- Define key terms associated with mutual funds
- Calculate the dollar cost of expenses and fees associated with mutual funds
- Compare and contrast a Traditional vs. Roth IRA/401(K)
- Identify maximum contribution to an IRA and 401(K) Plan
- Identify the tax benefits associated with IRAs and 401(K) Plans
- Identify the role of a Rollover IRA
- Differentiate between an IRA and a 401(k) Plan
- Explain the advantage of matching contributions associated with a 401(k) Plan
- Define the concept of vesting and explain its importance

9.1: Retirement

9.2: Mutual Funds

9.3: Individual Retirement Accounts (2021)

9.4: 401(k) PLANS

9.5: Key Takeaways

9.6: Exercises

9.7: References and Attributions

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9.1: Retirement

In Chapter Three, we introduced the importance of time value of money as a key component of retirement planning. So, how well do we do as a society in preparing for retirement? The article, Good News: You might live to be 100…That's also the bad news, provides a less than encouraging answer. As life expectancies rise (which is great), it magnifies the importance of being proactive in retirement planning. For people born in 1997, the life expectancy may be as high as 100 years. If someone retires at 65, that means 35 years of retirement income that needs to be planned for. The global retirement savings gap is expected to expand rapidly over the next few decades. This raises the



Figure 9.1.1: 401k, IRA and Mutual Funds are three places to invest for retirement

question of how you avoid falling into this widening gap? Fortunately, there are several tools that can help you with this process. Mutual funds provide easy and convenient ways to invest in a broad asset classes and retirement tax shelters like Individual Retirement Accounts (IRAs) and 401(k) plans help provide tax advantages. Below, we will spend some time talking about these tools to help you meet your personal financial goals, including, but not limited to, retirement.

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9.2: Mutual Funds

A Mutual Fund is a pooled investment portfolio managed by a professional portfolio manager (or management team). Each investor in the mutual fund owns a pro-rated amount of the overall portfolio based on their contributions to the fund over time. The portfolio manager will invest these funds according to specific guidelines.



Figure 9.2.1: Advantages of Mutual Funds

Advantages of Mutual Funds

Professional Management

Most people do not want to make investing for their financial goals a full-time career. A mutual fund allows them to hire someone who has significant training, support and resources to make the decisions of which securities to own and when to buy/sell those securities.

Low Cost

While the costs vary dramatically from one mutual fund to the next, most mutual funds are managed at a relatively low cost to investors. The specific costs will be discussed in greater detail below.

Diversification

By pooling the investment dollars from many investors, mutual funds allow individual investors with small amounts of capital to own diversified portfolios usually containing more than 100 individual securities.

Low Minimum Investment

Most mutual funds can be started with investments of $500 – $2500. Also, some mutual funds will allow you to start with even less than that if you agree to contribute a fixed amount each month.

Flexible and Easily Tailored to Your Needs

There are approximately 8000 different mutual funds available with different objectives and risk profiles. With so many options available, it is easy to find a mutual fund or a combination of a few mutual funds to meet your specific goals for risk and performance.

Major Mutual Fund Categories

Money Market Mutual Funds

Money market mutual funds are extremely low risk investments, but also offer low rates of return. It is extremely rare to lose money in a MMMF and most maintain a fixed price of $1.00 per share while offering their investors low interest payments. As of January 2021, most MMMF are yielding less than 1.00% annual rates of return due to the Federal Reserve's easing of monetary policy to combat the economic impacts of the COVID-19 pandemic. The rates of return will tend to fluctuate with short-term interest rates. Historically, MMMF have averaged returns of 2%-4%, but as of the start of 2021, it has been several years since we've been at those levels for any sustainable time frame.

Bond Funds

Bond mutual funds can range from low to moderately high levels of risk. At the low-risk end, the mutual fund will invest in short-term US Treasury bonds. While low risk, these funds will typically offer low rates of return only marginally higher than a MMMF. At the higher-risk end, the mutual fund will invest in junk bonds issued by corporations. In exchange for the higher risk, returns on these funds can be significantly higher than most bond funds. Bond funds can lose money when (A) interest rates increase and/or (B) the bonds suffer from defaults. Funds that focus on Treasury bonds will eliminate the default risk and funds that invest in shorter-term bonds will have less interest rate risk. Historically, bond funds have averaged returns of 4%-9% depending on the level of risk exposure. For the 10 years concluding in 2019, the Vanguard Total Bond Market Fund earned an average return of 3.68%, while their High-Yield Corporate Bond Fund earned 7.10% per year.

Stock Funds

Stock mutual funds are the most common type of mutual fund. These tend to be the riskiest type of fund as they invest in common stocks. However, the risk can range quite a bit within the stock fund category depending on how aggressive or conservative the style of the fund. Over time, you can expect the average stock fund to earn rates of 7%-13% with quite a bit of variance between funds and across time frames. For the 10 years concluding in 2019, the Vanguard Total Market Index Fund has earned 13.43% as a rate of return. However, during the period from February 19, 2020 to March 23, 2020, it lost 35% of its value. Alternatively, for the entire 2020 year, it was up approximately 20% on the year. This provides a glimpse of the volatility associated with stock funds.

Hybrid Funds

Hybrid funds combine a mix of asset classes and are often a combination of stocks and bonds. This provides less risk and greater diversification, but also lowers expected returns. The average returns for hybrid funds are typically in the 5-9% range. The Vanguard Balanced Index Fund earned an average annual return of 9.54% for the 10 year period ending in 2019.

Lifecycle Funds

A lifecycle fund picks a set “retirement” date and manages the risk exposure accordingly. So, if you plan to retire in 2050 you could buy a fund with that target date. As of 2020, retirement would be about 30 years away so the fund would have higher risk (heavy equity exposure). Over time, the amount allocated to equities would decrease and the amount allocated to bonds and money-market instruments would increase, lowering the risk (and expected return) as you move closer to retirement. For example, as of the summer of 2020, the Fidelity 2050 Freedom Fund had about 51% domestic equities, 40% international equities, and about 9% bonds/money-market securities. Alternatively at that same time, the Fidelity 2015 Freedom Fund had about 23% domestic equities, 21% international equities, 41% bonds, and 15% money market securities. The idea is to create a passive fund that requires little management from investors (saving the investor time and preventing investors from ignoring their asset allocation and ending up taking too much or too little risk than they planned). The downsides include slightly higher expenses, less control over your asset allocation, and the inability to pick specific stock-based or bond-based funds within the mix.

The chart below shows the percent of total net assets held by US mutual funds at the end of 2019.

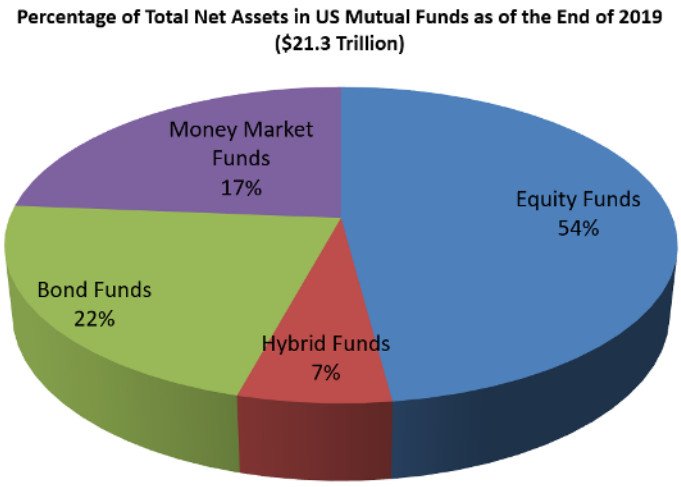


Figure 9.2.2: Total assets in US Mutual Funds at the end of 2019 [$21.3 Trillion]

Source: 2019 Investment Company Factbook

Mutual Fund Terminology

Prospectus

The prospectus of the mutual fund tells you all the important information you need to know. Here is a link to the prospectus for the Fidelity Magellan Fund. It discusses the investment style of the fund, the risk level of the fund, the various costs of the funds and much more. While some of it can get quite technical, most of the important information in the prospectus is presented in a "friendly" format. Read it before investing!

Load Charge

A load charge is an upfront fee that is taken from your investment. Load charges are usually used to help pay for the sales costs associated with marketing mutual funds. By law, mutual funds can not charge more than 8.5% of a load charge. If a fund charges a 5% load and we invest $1000 into the fund, $50 will be taken out as a load fee and $950 will actually be invested in the fund. Some funds do not charge sales loads (they are called "no-load" funds). The article, No-Load Funds vs Load Funds has a more in-depth discussion on load charges for those interested.

Expense Ratio

The expense ratio is the amount of money taken out on an annual basis to cover the funds operating expenses (pays portfolio manager, customer service reps, overhead, profit, etc.). This can range from around 0.05% at the low end up to over 2% at the high end (the average is right around 1%). If the mutual fund with a 1% expense ratio earns a 12% return before the expense ratio, it will result in a return to investors after expenses of 11%. The article, Definition and Explanation of Mutual Fund Expense Ratios, offers more details on mutual fund expense ratios.

A,B,C Shares

Some funds are sold with various expense packages known as "A", "B" or "C" shares that are used to pay the brokers/advisors who sell these shares. "A" shares have higher front-end load charges, "B" shares have higher annual expenses and back-end loads (and often convert to "A" shares over time), and "C" shares typically avoid load charges but have higher annual expenses. For short-term holdings, C shares would be better. For longer-term holdings, A shares are best. Investopedia has a discussion on mutual fund share classes that adds more detail.

Fund Families

Many mutual funds are parts of a large "fund family." For example, Fidelity is one of the largest fund families and they offer well over 100 different mutual funds. Other large fund families include, but are not limited to, Vanguard, American Century Investors, T. Rowe Price, and Blackrock.

ETFs

An Exchange Traded Fund (ETF) is a stock/mutual fund hybrid. It trades like a stock in that you can buy/sell it at any time of the trading day (mutual fund contributions and withdraws are only done based on end-of-the-day pricing), but each share you buy represents a basket (portfolio) of underlying stocks. The underlying portfolio depends on the ETF, but some try to match indices (such as the S&P 500 or Dow Jones Industrial Average), international indices (so you can get exposure to China, India, Brazil or other countries without worrying about picking individual stocks), sectors (such as financials, biotechnology, retail, etc.), or other characteristics (short funds that go up when the market is down and down when the market is up, high dividend yield stocks, etc). ETFs tend to have relatively low expense ratios and tend to use more passive stock selection (not trying to pick the "best" stocks but just hold a basket of stocks meeting the objective). More discussion on ETFs can be found in the article, Exchange-Traded Funds.

Tips for Mutual Fund Investing

Consider Your Goals First



Before picking a mutual fund to invest in, you need to know what you're trying to accomplish. What time frame are you looking at? What level of risk are you comfortable with? What rate of return do you need to earn? Once you know this, you can start picking mutual funds that meet your needs. Choosing the right mix of exposure to stocks, bonds, international securities, etc. to match your risk-return goals is more important than choosing the "right" fund. With so many funds out there, you can be confident that you ***won't*** choose the best fund without getting very lucky. However, don't worry about getting the best one and instead focus on a good fund (or funds) that meet ***your*** needs.

Bad Performance Persists

The worst mutual funds tend to stay bad. Part of the reason for being a bad mutual fund this year is having high costs. These costs don't go away, so eliminate the worst performing 25% of funds over the past few years within a particular category from consideration.

Don't Chase Hot Funds

A big mistake a lot of investors make is trying to invest in whatever last year's top fund was. While bad performance persists, there is less persistence among the top performers. Usually the top performing funds for a given year are not very diversified and will do poorly when trends change. Here is a brief look at mutual fund performance persistence. Keep in mind that switching funds may also increase your load charges and trading costs.

Focus on Costs

Most mutual funds fail to outperform the averages because of diversification and costs. If we focus on funds that have low costs (loads and expense ratios) we will keep more of the investment return instead of paying it to the mutual fund company. Index funds tend to be the lowest cost type of funds and small-cap or international funds tend to be the most expense. Look closely at the expense ratio. Assuming a 9% pre-expense ratio return, the difference between a mutual fund with a 0.50% expense ratio and one with a 1.25% expense ratio will be $47,993 to an investor that invests $3000 per year over 30 years ($372,644 vs. $324,651). For a long-term investor adding to their mutual fund on a regular basis, load charges are less important than expense ratios. Consider two mutual funds that both charge a 1% expense ratio and earn 9% before any expenses. One fund charges a 5% load while the other is a no-load fund. If we invest $3000 in each fund each year over 30 years, the no load fund will have $339,850 vs. $322,857 for the load fund (a cost of $16,993). Notice this difference is much less than our previous example with different expense ratios.

Think Long-Term

Try to focus on your long-term returns instead of annual fluctuations. Studies have shown that investors tend to underperform the mutual funds that they invest in by about 1.1% per year due to poor market timing (selling low and buying high)

Consider Some International Exposure

While markets are more interconnected than they were 20-30 years ago, there is still some advantage to international diversification. Having some exposure to emerging markets and other global economies will help diversify your portfolio and also offer the opportunity for higher returns.

Calculating Impact of Load Charges and Expense Ratios

Remember that the load charge impacts the amount of your contribution and the expense ratio impacts the rate or return. So, in order to calculate the impact, we can use the 5-key approach on our calculator. Assume you are dealing with a mutual fund that has a 4% sales load and a 1.25% expense ratio. If you invest $10,000 today and $200 per month for 30 years, how much are these costing you if the fund earns 10% before any fees?

Calculate FV without any fees (Calculator set to 12 P/Y):

360 N
10 I/Y
10,000 PV
200 PMT
⇒ FV = $650,471.58

Calculate FV with fees – 1.25% expense ratio and 4% load charge. (Calculator set to 12 P/Y):

360 N
8.75 I/Y
9,600 PV
192 PMT
⇒ FV = $464,984.97

Total Cost ⇒ $185,486.61

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9.3: Individual Retirement Accounts (2021)

Purpose

The purpose of the IRA is to provide a tax-incentive for personal retirement savings. Theoretically this should increase the savings rate and encourage more people to prepare for their financial future.

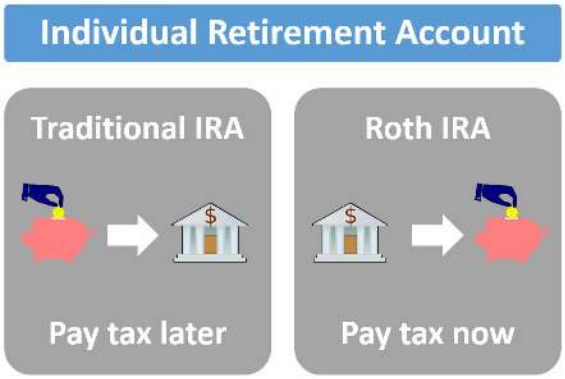


Figure 9.3.1: Tax situation for traditional IRA (pay tax on withdrawl) and Roth IRAs (pay tax on deposit)

Traditional IRA

Each individual can contribute up to $6000 per person per year into an IRA with the following stipulations (for 2021 tax year — some of these numbers will change for future years).

1. The contribution cannot exceed a person's earned income. However, a non-working spouse is eligible to contribute the full $6000, assuming sufficient family income.
2. If you are not an active participant in an employer sponsored pension program, you can contribute the full $6000 regardless of income (if you are not covered and your spouse is, there is an income cutoff, but it is higher).
3. If you earn (Adjusted Gross Income) less than $66,000 per year (single) or $105,000 (joint), you may contribute the full $6000 even if you are an active participant in an employer sponsored pension program.
4. If you earn (AGI) more than $76,000 per year (single) or $125,000 (joint), you can NOT make a tax-deductible contribution to an IRA if you are an active participant in an employer sponsored pension program. Note that at incomes above these limits, you can still contribute, but your contribution will NOT be tax deductible.
5. If you are above the lower limits and below the upper limits, you can contribute a portion of the $6000. For example, a single individual earning $69,000 per year is eligible to contribute $4200 per year [($7000/$10,000)*$6000]. A married couple earning $115,000 would each be able to contribute $3000 [($10,000/$20,000)*$6000] per year.
6. If you are 50 years of age or older, you can contribute up to $7000 per person per year instead of $6000.

The contributions to the IRA are tax-deductible in the contribution year. For instance, if you had a taxable income (single) of $50,000 prior to an IRA contribution and contributed the full $6000 to an IRA, the IRS would lower your taxable income in that year to $44,000. This level of income places the individual in a 22% marginal tax bracket for taxable income between $40,526 – $86,375 for 2021, so would result in a tax benefit of $1,320 ($6000*0.22) in the year of contribution.

All interest, capital gains, and dividend income are allowed to compound tax-free during the investment period.

Withdrawals taken after age 59½ are taxed as ordinary income at the time they are withdrawn.

Any withdrawals taken prior to age 59½, are subject to a 10% tax penalty unless they are (note – regular taxes are still due, just not the penalty):

- To purchase a primary residence for yourself, your parents, grandparents, spouse, child or grandchild. You can withdraw up to $10,000 (total during your lifetime). The distribution generally is available if you have not owned a primary residence for two years. Home-buying funds must be used within 120 days for expenses such as settlement charges, financing fees and closing costs.
- For qualified college expenses, such as tuition, fees, books, supplies, equipment, and room and board.

- If distributed in “substantially equal” payments, such as an annuity, based on your life expectancy.
- Due to death or permanent and total disability.
- To pay certain medical expenses if your medical bills exceed 7.5 percent of your adjusted gross income.
- For health insurance premiums if you’ve received unemployment compensation for 12 weeks or longer.
- Being called up to active military duty.

Withdrawals must be initiated by the time an individual reaches age 72

Typical investment options include mutual funds, individual stocks, bank CDs, and bonds. Some investments such as derivatives with potentially unlimited loss, collectibles, life insurance, etc. are not permitted in IRAs.

Roth IRA

Each individual can contribute up to $6000 per person per year into a Roth IRA with the following stipulations (for 2021 Tax Year).

1. The contribution cannot exceed a person’s earned income. However, a non-working spouse is eligible to contribute the full $6000, assuming sufficient family income.
2. If you earn (AGI) less than $125,000 per year (single) or $198,000 (joint), you may contribute the full $6000.
3. If you earn (AGI) more than $140,000 per year (single) or $208,000 (joint), you can NOT make a contribution to a Roth IRA.
4. If you are above the lower limits and below the upper limits, you can contribute a portion of the $6000. For example, a single individual earning $128,000 per year is eligible to contribute $4800 per year [($12,000/$15,000)*$6000]. A married couple earning $207,000 would each be able to contribute $600 per year [($1000/$10,000)*$6000].
5. If you are 50 years of age or older, you can contribute up to $7000 per person per year instead of $6000.

Contributions to a Roth IRA are NOT tax-deductible in the year of the contribution. For example, if your taxable income was $40,000 prior to making a $6000 contribution to a Roth IRA it would remain $40,000 after your contribution. There is no tax benefit at the time of contribution.

All interest, capital gains, and dividend income are allowed to compound tax-free during the investment period.

Withdrawals taken after age 59½ (and minimum 5 years) are NOT taxed. This is one of the primary benefits of the Roth IRA.

Early withdrawals are subject to penalty unless special situation (see traditional IRA). Note that withdrawals of contributions are not penalized or taxed. Only early withdrawal of investment income is penalized/taxed. While there may not be a penalty associated with withdrawing your contributions, it is not recommended as this greatly limits the ability of the Roth IRA to take advantage of the power of compounding.

Withdrawals do NOT need to be initiated by the time an individual reaches a specific age. This is because withdrawals are not taxed and therefore, there is no tax revenue to be generated by requiring investors to withdraw capital at a certain point.

Typical investment options include mutual funds, individual stocks, bank CDs, and bonds. Some investments such as derivatives with potentially unlimited loss, collectibles, life insurance, etc. are not permitted in IRAs.

Rollover IRA

Rollover IRAs are designed to allow individuals to move their pension plan into a tax-sheltered account when they switch jobs, essentially turning the old pension plan into a traditional IRA. If the rollover is done directly (so that the previous employer handles the transaction directly with the institution offering the IRA), the full amount is transferred. If the previous employer transfers the money to the individual, allowing the individual to then set-up the rollover IRA, there will be a 20% withholding charge. If the new account is established (for the full amount) within 60 days, the IRS will return this withholding.

How Much Benefit Can an IRA Make?

This answer varies based on time horizons, tax rates, and rates of return. Also, if you use a traditional IRA, it depends on whether you reinvest your tax savings each year or spend them. I am going to run through a scenario with several assumptions to give you an idea of the financial benefits of an IRA. Note that your specific benefits will vary – these results are specific to this example, but are designed to provide a realistic look at how much you can gain from choosing an IRA over an ordinary taxable account. Typically, you can expect greater benefits for using an IRA when you have

Longer time horizons (starting in your 20's vs. starting in your 40's)
Higher tax rates (because the IRA is a tax shield)
Higher rates of return (the compounding effect is bigger)

However, to give you an idea, consider the following scenario

Let's assume you are 22 years old and want to start saving for retirement.

You plan to save

$100 per month at the end of each month for the next 5 years
$200 per month for the following 10 years
$300 per month for the remaining 23 years until you retire at age 60.

Assume you will earn a 9% rate of return over the entire 38-year time frame.

Also, assume that you pay an average tax rate of 18% on your investment income and an average tax rate of 25% on your ordinary income (note that these are different because dividends and long-term capital gains are currently taxed at lower rates than ordinary income).

You want to take out your money at the start of each month for 35 years

You will earn a 6% rate of return during retirement (the lower return is because you plan to move to less risky investments in retirement).

If you use a traditional IRA, you will reinvest your tax savings each year.

Given all these assumptions, here is how much you will have at retirement and to spend each month during retirement if you (A) don't use an IRA, (B) use a traditional IRA, or (C) use a Roth IRA. Note that you can't easily do this with your financial calculator because of all the assumptions. I used a spreadsheet to generate these values. Also, note that while you have more money at retirement with the traditional IRA, because you have to pay tax on each $1 you withdraw, you actually have a higher after-tax monthly income with the Roth IRA. In this scenario, using a Roth IRA generates an additional $1670.69 every month over your 35-year retirement compared to just an ordinary taxable account – a very substantial benefit.

Don't Use an IRA (Ordinary Taxable Account)
Retirement Wealth $490,127.93
Monthly Income $2438.67

Traditional IRA
Retirement Wealth $846,835.17
Monthly Income $3691.68

Roth IRA (Ordinary Taxable Account)
Retirement Wealth $724,303.18
Monthly Income $4109.36

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9.4: 401(k) PLANS

A 401(k) plan is a retirement savings plan offered through an employer that allows employees to put away a portion of their paycheck each period on a pre-tax basis into an investment plan. Typically, the employer will have a selection of different accounts into which employees can allocate their investment. The accounts will usually have a mix of low risk to higher risk alternatives such as a money market fund, a couple different types of bond funds, and a couple of different types of stock funds so that you can match the risk/return profile you are searching for. Some employers will match (or partially match) an employee's contribution. The money in the 401(k) plan compounds tax-free during the employee's working life and withdraws are taxed as ordinary income. The tax structure is similar to the traditional IRA. Roth 401(k) plans were introduced in 2006 and are offered by some employers. A Roth 401(k) will have a tax structure similar to the Roth IRA (no tax deduction on contributions, withdraws are tax-free). The maximum contribution to a 401(k) plan for an employee in 2020 is $19,500 ($26,000 for 50+ years of age) per year.

If you leave the company prior to retirement, you can have several options.

Leave your money with the company

Most firms will allow you to leave the money in the plan and then access it when you retire. The downside of this is that you have less control and if you change jobs frequently you will have several accounts to keep track of.

Move your money to your new employer's 401(k) plan

Most employers will allow you to transfer your money to your new company's plan. The downside of this is that you are limited to the options available in your new plan.

Use a Rollover IRA

You can set up a special account called a "rollover IRA" (discussed above), which allows you control over your investment decisions. If you put your money in a rollover IRA it is important that your old employer transfer the money directly to the IRA account to avoid a 20% withholding penalty.

Cash Out

This will result in significant tax penalties and should only be done as a last resort if you desperately need the cash.

Vesting

Vesting refers to the concept that your retirement benefits belong to you even if you leave the firm before retirement. Every company has different vesting requirements, but there are minimum vesting standards that require you to be fully vested in 3-6 years. If you are 60% vested, then 60% of your retirement benefits belong to you if you leave the firm early. Note that your contributions and the return on those contributions always belong to you. It is only the matching contributions and the return on those contributions that need to be vested.

401(k) Tips

Consider employer's retirement plan when choosing a job

Look at your employer's retirement plan as a key benefit when considering a job. The quality of plans varies dramatically from employer to employer with regard to matching, investment options, and vesting. Take a look at this web page for some general information on common 401(k) benefits.

Diversify

Don't use the stock of the company you work for as your primary investment choice! If the company matches in company stock, transfer it out as soon as possible. Don't get "Enroned." Don't let company stock represent more than 20% of your retirement assets (and 20% is way on the high side – less than 10% is even better)

Be careful about being too safe

If you choose the safest investment option you likely won't ever lose money, but you won't make much either. If you have a low return, it will be hard to accumulate much wealth. The person that puts away $300 per month (note that with a 50% match from

your employer, this is only $200 out of your pocket and $100 from your employer) for thirty-five years and earns 10% will have $1,138,991 whereas the person that puts away $300 per month for thirty-five years and earns 5% will only have $340,828 (or would need to put away about $1000 per month to get the same amount as the person who saved $300 per month at 10%). As you get closer to retirement, you should start to reduce your risk exposure. Don't worry too much about stock market crashes during your first 10-20 years of savings. They mainly create opportunities for your monthly contributions to buy more.

Participate

The biggest mistake many people make is they say "I'll start participating next year" and next year never comes. The person that saves $250 per month for thirty-five years at 9% will have $735,446 whereas the person that saves $250 per month for twenty years at 9% will only have $166,972.

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9.5: Key Takeaways

Key Takeaways

Retirement planning is a major issue facing most people in the United States. Between the looming challenges facing Social Security (can you fix them?) and the decline in traditional defined-benefit pension plans, more individuals are going to need to save for their own retirement. While we have introduced the concepts of time value of money, bonds, stocks, and risk-and-return over previous chapters, the purpose of this chapter is to provide students with information on the principal tools available for meeting retirement goals – mutual funds, Individual Retirement Accounts, and 401(k) plans. Mutual funds provide a simple, potentially low-cost method for investors to easily invest their potential retirement savings. These can be used inside tax-advantaged retirement accounts (such as IRAs and 401(k) plans) or outside of tax-advantaged retirement accounts. IRAs and 401(k) plans are not investments, but tax shelters to protect investment income from taxes in order to help individuals better prepare for retirement. Unfortunately, the state of retirement savings in the US is in poor shape with the average (mean) retirement savings for families in the 56-61 age bracket being a mere $163,577 as of 2013. To put that in perspective, that would provide a couple with $956.25 per month in retirement income (or less than $12,000 per year) for 25 years if they could earn a 5% return over that 25 years. While that is not good, the picture is actually much worse. Because of the skewed nature of retirement wealth (if one family has $1,000,000 and 9 families have $70,000 each, that will provide a mean of $163,000 even though 90% of the families have less than half of the average amount), the mean likely overstates the retirement health of most families. If we instead turn to the median (half of the families have more and half have less) instead of the mean, half of families in the 56-61 age bracket have less than $17,000 saved for retirement. For the same 25 years with a 5% return, they would have just under $100 a month in retirement income. Using the tools covered in this chapter and the discipline to develop a savings plan, your chances of having a much healthier retirement is highly probable. Saving $200 per month and getting a $100 match from your employer from age 25 through age 64 (40 years) at 8%, will generate $1,047,302 available for retirement. This requires neither aggressive savings or unrealistic return assumptions.

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9.6: Exercises

Exercise 9.6.1

Explain the difference between an expense ratio and a load charge? Which is more important for short-term investors? Which is more important for long-term investors?

Answer

An expense ratio refers to an annual charge (taken out on a daily basis) for the company that manages the mutual fund. For example, a mutual fund with a 1% expense ratio would charge investors 1% of their assets each year for managing the fund (note: assuming 250 trading days, that would work out to 0.004% per day). This is designed to cover the mutual funds expenses (mutual fund managers, cost of gathering information, cost of presenting information to investors, earning a profit, etc.) and does not factor in actual trading costs (brokerage commissions paid by the mutual fund, etc.). A load charge refers to an upfront charge based on investments into the fund. For example, if I decide to invest $100 a month into a fund with a 4% load charge, then $4 each month will go to the fund for the load and $96 will actually get invested into the fund. Typically load charges are designed to cover compensation to financial advisors and other marketing costs.

For a short-term investor, load charges are typically more important while for long-term investors expense ratios are more critical. The crossover point in terms of how long depends on the relative size of expense ratios and load charges. You can estimate the impact of load charges and expense ratios as follows:

- Estimate your future value based on contributions to the mutual fund and anticipated rate of return without expenses.
- Estimate your future value based on contributions to the mutual fund and anticipated rate of return with expenses.

For example, what is the impact of a 5% load charge and a 0.8% expense ratio for an investor who plans to initially contribute $2000 today and make additional contributions of $200 per month for the next 40 years if the mutual fund anticipates earning 6.5% before expenses?

Baseline

480 N
6.5 I/Y
-2000 PV
-200 PMT
FV⇒$483,462.99

With Expenses

480 N
5.7 I/Y
-1900 PV
-190 PMT
FV⇒$367,437.65

The baseline (without expenses) results in you having an additional $116,025.34 at retirement, so this is your net cost for the expenses. Note that reducing the expense ratio from 0.8 to 0.4 would have allowed you to accumulate an extra $43,035.87 at retirement. Small changes in the expense ratio don't amount to much in a given year, but are big over a long time-frame.

? Exercise 9.6.2

What kind of information would one find in the prospectus?

Answer

The prospectus provides all the important information to a potential investor on the fund. It details the fund objective, talks about investment strategy, details who the fund manager is, breaks down expenses, discusses risk, looks at past returns, etc. In addition, it talks about minimum initial investments and looks at portfolio holdings for the most recent quarter. While the prospectus can't tell you if a fund will perform well in the future, it is an important document to look through to get a feel if the fund is right fit for you.

? Exercise 9.6.3

What is an ETF? How is it similar to a traditional mutual fund and how is it different?

Answer

An ETF is an Exchange Traded Fund. It is a mutual fund that trades like an individual stock. Normally, mutual funds can only be bought/sold at the end of the trading day (NOT while markets are open). Also, mutual funds discourage investors from short-term trading. They don't want people buying one day and selling a week later. Instead they want them to invest and hold the fund for multiple years. Finally, most mutual funds are actively managed. This means that mutual fund managers try to identify good stocks to own and bad stocks to avoid. They buy/sell stocks within the mutual funds portfolio regularly (most actively managed mutual funds have turnover of over 100% which means that they hold the average stock in their portfolio for less than one year). Active management is less tax-efficient (more short-term capital gains) and more expensive (more trading costs which lowers the funds returns unless they're able to find undervalued/overvalued stocks consistently…evidence suggests this doesn't happen). While some traditional mutual funds are passive (these are known as index funds and are among my favorite type of funds), they are in the minority. While most traditional mutual funds are actively-managed, most ETFs are passive. By passive, we mean that instead of trying to choose good stocks and avoid bad ones, they try to match a particular index. The index may be a broad market index (like the S&P 500), a sector (like energy stocks), international (like Brazil), or many other categories. This tendency for passive investment-strategies tends to result in lower expense ratios than traditional ETF. However, some ETFs can have exotic strategies (such as levered funds which are supposed to increase/decrease 2-3 times as fast as the overall market or levered inverse funds which are supposed to move in the opposite direction of the overall market AND at a faster pace) or focus on areas outside stocks such as gold. Because ETFs are bought like individual stocks, you need a brokerage account to trade them and pay brokerage commissions when you buy/sell. ETFs have become extremely popular and are one of the fastest growing areas of mutual funds over the last 10 years. Quick recap on ETFs:

- Purchased through a broker
- Trade like a stock (buy/sell during periods when the market is open) so better for active traders
- Tend to have lower expense ratios
- Tend to follow a passive investment management strategy
- Can have a wide variety of objectives to match the interests of a wide-variety of investors

? Exercise 9.6.4

What is a Lifecycle fund? What are advantages/disadvantages to this type of fund?

Answer

In class, we have often discussed the idea that risk-aversion is closely related to age (or years to retirement). As people are younger (20s – 40s), they can afford to take more risks for higher expected returns as they have more time to recover from losses and adjust their savings. However, as people get close to retirement (50s – 60s), they need to reduce their risk exposure. Lifecycle funds are designed to do this automatically by investors choosing a target date for their retirement

(typically in 5 year increments). For example, a person like myself with about 10 years to retirement might choose a target-date of 2030. A person near retirement may choose a target date of 2020. Someone just graduating may choose a target date of 2055, 2060, or even 2065. Each of these different "target-dates" would be different mutual funds with noticeably different investment strategies. The 2020 fund would probably have about 50-55% stock exposure (with many of the stocks more conservative companies), 35-40% bond exposure, and 5-10% cash exposure for a less risky mix. The 2055 fund would probably have about 90% stock exposure (with more of it in aggressive growth stocks, emerging markets investments, etc.) and 10% bond exposure (including some junk bonds). Over time, the management team running the 2055 fund would slowly reduce the risk by moving to fewer, more conservative stocks and more (and safer) bonds. This way the investor does not need to worry about adjusting the risk over time. It is designed to maximize "ease of management" for the individual investor as risk is gradually reduced to match age.

The advantage is clearly simplicity for the average investor. Many people find reviewing/managing their investment funds as much fun as a trip to the dentist. This reduces the time that needs to be spent assessing the portfolio mix as it is taken care of for you by the fund managers. There are however a couple of disadvantages that one needs to be aware of before choosing this route. First, risk aversion is not solely dependent on time to retirement. It is also impacted by personality, income, wealth, job security, dependents, and many other factors. The lifecycle fund only controls for one factor (although typically one of the most critical factors), so may provide a risk mismatch for YOU if you do not fit the normal profile in all other areas. Second, each lifecycle fund is managed a bit differently. The 2030 fund offered by one firm may have 70% weighting in stocks while the 2030 fund offered by another may have 50% weighting. Because of this, even if an investor fits the normal profile and chooses the right target date, they may have a slightly riskier/higher expected return fund or a slightly safer/lower expected return fund depending on which mutual fund company he/she buys from. A third disadvantage is that these funds typically have higher expense ratios. Often they are formed not by individual securities, but essentially mutual funds within mutual funds. This can mean paying expenses for management of the lifecycle fund and paying expenses within the mutual funds the lifecycle fund holds. Check the prospectus of the lifecycle fund you are choosing to before buying to see about its risk profile and its expenses instead of just picking any fund with the appropriate target date.

? Exercise 9.6.5

When looking for a mutual fund (or funds), what should you look for?

There are many things to consider when evaluating a mutual fund. However, a few simple ones that I would recommend are as follows:

- Eliminate any fund that is in the bottom 25% of its category over the last 3-5 years in performance. Often (not always), this is a sign that there are some structural problems with the fund.
- Look for funds with below average expense ratios. I prefer index funds because they have extremely low expense ratios and evidence suggests that mutual fund managers do not outperform the market on a risk-adjusted basis. If they don't have an edge over the market, why pay for them to try to outperform it? Instead, just get exposure to the assets you want through low-cost, passive funds.
- Focus on risk for you. Look at the risk of the funds you invest in and make sure you are comfortable with it. If losing 30% of your money is going to cause you to not sleep at night, don't expose yourself to that risk. There are thousands of funds with very different risk-return profiles, so choose ones that you are comfortable with.
- Closely related to the previous factor – choose a portfolio of funds that works for you. Even if you are more risk averse, you can put SOME of your funds into higher-risk, higher-return type funds as long as you have a portfolio. A portfolio doesn't mean 10 random mutual funds, but maybe 3-8 specific mutual funds with different objectives (such as 10% in an emerging market stock fund, 10% in an emerging market bond fund, 10% in a broader international stock fund, 10% in a broader international bond fund, 30% in a US stock index fund, 20% in a US bond fund, and 10% in a precious metals or real estate fund – note, this mix is meant as an example NOT a recommendation).
- Adjust your asset allocation (how much stocks, bonds, international, etc) at least annually to maintain an appropriate risk balance. Otherwise you will find yourself over-weighted towards areas that did well in the recent past and underweighted towards areas that did poorly. It also allows you to re-evaluate how much risk you feel comfortable with based on your current situation.

? Exercise 9.6.6

Evidence suggests that mutual funds do not outperform the broader market on a risk adjusted basis (they actually slightly underperform). Why might this be and does it mean that mutual funds are a poor investment tool?

Answer

The primary reasons mutual funds don't outperform the markets on a risk-adjusted basis are (a) markets are relatively efficient and (b) managing a fund entails costs which are not captured by market indices (such as the S&P 500). Even though mutual fund managers are professionals and typically very good at what they do, they are largely competing against other professionals who are typically very good at what they do. The vast majority of trading in the financial markets is among professional/institutional investors. They all are smart, have access to lots of information, etc. Because of this, it is rare for one to consistently outdo the others. The efficient markets hypothesis may not be 100% valid, but it is reasonably close. There are not a lot of easily exploitable opportunities out there because so many people are constantly seeking them out. Also, running a mutual fund involves costs. There are basic trading costs, costs to gathering information, cost to paying the portfolio manager and staff, cost to preparing/presenting information to investors, the fund company's profit, etc. These things are covered in the expense ratio (except for trading costs which lower pre-expense returns) and impact the return that the investor receives from the mutual fund (often these costs are around 1%). Because the index is not a managed portfolio, it doesn't have any of these costs to lower its performance. Studies show that after accounting for trading costs and expense ratios, mutual funds typically match the overall market returns.

This does not mean that mutual funds are a poor investment tool. If you tried to invest on your own through individual stocks/bonds, you also would likely not outperform the market due to investment skill (it's possible, but not likely). You would also be gathering information (dollar cost and time cost), paying brokerage commissions, and needing to have a large enough portfolio to adequately diversify (remember that you'd need at LEAST 15 different stocks – most mutual funds have over 100 different stocks in their portfolio). Between the time spent managing your portfolio, the initial investment required to have a diversified portfolio, and the trading costs you would encounter, most people find mutual funds far more efficient than managing their own stocks/bonds. I would argue that unless you had at least $50,000 (probably a low estimate) AND enjoyed doing investment research, you are better off with mutual funds (carefully selected mutual funds) than trying to manage your individual portfolio of stocks/bonds. However, if you really like investments, there can be other advantages other than pure cost efficiency (enjoyment of the challenge provided, learning experience, etc.). The vast majority of individuals are better served by mutual funds than opening a brokerage

? Exercise 9.6.7

Explain key differences and similarities between a Roth and a Traditional IRA.

Answer

SIMILARITIES

- Both allow $6000 per person per year contribution ($7000 for people 50 and older under catch up IRA rules)
- Both allow investments to compound tax-free during the time period they are in the IRA (no taxes on investment income – dividends, interest, capital gains)
- Both allow a wide variety of investments (stocks, bonds, mutual funds, bank CDs, etc.) to be held within the IRA

DIFFERENCES

- The Traditional IRA has a tax incentive for your contribution. For every $1 you put in the IRA, the IRS allows you to lower your taxable income by $1. For someone in the 25% tax rate, this is essentially the same as getting an extra $0.25 for every $1 you contribute. This is a front-loaded tax incentive. The Roth IRA does not provide a tax incentive on your

contribution (you don't pay any extra taxes than you would if you spent/invested the money elsewhere…you just don't get the tax break).

- The traditional IRA has more restrictive income guidelines for getting the full tax advantage. For example, if you are married and make $124,000 or more (2020) in joint adjusted gross income, neither you nor your spouse can take advantage of a traditional IRA (assuming you are covered by a retirement plan at work). However, you can take full advantage of a Roth IRA assuming you don't make more than $196,000 (2020). This allows more people to take advantage of Roth IRAs than Traditional IRAs
- With the Roth IRA, you do not pay any taxes on eligible withdraws (post-retirement). With a Traditional IRA, eligible withdraws are taxed as ordinary income. This creates a back-loaded tax incentive for Roth IRAs
- With the Roth IRA, you are not required to initiate withdraws at age 70½. This is because there is no tax payment necessary on withdraws, so the IRS has no incentive to make you initiate withdraws. This makes Roth IRAs better for estate planning purposes.
- With the Roth IRA, you can withdraw contributions (not investment income) prior to retirement without a tax penalty. This is because you did not get any tax break on your contribution (only the investment income) so there is no rationale for a penalty. However, I would strongly recommend avoiding early withdraws if possible as it limits your ability to use the IRA to accumulate significant wealth at retirement.

? Exercise 9.6.8

What rate of return should I expect to earn on an IRA?

Answer

This is an example of a poor question. The reason it is a poor question is because IRAs (like 401k plans) are not investments and therefore don't earn rates of returns. Instead they are tax shelters that we can put investments into to reduce the taxes associated with our investment income. Someone that is very conservative could put short-term bank CDs into their IRA. Right now (7-13-2020), most banks are paying approximately 1.00% on a 2-year CD, so if that was the investment you were holding in your IRA, you would earn a 1.00% return. You could invest your entire IRA into a single stock. If it did well, you'd have a great return. If it did poorly, you'd have a negative return. Within your IRA, you can choose a wide variety of investments (a few – such as collectibles – are typically off limits) and then your rate of return will depend on the rate of return from those investments. So, to answer this question for YOUR IRA (or 401k plan), think about what you are going to invest in within the tax shelter and that will provide you your anticipated rate of return.

? Exercise 9.6.9

What is the maximum contribution you can make to an IRA each year?

Answer

$6000 per person per year (this is the answer you need to know for the test). However, there are a few exceptions. One, you need to have earned income of that amount (so you can't start funding your kids IRA at $6000 per year when they are 2). Two is that you might be restricted by the income restrictions on eligibility (if you earn above certain amounts you will be able to contribute less – or even zero – to an IRA). Third is that if you are over 50, you are eligible to contribute $7000 per person per year. Note that those are individual levels, so a couple could contribute up to $12,000 per year by each contributing $6000 to their personal IRAs (remember that IRAs are individual accounts).

? Exercise 9.6.10

Why would we say that more people are eligible to take full advantage of a Roth IRA compared to a Traditional IRA?

Answer

This is based on the income restrictions. For people filing individual tax returns, only those earning under $65,000 in adjusted income are able to take full advantage of a Traditional IRA (and the ability to use the traditional IRA – assuming you are covered by a retirement plan at work – is phased out entirely for those making $75,000 or more). For a Roth IRA, individuals can participate fully at up to $124,000 in adjusted income and are not phased out entirely until $139,000. For couples, the Traditional IRA cutoff point kicks in at $104,000 and any couple with over $124,000 is not eligible. Again, Roth IRAs are less restrictive in that the cutoff point kicks in at $196,000 and eligibility is eliminated at $206,000 (note that these income limits are for the 2020 tax year). Therefore, while everyone at lower income points could choose either type of IRA, people at higher income points are limited to the Roth version.

? Exercise 9.6.11

What types of assets are typically held in Roth IRAs?

Answer

Mutual funds are probably the largest type of asset. However, individual stocks and bonds are also popular choices. Bank CDs are another popular investment that is held within IRAs. Under certain circumstances, real estate, precious metals, and other types of investments can also be held within IRAs. However, it is harder to find financial institutions that will fulfill a custodial agreement, so most people use traditional securities (mutual funds, stocks, bonds, and CDs). Some investment strategies (collectibles, using margin, and/or many derivatives such as options and futures are typically not approved IRA assets).

? Exercise 9.6.12

What is a 401(k) plan?

Answer

A 401(k) plan is what we would describe as a DEFINED CONTRIBUTION pension plan. Defined contribution pension plans base their benefits on (a) how much is contributed and (b) what return on investment is generated. In other words, people that make significant contributions to their 401(k) plans over a long period of time and earn decent rates of return will have significantly more retirement assets (and, in turn, retirement income) than those that don't make many contributions or earn poor rates of return. This differs from a DEFINED BENEFIT plan where retirement benefits are based on years of service and average salary (or last year's salary). Due to longer life expectancies, companies realized that the traditional defined benefit plan was too expensive and most have moved to 401(k) plans. Many companies will provide a matching contribution. The level of the match varies significantly from firm to firm, but an example would be a 50% match on the first 6% contribution. So, assume you earn $1000 for your paycheck and contribute 6% ($60). Then your employer would match that at 50% ($30) and your total contribution to your 401(k) plan would be $90. Some employers match more, some less so it is one thing to evaluate as you look at potential job offers. Many firms cut or eliminated matching plans during the worst of the financial crisis, but a recent article noted that ¾ of those firms have reinstated their matching.

Once you decide how much you are going to contribute and what the match is, the next step is to figure out how you are going to invest it. Most 401(k) plans provide a variety of mutual-fund based alternatives within the plan. The better the plan, the more choices (and better choices) you will have to allocate your contribution dollars. It will be up to you to decide how much risk you are willing to take in search of higher expected returns and to monitor the allocations over time to make sure that you stay on track with your goals. Effectively, 401(k) plans have shifted the burden of retirement income from the employer to the employee. While they may help with that burden through matching contributions, if you don't contribute enough or don't earn enough on your investments, you will have less wealth/income during retirement. On the plus side, it also increases your ability to control that by letting you set how much you want to save and how you want to invest those savings.

The 401(k) plan has tax treatment similar to a Traditional IRA. Your taxable income is reduced by the amount you contribute and the investment income is not taxed while it is in the 401(k). However, when you withdraw money from your 401(k) in retirement, it is taxed as ordinary income. Recently, legislation was passed to allow Roth 401(k) plans. These may

or may not be an option for you depending on your employer. The current maximum contribution to a 401(k) plan is $19,500 per person per year ($26,000 for those 50 and older).

? Exercise 9.6.13

What do we mean by vesting with a 401(k) plan?

Answer

Vesting refers to your ability to take your firm's matching contributions (and the investment income from those contributions) with you when you leave the firm. If you are not vested, you can only take your contributions and investment income from those contributions. Contributions from the employer belong to the employer if you leave the firm. However, once you are vested, the employer's contributions are officially yours even if you leave the firm. The sooner you are vested, the more valuable the employer's contribution is to you. If you are not vested, it may be an anchor that ties you to the firm and prevents you from taking an attractive opportunity with a different company because of the cost of giving up the employer's contribution. Vesting policies vary from firm to firm, but firms are required to meet minimum standards that have you fully vested within a 5-7 year time-frame (either fully vested at 5 years or gradually vested starting 20% in year 3 to 100% in year 7). Note that firms can vest quicker than this, but not slower.

? Exercise 9.6.14

What is a guideline for how much of your firm's stock you should put in your 401(k) plan?

Answer

The less the better. Remember that not only are you investing your retirement funds, but your current earnings into the performance of your current employer. If the company does poorly you may be out of a job AND see your retirement assets shrink (especially if it goes bankrupt). An absolute upper ceiling should be 20%, but under 10% is better. This is essential, especially as you get older and your risk tolerance drops.

? Exercise 9.6.15

If you leave your employer before retirement, what options are typically available to you for your 401(k) plan assets?

Answer

Leave your money with the company – Most firms will allow you to leave the money in the plan and then access it when you retire. The downside of this is that you have less control and if you change jobs frequently you will have several accounts to keep track of.

Move your money to your new employer's 401(k) plan – Most employers will allow you to transfer your money to your new company's plan. The downside of this is that you are limited to the options available in your new plan.

Use a Rollover IRA – You can set up a special account called a "Rollover IRA" (discussed in the IRA handout), which allows you control over your investment decisions. If you put your money in a Rollover IRA it is important that your old employer transfer the money directly to the IRA account to avoid a 20% withholding penalty.

Cash Out – This will result in significant tax penalties and should only be done as a last resort if you desperately need the cash.

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9.7: References and Attributions

Student Resources

The Investment Company Institute Guide to Understanding Mutual Funds

Yahoo Finance Mutual Funds

Morningstar

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CHAPTER OVERVIEW

10: Marginal Cost of Capital

Learning Objectives

Upon completion of this chapter, students should be able to:

- Define cost of capital and explain its relevance
- Explain basic sources of financing
- Calculate the financing weights and explain why market values are preferred to book values
- Calculate the after-tax cost of debt
- Explain why the Yield-to-Maturity is preferred to the coupon rate as the before-tax cost of debt and why debt is expressed as an after-tax cost
- Calculate the cost of preferred stock
- Calculate the cost of common stock using an average of the three different approaches (dividend valuation, SML, and bond yield plus risk premium)
- Explain why we use three different approaches for the cost of common stock financing and issues associated with each of the three methods
- Calculate the cost of capital and use it to evaluate capital budgeting projects
- Explain two key situations where the cost of capital needs modified before it can be used to evaluate capital budgeting projects
- Explain the concept of a target capital structure
- Diagram the cost of capital and value of the firm as the ratio of debt/equity increases
- Explain why the target capital structure may be different for different firms

10.1: What is the Marginal Cost of Capital?
10.2: When is the MCC appropriately used as the required return for capital budgeting?
10.3: The Key Components of the Cost of Capital
10.4: Estimating the Market Value Weights of the Financing Components
10.5: Estimating the After-Tax Cost of Debt
10.6: Estimating the Cost of Preferred Stock
10.7: Estimating the Cost of Common Stock
10.8: MCC Example
10.9: Capital Structure
10.10: Key Takeaways
10.11: Exercises
10.12: Problem
10.13: References and Attributions

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10.1: What is the Marginal Cost of Capital?

The Marginal Cost of Capital (MCC), which is sometimes called the Opportunity Cost of Capital (OCC) or Weighted Average Cost of Capital (WACC), tells us how much we are paying for our financing. This will help us determine the required return for our investment projects. Specifically, under two basic assumptions (discussed below), the MCC will be the required return that we use when performing capital budgeting analysis from Chapter Eight.

Let's expand on the idea that the Marginal Cost of Capital represents our cost of financing and, in turn, the required return for our capital budgeting projects. Firms need to raise capital in order to invest in various capital budgeting projects. For instance, if a company wants to spend $500 Million to launch a new satellite they need to find a way to pay for that. There are two primary ways in which companies can raise capital — (A) debt or (B) equity.

Debt

The firm can issue bonds in order to raise capital.

Equity

The firm can have stockholders provide capital in one of three ways.

Preferred Stock

Issuing shares of preferred stock will help provide capital for the firm.

Common Stock

Issuing shares of common stock will help provide capital for the firm.

Internal Equity

Any profits that the firm makes and doesn't pay out to shareholders in the form of dividends can be used to provide capital for future periods. Since this money technically belongs to existing common stockholders, it is considered a form of common stock financing. Some models separate out internally generated equity from the issuance of additional shares, however we will not do this. For the purposes of our class, we will treat both newly issued common stock and internally generated equity as the same since they both represent capital provided by common stockholders.

Once we figure out where our financing is coming from, we must figure out how much it is costing us. The details of this are discussed below. Our Marginal Cost of Capital calculation incorporates the cost from each source along with how much financing is being provided from each source. This gives us an average cost for each dollar of financing that we are using as a firm.

Once we know how much each dollar of financing is costing us, we can determine if we are using that financing appropriately. For instance, pretend that our MCC is 9.5%. Then, we have the opportunity to invest in a capital budgeting project that has an IRR of 8.5%. That means we are paying 9.5% to raise money and then investing this money to earn 8.5%. Since we are earning less on our investments than it is costing us to raise our money, the project is not worthwhile. On the other hand, if we have a project that will generate an IRR of 12% we will earn more on our investment project than it is costing us to raise our money. This makes the project profitable and we should pursue it. We cannot properly evaluate our capital budgeting projects without having a reasonable estimate of our cost of capital.

One of the themes for this chapter is that when we are estimating the costs of each source of financing, we are going to focus on estimating the required return for investors who buy those securities. The idea is that we have been focusing on stocks and bonds previously in this class from the perspective of investors. However, the return that these investors receive is paid by the corporations. Therefore, the investors' required return is the firm's cost of capital. This means that we are going to rely on concepts we already have covered that focus on required return, but now instead of referring to it as the required return, we will call it a cost of capital.

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10.2: When is the MCC appropriately used as the required return for capital budgeting?

As mentioned previously, there are two basic conditions that must be met before we can use the MCC as the required return in capital budgeting analysis. These assumptions are as follows:

1. The risk of the project must be of average risk for the firm. The MCC is influenced by the perceived riskiness of the firm as a whole. Since investors set the MCC by "charging" the firm enough to compensate for the risk of investing in the firm. The higher the perceived risk, the more investors will demand as a rate of return (cost of financing). Since the firm can be thought of as the sum of all of its various projects, then we can say that the MCC appropriately captures the risk of the average project. Many projects will be more risky or less risky than what is considered "average." If we undertake high-risk projects, the average risk of the firm will increase (causing the MCC to increase) so we need to earn more to compensate us for the risk of that project. The opposite holds for low-risk projects. Anytime we evaluate a high-risk project we should use a required return higher than the MCC and anytime we evaluate a low-risk project we should use a required return lower than the MCC.
2. The financing weights should not change in a significant manner due to financing the project. The MCC is based on the financing weights for the firm as a whole. If we alter that financing mix to undertake a project we must account for it. Therefore, if the financing weights for the project are significantly different than our present financing mix, we need to use the weights associated with the project. Another complication that is more difficult to correct is that drastically different financing weights may alter the risk of the firm and thus change financing costs. Specifically, increasing the amount of debt financing should increase the risk of the firm (and result in higher financing costs from each source of financing) while increasing the amount of equity financing should lower the risk of the firm (and result in lower financing costs from each source of financing).

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10.3: The Key Components of the Cost of Capital

There are four critical components that must be estimated in order to estimate the cost of capital.

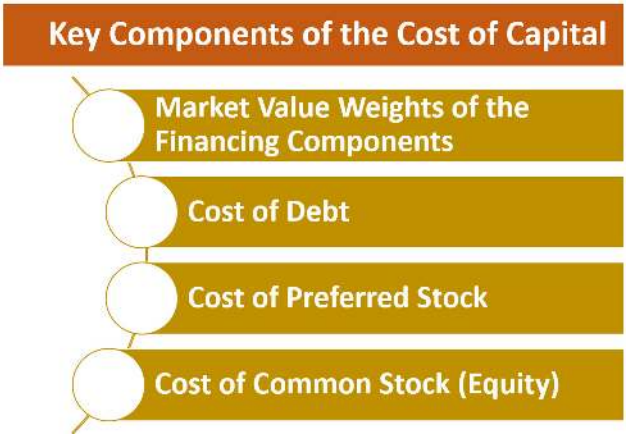


Figure 10.3.1: Four critical components for estimating the cost of capital are market value, cost of debt, and costs of preferred and common stock.

Note: We will be ignoring the role of flotation costs for this course. However, if you are interested in this topic, an optional discussion of flotation costs is provided at the appendix of the chapter.

Once these are estimated, we use the following equation to estimate the MCC

$$MCC = W_{\text{debt}}\ k_i + W_{\text{pref}}\ k_p + W_{\text{com}}\ k_s$$

Where

W_{debt} represents the proportion of total financing coming from LT Debt
k_i represents the after-tax cost of debt financing
W_{pref} represents the proportion of total financing coming from preferred stock
k_p represents the cost of preferred stock financing
W_{com} represents the proportion of total financing coming from common stock
k_5 represents the cost of common stock financing

Note that the weights should all be plugged into the formula as a decimal (10% = 0.10) while the costs should be written as a percentage (10% = 10)

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10.4: Estimating the Market Value Weights of the Financing Components

The weights represent the market value weights of each of the components, not the book value. (Note: In many instances, the book value of debt can be a close approximation for the market value of debt. However, if we can estimate the market value we should always use it.) We first estimate the market value of debt, market value of preferred stock and market value of common stock by multiplying the number of shares (or bonds) times the value of each share (or bond). Then we sum up the value of each component. This represents the market value of the firm. The appropriate weight is the market value of that component divided by the market value of the firm. Market values are preferred because they are always current, taking into account investors' current outlook on our firm's prospects and risks and are the best measure of what the securities are worth.

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10.5: Estimating the After-Tax Cost of Debt

The after-tax cost of debt is found through the following equation

$$k_i = YTM(1 - T)$$

Where

k_i represents the after-tax cost of debt
YTM represents the Yield-to-Maturity on the debt
T represents the marginal tax rate on interest

It is critical to note that we must use the after-tax cost of debt as opposed to the before-tax cost of debt. Interest appears on the income statement before taxes. This means that each dollar paid in interest lowers our tax bill. The Federal government is paying part of our interest bill for us through this reduction in tax expense. Unfortunately, dividends are paid after taxes, so this adjustment is only for debt, not preferred or common stock.

In addition, it is important to note that we use the YTM here as the before-tax cost of debt instead of the coupon rate. It is easy to think that the coupon rate would be better as that is the actual dollar amount paid to investors each year. However, that ignores the true cost to the firm (return to the investor). If investors pay a premium to buy the bond (pay more than $1000), then the effective cost of the bond will be less than the coupon rate. Alternatively, if investors buy the bond at a discount, then the effective cost of the bond will be higher than the coupon rate. Consider a zero-coupon bond. This is not free financing just because it doesn't pay a coupon payment. Instead, the firm will receive substantially less than $1000 per bond today, but be forced to pay out the $1000 at the bond's maturity with the difference (spread over the life of the bond) representing the cost of interest. The YTM takes into account coupon payments and spreading the premium/discount out over the life of the bond.

While we typically will only encounter one source of debt financing in this class, it is not uncommon for firms to end up issuing many bonds with different coupons and times to maturity. In order to estimate the cost of debt in this type of situation, a weighted average of each bond can be used.

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10.6: Estimating the Cost of Preferred Stock

The cost of preferred stock is found through the following equation

$$k_p = \frac{D}{P_0} = \frac{(\text{ par value })(\text{ dividend rate })}{P_0}$$

Where

k_p represents the cost of preferred stock financing
D represents the dividend on preferred stock (alternatively found by taking the par value times the dividend rate on the preferred)
P_0 represents the current price of the preferred stock

Note that here (as with other costs), we are merely solving for the investors' required return on preferred stock as their return is the firm's cost of financing from preferred. One common mistake students sometimes make here is to use the common dividend instead of preferred. Be careful to use the right dividend. Another common mistake is that when this formula is applied, the answer comes out as a decimal (8% would be 0.08). Assuming you are plugging the other costs in as percent, make sure you do the same with this. You can't enter the cost of debt as 6 (for 6\%) and the cost of preferred as 0.08 (for 8\%)...you need to be consistent.

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10.7: Estimating the Cost of Common Stock

Common stock gets a little trickier. There is not one correct formula for estimating the cost of common stock financing. Instead there are three. First, we can go back to the constant growth pricing model and solve for ks. This will give us the following formula:

$$k_s = \frac{D_1}{P_0} + g = \frac{D_0(1+g)}{P_0} + g$$

Where

k_5 represents the cost of common stock financing
D_1 represents the forecasted dividend next year
D_0 represents the current dividend
Po represents the current price of the common stock
g represents the forecasted constant growth rate

Note that the two formulas are essentially the same. D_1 equals $D_0(1+g)$. We use the first version if we are given D_1 in the problem and we use the 2 nd version if we are given D_0 in the problem. Be careful to read the problem carefully and choose the right version for the specific dividend provided.

Because the above formula is derived from the constant growth model, it does not work as well in non-constant growth situations. It also only works for firms that pay dividends. Therefore, while it can be useful in some situations (dividend paying firms with stable growth rates), it would be worthwhile to think about other ways to estimate the required return our common stockholders are charging to provide capital.

One alternative approach is to refer to the Security Market Line. We introduced this in Chapter Seven as a way to estimate the required return associated with common stock. This allows us to estimate the cost of stock financing using the following formula:

$$k_s = k_{RF} + \beta\left(\overline{k_m} - k_{RF}\right)$$

Where

k_s represents the cost of common stock financing
k_{RF} is the risk-free rate of interest (often approximated by the yield on 10 -year Treasury Bond)
β is the beta for our firm's stock
$\bar{k_M}$is the expected return on the market

However, while this does not require firms to pay dividends or have stable growth rates, there is some concern as to how well the security market line holds up in practice. Therefore, like the dividend growth model, the SML approach is not perfect. Is there another way we can estimate the cost of common stock financing?

A less theoretical, but still valid, model can also be used to estimate what investors are demanding as appropriate compensation for providing equity capital to the firm. This model simply assumes that stocks are riskier than bonds, so adds a risk premium to the Yield-to-Maturity on our bonds. The exact risk premium to be added is open for debate and will fluctuate based on many factors (economy, investor demographics, etc), however a range of 3% to 7% is probably most appropriate. Thus, we get the following formula

$$k_s = YTM + \text{ Risk Premium}$$

Where

k_s represents the cost of common stock financing
YTM represents the Yield-To-Maturity on our firm's debt financing
Risk Premium represents the risk premium on stocks over bonds

This model is also flawed. Specifically, it is not clear exactly what the risk premium for stocks should be. Second, firms that don't use long-term debt financing (and there are quite a few firms that do not use long-term debt financing) won't have bonds

outstanding for us to estimate their YTM. Therefore, we have to guess at what their YTM would be (which would introduce more error) or skip this model.

The best approach when estimating the cost of equity financing is to estimate it under all three equations (assuming we can), then take an average of the three methods. However, we may run into a situation where one of the methods produces an answer way out of line with the other two. In this case, it is probably best to eliminate the outlier and only use the two "more reasonable" answers. Also, in some instances, we may not be able to use one of the three cost of equity approaches. In these cases, we just rely on an average of the one's we can estimate.

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10.8: MCC Example

Calculate the Marginal Cost of Capital Based on the following information.

Price per share of Common Stock	$45
Price per share of Preferred Stock	$60
Price per Bond ($1000 par value)	$865
Number of shares of Common Stock Outstanding	2,300,000
Number of shares of Preferred Stock Outstanding	500,000
Number of Bonds Outstanding	60,000
Coupon Rate on Bonds	5%
Time Remaining Until Maturity for Bonds	15 years
Marginal Tax Rate	25%
Par Value of Preferred Stock	$50
Dividend Rate on Preferred Stock	9%
Common Stock Dividend (D1)	$3.00
Dividend Growth Rate (Common)	6%
Risk-Free Rate	5%
Beta	1.2
Expected Return on the Market	12%
Risk Premium on Stocks over Bonds	4.50%

Step 1: Find the Weights

MV_{debt} =60,000*865 = $51,900,000
$MV_{preferred}$ = 500,000*$60 = $30,000,000
MV_{common} = 2,300,000*45 = $103,500,000
MV_{TOTAL} = $185,400,000

W_{debt} = 51,900,000/185,400,000 = 0.28
W_{pref} = 30,000,000/185,400,000 = 0.16
W_{com} = 103,500,000/185,400,000 = 0.56

Step 2: Find the after-tax cost of debt

Find YTM

Set Financial Calculator to 2 Periods Per Year
30 N
-865 PV
25 PMT
1000 FV
Solve for I/Y = 6.41%

Convert to After-tax Cost k_i = YTM*(1-T)

k_i = 6.41%*(1 – 0.25)
k_i = 4.81%

Step 3: Find the cost of preferred stock

k_p = D/P
k_p = ($50*.09)/$60
k_p = $4.50/$60
k_p = 7.50%

Step 4: Find the cost of common stock

Method One — Dividend Valuation Approach

k_s = (D_1/P) + g
k_s = ($3.00/$45.00) + 0.06
k_s = 0.0667 + 0.06
k_s = 12.67%

Method Two – Security Market Line (SML)

$$k_s = k_{RF} + \beta\left(\overline{k_m} - k_{RF}\right)$$

k_s = 5% + 1.20(12% – 5%)
k_s = 5% + 1.20(7%)
k_s = 5% + 8.4%
k_s = 13.4%

Method Three — Bond Yield + Risk Premium

k_s = YTM + RP
k_s = 6.41% + 4.5%
k_s = 10.91%

Take an average of the three methods to get cost of common stock financing

k_s = (12.67% + 13.40% + 10.91%)/3
k_s = 36.98/3
k_s = 12.33%

Step 5: Calculate the MCC

MCC = (W_{debt})(k_i) + (W_{pref})(k_p) + (W_{com})(k_s)
MCC = (0.28*4.81) + (0.16*7.50) + (0.56*12.33)
MCC = 1.35 + 1.20 + 6.90
MCC = 9.45%

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10.9: Capital Structure

It is important to note that the firm can influence its cost of capital by altering the weights of their financing mix. Specifically, they can use more debt financing (issue bonds, buy back stock, pay higher dividends to reduce internally generated capital, etc.) or use more equity financing (buy back bonds, issue more common stock, pay fewer dividends to increase internally generated capital). Changing this mix (referred to as capital structure) will change the firm's cost of capital. At first glance, we might think that using more debt financing is always better. This is because debt financing (due to the interest tax shield of debt and the idea that bonds are less risky for investors) is a cheaper source of financing than common stock (equity) financing. However, while bonds are less risky than stocks from the perspective of the investor, using debt financing actually increases the risk of the firm. The reason for this is that firms have to be able to make interest payments or bondholders can force the firm into bankruptcy. On the other hand, dividends are optional. While firms are reluctant to cut dividends, they can do so when faced with financial distress in order to stay solvent.



There are two counterbalancing forces when firms alter their capital structure. Initially, using debt can lower the firm's cost of capital by taking advantage of the lower-cost characteristics of debt financing (relative to equity). However, if too much debt is taken on, the increased risk of the firm will cause the cost of equity and the cost of debt to rise (as investors demand higher compensation for investing in a riskier firm) and start to cause the cost of capital to rise. Therefore, the optimal mix of debt vs. equity (capital structure) is the level at which the cost of capital is minimized. When this occurs, the value of the firm (shareholder wealth) will be maximized. This level will vary from firm-to-firm. For example, firms that are very profitable with high effective tax rates and also very stable will tend to find their optimal capital structure having higher debt levels (they get more of the tax benefits of debt and the risk of additional leverage is lower due to the predictable cash flow generation). On the other hand, firms that are less profitable, face lower effective tax rates, or have higher levels of business risk will tend to find that their optimal capital structure involves less debt (they get less tax benefits of debt and are more susceptible to the higher risk of additional leverage).

One final note here is that the target capital structure is more of a range than a precise point. Because it is hard to estimate the exact optimal mix for each firm and because weights (based on market values) are constantly fluctuating, most firms try to identify a range where there cost of capital is near the minimum point and, in turn, the value of the firm is near the maximum point. The following diagrams illustrate the capital structure issue graphically.

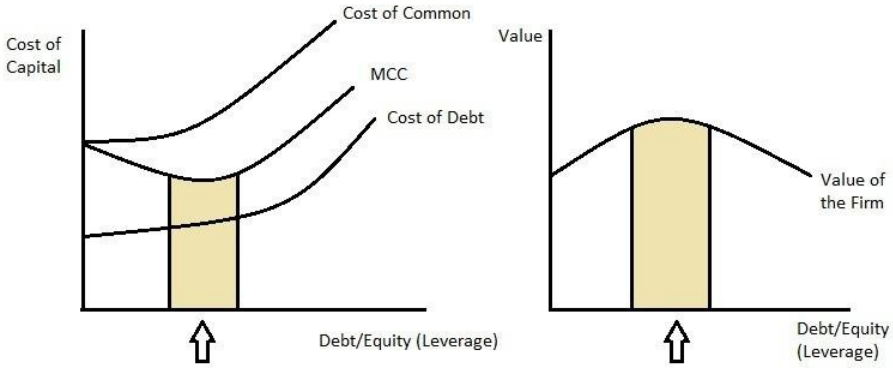


Figure 10.9.1: How to use the target capial structure to keep the cost of capital near its minimum

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10.10: Key Takeaways

Key Takeaways

Firms raise capital from investors in the form of debt and equity with the intention of investing that capital into developing products and services for customers. Back in Chapter One, we introduced the goal of maximizing shareholder wealth and, in order to accomplish this goal, the firm needs to invest this capital in such a manner as to ensure that the return generated exceeds the cost of acquiring the capital. To evaluate this, the firm needs to be able to estimate their marginal cost of capital. This is done by determining the market value weights of the appropriate financing sources and the costs of the individual financing sources. These values are then used to create a weighted average to estimate the firms cost of capital. It is important to remember that the appropriate cost of each financing source is effectively the required return demanded by investors. However, there are some challenges that occur in that we need to acknowledge that interest expense is a pre-tax expense, so the cost of debt needs to reflect the interest tax shield. In addition, the cost of common is difficult to model precisely, so we often use an average of multiple methods in order to try to get a more reliable estimate. Finally, it is important to recognize that the cost of capital will vary depending on the mix of debt vs. equity financing (capital structure) that the firm chooses. Therefore, firms need to reflect on how their decision related to capital structure can be optimized to keep the cost of capital low and the value of the firm high.

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10.11: Exercises

Exercise 10.11.1

Why do we need to convert debt to an after-tax cost when preferred stock and common stock do not take this same conversion?

Answer

Debt holders are paid through interest payments whereas preferred and common stockholders are paid through dividends. Interest is paid out of pre-tax income. This means that each dollar we pay our bondholders results in fewer taxes. Thus, interest is providing a "tax-shield" which we must account for when estimating the cost. On the other hand, dividends are paid out of after-tax income. Since dividends offer no tax shield, we do not have to make a conversion to after-tax cost. The after-tax cost of common and preferred stock is the same as the before-tax cost.

Exercise 10.11.2

Why is the cost of common stock the highest of the three types of financing and the cost of debt the lowest?

Answer

There are two reasons for this. The first relates to risk. Investors determine our cost of financing by the required return that they demand for investing in our stocks and bonds. The more risk the investor faces, the higher the required return that the investor will demand (which means a higher cost of financing to the firm.) From an investors perspective, it is the least risky to hold bonds (as bonds have the most stable and predictable cash flow streams and are first in line in the event of bankruptcy.) The most risky is common stock (as common stock has a very unstable/unpredictable cash flow stream and is last in line in the event of bankruptcy. Preferred stock falls somewhere between the risk levels of bonds and common stock. The second reason has to do with the tax-shield discussed in Question 1. Because interest provides a tax-shield that is not provided by dividends, the effective cost of debt is lowered. To summarize, debt is the lowest cost source because it is the least risky to investors and has a tax-shield. Common stock is the most risky because it is the most risky to investors.

Exercise 10.11.3

What advantage do we get from using three different methods to calculate the cost of common stock financing?

Answer

Each method is flawed. Specifically, the dividend valuation method assumes (A) dividends are being paid and (B) those dividends are growing at a constant rate. When we violate those assumptions, it introduces error into our calculations. The more unstable the dividend growth rate the greater the error. The SML approach is useful in that every stock has a beta and it is reasonably easy to get estimates for the expected market return and risk-free rate. However, there is evidence that beta may not be a reliable indicator of return. This makes us question the accuracy of the SML approach. Finally, the bond yield plus risk premium approach is also flawed. It is difficult to estimate exactly what the risk premium should be and is difficult to apply to firms that do not use debt financing (as we have no YTM for these firms.) Since each method is flawed, we hope that an average of the three will result in a lower error than applying any of the models in isolation. It should also be noted that the SML approach is the only approach that can be used with all firms.

Exercise 10.11.4

Why is the YTM used as the before tax cost of financing rather than the coupon rate?

Answer

The first reason for this is that the coupon rate can be misleading because it doesn't take into account whether the bond was issued at a discount or premium. A zero-coupon bond is not free financing. The YTM corrects for this. The second reason is that the coupon rate is historical. It is set when the bond is issued and doesn't change. If our firm last issued bonds 10 years ago, that would tell us little about what return investors are requiring to hold our bonds today. YTM is current (or forward-looking) in that it incorporates today's bond price and remaining interest payments to estimate what investors are demanding as a rate of return to hold our bonds today. The cost of capital needs to be current in order to be useful.

? Exercise 10.11.5

Should we use market values to estimate our financing proportions or book values? Why?

Answer

Always use market values. Market values are based on all available information about our firms risk and prospects TODAY. Book values are historical and may miss several areas of intangible assets. Thus, market values better capture the true "economic" value of our financing weights. If we issue new stocks and bonds, today's market values are a better indicator of what we can expect to receive.

? Exercise 10.11.6

Why is the MCC important? What is it used for?

Answer

The MCC tells us our cost of financing. It is impossible for a firm to maximize value if it doesn't know how much it is paying to finance its operations. The MCC provides us a baseline required return to use in our capital budgeting analysis. If a project does not earn enough to pay for the financing it will not add value to the firm. On the other hand, a project that earns more than the cost of financing IS adding value to the firm. The lower the MCC, everything else being equal, the greater the value of the firm. This is because at a lower required return (MCC), each project will have a higher NPV meaning that every project the firm undertakes is worth more to them.

? Exercise 10.11.7

To use the MCC as the required return in our capital budgeting analysis, what two conditions must be met?

Answer

The first condition is that the financing weights for the project are similar to the financing weights for the firm. For instance, if our firm uses a 20%/20%/60% mix of debt/preferred/common and we decide to finance our next project with 100% common, the MCC is not capturing the true cost of financing the project. The actual cost will probably be more expensive than the MCC (since common stock is our most expensive form of financing). A correction for this problem is to adjust our weights in the MCC calculation to reflect the financing weights for the project.

The second condition is that the risk of the project is similar to the average risk level for our firm. If we undertake high risk projects, this makes our firm riskier and investors will want more compensation. Thus, we have to increase the cost of capital to reflect this. If we undertake low-risk projects, this makes our firm less risky and investors will settle for less compensation. Thus, we can lower the cost of capital to reflect this.

? Exercise 10.11.8

If a firm can lower their cost of capital, all else equal, this should result in an increase in the value of the firm. True or False? Explain.

TRUE. Think of a firm as a series of past and present capital budgeting projects. All the different projects that the firm has undertaken in the past, is currently working on, and will initiate in the future are what make the firm what it is right now. All the expected cash flows that are going to be generated are based off of these various projects. The cost of capital determines the required return for capital budgeting projects. We know that if we lower the required return for a cash flow stream, the PV of that cash flow stream will increase. The value of the firm is just the PV of the cash flows it will generate. Therefore, lowering the cost of capital, all else equal, will increase the value of the firm.

? Exercise 10.11.9

If debt is the cheapest form of financing, then issuing more debt should automatically lower our cost of capital. True or False? Explain.

Answer

FALSE. While at first glance, this appears to be a logical statement, it ignores a key factor about using more and more debt. Because debt generates a fixed cost (interest payments and the return of par value at maturity) that must be repaid (or the firm will be forced into bankruptcy), increasing the amount of debt financing used will also increase the risk associated with the firm. As we know, when risk increases, investors want higher returns. Thus, as the amount of debt increases, both stockholders and bondholders will start wanting higher returns to compensate them for the additional risk. This means the cost of equity financing and cost of debt financing will both increase. For most firms, there is an additional benefit to using some debt financing. Having some debt does not increase the risk much and therefore the cheaper source of financing (debt) offsets the impact of higher risk. However, as more and more debt gets added, the risk increases at an increasing rate. At some point the benefits of a cheaper source of financing are more than offset by the increased risk.

This optimal point varies from firm to firm. Firms with more predictable cash flows are not as sensitive to higher levels of debt (in terms of risk) and can carry more debt. Also, one of the things that makes debt cheaper is the tax benefits. Firms in high tax brackets will have a more significant tax benefit and thus can carry more debt. Thus, we typically see firms with high tax rates and/or predictable cash flow streams use more debt financing while firms with volatile cash flow streams and/or low tax rates will use less debt financing. The issue of how much debt financing should be used is referred to as “CAPITAL STRUCTURE”. The following diagram illustrates the capital structure decision.


Target Cost of Capital

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10.12: Problem

Problem 10.12.1

Assume our company has a bond outstanding with 20-years remaining until maturity. This bond has a 7.5% coupon rate. Our marginal tax rate is 35%. Find our after-tax cost of debt if the bond price is:

a. $1135
b. $875

Answer

First we must find the YTM and then plug it into the formula:

$k_i = YTM(1 – T)$

Remember that bonds pay interest semi-annually so that we must set our calculators to 2 Periods per Year and adjust the N and PMT to reflect the semi-annual framework.

Part a

40 N
-1135 PV
37.50 PMT
1000 FV
I/Y ⇒ 6.30%

$k_i = 6.30\%(1 – 0.35) = 4.10\%$

Part b

40 N
-875 PV
37.50 PMT
1000 FV
I/Y ⇒ 8.84%

$k_i = 8.86\%(1 – 0.35) = 5.75\%$

Problem 10.12.2

If the par value of our preferred stock is $30 and the dividend rate is 5% of par while the current price is $16.50, what is the cost of preferred stock?

Answer

$k_p = D/P = (0.05)(30)/16.50 = 1.50/16.50 = 9.09\%$

Problem 10.12.3

The price of our common stock is $25. The constant growth rate in dividends is 8% and our current dividend (D0) is $0.75. Also, the risk-free rate of interest is 5% and the expected return on the market is 12%. Beta for this stock is 0.8. Finally, we estimate a risk premium of 5% for stocks relative to bonds and the current YTM on our long-term debt is 9%. Find the estimated cost of capital for common stock under each of the 3 methods.

Answer

Dividend Valuation Approach

$k_s = (D_1/P) + g = [(0.75)\times(1.08)/25] + 0.08 = 11.24\%$

Security Market Line Approach

$k_s = k_{rf} + \beta(k_m - k_{rf}) = 5\% + 0.8(12\% - 5\%) = 5\% + 5.6\% = 10.60\%$

Bond Yield plus Risk Premium Approach

$k_s = YTM + RP = 9\% + 5\% = 14.00\%$

Average $k_s = (11.24\% + 10.60\% + 14.00\%)/3 = 11.95\%$

? Problem 10.12.4

You have the following information about XYZ Corp:

Asset	Book Value	Market Value
Bonds	$20,000,000	$24,000,000
Preferred Stock	$4,000,000	$5,000,000
Common Stock	$10,000,000	$35,000,000

Constant growth on common	6.5%
YTM on bonds	11%
Beta	1.35
Treasury bond yield	5%
Price of common stock	$34
Tax rate	40%
Coupon rate on bonds	10%
Risk prem. stocks over bonds	5%
Expected market return (k_m)	12%
Expected Common Dividend (D_1)	2.75
Number of pref. shares	100,000
Per share dividend on preferred	$6.50

a. What is the marginal cost of capital for this firm?
b. If you have a capital budgeting project that will generate after tax cash flows of $25,000 per year for the next four years and costs $75,000, should you take it?

Answer

Part a

Step 1 ⇒ Solve for Market Value Weights

$MV_{debt} = 24,000,000$
$MV_{pref} = 5,000,000$
$\underline{MV_{com} = 35,000,000}$
$MV_{total} = 64,000,000$

W_{debt} = 24,000,000/64,000,000 = 0.38
W_{pref} = 5,000,000/64,000,000 = 0.08
W_{com} = 35,000,000/64,000,000 = 0.55

Step 2 ⇒ Solve for After-tax Cost of Debt

k_i = YTM(1 – T) = 11%(1 – 0.40) = 6.60%

Step 3 ⇒ Solve for Cost of Preferred Stock

k_p = D/P = 6.50/50 = 13%

Note that the price per share for preferred stock is found by taking the total market value of preferred stock divided by the number of shares ⇒ $5,000,000/100,000 = $50

Step 4 ⇒ Solve for Cost of Common Stock

Dividend Valuation Approach
$k_s = (D_1/P) + g = (2.75/34) + 0.065 = 14.59\%$

Security Market Line Approach
$k_s = k_{rf} + \beta(k_m – k_{rf}) = 5\% + 1.35(12\% – 5\%) = 14.45\%$

Bond Yield Plus Risk Premium Approach
k_s = YTM + RP = 11% + 5% = 16.00%

Cost of Common Stock Financing
(14.59% + 14.45% + 16.00%)/3 = 15.01%

Step 5 ⇒ Solve for Marginal Cost of Capital (MCC)

$MCC = W_{debt}(k_i) + W_{pref}(k_p) + W_{com}(k_s)$
= (0.38)(6.60%) + (0.08)(13.00%) + (0.55)(15.01%)
= 11.80%

Part b

Solve for IRR ⇒ IRR = 12.59% > 11.80% ⇒ Accept Project
Solve for NPV@11.80% ⇒ $1254.70 > $0 ⇒ Accept Project

Note – Since there is no crossover problem and it is a single project instead of mutually exclusive, we can use either IRR or NPV to make our decision.

? Problem 10.12.5

The following information is available about ACME Inc.
Balance Sheet:

LT 10% Coupon Bonds (10,000 bonds)	$10,000,000
Preferred Stock (40,000 shares) ($50 par with a 10% dividend)	2,000,000
Common Stock (1,000,000 shares)	20,000,000

The market values are $1060 for each $1000 par value bond, $53 for each share of preferred, and $41.25 for each share of common. The bonds are recorded on the balance sheet at their par value and mature in 10 years.

Beta	1.3
Current Treasury bond rate	6%
Risk Premium for stocks over bonds	5%
Tax Rate	40%
Growth rate in dividends	10%
Expected market return	13%
Dividend (D_0)	2.25

a. What are the appropriate weights for the opportunity cost of capital?
b. What are the appropriate costs of debt, preferred, and common (use an average of the 3 methods for common)?
c. What is the marginal cost of capital?

Answer

Part a

MV_{debt} = 10,000*1060 = $10,600,000
MV_{pref} = 40,000*53 = $ 2,120,000
MV_{com} = 1,000,000*41.25 = $41,250,000
MV_{total} = $53,970,000

W_{debt} = 0.20
W_{pref} = 0.04
W_{com} = 0.76

Part b

$k_i = YTM(1 - T) = 9.07\%(1 - 0.40) = 5.44\%$

Find YTM
20 N
-1060 PV
50 PMT
1000 FV
I/Y ⇒ 9.07%

$k_p = D/P = \$5/\$53 = 9.43\%$

Div Val Approach ⇒ $k_s = (D_1/P) + g = [(2.25)(1.10)/41.25] + 0.10 = 16.00\%$
SML Approach ⇒ $k_s = k_{rf} + \beta(k_m - k_{rf}) = 6\% + 1.3(13\% - 6\%) = 15.10\%$
BY + RP Approach ⇒ $k_s = YTM + RP = 9.06\% + 5\% = 14.06\%$
Average of Three Approaches ⇒ (16.00% + 15.10% + 14.06%)/3 = 15.05%

Part c

$MCC = W_{debt}(k_i) + W_{pref}(k_p) + W_{com}(k_s)$
$= (0.20)(5.44\%) + (0.04)(9.43\%) + 0.76(15.05\%)$
$= 12.90\%$

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10.13: References and Attributions

Student Resources

Floatation Costs in Appendix B

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CHAPTER OVERVIEW

11: International Finance

Learning Objectives

After completing this chapter, students should be able to

- Identify and discuss reasons why firms engage in international operations
- Identify and discuss challenges/risks associated with international operations
- Define a fixed exchange rate system and a floating exchange rate system
- Identify and discuss factors that may cause the currency to strengthen or weaken
- Convert between an indirect quote and a direct quote for exchange rates
- Convert from dollars to a foreign currency or from a foreign currency to dollars given either an indirect or direct exchange rate
- Identify whether a currency is getting stronger or weaker relative to another currency given either indirect or direct exchange rates
- Identify who benefits or suffers from a currency getting stronger or weaker (first-level effect)
- Calculate cross-currency exchange rates (given two exchange rates with the dollar, calculate the exchange rate between those two foreign currencies)
- Differentiate between spot and forward exchange rates
- Discuss and differentiate between hedging exchange rate risk and speculating on exchange rate fluctuations
- Identify and discuss advantages to international investing
- Compare the size of the US equity market to global equity markets
- Identify and discuss key approaches to adding international equity exposure

11.1: Why Do Firms Establish International Operations?
11.2: Difficulties in International Operations
11.3: Currency Issues
11.4: Factors Influencing Exchange Rates
11.5: Types of Currency Quotations
11.6: Currency Conversion
11.7: Strengthening vs. Weakening Currencies
11.8: Cross Currency Exchange Rates
11.9: Spot vs. Forward Rates
11.10: Hedging vs. Speculating
11.11: International Investing
11.12: Key Takeaways
11.13: Exercises
11.14: Problems
11.15: References and Attributions



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11.1: Why Do Firms Establish International Operations?

Business and finance are no longer national activities. Instead, they are global activities. Regardless of whether you are looking at retailers like Wal-Mart, technology firms like Apple, restaurants like McDonalds, money-center banks like Citigroup, or investment companies like Goldman Sachs, today's firms have a global footprint. In 2018, the S&P 500 saw 42.9% of their sales come from outside the US. There is also a combination of US firms with international production facilities and foreign firms with US-based production facilities. Why is global such an essential part of business? Here are a few reasons.

To get access to additional customers

While the US is one of the biggest consumer markets in the world, it still represents only a fraction of the total consumer market worldwide. Remember from Chapter One that we estimated that more than 95% of the population and more than 75% of global GDP is based outside the US. If firms operate solely in the US, they are giving up a large amount of potential sales. Expanding to new markets worldwide is especially important for firms that have saturated the US markets (Coca-Cola, Pepsi, Wal-Mart, etc.) or firms that see a decline in their US market (tobacco firms).

To acquire raw materials

Raw materials necessary to produce many products are found throughout the world. We can think of many different materials (oil, coffee, cocoa, diamonds, etc.) that are primarily found outside the US. For firms that use a significant amount of non-US-based resources, it makes sense to open production facilities in countries where these resources are more prominent.

To lower costs

Firms can increase profitability in two ways: (1) increase revenues and/or (2) lower costs. In many situations, firms can lower costs by producing outside the US. This cost savings may come from direct wages, benefits (such as health care), or less restrictive regulatory environments. Typically, these costs have been high in the US compared to some developing economies (although this article, The Rising Cost of Manufacturing, shows that this international cost advantage is lessening). There are also markets where production costs are higher than the US. This is one of the most controversial aspects of international operations. Are firms taking necessary steps to stay competitive (and creating economic growth in areas that need it), or are they exploiting foreign laborers and at the same time depriving the US labor force of jobs in exchange for higher profits for shareholders and upper level management? There are legitimate arguments on both sides and we do not plan to solve the debate here. However, consider the article linked above showing manufacturing costs of 25 major exporting nations. Note that many have seen their costs rise relative to the US over the 10-year period between 2004 and 2014. This happens as the capital flowing to cheaper manufacturing areas tends to push up the relative cost.

To diversify

Given that national economies tend to move in different business cycles, firms can diversify some of their business risk by operating internationally. Interest rates, inflation, and recessions occur at different times in different countries. By having operations across the globe, firms can offset down years in one country with strong years in markets in other countries. While there are significant "world economy" impacts (such as the Global Financial Crisis of 2008) that cannot be diversified away, there are still some benefits in diversifying country-specific risk.

To reduce currency risk

One of the issues we will encounter in this chapter is the impact of currency risk associated with international operations (or international competitors). When firms market their products outside their home country, they open themselves up to currency risk. A US firm that earns revenues in euros must convert those euros back to dollars. If the dollar increases in value relative to the euro, each euro received in revenue is now worth less than previously anticipated. By moving production costs into the same currency as their revenues, the firm will have less currency risk.

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11.2: Difficulties in International Operations

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11.3: Currency Issues

The current currency environment can best be described as a managed floating system. Following the collapse (in 1972) of the Bretton Woods System in which countries strived to maintain fixed exchange rates, the international community has allowed currency rates to be established primarily by market forces. Supply and Demand conditions operate on a daily basis to influence the level of exchange rates. Exchange rates fluctuate on a daily basis. However, government central banks may operate in the market in attempts to influence the movement in currency markets. This intervention is why it is sometimes referred to as a managed floating system as opposed to a pure floating system. It should be noted that government intervention is typically a very minor component in exchange rate fluctuations. One important implication of a floating system is that by allowing exchange rates to fluctuate on a daily basis, currency risk becomes an important element that firms must address.

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11.4: Factors Influencing Exchange Rates



Figure 11.4.1: Exchange rates are influenced by trade balances, investment, spectulation and the actions and policies of governments and central banks

In the above paragraph, we mention that supply and demand conditions are the primary factor setting exchange rates and leading to the changing values of currencies. What factors influence supply and demand and what impact do they have on exchange rates? There are too many forces that impact supply and demand to make an inclusive list, but here are a few examples.

Trade balances

When foreign firms and consumers purchase US goods and services, there is demand for US dollars (either because the US firms demand dollars or because they convert the foreign currency to dollars after the transaction). When US firms and consumers purchase foreign goods, there is increased supply of US dollars in the marketplace (either because US importers are selling dollars to buy foreign currency or foreign exporters are selling dollars to convert to their home currency after the transaction). Thus, when the US runs a trade deficit, we should expect weaker US dollar (and vice-versa). See the diagram below, which illustrates the supply curve shifting out from S to S1 to reflect increased selling of US dollars and the subsequent drop in the exchange rate.

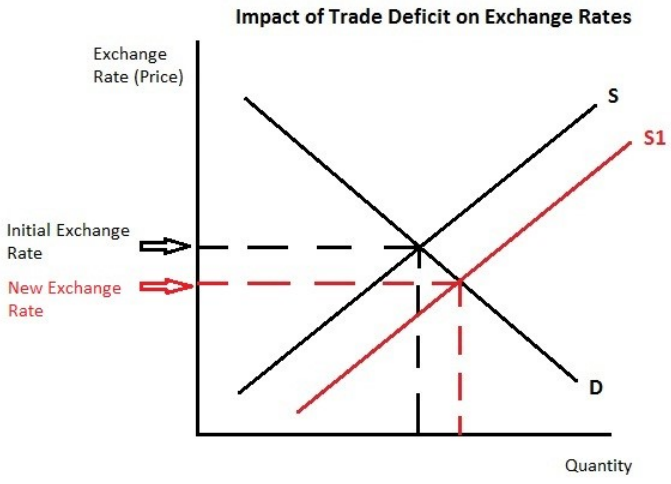


Figure 11.4.2: Showing how trade deficits can influence exchange rates

Investment

When foreign firms and individuals invest in the US (purchasing stocks/bonds, real estate, bonds, etc.), they need US dollars (creating demand for dollars). This is referred to as capital account activity. When US firms and individuals invest outside the US, the opposite situation develops (creating demand for foreign currencies). Thus, as investment flows into the US increase, the US dollar should get stronger (and vice-versa). As US interest rates and investment prospects increase, we would expect more net

investment inflows into the US (and a stronger US dollar). As US interest rates and investment prospects decrease, we would expect more net outflows (and a weaker US dollar). See the diagram below, which illustrates the demand curve shifting up from D to D1 to reflect increased demand for US dollars due to higher relative interest rates in the US and the subsequent increase in the exchange rate.

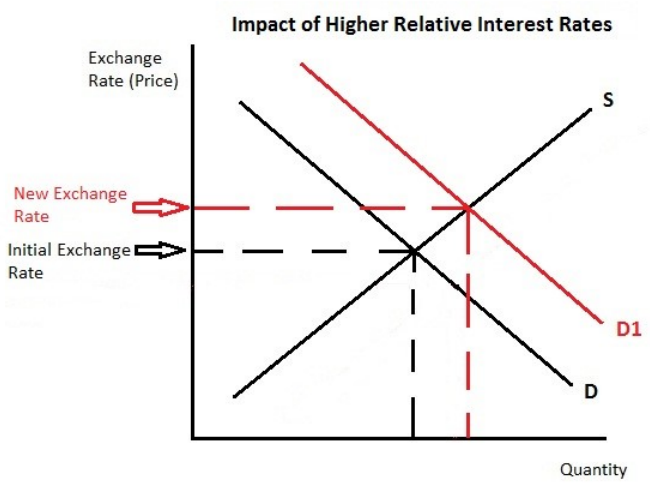


Figure 11.4.3: Showing how higher relative interest rates influence exchange rates

Sometimes supply and demand are driven by real economic forces (as in the two situations above) and sometimes by investor (currency speculator) psychology and expectations. For instance, if currency speculators anticipate that the US dollar is going to decline due to reduced demand or increased supply, then they will likely sell US dollars. This selling will result in increased supply and cause the value of the dollar to decline (assuming all other forces are held constant). Note that this looks like an easy way to make money. All a speculator has to do is to start buying US dollars and then the price will increase due to the increased demand that she created. However, several things make this much more difficult. First, she is one of many investors in the currency market and it is very unlikely she can buy/sell enough to move prices. Second, all the other factors impacting supply and demand are likely to dominate any influence her actions create. Third, even if she can raise the value of the US dollar by buying enough dollars, in order for her to profit she will need to sell them. If she made the price go up by buying, she will make the price go down by selling and offset her influence. Thus, any one speculator is not likely to influence prices. However as a group they will be one of the factors driving supply/demand.

Governments/Central Banks

The US Government (through the Treasury and Federal Reserve system) determine the monetary supply. Thus, they influence the amount of US dollars available in the markets (supply) and impact the value of the US dollar. Also, many foreign governments hold US dollars (as well as their own currencies) and can buy/sell these dollars (or change the supply of their currencies) to influence the market prices of exchange rates. Sometimes these actions are undertaken to influence exchange rates (the managed portion of the managed floating system) and sometimes they are done for other purposes (such as using monetary supply to influence inflation and economic activity).

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11.5: Types of Currency Quotations

A **direct quotation** is an exchange rate stated to tell us how many dollars are required to purchase one unit of a foreign currency. For example, if we say that the exchange rate is .009132 $/yen, we know that it will cost $0.009132 to buy 1 yen. Alternatively, we could state the exchange rate as 109.50002 yen/$. This is an **indirect quotation** and tells us how many foreign currency units we can buy with one dollar. In this case, we can buy 109.50002 yen with $1. We can move from direct to indirect quotations by inversion. One divided by the direct quotation gives us the indirect quotation and one divided by the indirect quotation gives us the direct quotation. Use the link below to access several currencies relative to the US dollar during 2020 (as of the first day of each month).

Tables are from X-rates

US Dollar	1.00 USD	inv. 1.00 USD
Euro	0.922428	1.084095
British Pound	0.791181	1.263932
Indian Rupee	83.293444	0.012006
Australian Dollar	1.520025	0.657884
Canadian Dollar	1.359054	0.735806
Singapore Dollar	1.348918	0.741335
Swiss Franc	0.901952	1.108707
Malaysian Ringgit	4.746042	0.210702
Japanese Yen	151.616063	0.006596
Chinese Yuan Renminbi	7.233262	0.138250

US Dollar▲	1.00 USD▲▼	inv. 1.00 USD▲▼
Argentine Peso	862.501579	0.001159
Australian Dollar	1.520025	0.657884
Bahraini Dinar	0.376000	2.659574
Botswana Pula	13.716317	0.072906
Brazilian Real	5.070366	0.197224
British Pound	0.791181	1.263932
Bruneian Dollar	1.348918	0.741335
Bulgarian Lev	1.804113	0.554289
Canadian Dollar	1.359054	0.735806
Chilean Peso	948.758305	0.001054
Chinese Yuan Renminbi	7.233262	0.138250
Colombian Peso	3767.802189	0.000265
Czech Koruna	23.346686	0.042833
Danish Krone	6.882282	0.145301
Emirati Dirham	3.672500	0.272294
Euro	0.922428	1.084095
Hong Kong Dollar	7.829068	0.127729
Hungarian Forint	359.826279	0.002779
Icelandic Krona	138.752338	0.007207
Indian Rupee	83.293444	0.012006
Indonesian Rupiah	15865.339330	0.000063
Iranian Rial	42002.596116	0.000024
Israeli Shekel	3.756180	0.266228
Japanese Yen	151.616063	0.006596
Kazakhstani Tenge	445.608909	0.002244
Kuwaiti Dinar	0.308602	3.240420
Libyan Dinar	4.833999	0.206868
Malaysian Ringgit	4.746042	0.210702
Mauritian Rupee	47.165153	0.021202
Mexican Peso	16.461451	0.060748
Nepalese Rupee	133.331981	0.007500
New Zealand Dollar	1.663065	0.601299
Norwegian Krone	10.729818	0.093198

US Dollar▲	1.00 USD▲▼	inv. 1.00 USD▲▼
Omani Rial	0.385047	2.597083
Pakistani Rupee	277.856276	0.003599
Philippine Peso	56.494835	0.017701
Polish Zloty	3.947910	0.253299
Qatari Riyal	3.640000	0.274725
Romanian New Leu	4.583186	0.218189
Russian Ruble	92.560338	0.010804
Saudi Arabian Riyal	3.750000	0.266667
Singapore Dollar	1.348918	0.741335
South African Rand	18.685682	0.053517
South Korean Won	1352.939851	0.000739
Sri Lankan Rupee	299.034035	0.003344
Swedish Krona	10.651984	0.093879
Swiss Franc	0.901952	1.108707
Taiwan New Dollar	32.158238	0.031096
Thai Baht	36.604141	0.027319
Trinidadian Dollar	6.722669	0.148750
Turkish Lira	32.040226	0.031211
Venezuelan Bolivar	3612525.972090	0.000000

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11.6: Currency Conversion

The process of converting from one currency to the next is relatively simple, but can also be confusing. Because currencies quotations can be presented in two ways (direct vs. indirect quotes) it is not always easy to remember if you should multiply by the exchange rate or divide by the exchange rate. One way to keep this straight is through labels. For instance, let us say we need to convert $\$400$ US into British pounds. We know the exchange rate is 0.7280 pounds/dollar (an indirect quote). Since I want to know the value in pounds, I set this up as follows:

$$(\$400)\left(\frac{0.7280 \text{ pounds}}{\$1}\right) = 291.20 \text{ pounds}$$

Note that the " $ " labels cancelled out with one in the numerator and one in the denominator, leaving me with pounds. What if I would have divided instead of multiplied?

$$(\$400)\left(\frac{\$1}{0.7280 \text{ pounds}}\right) = 549.45\$^2/\text{ pound}$$

Now, the dollars will not cancel out and I am left with "dollars squared/pound" which makes no sense. By leaving the labels in unless they cancel out, I can tell if I did my conversion correctly. This system will work for any currency conversion regardless of which direction I am converting (from foreign currency to US dollars or US dollars to foreign currency) or which quote format (direct or indirect) I am given.

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11.7: Strengthening vs. Weakening Currencies

We often hear on the news about the US dollar strengthening or weakening and this concept has been mentioned a few times above. However, what does it mean, what are the implications, and how do we know if the dollar is getting stronger or weaker? First, let us look at what we mean by strengthening and weakening. We can think of exchange rates as prices — the price of one currency relative to another. If the US dollar is getting stronger relative to another currency, that means that it costs more of the foreign currency to purchase one dollar (or one dollar can buy more of the other currency than it could previously). In other words, the price of the dollar has gone up. If the dollar is weakening, then the price of the dollar has gone down and it takes more dollars to purchase a specific amount of foreign currency. Let's look at two examples from the currency table above.

Example One – Indirect Quote



On October 1, 2020, the exchange rate was 0.8509 euros/$. A month prior (September 1, 2020), the exchange rate was 0.8370 euros/$. This means that on the starting month (September), one US dollar could buy 0.8370 euros. At the ending month (October), the same dollar could buy 0.8509 euros. Since each dollar buys more euros on Oct. 1st than it could on Sept. 1st, the US dollar has gotten stronger relative to the euro (or, alternatively, the euro has weakened relative to the dollar).

Example Two – Direct Quote

On October 1, 2020, the exchange rate was $1.1752/euro. A month prior (September 1, 2020), the exchange rate was $1.1947/euro. This means that on the starting month (September), a single euro could buy $1.1947. At the ending month (October), the same euro could buy $1.1752. Since each euro buys fewer dollars on Oct. 1st than it could on Sept. 1st, the euro has gotten weaker relative to the US dollar (or, alternatively, the US dollar has strengthened relative to the euro).

Note that the exchange rates used in example one and two are exactly the same, just presented in a different format. However, some students try to focus only on the number and not the meaning of the exchange rate and this can cause problems. In the first example, the number got larger (0.8370 ⇒ 0.8509) and in the second example, the number got smaller (1.1947 ⇒ 1.1752). However, in both cases the US dollar got stronger relative to the euro. **Be sure to think of what the numbers represent (dollars per foreign currency or units of foreign currency per dollar) and not just on whether the number got larger or smaller.**

One thing to keep in mind here is that currencies are a relative price. The price of the US dollar in yen (the yen/dollar exchange rate) is different from the price of the US dollar in euros (the euro/dollar exchange rate). Therefore, it is important when we talk about the US dollar getting stronger or weaker to be precise and say what currency it is stronger or weaker relative to. The US dollar may strengthen relative to the yen while weakening relative to the euro. Look at the month from May 1, 2020 to June 1, 2020. Each dollar bought fewer euros (0.8991 euros in June vs. 0.9093 euros in May). Meanwhile, each dollar bought more yen (107.5741 yen in June vs. 106.7809 yen in May). Therefore, during this time period, the dollar weakened relative to the euro (dollar buys fewer euros) and strengthened relative to the yen (dollar buys more yen).

Second, we need to look at the implications. Who benefits from a stronger US dollar? Who benefits from a weaker US dollar? Let's start with a disclaimer. The effects of changing exchange rates are often complex and impact a variety of economic factors (some of which feed back to the exchange rate itself). Therefore, think of these as the primary (or first-level) impacts.

- US-based consumers will typically benefit from a stronger US dollar. The stronger dollar means that it is now cheaper for US consumers to buy imported goods. This may also cause US firms to lower prices to stay competitive. A weaker US dollar will typically increase the costs of goods and services for US-based consumers.
- US-based firms will typically benefit from a weaker US dollar. A weaker dollar means that foreign firms will become less competitive. Also, exports will be cheaper to foreign customers (as each unit of foreign revenue buys more US dollars). A stronger US dollar will typically have a negative impact for US-based firms.
- Foreign-based firms will typically benefit from a stronger US dollar. The stronger dollar means that each dollar in revenues they receive in US markets translates into more revenues in their home currency.
- US-based investors in international markets will typically benefit from a weaker US dollar. Their investment returns in these foreign markets will need to be converted back into dollars. A weaker US dollar means each unit of foreign currency earned as investment income will buy more US dollars, increasing their return in US dollars.

- Foreign-based investors in US markets will typically benefit from a stronger US dollar. As the dollar strengthens, each dollar received in investment income will buy more of their home currency, which increases their rate of return in their home currency.

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11.8: Cross Currency Exchange Rates

If we know the exchange rate between currency one and the dollar and we know the exchange rate between currency two and the dollar, we can get the exchange rate between currency one and two. For example, let us assume that we know the following two exchange rates: 21.99704 pesos/$ and 0.899054 euros/$. What is the euro/peso exchange rate?

$$\left(\frac{0.899054 \text{ euros}}{\$1}\right)\left(\frac{\$1}{21.99704 \text{ pesos}}\right) = 0.040872 \text{ euros / peso}$$

Note: One key to converting currencies is to make sure the units in your final answer make sense. If the dollar in the numerator cancels out the dollar in the denominator, we know we are doing it right. Let's walk through another example. Assume that the exchange rates are given as direct quotes $\Rightarrow \$0.045461/$ peso and $\$1.112281/$ euro and I asked for the euro/peso exchange rate. Again, you want to make sure the dollars cancel out and you are left with euros in the numerator and pesos in the denominator so it would be set up as follows:

$$\left(\frac{\$0.045461}{1 \text{ peso}}\right)\left(\frac{1 \text{ euro}}{\$1.112281}\right) = \frac{0.045461 \text{ euros}}{1.112281 \text{ pesos}} = 0.040872 \text{ euros / peso}$$

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11.9: Spot vs. Forward Rates

The **Spot Rate** refers to the exchange rate for a transaction to take place today. Alternatively, the **Forward Rate** refers to an exchange rate that is set today, but the transaction does not take place until a later date. The spot and forward rates will rarely be equal and the difference is typically based on interest rate differentials between the two countries. Forward rates (and associated forward contracts) provide a way for firms to reduce (hedge) their exchange rate risk by locking in an exchange rate. Consider a US firm that agrees to sell 10,000 widgets to a German firm for 125,000 euros on credit with the payment being due in 2 months. The US firm is now subject to exchange rate risk (if the dollar strengthens, the euros will be worth less at the time they are received). By entering into a forward contract that allows them to exchange euros for dollars at the agreed forward rate, they no longer have this exchange rate risk as they now know exactly how much the 125,000 in euros will be worth when payment is received in 2 months.

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11.10: Hedging vs. Speculating

Hedging is the process of entering into a forward, future, option, or swap contract to offset a natural risk position (note – there are also ways to hedge risk exposure without the use of derivative contracts). The object is not to make a profit, but to eliminate risk. One example would be a US company that knows it will need to make a payment of 2,000,000 yen six months from now purchasing a forward contract to exchange dollars for yen in six months at forward rate set today. Entering this contract allows the company to eliminate the natural risk arising from their currency situation. While the spot rate of exchange may be more or less favorable in six months when the payment is due, this is not relevant. What is relevant is that the exchange rate fluctuation had no impact on the dollar cost of that payment because it had been hedged away with the use of the forward contract.

Speculation is the process of entering into a forward, future, option, or swap contract in an attempt to generate a profit. This type of transaction creates risk where none previously existed. For instance, if a speculator thought that the US dollar was going to get weaker in the near future relative to the euro (the euro price in dollars would increase), he might enter into a futures contract which would allow him to buy euros at a price set today (the futures price). If he was right and the dollar did indeed get weaker relative to the euro, his futures contract would increase in price and he would make a profit. If he was wrong and the dollar got stronger relative to the euro, his futures contract would decrease in price and he would lose money. Therefore, he has created a situation where he will make or lose money based on the dollar/euro exchange rate — creating a risk position in an attempt to make a profit.

The primary contracts for hedging and speculating in currencies are forward, future, swap, and option contracts. The characteristics of each are quite different. Some (futures and options) are tools for both individual investors and institutions while others (forwards and swaps) are institutional contracts. Also, the risk, complexity, and costs can vary across the contracts. For this class, you will not need to know the differences across these instruments. The following information describing the basics of each contract.

Forward Contracts

Forward contracts are negotiated instruments (size, pricing and expiration date are determined between the parties involved in the contract). They are a legal agreement in that we are bound to carry out our contract regardless of whether it is profitable for us. There are no money flows taking place in forward contracts until the expiration. Also, forward contracts tend to be used primarily by large creditworthy corporations. Individuals do not use forward contracts.

Futures Contracts

Futures contracts are standardized instruments. They have a set expiration date and contract size. Prices are determined in financial markets. They are also a legal agreement that we are bound to carry out (or settle) regardless of whether it is profitable for us. Money flows take place throughout the contract period as gains/losses are settled on a daily basis (referred to as “marked-to-market”. Futures contracts can be used both by corporations and individuals and typically involve significant leverage.

Swap Contracts

Swap contracts are negotiated instruments between the parties involved in the contract. In a swap, parties agree to exchange cash flows associated with specific assets. For example, company A in Japan may issue a bond in its home market in yen. Company B in the US may issue a bond in its home market in dollars. Then, they agree to swap the interest payments so that the US firm’s interest expense is in yen while the Japanese firm’s interest expense is in dollars. This is attractive if the Japanese firm has some revenues in dollars and the US firm has some revenues in yen. By matching their revenues and expenses in the same currency, they reduce their overall currency risk.

Options Contracts

Options contracts are standardized instruments. They have a set expiration date and contract size. Prices are determined in the financial markets. The give the option holder the right to buy (a call) or the right to sell (a put) at the contract expiration if the holder of the option chooses to do so. If the currency fluctuation is in the option holder’s favor, the option will be exercised. If the currency fluctuation is against the option holder, the option will expire worthless (costing the option holder the initial price paid to purchase the option).

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11.11: International Investing

While the majority of people invest in stocks and bonds from their home country, there are reasons to consider investing at least a portion of one's assets with an international perspective. International investing may be beneficial due to increased diversification benefits and more opportunities. Complications with international investing can include currency issues, tax complications, information, and potentially greater risk. However, there are also ways to invest internationally while reducing the complications.

There has been ample evidence to document that international stock and bond markets do not always move in the same direction. Therefore, the correlations across the various national markets are less than one. See Table: Correlations, Returns and St. Deviations Across National Equity Markets (table based on returns from single country exchange traded funds from January 2011 – December 2020). If you remember from Chapter Seven, we can reduce the risk of our portfolio by investing in countries that have low correlations with our home markets. While these risk reductions are real, there is also evidence to suggest that the correlations are highest at the times when markets are crashing. This means that the diversification benefits are smallest when they are needed the most.

Another reason to invest internationally is the increased opportunities. There are many great companies that exist outside the US. By expanding our horizons to include these companies, we can develop stronger portfolios. Also, some developing and emerging markets might offer the opportunity for higher returns (although likely with more risk) that might appeal to many investors. Note that returns vary significantly from country-to-country across time period. Therefore, while the US appears to be the dominant market in the table above (with the highest average return and virtually lowest standard deviation), that does not imply that it will (or won't) be the dominant market over the next 5-10 years.

While there are advantages to investing internationally, it can also lead to many complications. Countries outside the US don't follow the same Generally Accepted Accounting Principles (GAAP) and thus financial statement analysis can be challenging. Also, tax complications can occur when profits are made in other countries. Additionally, we have currency issues to worry about as investing in different countries means investing with different currencies and introducing exchange rate risk (the table above is reported based on US dollar returns). Finally, getting information and trading while the markets are open can sometimes be a challenge.

If we do decide to invest internationally, there are a few different ways to accomplish this.

International Mutual Funds and ETFs

International mutual funds allow us the advantages of international investing while letting a professional manage the currency, tax, and information issues. In addition to traditional mutual funds, there are Exchange Traded Funds that allow us to purchase a basket of stocks from a specific country that represent an index of that country's stocks. Note that while mutual funds eliminate the hassle of currency conversion, they are still affected by currency fluctuations.

Direct International Purchases

Most large brokerage firms allow their customers to make purchases of stocks outside the US. However, these purchases need to be made in a foreign currency which entails an additional transaction. In addition, investors may face additional tax issues. Finally, due to time differences, many foreign exchanges are open during inconvenient hours for trading. These complications make direct international purchases the most difficult method of international investing.

US Listed (ADR's) International Stocks

Many international companies are listed on the US exchange. Many of these are structured as American Depository Receipts (ADR's). These allow us to buy stock in many foreign firms (Nokia and Sony for instance) in the US markets. This eliminates many of the extra hassles. Specifically, our purchases are in dollars and trading takes place during normal US hours. As with the International Mutual Funds, the currency risk is not eliminated, merely the need for trading in different currencies.

Multinational Firms Based in the US

Finally, we might be able to get some of the same benefits by investing in companies with substantial international activities. For instance, Coca-Cola gets a substantial amount of its revenues and profits from outside the US and thus might provide us with some

international diversification. Unfortunately, it appears that the benefits from investing in Multinationals are not as good (from a diversification standpoint at least) as other strategies for investing internationally.

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11.12: Key Takeaways

Key Takeaways

Finance, like other areas of business, is a global discipline. In order to achieve the goal of maximizing shareholder wealth, it is necessary for management to consider the role of international opportunities for production and marketing of goods and services. However, engaging in international operations introduces additional risks, one of which is currency risk. Given that most major currency markets operate on a floating rate system, the US dollar will strengthen and weaken relative to other currencies over time based on trade balances, international capital flows, interest rates and many other factors. These currency fluctuations provide advantages and/or disadvantages to different parties. It is essential that financial decision makers understand how to interpret currency fluctuations and how to manage the risk associated with these fluctuations. In addition, investors also need to consider the role of international markets into their investment allocations. Adding international stocks and bonds to a portfolio can provide diversification benefits and increase the potential returns. However, it also provides additional complications in the form of currency risk, information risk, and taxes.

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11.13: Exercises

Exercise 11.13.1

What are some risks associated with doing business internationally? Given these risks, why do companies engage in international business?

Answer

See discussion in Ch 11.

Exercise 11.13.2

Your instructor has argued that the current international currency market could best be described as a managed floating rate system. Explain what is meant by this. Also, do all countries follow this model?

Answer

A managed floating system means that currency prices are predominantly determined by supply and demand conditions in an open market (the floating part). However, governments can (and do) occasionally intervene in the currency markets (either directly or indirectly) to try to support a currency that they believe is falling too rapidly or to pressure a currency that is rising too rapidly. Governments typically can't counter market forces for an infinite amount of time so usually this is a temporary tactic designed to reduce extreme swings. The "floating" part of the managed floating system is far more prevalent than the "managed" part as government intervention is usually minimal.

In addition, not all countries choose to follow the managed floating system. Instead, some operate on a fixed (pegged) exchange rate system while others adopt a policy (either officially or unofficially) of dollarization. The advantage of both of these systems is greater currency stability. However, in a policy of pegged exchange rates the country gives up the ability to use monetary policy as an economic tool and instead must use it as a currency tool. In an official dollarization policy, the country gives up control of a currency system (and their monetary policy is determined indirectly by the US).

Exercise 11.13.3

Differentiate between a spot and forward exchange rate.

Answer

A spot rate of exchange is the exchange rate in place today for transactions that are taking place now. If I want to convert US Dollars into Euros today, I would be using the spot rate of exchange.

A forward rate of exchange is the exchange rate in place today for transactions that will take place at a later date. For instance, let's assume that I am selling material to a customer in Japan and the price is set in yen. If I give them 30-days to pay, I am exposed to currency risk. If the dollar gets weaker relative to the yen, the yen that they pay me will be worth more dollars and I will have a currency gain. On the other hand, if the dollar gets stronger relative to the yen, the yen that they pay me will be worth fewer dollars and I will have a currency loss. If I want to eliminate this currency risk, I can sell yen in the forward market (one month forward). I will agree to sell yen for dollars at a rate agreed upon today, but not actually carry out the transaction for one month. That way, when my customer pays me in yen, I already know what I will get in dollars and have eliminated the currency risk.

Exercise 11.13.4

If Citigroup (one of the largest banks in the world and based in the US) makes loans to a German corporation in Euros, which would they benefit the most from — a weaker or stronger US$ (with regard to the German loans)?

Answer

Answer

Since Citi is lending in Euros and will receive interest and principal repayment in euros, they will benefit from a weaker US dollar. A weaker US dollar means each euro that they receive from the loan will buy more dollars when converted. They will earn the return from the loan, plus a bonus return from the exchange rate. On the other hand, a stronger US dollar would mean that each euro received would buy fewer dollars. Thus, the would earn the return from the loan, but lose money from the exchange rate.

? Exercise 11.13.5

Briefly discuss how an increase in the value of the US Dollar could impact

a. A US investor with significant foreign investments
b. A foreign investor with significant US investments
c. The US Consumer
d. A US-based manufacturer that sells its products internationally
e. A foreign-based manufacturer that sells its products in the US

Answer

a. The US investor is primarily concerned with her return in US dollars. As the foreign investments would offer investment income (dividends, capital gains, interest) in foreign currency, this investment income would have to then be converted into dollars. With a stronger US dollar, the US investor would be able to purchase fewer dollars with the foreign currency earned on her investment and thus would make a lower return than anticipated. A stronger US dollar would have a negative impact on dollar-based returns from foreign investments.
b. This would work in an opposite manner as above. The foreign investor would be concerned with his return in his home currency. As his investment income would be in dollars, each dollar received would now buy more of the home currency. This would mean a higher rate of return in his home currency. A stronger US dollar would have a positive impact on foreign- currency based returns from investments within the US.
c. A stronger US dollar means that foreign manufacturers would be able to charge less in US dollars and still get the same amount of foreign currency after currency conversion. US manufacturers would also feel price pressures on products sold in the US as they would need to keep prices down to stay competitive. Therefore, a stronger US dollar is likely to lead to lower inflation in the US.
d. As with the US-based investor, the US-based manufacturer is concerned about cash flows in dollars. As selling items outside the US results in receiving revenues in foreign currencies, these currencies must be converted to US dollars. A stronger US dollar means each unit of foreign currency will buy fewer dollars. Thus, a stronger US dollar will tend to hurt US-based manufacturers that sell their products internationally.
e. A foreign-based manufacturer is concerned about their cash flows in their home currency. A stronger US dollar means that each dollar earned in revenues will translate into more of their home currency. Thus, a stronger US dollar will tend to help foreign-based manufacturers that sell their products in the US.

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11.14: Problems

Problem 11.14.1

We are considering the purchase of some parts from a German manufacturer. The German manufacturer wants us to pay 2,000,000 Euros. If the current exchange rate is 0.7347 Euros/$, how much will the parts cost in dollars?

Answer

(2,000,000 Euros)($1/0.7347 Euros) = $2,722,199.54

Problem 11.14.2

Our sales staff has reached an agreement to sell our product to a large customer in Argentina. Normally the product sells for $455 per 25 units. How much must we charge in Argentina Pesos in order to get the same price? Assume that the exchange rate is 3.0875 Pesos/$?

Answer

($455)(3.0875 Pesos/$) = 1404.81 pesos

Problem 11.14.3

Today the exchange rate is 1.1304 Canadian Dollars per US$. Last year, the exchange rate was 1.0422 Canadian Dollars per US$. Has the US$ strengthened or weakened relative to the Canadian Dollar over the last year?

Answer

Last year, $1 could buy 1.0422 Canadian Dollars. Now, $1 can buy 1.1304 Canadian Dollars. Since each $1 is buying more Canadian Dollars, then the US $ has gotten stronger relative to the Canadian Dollar.

Problem 11.14.4

Today the exchange rate is $0.0308 per Thai Baht. Last year the exchange rate was $0.0267 per Thai Baht. Has the US$ strengthened or weakened relative to the Thai Baht over the last year?

Answer

Last year, 1 baht could buy $0.0267. Now, 1 baht can buy $0.0308. Since each baht is buying more dollars, the Thai baht is stronger relative to the US dollar ⇒ the US dollar is weaker relative to the Thai baht.

Problem 11.14.5

We know that the Japanese Yen/US $ exchange rate is 118.43 yen/$. Also, the Mexican Peso/US$ exchange rate is 10.998 pesos/$. What is the yen/peso exchange rate? What is the peso/yen exchange rate?

Answer

(118.43 yen/$)($1/10.998 pesos) = 10.768 yen/peso
(10.998 pesos/$)($1/118.43 yen) = 0.0929 peso/yen

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11.15: References and Attributions

Student Resources

Table: Foreign Currency relative to US dollar in 2017

Table: Correlations, Returns and St. Deviations Across National Equity Markets

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12: Appendix A- Financial Tables

Use the link below to access the Financial Tables introduced in Chapter 3.

Financial Tables

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13.1: Explanations of Ratios (CH 2)

Liquidity Ratios

Liquidity Ratios are designed to measure a firm's ability to meet short-term liability (accounts payable, accruals, short-term loans, etc.) obligations. If these ratios are too low, that could mean that a company does not have the ability to repay its current liabilities as they become due and would be a sign of financial distress. Some firms will intentionally keep these ratios low as an aggressive strategy. Since short-term liabilities are typically a cheap form of financing and current assets typically offer low rates of return, firms that are confident that they can refinance short-term liabilities as they become due or generate enough cash flows to cover those short-term liabilities may try to maintain low liquidity ratios to maximize returns. However this can be a risky strategy. On the other hand, if these ratios are too high it may indicate that a company is not doing enough to maximize returns as they are focusing too much on current assets and not enough on developing new products/markets.

Current Ratio

The current ratio measures the ratio of a firm's current assets to its current liabilities. As a simple rule of thumb, most people like to see this ratio be between 1.5 and 4. However, industry and strategy differences may result in occasionally higher/lower values that are also considered "okay".

Quick Ratio

The Quick Ratio (sometimes called the Acid Test ratio) removes inventory from the current asset mix because it is the least liquid current asset. Before it can become cash to pay off liabilities it must first be sold and (if it is sold on a receivable basis) the sale be paid for in cash. As a simple rule of thumb, most people like to see this ratio between 1 and 2. As with the current ratio, some firms may be above or below this due to industry norms or strategic decisions and still be okay.

Asset Management Ratios

Asset Management ratios are designed to see how well a company is doing at generating sales from their current and long-term assets. The Days Sales Outstanding ratio is a little different from the other ratios in this category in that it is measuring collection time for our accounts receivable instead of our ability to generate sales from accounts receivable.

Inventory Turnover

The more frequently we can "turn over" our inventory the better off we will be. Holding inventory is expensive in terms of storage, obsolescence, and financing costs. A higher inventory turnover means more inventory moving through our firm and less sitting on the shelves. This ratio is very industry dependent, so determining what is "good" or "bad" will depend a lot on the industry. In general, the higher the better. However, we should not necessarily try to maximize the inventory turnover ratio as that may mean stock outages or not enough variety of merchandise and lower our overall revenues.

Days Sales Outstanding

The quicker we can collect our receivables, the better off we will be. High values for the DSO ratio (sometimes referred to as the Average Collection Period) indicate that it is taking us longer to collect our sales. This likely means higher financing costs and/or more bad debt expenses. It also may be a sign that we have to offer our customers more favorable financing terms in order to maintain sales. Sometimes this is referred to as "stuffing the channel" as our customers may be encouraged to "buy ahead" due to the favorable financing terms and will not need to buy as much from us next month/quarter. While a high level of DSO is likely a bad sign, it is not necessarily true that we want the ratio to be as low as possible. Allowing our customers to use credit is likely to help increase our sales (and in turn, our profits/cash flows). If our DSO is too low, we may be losing sales opportunities. A sudden increase from last year or being notably higher than our competitors is likely to be a red flag (unless there is a reasonable explanation).

Fixed Asset Turnover

Fixed Assets typically refer to long-term assets such as property, plant, and equipment. The greater the fixed asset turnover ratio, the better job we are doing of generating high sales with limited capital investment. As with many ratios, this one will be very dependent on industry as some industries are much more capital intensive than others.

Total Asset Turnover

Total Assets include both long-term and short-term assets. Just like the FAT ratio, higher is generally better as it indicates that we are generating high levels of sales on our investment in assets.

Debt Management Ratios

Debt Management ratios are designed to see how well a company is doing at servicing their long-term debt obligations.

Total Debt to Total Assets

The higher the level of TD/TA, the more risk the company is taking in their financing mix. This is not necessarily good or bad. There are some advantages to using debt financing, but it also increases the risk. Some companies can afford higher levels of TD/TA without increasing the risk too much while other firms need to keep this ratio lower. Management philosophy, firm size, profitability, and industry will play a large part in determining what an "acceptable" TD/TA level is. However, if this number is increasing dramatically or much higher than the industry average, there is reason to be concerned.

Total Debt to Total Equity

The TD/TE ratio is similar to the TD/TA assets as A = L + OE. The primary difference is that TD/TA will almost always be less than 1.0 while TD/TE can often be greater than 1.0. Again, a higher value is neither good or bad, but indicative of greater risk.

Times Interest Earned

The TIE ratio looks at how easily we are able to meet our interest requirements. Since we can be forced into bankruptcy if we can't pay our interest payments, this is important. Companies can typically meet interest obligation for a short time when the TIE is less than one or negative by reducing their assets, but this is only a short-term solution. In general we would like to see TIE above 2 in order to provide a little cushion. Another concern is that the TIE ratio may provide a false sense of comfort if we are starting a downturn because we are more concerned with the ability to meet future interest payments rather than past and a downturn may cause our EBIT to fall much faster than our interest.

Profitability Ratios

Profitability ratios analyze how well we are doing at generating profits for our shareholders. There are multiple ratios here as there are different ways to identify profits and different bases (sales, assets, owner's equity) that may be relevant.

Gross Profit Margin

The higher the gross profit margin, the greater markup we are able to have on our inventory. Looking at this ratio over time (or compared to key competitors) is a good way to evaluate our inventory costs and (in some cases) the ability of our brand to extract higher value.

Net Profit Margin

The higher the Net Profit Margin, the more of each sales dollar is making it to the bottom line. A company with a high profit margin will generate much more for its shareholders than a company with a low profit margin at the same level of sales. Profit margins are typically sensitive to economic conditions and also vary substantially from industry to industry.

Return on Assets

The higher the ROA, the better. We want to generate as much profit from each dollar invested in assets as possible. Typically ROA, like profit margin, will be sensitive to economic conditions and vary substantially from industry to industry. The more asset-intensive the industry, the lower the ROA.

Return on Equity

The equity represents the shareholders' contribution to the firm. Therefore, the ROE looks at how much profit we are making for each dollar invested by shareholders. The higher the ROE, the better. Companies can increase their ROE by using more debt financing. However, as mentioned earlier this increases the risk level. ROE (assuming it is positive) should always be higher than ROA.

Market Value Ratios

Market Value ratios are the most difficult to interpret. They measure how "cheap" or "expensive" the stock is relative to accounting measures. However, there are a large number of reasons why a stock should be more/less expensive than another relative to a specific accounting measure. While there are too many issues to discuss related to these ratios to explain them all, I will offer a sample issue with each ratio.

Price/Earnings Ratio

The PE ratio measures how much are you paying for each dollar that the firm makes (on a per share basis). While a lower PE ratio is "cheaper," consider a company's growth rate. If company A is growing rapidly and company B is not growing at all, you should expect to pay more for $1 in earnings from company A than for the same $1 of earnings from company B. Finance is forward-looking and company A should make much more per share going forward than company B. There are many other reasons why PE ratios vary from firm to firm and, by itself, the PE ratio is not a very good indicator of whether a stock is too cheap or too expensive. However, it is much better than just looking at the stock price by itself. For instance, on August 11, 2017, Alphabet (GOOGL) stock has a price of $930.09 while Facebook (FB) has a price of $168.08. At first glance, it seems like Alphabet is about 5 times as expensive as Facebook. However, Alphabet earned $29.59 per share (EPS) while Facebook earned $3.93 per share (EPS) over the previous twelve months. Thus, Alphabet is actually cheaper (in terms of earnings power per share relative to what you pay for the share) than Facebook. As Alphabet has a PE of 31.43 vs. Facebook's PE of 42.74. A simple way to think of these PE ratios is that it costs $31.43 to buy one dollar of earnings if you buy Alphabet while it costs $42.74 to buy one dollar of earnings if you buy Facebook. Why are investors paying 25-30% more for each dollar earned by Facebook? The answer is likely in perceived EXPECTED growth (although there may be other factors). Typically, the higher the expected growth, the more expensive (higher PE) the stock. Investors are expecting higher growth rates for Facebook than Alphabet over the remaining life of the two companies. Other possibilities may include risk (higher risk tends to lead to lower PE ratios), quality of earnings (higher quality of earnings should lead to higher PE ratios), and several other factors.

Market/Book Ratio

The MV/BV ratio measures how expensive the stock is relative to its accounting value. The higher the MV/BV ratio, the more "expensive" a stock is. Typically MV/BV will be high due to (A) intangible assets (such as brand names) not being fully recognized by the balance sheet, (B) high future growth rates not recognized by the historical value of assets, or (C) investors being overoptimistic about the future. Because of item C, there is a tendency for low MV/BV stocks to be better investments (higher risk-adjusted rates of return – on average over long periods) than high MV/BV stocks. Let's look at Alphabet and Facebook again. The book value per share (again as of August 11th, 2017) for Alphabet is $209.43 while Facebook has a book value per share of $21.50. Given the price of each stock ($930.09 for Alphabet and $168.08 for Facebook), that gives Alphabet a MV/BV ratio of 4.44 and Facebook a MV/BV ratio of 7.82. Again, Alphabet is "cheaper" than Facebook in terms of MV/BV ratio despite its higher price tag. In both cases, Alphabet being "cheaper" does not automatically make it a better investment. It depends on whether or not Facebook is worth the higher valuation.

Dividend Yield

Many conservative investors look for stocks that pay dividends as a source of (a) current income and (b) safety. Since firm's are reluctant to cut dividends and tend to only do so in times of severe financial distress, dividends provide a little bit of market protection for stock prices (if the stock price starts to fall too much, the current income potential of the dividend attracts buyers) and are more predictable than capital gains (although capital gains can be quite a bit higher). Dividend yields will vary significantly with many companies not paying dividends and some companies paying dividends as high as 5-6% (or occasionally even higher). Typically, firms that pay dividends are ones that have entered the "cash cow" stage of their life cycle where they are generating more cash flows than they can reasonably reinvest. Younger, faster growing firms are less likely to pay dividends and reinvest it into the firm. Some companies will use their extra cash flow to buy back shares instead of paying dividends (which theoretically should cause the stock price to rise slightly by reducing the shares outstanding – the pie is cut into fewer pieces).

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13.2: Financial Statement Analysis Guided Tutorial (CH 2)



OBJECTIVE – The purpose of this handout is to walk you through the topic of financial statement analysis. This should be used as a supplement to the online text chapter on Financial Statement Analysis.

LEARNING OBJECTIVES

After completing this tutorial, students should be able to

- Discuss the purpose and key issues associated with the income statement, balance sheet, and statement of cash flows
- Identify the three components of the statement of cash flows and interpret each of the three components
- Calculate and interpret key financial ratios
- Calculate and interpret a common size income statement and common size balance sheet
- Discuss and apply the concept of trend analysis, including both its strengths and weaknesses
- Discuss and apply the concept of comparative analysis, including both its strengths and weaknesses
- Identify key users of financial statement analysis
- Identify potential strengths and weaknesses for a firm, given financial statements for the firm and industry (or competitor)
- Discuss and interpret the many issues associated with financial statement analysis (such as seasonality, context, etc.)

Introduction

One of tools that finance professionals have at their disposal for analyzing the health and performance of corporations is financial statement analysis. Financial statement analysis can be used by a variety of people for different purposes. Some examples are presented below:

Company (and competitor) management

Company (and competitor) management can use financial statement analysis to identify the firm's (or the firm's competitor's) strengths and weaknesses. Knowing this information can improve management's ability to make strategic decisions that improve financial performance and the value of the firm.

Stock Investors

Stock investors (both current stockholders and potential stockholders) can use financial statement analysis to evaluate the potential risks and rewards of owning the stock, make forecasts of future performance, and help them determine if the stock prices are overvalued, undervalued or fairly valued.

Short-term Creditors

Short-term creditors (such as suppliers and banks) can use financial statement analysis to evaluate the ability of a firm to repay their loans before they extend credit.

Bond Investors

Bond investors (both current bondholders and potential bondholders) can use financial statements to evaluate the ability of the firm to make all the promised coupon payments and the maturity payment at the bond's maturity. This can help bond investors decide if the expected return that they anticipate earning on the bond is sufficient to compensate them for the risk.

All of these parties place their emphasis on different aspects of financial statements and use different tools to develop the information that helps them with their decision process.

Financial Statements

There are three key financial statements that we will focus on in our coverage of financial statement analysis – the income statement, the balance sheet, and the statement of cash flows. I have included information from these three statements from the 2017 fiscal year for Wal-Mart (WMT) and Target (TGT) with data pulled from Yahoo!Finance. Financial Statements are reported according to Generally Accepted Accounting Principles (GAAP). The advantage of a source like Yahoo!Finance is that they put the reports into a standard format for easier comparison. The disadvantage is that they do not contain the full statements as reported in the annual reports along with the footnotes. In order to do a professional-quality financial statement analysis, it is critical that you read through the annual and/or quarterly reports (10-K and 10-Q documents) so that you know not only what numbers are reported, but the details behind those numbers. This information will not be seen in summary reports like presented in Yahoo!Finance or other common repositories of financial statement information.

Income Statement

The income statement is designed to provide information related to a company's revenues (sometimes called sales), expenses, and profits.

The income statement is presented on an "accrual" basis. This means that revenues are recognized as they are earned and expenses are recognized as they are incurred. This is very different from a "cash" basis which looks at when money is received or spent. For example, consider a company that manufactures and sells widgets. When this company purchases a large piece of equipment to manufacture their widgets, they will record the expense of the equipment spread out over its lifetime (usually several years) instead of recording it when the equipment is purchased. Now, let's assume that a customer purchases 1000 widgets on credit and doesn't have to pay until 3 months after the purchase. The revenue is still recorded at the time of the sale, even though no money was received. Being aware of these accrual concepts and their implications is very important from a finance perspective because in finance we are focused on cash. While accrual accounting does a good job of capturing a firm's performance, it can distort timing and have an impact on valuation analysis due to the time value of money.

The income statement captures a firm's performance **OVER** time. This means that all transactions during the period are treated equally regardless of when they occur within the period. For instance, if I am preparing an annual income statement, sales made at the start of the year are no different than sales made at the end of the year. All transactions related to revenues and expenses are a part of the income statement as long as they occurred in the period.

Balance Sheet

The balance sheet is designed to capture information about a firm's assets, liabilities, and equity at a point in time.

- Assets represent things the firm has. These can be long-term assets (such as property, plant, and equipment) or current assets (such as cash, accounts receivable, and inventory).
- Liabilities represent what the firm owes and can also be long-term (such as bonds the firm has issued) or short-term (such as short-term loans, accounts payable, or accruals).
- Owners' equity represents what belongs to the shareholders. This is often broken down into what was originally contributed when the firm issued the shares and retained earnings (profits that have not been paid out in dividends – note that retained earnings are an accounting tool and do not represent cash that the company is holding).

A fundamental relationship in the balance sheet is the following formula Assets = Liabilities + Owners' Equity. Firms finance their assets through debt (liabilities) or equity. Everything that the firm has (its assets) minus its debt obligations (liabilities) belongs to the stockholders (equity).

The Balance Sheet tends to understate the true value of the firm's assets (and, in turn, the equity). The reason for this understatement comes from a couple of sources:

Assets are reported on the balance sheet at historical cost minus accumulated depreciation. This may be different than the market value of the asset.

Some assets (such as land) tend to appreciate in value over time.

Some assets do not depreciate on an economic basis as fast as they do on an accounting basis.

Some assets are more valuable in their cash-flow generating capability as they are employed by the firm then what the firm paid for them.

Intangible Assets are not recorded on the balance sheet unless they are purchased (such as in an acquisition). Intangible assets are things like brand name, copyrights, patents, etc. They have important economic value in that they help firms generate cash flows, however they typically are not purchased and therefore are hard to value from an accounting standpoint. (Note – Both Pepsi and Coca-Cola have Goodwill and Other Intangible Assets on their Balance Sheets. These are primarily derived from purchases of many smaller companies over their corporate lives and are not capturing the FULL value of the intangible assets these companies possess.)

For many companies, their brand name and reputation are among their most valuable assets. Consider a company like Nike. People pay more for their products partially due to the brand name. Coke sells for more than generic cola because people identify with the name brand.

Patents and copyrights can be valuable due to the pricing power that they provide, however, the value of these will vary significantly based on the specific patent and copyright. Some may be worth millions and others may be virtually worthless.

Some activities that are treated as expenses (such as marketing, research and development, employee training, etc.) can create intangible assets.

The Balance Sheet reflects a POINT IN TIME. It represents the firm's assets, liabilities, and equity on a specific date. If a firm makes its payroll payment one day before the balance sheet is prepared, the cash account may appear low. If it is ready to make the payroll payment one day after the balance sheet is prepared, the cash account may appear high. Several items on the balance sheet (mainly current assets and current liabilities) will vary significantly throughout the year, so the seasonality factor in balance sheets will be high. Also, if a firm borrows a large sum of money one week after the fiscal year starts and pays it back one week before the fiscal year ends, this transaction will not have any direct impact on the annual balance sheet.

The Statement of Cash Flows

The Statement of Cash Flows is designed to present the firm's income on a cash basis and to show where cash flows came from and went to during the period.

The Statement of Cash Flows has three main components – Cash Flows from Operating Activities, Cash Flows from Investing Activities, and Cash Flows from Financing Activities.

Cash Flows from Operating Activities

CF from Operating Activities measures the firm's operating income on a cash flow basis.

Starts with net income and then adjusts to remove accrual-based impacts.

For a healthy company, we want to see this be positive and growing over time. If a company cannot earn positive cash flows from its operating activities, it will not be able to stay operational over time. Also, companies strive for growth. If it is not positive and growing over time, we want to see (A) a reasonable explanation and (B) a plan for moving towards a positive and growing cash flow from operating activities.

Often, young firms lose money during their first few years. If the firm has negative CF from operating activities due to it being young, it is important that we see the values moving towards a positive level. We also want to make sure the firm has enough capital and/or access to additional capital to stay alive until it starts generating positive cash flows from operating activities.

Sometimes when there are industry problems or the economy enters a recession, many normally healthy companies will see a decline in (or even negative) CF from operating activities. If this happens, we want to make sure that it is a short-term issue and is correctable.

Cash Flows from Investing Activities

CF from Investing Activities looks at cash outflows associated with purchasing new property, plant and equipment (PPE) along with other long-term investments. Also, cash inflows from selling existing PPE and other LT investments will fall in this category.

Cash Flows from Investing Activities will typically be negative for almost every company. In order to grow over time, companies need to spend on long-term assets which causes the cash outflows in this category to outweigh cash inflows in most cases. However, if CF from Investing Activities is growing more negative over time without seeing CF from operating activities also increasing at the same rate or better, this is likely a problem.

Cash Flows from Financing Activities

CF from Financing Activities looks at cash outflows from repaying existing debt, buying back shares of stock, and paying dividends along with cash inflows from issuing new debt or issuing new shares of stock.

CF from Financing Activities often tells us more about where a company is in its life cycle than it does about the company's health (although negative cash flows from financing activities are preferred to positive values, all else equal).

Young firms will typically have positive CFs from Financing Activities as they are spending more on LT investments than they are bringing in from operations. This difference must be financed by borrowing or issuing new equity.

Rapidly growing firms will typically have positive CFs from Financing Activities as they are spending significant amounts on Property, Plant, and Equipment and other LT Investments to support the growth. Often, not all of this growth can be financed from operating CFs and must come from financing.

Older, established firms will typically have negative CFs from Financing Activities as they are generating significant CFs from Operating Activities and can use the excess cash to pay off existing debt, buy back existing shares of stock, or pay dividends.

Financial Statements for Walmart & Target from Appendix B

Wal-Mart						Target				
Income Statement	**1/31/2018**	**1/31/2019**	**1/31/2020**	**1/31/2021**		**Income Statement**	**1/31/2018**	**1/31/2019**	**1/31/2020**	**1/31/2021**
Sales	500,343	514,405	523,964	559,151		Sales	71,879	75,356	78,112	93,561
Cost of Sales	373,396	385,301	394,605	420,315		Cost of Sales	51,125	53,299	54,864	66,177
Gross Operating Profit	126,947	129,104	129,359	138,836		Gross Operating Profit	20,754	22,057	23,248	27,384
Selling, General & Admin. Expense	106,510	107,147	108,791	116,288		Selling, General & Admin. Expense	14,248	15,723	16,233	18,615
EBITDA	27,982	24,484	33,702	34,031		EBITDA	6,506	6,334	7,015	8,769
Depreciation & Amortization	10,529	10,678	10,987	11,152		Depreciation & Amortization	2,194	2,224	2,357	2,230
EBIT	17,453	13,806	22,715	22,879		EBIT	4,312	4,137	4,667	6,523
Interest Expense	2,330	2,346	2,599	2,315		Interest Expense	666	461	477	977
Pre-tax Income	15,123	11,460	20,116	20,564		Pre-tax Income	3,646	3,676	4,190	5,546
Income Taxes	4,600	4,281	4,915	6,858		Income Taxes	718	746	921	1,178
Net Income from Cont. Operations	10,523	7,179	15,201	13,706		Net Income from Cont. Operations	2,928	2,930	3,269	4,368
Net Income from Other Items	-661	-509	-320	-196		Net Income from Other Items	6	7	12	0
Total Net Income	**9,862**	**6,670**	**14,881**	**13,510**		**Total Net Income**	**2,934**	**2,937**	**3,281**	**4,368**
Balance Sheet	**1/31/2018**	**1/31/2019**	**1/31/2020**	**1/31/2021**		**Balance Sheet**	**1/31/2018**	**1/31/2019**	**1/31/2020**	**1/31/2021**
Current Assets						Current Assets				
Cash and Equivalents	6,756	7,722	9,465	17,741		Cash and Equivalents	2,643	1,556	2,577	8,511
Receivables	5,614	6,283	6,284	6,516		Receivables	929	1,100	962	1,135
Inventories	43,783	44,269	44,435	44,949		Inventories	8,657	9,497	8,992	10,653
Other Current Assets	3,511	3,623	1,622	20,861		Other Current Assets	335	366	371	457
Total Current Assets	59,664	61,897	61,806	90,067		Total Current Assets	12,564	12,519	12,902	20,756
Long Term Assets						Long Term Assets				
Property, Plant & Equipment, Net	114,818	111,395	127,049	109,848		Property, Plant & Equipment, Net	25,018	27,498	28,519	29,106
Intangibles/Goodwill	18,242	31,181	31,073	28,983		Intangibles/Goodwill	782	699	686	668
Other Non-Current Assets	11,798	14,822	16,567	23,598		Other Non-Current Assets	635	574	672	718
Total Non-Current Assets	144,858	157,398	174,689	162,429		Total Non-Current Assets	26,435	28,771	29,877	30,492
Total Assets	**204,522**	**219,295**	**236,495**	**252,496**		**Total Assets**	**38,999**	**41,290**	**42,779**	**51,248**
Current Liabilities						Current Liabilities				
Accounts Payable	46,092	47,060	46,973	49,141		Accounts Payable	8,677	9,761	9,920	12,859
Short Term Debt	9,662	7,830	8,241	5,296		Short Term Debt	270	1,052	161	1,144
Other Current Liabilities	22,767	22,587	22,576	38,208		Other Current Liabilities	4,254	4,201	4,406	6,122
Total Current Liabilities	78,521	77,477	77,790	92,645		Total Current Liabilities	13,201	15,014	14,487	20,125
Long Term Liabilities						Long Term Liabilities				
Long Term Debt	36,825	50,203	64,192	57,950		Long Term Debt	11,317	12,227	13,613	13,754
Deferred LT Liabilities	8,354	11,981	12,961	14,370		Deferred LT Liabilities	1,816	2,014	2,154	2,048
Other Non-Current Liabilities	0	0	0	0		Other Non-Current Liabilities	956	738	692	881
Total Non-Current Liabilities	45,179	62,184	77,153	72,320		Total Non-Current Liabilities	14,089	14,979	16,459	16,683
Total Liabilities	123,700	139,661	154,943	164,965		Total Liabilities	27,290	29,993	30,946	36,808
Stockholders Equity						Stockholders Equity				
Total Equity	80,822	79,634	81,552	87,531		Total Equity	11,709	11,297	11,833	14,440
Total Liabilities & Stock Equity	**204,522**	**219,295**	**236,495**	**252,496**		**Total Liabilities & Stock Equity**	**38,999**	**41,290**	**42,779**	**51,248**
Total Common Shares Outstanding	2952	2900	2800	2821		Total Common Shares Outstanding	542	518	504	501
Stock Price	$106.60	$95.83	$114.49	$140.49		Stock Price	$75.22	$73.00	$110.74	$181.17
Dividends	$2.04	$2.08	$2.12	$2.16		Dividends	$2.44	$2.52	$2.60	$2.68
Statement of Cash Flows	**1/31/2018**	**1/31/2019**	**1/31/2020**	**1/31/2021**		**Statement of Cash Flows**	**1/31/2018**	**1/31/2019**	**1/31/2020**	**1/31/2021**
Cash Flows From Operating Activities						Cash Flows From Operating Activities				
Net Income (Loss)	9,862	6,670	14,881	13,510		Net Income (Loss)	2,934	2,937	3,281	4,368
Depreciation and Amortization	10,529	10,678	10,987	11,152		Depreciation and Amortization	2,445	2,474	2,604	2,485
Other Adjustments to Net Income	3,493	8,376	-1,231	1,919		Other Adjustments to Net Income	111	450	341	528
Changes in Other Operating Activities	1,210	1,734	945	1,521		Changes in Other Operating Activities	192	95	29	86
Change in NC Working Capital						Change in NC Working Capital				
(Increase) Decr. in Receivables	-1,074	-368	154	-1,086		(Increase) Decr. in Receivables	-168	-299	18	-137
(Increase) Decr. in Inventories	-140	-1,311	-300	-2,395		(Increase) Decr. in Inventories	-348	-900	505	-1,661
(Decrease) Incr. in Liabilities	4,457	1,974	-181	11,453		(Decrease) Incr. in Liabilities	1,757	1,216	339	4,856
Net Cash from Operating Activities	**28,337**	**27,753**	**25,255**	**36,074**		**Net Cash from Operating Activities**	**6,923**	**5,973**	**7,117**	**10,525**
Cash Flow from Investing Activities						Cash Flow from Investing Activities				
Capital Expenditures	-10,051	-10,344	-10,705	-10,264		Capital Expenditures	-2,533	-3,516	-3,027	-2,649
Other Investing Cash Flow Items, Total	991	-13,692	1,577	193		Other Investing Cash Flow Items, Total	-542	100	83	58
Net Cash from Investing Activities	**-9,060**	**-24,036**	**-9,128**	**-10,071**		**Net Cash from Investing Activities**	**-3,075**	**-3,416**	**-2,944**	**-2,591**
Cash Flow from Financing Activities						Cash Flow from Financing Activities				
Total Cash Dividends Paid	-6,124	-6,102	-6,048	-6,116		Total Cash Dividends Paid	-1,338	-1,335	-1,330	-1,343
Issuance (Retirement) of Stock, Net	-8,296	-7,410	-5,717	-2,625		Issuance (Retirement) of Stock, Net	-1,046	-2,124	-1,565	-745
Issuance (Retirement) of Debt, Net	-4,496	12,035	-1,071	-5,706		Issuance (Retirement) of Debt, Net	-1,441	-281	-330	65
Other Financing Cash Flows	-959	-1,060	-1,463	-1,670		Other Financing Cash Flows	108	96	73	23
Net Cash from Financing Activities	**-19,875**	**-2,537**	**-14,299**	**-16,117**		**Net Cash from Financing Activities**	**-3,717**	**-3,644**	**-3,152**	**-2,000**
Effect of Exchange Rate Changes	487	-438	-69	235		Effect of Exchange Rate Changes	0	0	0	0
Net Change in Cash & Cash Equivalents	-111	742	1,759	8,273		Net Change in Cash & Cash Equivalents	131	-1,087	1,021	5,934
Cash at Beginning of Period	6,867	7,014	7,756	9,515		Cash at Beginning of Period	2,512	2,643	1,556	2,577
Cash at End of Period	6,756	7,756	9,515	17,788		Cash at End of Period	2,643	1,556	2,577	8,511

Financial Ratios

In addition to this handout, the chapter includes a list of key financial ratios along with their formulas. Also see Explanation of Ratios in Appendix B for explanations and interpretations of these ratios. Note that the ratios covered in this class are a subset of financial ratios and not an inclusive list. Financial ratios are a tool that allows us to use information from the Income Statement and Balance Sheet to look at specific issues associated with a company's financial health. Using the Wal-Mart and Target financial statements, we have prepared ratios for their fiscal years 2017 through 2020. We would encourage you to calculate at least one year of these ratios for practice). Here are the results of all the ratio calculations:

Financial Statements for Walmart & Target from Appendix B

Wal-Mart				
	1/31/2018	1/31/2019	1/31/2020	1/31/2021
Liquidity Ratios				
Current Ratio	0.76	0.80	0.79	0.97
Quick Ratio	0.20	0.23	0.22	0.49
Asset Management Ratios				
Days Sales Outstanding	4.10	4.46	4.38	4.25
Inventory Turnover	8.53	8.70	8.88	9.35
Fixed Asset Turnover	3.45	3.27	3.00	3.44
Total Asset Turnover	2.45	2.35	2.22	2.21
Debt Management Ratios				
Total Debt to Total Assets	22.73%	26.46%	30.63%	25.05%
Debt-to-Equity Ratio	57.52%	72.87%	88.82%	72.26%
Market Debt Ratio	12.87%	17.27%	18.43%	13.76%
Liabilities to Assets	60.48%	63.69%	65.52%	65.33%
Times Interest Earned	7.49	5.88	8.74	9.88
Profitability Ratios				
Gross Profit Margin	25.37%	25.10%	24.69%	24.83%
Operating Profit Margin	3.49%	2.68%	4.34%	4.09%
Net Profit Margin	1.97%	1.30%	2.84%	2.42%
Basic Earnings Power	8.53%	6.30%	9.60%	9.06%
Return on Assets	4.82%	3.04%	6.29%	5.35%
Return on Equity	12.20%	8.38%	18.25%	15.43%
Price Ratios				
PE Ratio	31.91	41.67	21.54	29.34
P/CF Ratio	15.43	16.02	12.39	16.07
Market/Book Ratio	3.89	3.49	3.93	4.53
DuPont Analysis				
Net Profit Margin	1.97%	1.30%	2.84%	2.42%
Total Asset Turnover	2.45	2.35	2.22	2.21
Equity Multiplier	2.530524	2.753786	2.899929	2.884647
ROE	12.20%	8.38%	18.25%	15.43%

Target				
	1/31/2018	1/31/2019	1/31/2020	1/31/2021
Liquidity Ratios				
Current Ratio	0.95	0.83	0.89	1.03
Quick Ratio	0.30	0.20	0.27	0.50
Asset Management Ratios				
Days Sales Outstanding	4.72	5.33	4.50	4.43
Inventory Turnover	5.91	5.61	6.10	6.21
Fixed Asset Turnover	2.72	2.62	2.61	3.07
Total Asset Turnover	1.84	1.83	1.83	1.83
Debt Management Ratios				
Total Debt to Total Assets	29.71%	32.16%	32.20%	29.07%
Debt-to-Equity Ratio	98.96%	117.54%	116.40%	103.17%
Market Debt Ratio	22.14%	26.00%	19.79%	14.10%
Liabilities to Assets	69.98%	72.64%	72.34%	71.82%
Times Interest Earned	6.47	8.97	9.78	6.68
Profitability Ratios				
Gross Profit Margin	28.87%	29.27%	29.76%	29.27%
Operating Profit Margin	6.00%	5.49%	5.97%	6.97%
Net Profit Margin	4.08%	3.90%	4.20%	4.67%
Basic Earnings Power	11.06%	10.02%	10.91%	12.73%
Return on Assets	7.52%	7.11%	7.67%	8.52%
Return on Equity	25.06%	26.00%	27.73%	30.25%
Price Ratios				
PE Ratio	13.89	12.87	17.02	20.77
P/CF Ratio	7.95	7.32	9.90	13.75
Market/Book Ratio	3.48	3.35	4.72	6.28
DuPont Analysis				
Net Profit Margin	4.08%	3.90%	4.20%	4.67%
Total Asset Turnover	1.84	1.83	1.83	1.83
Equity Multiplier	3.330686	3.654953	3.615229	3.54903
ROE	25.06%	26.00%	27.73%	30.25%

When conducting analysis of Wal-Mart, having the financial ratios for Target is critical for comparative analysis (ideally you would use the industry averages, however in this situation Target makes a nice comparison as they are a similar competitor). Also, we have included four years of data so that we can do some trend analysis. Be sure to read the online text for more discussion on trend analysis and comparative analysis. Both trend and comparative analysis are essential for providing some of the context necessary for financial statement analysis. Note that we say “some” of the context, as it is also important to really understand the specific companies under analysis, their strategies, and the overall economy to get the most out of looking at ratios and common size statements.

Common Size Statements

Common Size Statements are designed to present each line item in the income statement as a percentage of total revenues and each line item in the balance sheet as a percentage of total assets. This makes it easier to compare changes from year to year and from one company to the industry. For instance, below you will find common size income statements and common size balance sheets for Wal-Mart and Target. Be sure you understand how these statements are generated.

Financial Statements for Walmart & Target from Appendix B

Wal-Mart						Target				
Income Statement	1/31/2018	1/31/2019	1/31/2020	1/31/2021		**Income Statement**	1/31/2018	1/31/2019	1/31/2020	1/31/2021
Sales	100.0%	100.0%	100.0%	100.0%		Sales	100.0%	100.0%	100.0%	100.0%
Cost of Sales	74.6%	74.9%	75.3%	75.2%		Cost of Sales	71.1%	70.7%	70.2%	70.7%
Gross Operating Profit	25.4%	25.1%	24.7%	24.8%		Gross Operating Profit	28.9%	29.3%	29.8%	29.3%
Selling, General & Admin. Expense	21.3%	20.8%	20.8%	20.8%		Selling, General & Admin. Expense	19.8%	20.9%	20.8%	19.9%
EBITDA	5.6%	4.8%	6.4%	6.1%		EBITDA	9.1%	8.4%	9.0%	9.4%
Depreciation & Amortization	2.1%	2.1%	2.1%	2.0%		Depreciation & Amortization	3.1%	3.0%	3.0%	2.4%
EBIT	3.5%	2.7%	4.3%	4.1%		EBIT	6.0%	5.5%	6.0%	7.0%
Interest Expense	0.5%	0.5%	0.5%	0.4%		Interest Expense	0.9%	0.6%	0.6%	1.0%
Pre-tax Income	3.0%	2.2%	3.8%	3.7%		Pre-tax Income	5.1%	4.9%	5.4%	5.9%
Income Taxes	0.9%	0.8%	0.9%	1.2%		Income Taxes	1.0%	1.0%	1.2%	1.3%
Net Income from Cont. Operations	2.1%	1.4%	2.9%	2.5%		Net Income from Cont. Operations	4.1%	3.9%	4.2%	4.7%
Net Income from Extraordinary Items	-0.1%	-0.1%	-0.1%	0.0%		Net Income from Extraordinary Items	0.0%	0.0%	0.0%	0.0%
Total Net Income	2.0%	1.3%	2.8%	2.4%		**Total Net Income**	4.1%	3.9%	4.2%	4.7%
Balance Sheet	1/31/2018	1/31/2019	1/31/2020	1/31/2021		**Balance Sheet**	1/31/2018	1/31/2019	1/31/2020	1/31/2021
Current Assets						Current Assets				
Cash and Equivalents	3.3%	3.5%	4.0%	7.0%		Cash and Equivalents	6.8%	3.8%	6.0%	16.6%
Receivables	2.7%	2.9%	2.7%	2.6%		Receivables	2.4%	2.7%	2.2%	2.2%
Inventories	21.4%	20.2%	18.8%	17.8%		Inventories	22.2%	23.0%	21.0%	20.8%
Other Current Assets	1.7%	1.7%	0.7%	8.3%		Other Current Assets	0.9%	0.9%	0.9%	0.9%
Total Current Assets	29.2%	28.2%	26.1%	35.7%		Total Current Assets	32.2%	30.3%	30.2%	40.5%
Long Term Assets						Long Term Assets				
Property, Plant & Equipment, Net	56.1%	50.8%	53.7%	43.5%		Property, Plant & Equipment, Net	64.2%	66.6%	66.7%	56.8%
Intangibles	8.9%	14.2%	13.1%	11.5%		Intangibles	2.0%	1.7%	1.6%	1.3%
Other Non-Current Assets	5.8%	6.8%	7.0%	9.3%		Other Non-Current Assets	1.6%	1.4%	1.6%	1.4%
Total Non-Current Assets	70.8%	71.8%	73.9%	64.3%		Total Non-Current Assets	67.8%	69.7%	69.8%	59.5%
Total Assets	100.0%	100.0%	100.0%	100.0%		**Total Assets**	100.0%	100.0%	100.0%	100.0%
Current Liabilities						Current Liabilities				
Accounts Payable	22.5%	21.5%	19.9%	19.5%		Accounts Payable	22.2%	23.6%	23.2%	25.1%
Short Term Debt	4.7%	3.6%	3.5%	2.1%		Short Term Debt	0.7%	2.5%	0.4%	2.2%
Other Current Liabilities	11.1%	10.3%	9.5%	15.1%		Other Current Liabilities	10.9%	10.2%	10.3%	11.9%
Total Current Liabilities	38.4%	35.3%	32.9%	36.7%		Total Current Liabilities	33.8%	36.4%	33.9%	39.3%
Long Term Liabilities						Long Term Liabilities				
Long Term Debt	18.0%	22.9%	27.1%	23.0%		Long Term Debt	29.0%	29.6%	31.8%	26.8%
Deferred Income Taxes	4.1%	5.5%	5.5%	5.7%		Deferred Income Taxes	4.7%	4.9%	5.0%	4.0%
Other Non-Current Liabilities	0.0%	0.0%	0.0%	0.0%		Other Non-Current Liabilities	2.5%	1.8%	1.6%	1.7%
Total Non-Current Liabilities	22.1%	28.4%	32.6%	28.6%		Total Non-Current Liabilities	36.1%	36.3%	38.5%	32.6%
Total Liabilities	60.5%	63.7%	65.5%	65.3%		Total Liabilities	70.0%	72.6%	72.3%	71.8%
Stockholders Equity						Stockholders Equity				
Total Equity	39.5%	36.3%	34.5%	34.7%		Total Equity	30.0%	27.4%	27.7%	28.2%
Total Liabilities & Stock Equity	100.0%	100.0%	100.0%	100.0%		**Total Liabilities & Stock Equity**	100.0%	100.0%	100.0%	100.0%

When you look at these statements, you can quickly see two important pieces of information. First, Wal-Mart has seen their cost of sales increase over the first three years and then decrease in the last year (albeit only slightly) which indicates that Wal-Mart is taking steps to manage their costs. The second item is that Target's cost of sales is much lower than Wal-Mart's each year. These comparisons are much easier to see on a percentage basis than they would be when just looking at the dollar values in the original financial statements. As a potential investor (or management), the next step would be to try to understand what is driving this. Is Wal-Mart doing a better job of negotiating terms with suppliers? Is there ordering and distribution system resulting in more efficient inventory management? Are they able to raise prices slightly? Is Target more efficient than Wal-Mart with respect to inventory costs or are they able to charge higher prices? Remember that financial statement analysis doesn't really identify and fix specific problems. Instead, it is a starting point that tells us where there MIGHT be a problem. Once we dig deeper we can then identify if there is a problem and how we might go about trying to address it. We will come back to these specific concerns with cost of sales in a little bit.

One issue that you will often find when developing common size statements for comparative analysis is that most companies follow slightly different formats for their income statements and balance sheets. In order to create common size statements for comparative analysis, there are two approaches. One is to obtain financial statements from a source such as finance.yahoo.com (as I did for this handout) which standardize all financial statements into a standard format. Alternatively, you can obtain the financial statements from each firm's annual report and make your own judgments as to how to form them into a standard format. While the first approach is easier, if you are doing a formal financial statement analysis, it is essential that you do read through the financial statements in their annual report rather than just pull up the statements from a source like Yahoo!Finance. The reason for this is that the annual report will explain all the accounting issues associated with the numbers so that you can better understand the story behind the numbers.

Analysis Using Financial Ratios and Common Size Statements

Conducting financial statement analysis using ratios and common size statements is as much of an art form as it is a science. These tools provide us with a quick way to skim the surface and identify areas that need to be explored in further detail. Contrary to popular opinion, the ratios and common size statements are the **STARTING** points for identifying strength/weaknesses, not the **ENDING** points. They help raise red flags over stuff that needs further investigation and identify **POTENTIAL** strengths and

weaknesses. There are many reasons why something that appears to be a weakness may not really be a problem for the firm or something that appears to be a strength be more illusion than real competitive advantage. As has been stated a few times previously, it is critical that you understand the story behind the numbers (the context) in order to adequately use them.

A Quick Example of Ratio/Common Size Analysis for Wal-Mart

Let's look at Wal-Mart and do a quick glance for potential strengths and weaknesses using ratios and common size statements.

Potential Weaknesses

Selling, General and Administrative Costs

Over the four-year time frame, Wal-Mart has seen their SGA costs decrease from 21.3% of sales to 20.8% of sales. While this is not a huge movement, keep in mind these lower costs directly impact the final margin. As Wal-Mart's net profit margin was 2.4% or more each of the last two years, it is easy to see that this decline in SGA expenses is having a noticeable impact on the bottom line. Also, while Wal-Mart had more than a 150-basis-point (100 basis points = 1%) disadvantage in SGA relative to one of their larger rivals (Target) at the start of the analysis period, it was able to close the gap in the following years. This is another indication that SGA costs are a concern for Wal-Mart. Now, the key is to figure out why these costs are declining. Is it a sign of efficiency or is Wal-Mart intentionally decreasing spending in this area but lose other advantages?

Accounts Payable

We want to be careful calling this a "weakness" as having higher accounts payable could be a sign that we are struggling to repay our inventory purchases or it could be a strategy to improve our cash flow (by hanging onto our cash a little longer). However, the fact remains that the accounts payable as a percent of assets has been increasing over the last few years. It would be worthwhile for analysts to get a good understanding of why.

Profitability Ratios

As mentioned earlier, Wal-Mart has seen its SGA expenses decline as a percentage of sales. This in turn has had a positive impact on their profitability ratios. The net profit margin (which we can see as both a ratio or in the common size statements) has improved (albeit in a volatile way) over the four-year window. Their return on assets and return on equity have also increased over this time-period. While we know the key reason for the increase in profitability (lower SGA expenses) it is not clear whether the trend can continue. That said, awareness of the issue can be useful to management/investors.

Net Income

Wal-Mart has seen their net income decline by more than 30% in FY2018 with a dramatic rebound in FY2019 and FY2020. While part of the volatility can be explained by the COVID-19 pandemic, this is still something that should draw the attention of both management and current/potential stockholders.

Potential Strengths

Days Sales Outstanding

If we look at Wal-Mart's DSO ratio, we can see a couple of things. First, the ratio itself is quite low as it takes them less than 5 days on average to collect their credit sales. Second, it also has declined over the past few years.

Inventory Turnover

Wal-Mart has seen their inventory turnover ratio increase slowly over each of the past four years. Importantly, it is also significantly higher than one of their primary competitors (Target). This indicates that Wal-Mart does a good job of moving through their inventory and not building up excess inventory. Maintaining a high inventory turnover ratio helps avoid spoilage costs and frees up financing costs as the firm has less time with "dead" money invested in inventory that is either sitting on store shelves or in the warehouse.

Fixed and Total Asset Turnover

While there is a slight downtrend in the asset turnover ratios, the real advantage is seen in comparison to Target. Wal-Mart does a much better job of generating sales from its investment into assets. One thing that should be noted is that some of this could be tied

to strategy. Remember that Wal-Mart had a notably higher cost of sales than Target did. One explanation for this is that Wal-Mart is pursuing a lower-margin, higher-turnover strategy while Target is pursuing a higher-margin, lower-turnover strategy. This is not an argument that one strategy is better than another, but instead is a way for the two firms to create a little differentiation in their markets.

Cash Flow from Operating Activities

While Wal-Mart's net income has declined noticeably over the past two years, their cash flow from operating activities has increased rather significantly over the past three years. Given some of our issues with net income, this may be more relevant. On the other hand, it may be a little misleading. For example, over the past year, Wal-Mart has seen their inventory drop by a little over a billion dollars and their liabilities increase by about $5.5 billion. Are those sustainable changes? Probably not. This may lessen the importance of the increase in cash flow from operating activities over the past year and without those changes, we could be looking at a net decline over the past two years.

Other

From the cash flow from financing activities portion of the statement of cash flows, we can see that both firms have been active in buying back shares of their own stock over the past few years. This is not a strength or weakness, but a way to return cash to shareholders (in that these firms use buybacks as a partial substitute to paying higher cash dividends).

Similarly, both companies have been engaged in retiring their debt over the past few years, although Wal-Mart had a big net increase in debt in FY 2018. The fact that cash flow from operating activities has been significantly higher than the outlays these firms have allocated to cash flow from investing activities, they have had significant ability to pay dividends, buy back shares of stock, and pay back portions of their long-term debt.

Other Issues with Financial Statement Analysis

Seasonality

When dealing with quarterly financial statements, we must be aware that many firms face seasonal patterns that can cause the numbers to behave strangely. Be careful to compare quarter one of this year with quarter one of last year instead of the previous quarter when you have significant seasonality.

Quarterly income statements, quarterly balance sheets, and annual balance sheets all have seasonality. When calculating ratios using inputs from any of these statements, we must be aware of seasonality.

While firms in the same industry will often have similar seasonal patterns, it is important to watch the fiscal year. A fiscal year is different from the calendar year and some firms end their fiscal year at the end of December while others end their fiscal year at the end of January or March. If firms have different fiscal years, their ratios and common size statements may not be comparable.

Accounting differences

While all firms use GAAP, there is a lot of flexibility in applying GAAP. Different depreciation approaches, inventory methods, etc. can cause two firms with similar levels of business activity appear to have different levels of profitability. The better you understand financial accounting, the better you will be able to dig into a company's financial statements and understand exactly how comparable the ratios are across firms.

Industry differences are not always clear

While Wal-Mart and Target have a lot of overlap in their primary business activities, they also have some differences. Be careful when comparing firms that the difference in the ratio or common size statement is not caused by non-comparable differences. This is where a thorough understanding of the company comes in. We discussed above how the differences in cost of sales and turnover ratios could be related as much to strategy differences as they are to differences in the underlying performance. The best way to find out about this is read each company's annual/quarterly reports (10-K and 10-Q), listen to conference calls made during quarterly earnings announcements, and pay attention to all aspects of the companies. Good financial statement analysis involves a lot of digging and attention to detail, not just number crunching.

When dealing with large, dominant firms, it is difficult to compare them to industries because they may dominate the industry and/or operate in many different industries. This is why it may be better to compare Wal-Mart to Target rather than industry

averages. If I compare Wal-Mart to the industry average, those numbers are going to be heavily influenced by Wal-Mart's numbers as Wal-Mart makes up a large portion of the industry.

Numbers can be difficult to interpret

Consider the low current ratios for Wal-Mart (and Target as well). They appear to be struggling to meet their liquidity demands when looking at the current ratio. However, one of the reasons for a low current ratio is that they have high inventory turnovers and they know that they will quickly be able to generate the cash necessary to pay off their current liabilities. Another issue is that they are a very profitable company with predictable cash flows, so they don't need much of a cash "cushion" to keep them safe from downturns. This allows them to move more cash into long-term assets which earn a higher return or to return that cash to investors through dividends and stock buybacks. What appears to be a liquidity problem, is likely more of a strategic decision to keep current assets low and invest more capital into long-term assets which can be more productive.

Rear view mirror

Finance focuses on future expectations and financial statements describe past performance. This does not mean that financial statement analysis is meaningless. It is hard to understand where you are going if you don't know where you have been. Financial statement analysis can help us see potential problems as they are developing so we can correct them (if we are management) or avoid them (if we are investors). However, we must be aware that things can change quickly in the business world. What was a strength six months ago when the financial statements were prepared may very well be a weakness today. Always be digging for new, updated information to avoid being blindsided by major, unexpected changes when new financial statements are released.

Companies change management and corporate strategies. New competitors enter the industry or existing competitors leave the industry. Technology and legal aspects change. Economic conditions change. All of these things can make it hard to use past financial statements to make forecasts about the future. Again, it doesn't mean that we ignore financial statement analysis. Instead it means we must be aware of the limitations and recognize that the numbers are a part of the story and not the story itself.

Context is critical

Any financial ratio without the proper context is close to meaningless. Think of the following analogy. Imagine you go into a doctor for a health checkup. One important piece of information for the doctor is your weight. However, if the doctor were to see a chart of "Patient X" and find out that the patient is 150 pounds, that information by itself is not very valuable. Is the patient a 6'6" 30-year old male or a 4'2" 12-year old female? Did the patient weight 135 pounds, 150 pounds, or 200 pounds 6-months ago? All of the vital information that the doctor collects (temperature, allergies, symptoms, blood pressure, etc.) are used together to help diagnose the health of the patient. Any one of these pieces of information without context is not very useful by itself. Financial ratios are very similar.

Ratios and Common Size Statements are **INITIAL** diagnostic tools

Similar to the item above regarding context, a medical analogy is helpful. When you go into a doctor with a set of symptoms, the doctor gathers information on you and your symptoms to get an idea of what **MIGHT** be wrong. Then, unless it is something common, the initial diagnosis is used as the basis for further testing and examination to find out what is really wrong. Ratios and common size statements are similar. They can be used to raise "red flags", but we want to be careful to remember that they identify areas that need further investigation more than they clearly identify strengths and weaknesses.

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13.3: Financial Statements from Walmart and Target (CH 2)

The combined financial statements can be downloaded using this link

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13.4: Financial Statements for Joe's Gadgets (CH2)

Income Statement

	2016	2017
Sales	15,000,000	20,000,000
COGS	6,000,000	11,000,000
S&A Expenses	3,000,000	3,500,000
Depreciation	2,000,000	2,500,000
EBIT (Operating Income)	4,000,000	3,000,000
Taxes (30%)	900,000	450,000
Net Income	2,100,000	1,050,000
Number of Shares	2,000,000	2,000,000
EPS	$1.05	$0.525
Dividends per Share	$0.50	$0.50
Stock Price	$25.00	$17.50

Balance Sheet

	2016	2017
Cash	3,000,000	3.,050,000
A/R	2,000,000	4,000,000
Inv.	2,000,000	4,000,000
Cur. Assets	7,000,000	11,050,000
Net Prop, Plant & Equip	10,000,000	11,000,000
Total Assets	17,000,000	22,050,000
A/P	2,500,000	3,500,000
Accruals	1,500,000	2,000,000
Notes Payable	500,000	1,500,000
Cur. Liabilities	4,500,000	7,000,000
Long-Term Debt	5,500,000	8,000,000
Total Liabilities	10,000,000	15,000,000
Common Stock	1,000,000	1,000,000
Retained Earnings	6,000,000	6,050,000
Owners Equity	7,000,000	7,050,000
Tot. Liab. & O.E.	17,000,000	22,050,000

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13.5: Table- Future Value of a $250 per month investment (CH3)

The table below represents the Future Value of a $250 per month investment that was discussed in Chapter 3.

Table: Future Value of $250 per month investment

Years/Rate of Return	5%	10%	15%
1	$3,069.71	$3,141.39	$3,215.09
5	$17,001.52	$19,359.27	$22,143.63
10	$38,820.57	$51,211.24	$68,804.26
15	$66,822.24	$103,617.59	$167,126.69
20	$102,758.42	$189,842.21	$374,309.87
25	$148,877.43	$331,708.35	$810,882.40
30	$208,064.66	$565,121.98	$1,730,819.90
35	$284,023.11	$949,159.51	$3,669,295.04
40	$381,505.04	$1,581,019.90	$7,754,013.69
45	$506,609.32	$2,620,625.43	$16,361,256.65
50	$667,162.99	$4,331,097.70	$34,498,278.44

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13.6: Setting up Your Financial Calculator (CH3)

Introduction



Financial calculators are tools that help us solve time value of money calculations. The advantage of calculators is that they are much more convenient than using tables or direct formulas. Also, by being more convenient, we are less likely to make mistakes. However, if you don't know how to set-up your calculator or how to use it, it becomes almost worthless. The main body of the Chapter Three notes walks through how to solve different problems on your financial calculator, but this page is focused exclusively on how to set up your calculator to deal with things like non-annual compounding periods, annuity dues (annuities with payments coming at the beginning of the period), and changing the decimal display. While there are many different types of financial calculators and each is set up differently, this page will focus on three specific calculators — the HP10BII+, the TI-BAII+, and the TI-83 or TI-84. If you have a different financial calculator, refer to the manual.

Setting Periods Per Year

If you are buying your calculator new, it is likely set to 12 periods per year (monthly). However, many things we do are designed to be done on an annual basis (1 period per year). As different problems will have different payment schemes, you need to be able to change the periods per year on your calculator. The following steps will walk you through changing your periods per year. Note that when you make a change in periods per year it will stay that way until you change it back. It is a good idea to always reset it to annual periods after doing a non-annual problem.

HP10BII+

1. To set your periods per year to 1 — 1 SHIFT P/YR (Note — The shift refers to the yellowish/orange shift key)
2. To set your periods per year to 12 — 12 SHIFT P/YR
3. You can also do this for weekly (52), daily (365), or any other compounding pattern.

TI-BAII+

1. To set your periods per year to 1 — 2nd P/Y 1 ENTER
2. To set your periods per year to 12 — 2nd P/Y 12 ENTER
3. You can also do this for weekly (52), daily (365), or any other compounding pattern.

TI-83 or TI84

1. You can set your periods per year in the on-screen 5-key application. Near the bottom of the screen, you will see a P/Y= and a C/Y=. These stand for periods per year and compounding periods per year — in this class, these will always be equal to one another.
2. If you are dealing with annual cash flows, just set P/Y=1 and C/Y=1 before solving.
3. If you are dealing with non-annual periods, just set P/Y to the appropriate periods per year (12 for monthly, 52 for weekly, etc.) and the C/Y will automatically adjust.

Setting BEGIN/END of Period

An ordinary annuity (the most common type) assumes all payments come at the end of the each period. Some types of annuities (annuity due) assume that all payments come at the start of each period. For an ordinary annuity, you must set your calculator to END and for an annuity due, you must set your calculator to BEGIN. As with the payments per year, once you set your calculator to either BEGIN or END, it will stay that way until you set it back.

HP10BII+

By pressing SHIFT BEG/END you toggle your calculator back and forth between BEGIN and END. If the calculator is in BEGIN mode, you will see the word BEG on the bottom center of your screen.

TI-BAII+

By pressing 2nd BGN you activate the BEG/END toggle on your calculator. At this point, either END or BEG will show on your screen. To change from the current setting shown on your screen, press 2nd SET. The 2nd SET command will toggle back and forth between BEG and END. If the calculator is in BEGIN mode, you should see BGN in the upper right hand corner of your screen.

TI-83 or TI-84

Like the Periods per year, this is part of the onscreen 5-key application. The very last line on the screen is “PMT: END BEGIN”. Just highlight the option you want (END unless the problem specifically states that payments come at the beginning of each period).

Changing Decimal Places

Both of the financial calculators are initially set to round to two decimal places. If you want to go beyond two decimal places (which you will at times), you must change the display to show more decimal places. The HP10BII+ can show up to 9 decimals and the TI-BAII+ can show up to 8. It is recommended for this class to set your calculator to the maximum decimal display.

HP10BII+

To display 9 decimals, press SHIFT DISP 9. If you wanted to convert back to 2 decimals, you could do SHIFT DISP 2. This works for any number of decimals between 0 and 9.

TI-BAII+

To display 8 decimals, press 2nd FORMAT 8 ENTER. If you wanted to convert back to 2 decimals, you could do 2nd FORMAT 2 ENTER. This works for any number of decimals between 0 and 8.

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13.7: TVM 5-Key Approach Guided Tutorials with TI-BAII+ (CH3)



Most of TVM analysis on your Financial Calculator can be done with the 5-key approach. The five keys are as follows

N ⇒ This key refers to the number of periods

I/Y ⇒ This key refers to the interest rate (do not enter as a decimal ⇒ 10% would be 10 not 0.10). Sometimes this interest rate is referred to as a discount rate or rate of return.

PV ⇒ This key refers to the Present Value

PMT ⇒ This key refers to the Annuity Payment

FV ⇒ This key refers to the Future Value

When entering values into your financial calculator you press the value you are entering first, then the key. For example, if we want to put in 10 periods, we would enter this as 10 N. Sometimes you will need to enter a negative value. To do this, you must use the "+/-" key on your calculator instead of the "–" key. The order that you enter the variables doesn't matter as long as you enter the four that you know first, and then solve for the fifth. To solve, you just press the Compute (CPT) key and then the key representing what you are trying to find. Now let's go through several examples.

EXAMPLE ONE – Future Value of a Single Cash Flow

You are investing $10,000 today and want to know how much you will have after 6 years if you earn a 7% rate of return over the 6-year time frame. Since you are starting with $10,000, that is your present value. You have 6 years, so the number of time periods is 6. The 7% rate of return means you have a 7% interest rate. In this example we are not using an annuity, so we are going to set the Annuity Payment to zero.

6 N
7 I/Y
10,000 PV
0 PMT
CPT FV -15,007.30

Thus, you will have $15,007.30 at the end of the 6th year. Notice that the answer came out negative instead of positive. This is due to the way the calculator "thinks" when it is solving TVM problems. The calculator needs to keep track not only of the dollar amounts, but which way the money is flowing. Because you entered the Present Value (PV) as $10,000, the calculator assumed you were receiving $10,000. If you receive $10,000 today, the only way for the problem to "balance out" is for you to give back $15,007.30 at the end of the 6th year. In a problem like this you can just ignore the negative sign in front of the $15,007.30. However, there are certain problems where this is important. Specifically – IF YOU ENTER NON-ZERO VALUES FOR TWO OR MORE OF THE CASH FLOW KEYS (THE CASH FLOW KEYS IN THE 5-KEY APPROACH ARE THE PV, PMT, AND FV KEYS), YOU MUST BE CAREFUL OF CASH FLOW SIGNS. In our example, we only entered 1 non-zero value for a cash flow (the $10,000 PV), so the sign doesn't matter. We will reintroduce this in a little bit.

PRACTICE PROBLEM ONE

You are investing $400 today and want to know how much you will have after 45 years if you earn a 9.5% rate of return over the 45-year time period. The solution to this and other practice problems can be found at the end of this tutorial.

EXAMPLE TWO – Present Value of a Single Cash Flow

You are going to receive $6000 in 5 years. Assuming a 9% discount rate, what is this worth to you today?

5 N
9 I/Y
0 PMT
6000 FV
CPT PV -3899.59

Again, we can ignore the negative sign in the answer (since the only non-zero cash flow that we entered was the $6000 Future Value). Thus, $6000 received in 5 years is only worth $3899.59 today (assuming a 9% discount rate). In other words, we are indifferent between receiving $3899.59 today and receiving $6000 in 5 years – they both are worth the same to us. Alternatively, we would be willing to pay $3899.59 or less to receive $6000 in 5 years, but we would NOT be willing to pay any more than $3899.59. The reason for this is that if we invested $3899.59 today and let it compound for 5 years at 9%, it would grow to $6000 at the end of the 5th year. Present value will be an important concept in valuation because most investments are structured in a manner that we pay a set amount today to receive cash flows in the future. Once we know what those future cash flows are worth to us today, we can evaluate the investment.

PRACTICE PROBLEM TWO

You are offered an opportunity to make an investment today that will pay you $100,000 in 20-years. Assuming a 5% discount rate, what is the most you would be willing to pay for that investment today?

ANNUITIES

An annuity is a sequence of equal, periodic cash flows. Many financial situations can be modeled as an annuity. For instance, calculating a mortgage payment on a home is an annuity. Simple retirement analysis can be structured as an annuity. Also, bond valuation is partially modeled as an annuity since we receive a fixed coupon payment each year. With annuities, we assume cash flows come at the end of each period. Note that there is a variation referred to as an "Annuity Due" that assumes cash flows come at the BEGINNING of the period. We will not work with Annuity Due situations in text, however it is relatively simple to do so by making a simple adjustment to your calculator. We will include a sample example to illustrate this, however, in this textbook we will assume cash flows come at the end of each period in all of our annuity problems.

EXAMPLE THREE – Lottery Jackpot

Assume you have just won a $10 Million Lottery Jackpot. However, instead of paying you the $10 Million up front, you have the choice of receiving $5 Million today or $400,000 per year at the end of each year for the next 25 years. Assuming a 6% discount rate, which would you prefer? In order to answer this, you need to find the PV of the $400,000 per year for 25 years. This is done as follows:

25 N
6 I/Y
400,000 PMT
0 FV
CPT PV 5,113,342.46 (Note that we dropped the negative sign)

Since the annuity is worth more than $5 Million to us, we would prefer to take the $400,000 per year for the next 25 years.

EXAMPLE THREE A – Lottery Jackpot Annuity Due (OPTIONAL)

Since many lotteries actually give you your first installment TODAY if you take the installment plan, we could make the example more realistic by assuming the prize was paid as $400,000 per year at the BEGINNING of each year for the next 25 years and leave

everything else the same. To adjust your calculator for this, you need to set it up to work with beginning of period payments. To do so, do the following:

2nd BGN 2nd SET ENTER

When you do this, you should see the letters "BGN" show up on the upper-right of your calculator screen to show you that your calculator is set for beginning of period payments. When you press 2nd BGN it activates the mode to change from BGN to END. Then 2nd SET toggles back and forth between BGN and END. Press the CE/C key a couple of times to clear it and you are ready to go.
Now repeat the calculation from the Example Three

25 N
6 I/Y
400,000 PMT
0 FV
CPT PV 5,420,143.01 (Note that we dropped the negative sign)

So, with beginning of period payments the jackpot is worth more to us (since we start receiving our money earlier). Now, set your calculator back to end of period payments so that you don't end up with the wrong answer on all your other problems. To set it back, just toggle the BEG/END mode again as follows:

2nd BGN 2nd SET ENTER

PRACTICE PROBLEM THREE

You are offered an investment that pays you $1000 per year for the next 30 years. Assuming a 10% discount rate, what is this investment worth to you today?

EXAMPLE FOUR – I want to be a Millionaire

You want to become a millionaire and plan to do so through a savings/investment plan. Assuming you want to reach your goal in 20 years and anticipate earning a 10% rate of return, how much must you save at the end of each year in order to reach your goal?

20 N
10 I/Y
0 PV
1,000,000 FV
CPT PMT $17,459.62

This means you will need to save $17,459.62 per year in order to achieve your goal.

PRACTICE PROBLEM FOUR

Since saving $17,459.62 per year is not realistic for most of us, let's try some adjustments. Calculate how much you would need to save under the following conditions

1. 30 years at 10%
2. 40 years at 10%
3. 30 years at 7.5%
4. 30 years at 5%

Note the large difference that time and rate of return make on savings. Having a short savings horizon or earning a low rate of return mean you must save considerably more each year to reach the same goal. This is especially important for retirement planning.

EXAMPLE FIVE – Changing Periods per Year

Now assume that you want to accumulate $1 million in 30 years, but instead of saving each year, you are going to save every two weeks (we will earn a 10% annual rate of return). There are 26 2-week periods in each year, so now you have to adjust your calculator to work with 26 periods per year. You can do this as follows:

2nd P/Y 26 ENTER

Now your calculator will recognize that you are not making annual contributions to your savings plan, but instead making a contribution every other week. Another issue when you change the number of periods per year is to recognize that the N key stands for periods and not necessarily years. Since all of our previous examples were done using 1 P/Y, the number of periods and years were the same. However, now 1 year will have 26 periods. Therefore, 30 years is equivalent to 780 periods (calculated by taking 26 times 30). Now that our adjustments have been made, we are ready to enter the problem into our calculator.

780 N
10 I/Y
0 PV
1,000,000 FV
CPT PMT $202.75

If we save $202.75 every two weeks for the next 30 years and earn a 10% rate of return, we will have $1,000,000 at the end of the 30th year.

PRACTICE PROBLEM FIVE

Repeat the above example, but now assume weekly payments (52 weeks per year) instead of payments every two weeks. Once you are done, figure out how much you are saving per year under both the once per week and once every other week alternatives and compare this to the answer we got in Practice Problem Four-1. Why are the answers different? (NOTE – Remember to reset your calculator to 1 period per year after you finish this problem).

EXAMPLE SIX – Solving for Interest Rates

Let's keep working with the goal of becoming a millionaire. However, instead of calculating how much you must save, we'll assume you can save $3000 per year and want to find the rate of return you will need to earn to reach your goal. This time we will give ourselves 35 years of saving $3000 per year.

35 N
0 PV
-3000 PMT
1,000,000 FV
CPT I/Y 10.89%

If we can save $3000 per year at the end of each year for the next 35 years, we will need to earn a 10.89% rate of return in order to become a millionaire. There is a very important step in this that must be done in order to get the right answer. Note that we made the annuity payment equal NEGATIVE 3000 instead of 3000. This is because we are now entering 2 non-zero values into our cash flow keys (PV, PMT, FV). When enter 2 or 3 non-zero values into our cash flow keys, we need to be careful with the signs of the cash flows. The signs indicate the direction of the cash flow. A negative sign indicates that the cash flow is flowing away from us. In this case, we are saving $3000 per year so we are giving up that amount and making it negative. At the end of the 35 years, we will receive back $1,000,000 so that is positive.

PRACTICE PROBLEM SIX

What rate of return would you need to earn if you were able to save $4500 per year each year for the next 35 years in order to become a millionaire?

EXAMPLE SEVEN – Combining PMT, FV, and PV

Here is one last variation on our millionaire example. This time, instead of starting with nothing, let's assume that we already have $40,000 and plan to save an additional $3000 per year over the next 35 years. Now, what rate of return must we earn in order to accumulate $1,000,000 at the end of the 35th year?

35 N
-40,000 PV
-3000 PMT

1,000,000 FV
CPT I/Y 7.63%

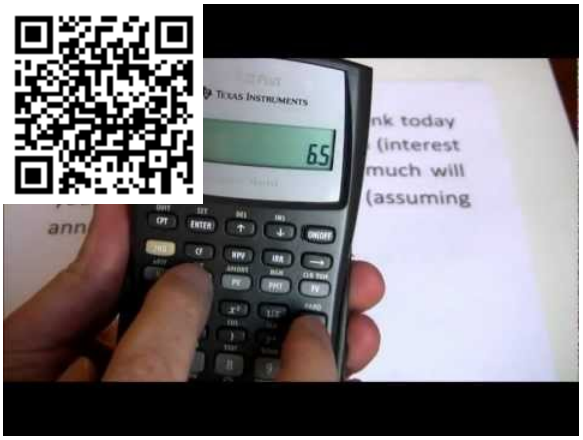
Note that here, we must make both the Present Value and the Annuity Payment negative as they both are flowing away from us into the savings plan. The Future Value will flow back to us at the end of the time period so it is positive.

PRACTICE PROBLEM SEVEN

You want to retire a millionaire and have accumulated $20,000 which you are putting into your retirement plan. In addition, you plan to earn a 9% rate of return. How much must you save PER MONTH over the next 35 years in order to reach your goal?

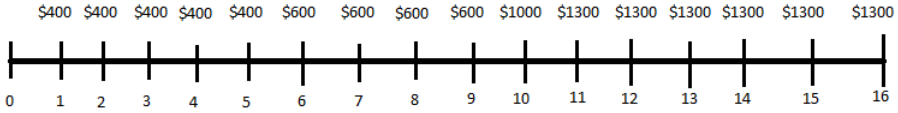
Video: [Introduction and 5-Key Approach (TI-BAII+)]





EXAMPLE EIGHT – Uneven Cash Flow Stream – Present Value

Assuming a 6.5% discount rate, solve for the present value of the following cash flow stream.



Here we can no longer use the 5-key approach (technically, we CAN…it would just be a lot more tedious). Instead we want to move to the cash flow worksheet on our financial calculator. The cash flow worksheet for the TI-BAII+ follows a basic 4-step process:

1. Clear out any previous values in your cash flow worksheet
2. Enter the cash flows and frequencies in your cash flow worksheet starting with year 0
3. Enter the discount rate
4. Solve for present value

Let's walk through this process with keystrokes using the example above:

1. CF 2nd CLR Work (this enters the cash flow worksheet module and then clears out the previous values from the worksheet)

2. 0 ENTER ↓ (this enters the CF0 which in this example is 0. Note that it will not always be zero and could have either a positive or negative value)
3. 400 ENTER ↓ (this enters the first cash flow sequence)
4. 5 ENTER ↓ (this enters the first cash flow frequency. Notice that before you pressed the 5 ENTER ↓, the onscreen display showed F1 = 1 to indicate that the default frequency is 1.)
5. 600 ENTER ↓ (this enters the second cash flow sequence)
6. 4 ENTER ↓ (this enters the second cash flow frequency)
7. 1000 ENTER ↓↓ (this enters the third cash flow sequence and accepts the default frequency of 1. Note the second down arrow which just moves us past the third frequency and sets us up for the next cash flow sequence)
8. 1300 ENTER ↓ (this enters the fourth cash flow sequence)
9. 6 ENTER (this enters the fourth – and final – cash flow frequency. Note that there is no down arrow after this as there are no more cash flows to enter. Don't worry if you hit a down arrow…it doesn't hurt anything, but is just not necessary)
10. NPV 6.5 ENTER ↓ (pressing the NPV button gets the calculator to ask for the discount rate. The onscreen display should say I = . This is where you put in the discount rate of 6.5% and then ENTER ↓ to move to the next – and final – step)
11. CPT (this calculates the answer. While the onscreen display will say NPV = before you press the CPT button, you won't have the correct answer until you press CPT to actually perform the calculation. Your final answer here should be $7,047.87.)

Note that the sum of your frequencies should add up to the length of the timeline (5+4+1+6 = 16). If not, you miscounted somewhere along the way.

EXAMPLE NINE – Uneven Cash Flow Stream – Future Value

We can use a similar process to solve for the future value of an uneven cash flow stream. However, we will start by doing the exact same steps we did to get the present value. The reason is that to get the future value of an uneven cash flow stream we first (A) solve for the present value of the cash flow stream and then (B) figure out what that value will grow to over the time horizon. So, if the problem would have given you the same cash flow stream as above, but instead asked what it would be worth as of year 16 (the end of the time horizon). As we found above, the present value of the cash flow stream (what is worth today) is $7047.87. So, if we want to know what the cash flow stream is worth in year 16, we just bring the present value ($7047.87) forward 16 years at the 6.5% rate of return using the 5 key approach as follows:

16 N
6.5 I/Y
7047.87 PV
0 PMT
CPT FV -19,304.19

This tells us that the value of the cash flows will grow to $19,304.19 at the end of the 16 year time horizon if we can invest them to earn a 6.5% rate of return. Note that the PV of an uneven cash flow stream will always be less than the sum of all the individual cash flows ($13,200 in this example) and the FV of an uneven cash flow stream will always be more than the sum of all the individual cash flows.

EXAMPLE TEN – Uneven Cash Flow Stream – Rate of Return

Assume you could buy the cash flow stream in this example for $6000 today. Based on this, what would your rate of return be? To do this, we will use the IRR function on the calculator with the cash flow worksheet. This is similar to what we did above for NPV with two major changes. First, our CF0 is now the initial investment (-6000) and is negative because it is a cash flow. Second, instead of initiating the solve process by pressing the NPV and putting in the discount rate, we press the IRR and then CPT to get the discount rate. So, it looks like this:

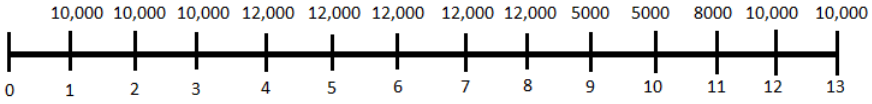
1. CF 2nd CLR Work
2. -6000 ENTER ↓
3. 400 ENTER ↓
4. 5 ENTER ↓
5. 600 ENTER ↓

6. 4 ENTER ↓
7. 1000 ENTER ↓↓
8. 1300 ENTER ↓
9. 6 ENTER
10. IRR CPT (this calculates the answer. While the onscreen display will say IRR = before you press the CPT button, you won't have the correct answer until you press CPT to actually perform the calculation…it may take a couple seconds. Your final answer here should be 8.39%.)

One of the most common mistakes we see on this type of problem is people putting the CF0 in as a positive value which will result in an error (no solution). The 8.39% represents the average annualized rate of return we earn over the 16 year time horizon on our $6000 investment.

PRACTICE PROBLEMS EIGHT, NINE AND TEN

Assuming a 12.5% discount rate, solve for the present value and future value of the following time line. Also, assuming you could buy the cash flow stream for $80,000, what would your rate of return be?



Video: Uneven Cash Flow Streams (TI-BAII+)



EXAMPLE ELEVEN – Effective Annual Rate

You are offered the choice of 7.8% compounded quarterly or 7.6% compounded daily. Which is a better investment (assuming both have the same risk)? In order to address whether we are better with the higher interest rate compounded less frequently or the lower interest rate compounded more frequently, we need to make them stable comparison by converting both to their annual compounding equivalent. We do this with the effective annual rate. It can be done with a formula or your financial calculator. If we use the formula, it looks like this:

keff=(1+knomm)m−1����=(1+�����)�−1

where

k_{eff} represents the annual equivalent
k_{nom} represents the nominal or stated interest rate
m represents the number of compounding periods per year

Plugging in our values for the 7.8% compounded quarterly we would get:

keff=(1+0.0784)4−1����=(1+0.0784)4−1
keff=(1.0195)4−1����=(1.0195)4−1
keff=1.0803−1����=1.0803−1
keff=0.0803����=0.0803
keff=8.03%����=8.03%

And for the 7.6% compounded daily we would get:

keff=(1+0.076365)365−1����=(1+0.076365)365−1
keff=(1.000208219)365−1����=(1.000208219)365−1
keff=1.0790−1����=1.0790−1
keff=0.0790����=0.0790
keff=7.90%����=7.90%

In this case, the 7.8% compounded quarterly is better. If using the formulas, be sure to (A) carry out your calculations to several decimal places (or better yet, don't round at all until you are done), (B) plug in rates into the formula as decimals, and (C) round your final answer to 2 decimal places in percentage terms. You can also do this with the financial calculator as follows:

2nd I Conv (this activates the interest conversion module – note it is the shift of the 2 key)

7.8 ENTER ↓↓ (when you enter the interest conversion module, your onscreen display should read NOM = . This is asking for the nominal interest rate which you enter as the 7.8. Once that is entered, you need to scroll down twice to get to the compounding periods per year screen.)

4 ENTER ↑ (the 4 is the compounding periods per year for quarterly. Once you enter that, you need to scroll up one to get to the effective annual rate screen)

CPT (once you are on the effective annual rate screen, just press CPT to get your final answer of 8.03%.)

For the 7.6% compounded daily it is:

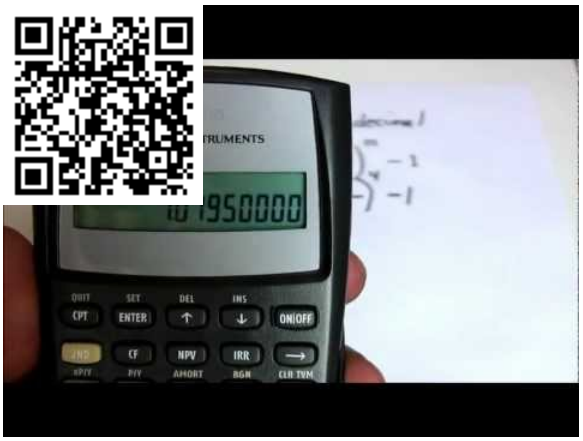
2nd I Conv
7.6 ENTER ↓↓
365 ENTER ↑
CPT

This will give you your answer of 7.90% indicating that it is better to take 7.8% compounded quarterly than 7.6% compounded daily.

PRACTICE PROBLEM ELEVEN

You are offered investments of 12% compounded annually, 11.75% compounded quarterly, or 11.5% compounded weekly. Assuming the same risk, which would you prefer?

Video: Effective Annual Rates (TI-BAII+)



PRACTICE PROBLEM SolutionS

Practice Problem 1

45 N
9.5 I/Y
400 PV
0 PMT
CPT FV $23,751.74

Practice Problem 2

20 N
5 I/Y
0 PMT
100,000 FV
CPT PV $37,688.95

Practice Problem 3

30 N
10 I/Y
1000 PMT
0 FV
CPT PV $9,426.91

Practice Problem 4A

30 N
10 I/Y
0 PV
1,000,000 FV
CPT PMT $6,079.25

Practice Problem 4B

40 N
10 I/Y
0 PV
1,000,000 FV
CPT PMT $2,259.41

Practice Problem 4C

30 N
7.5 I/Y
0 PV
1,000,000 FV
CPT PMT $9,671.24

Practice Problem 4D

30 N
5 I/Y
0 PV
1,000,000 FV
CPT PMT $15,051.44

Practice Problem 5

Set Calculator to 52 Periods Per Year ⇒ 2nd P/Y 52 ENTER
Calculate Number of Periods ⇒ 52 x 30 = 1560
1560 N
10 I/Y
0 PV
1,000,000 FV
CPT PMT $101.07

*Remember to set your calculator back to 1 period per year when you finish the calculation.

Annual Savings Required to Accumulate $1,000,000 in 30 years at 10%
A) Saving at the end of each year ⇒ $6,079.25
B) Saving at end of every 2 weeks ⇒ $202.75 x 26 = $5,271.50
C) Saving at end of each week ⇒ $101.07 x 52 = $5,255.64

The more frequently we make contributions, the less we have to save each year. This is because of the compounding effect. When we make annual contributions, we earn no return the first year. With weekly contributions we start earning a return during the second week.

Practice Problem 6

35 N
0 PV
-4500 PMT
1,000,000 FV
CPT I/Y 9.13%

Practice Problem 7

420 N
9 I/Y
-20,000 PV

1,000,000 FV
CPT PMT $183.13

Practice Problem 8

CF 2nd CLR Work
0 ENTER ↓
10000 ENTER ↓
3 ENTER ↓
12000 ENTER ↓
5 ENTER ↓
5000 ENTER ↓
2 ENTER ↓
8000 ENTER ↓↓
10000 ENTER ↓
2 ENTER
NPV 12.5 ENTER ↓
CPT ⇒ $63,878.58

Practice Problem 9

Step 1: Solve for Present Value (See solution to 8) ⇒ $63,878.58

Step 2: Bring forward to end of year 13
13 N
12.5 I/Y
63,878.58 PV
0 PMT
CPT FV $295,350.73

Practice Problem 10

CF 2nd CLR Work
-80000 ENTER ↓
10000 ENTER ↓
3 ENTER ↓
12000 ENTER ↓
5 ENTER ↓
5000 ENTER ↓
2 ENTER ↓
8000 ENTER ↓↓
10000 ENTER ↓
2 ENTER
IRR CPT ⇒ 7.93%

Practice Problem 11

Since the 12% compounded annual is already annual, there is no need for an effective annual rate.

The 11.75% compounded quarterly is
2nd I Conv
11.75 ENTER ↓↓
4 ENTER ↑
CPT 12.28%

The 11.5% compounded daily is
2nd I Conv
11.5 ENTER ↓↓
365 ENTER ↑
CPT 12.17%

Making the 11.75% quarterly the best deal.

13.7: TVM 5-Key Approach Guided Tutorials with TI-BAII+ (CH3) is shared under a CC BY-NC 4.0 license and was authored, remixed, and/or curated by LibreTexts.

13.8: TVM 5-Key Approach Guided Tutorial with HP10BII+ (CH3)



Most of TVM analysis on your Financial Calculator can be done with the 5-key approach. The five keys are as follows

N ⇒ This key refers to the number of periods

I/Y ⇒ This key refers to the interest rate (do not enter as a decimal ⇒ 10% would be 10 not 0.10). Sometimes this interest rate is referred to as a discount rate or rate of return.

PV ⇒ This key refers to the Present Value

PMT ⇒ This key refers to the Annuity Payment

FV ⇒ This key refers to the Future Value

When entering values into your financial calculator you press the value you are entering first, then the key. For example, if we want to put in 10 periods, we would enter this as 10 N. Sometimes you will need to enter a negative value. To do this, you must use the "+/-" key on your calculator instead of the "–" key. The order that you enter the variables doesn't matter as long as you enter the four that you know first, and then solve for the fifth. To solve, you just press the key representing what you are trying to find. Now let's go through several examples.

EXAMPLE ONE – Future Value of a Single Cash Flow

You are investing $10,000 today and want to know how much you will have after 6 years if you earn a 7% rate of return over the 6-year time frame. Since you are starting with $10,000, that is your present value. You have 6 years, so the number of time periods is 6. The 7% rate of return means you have a 7% interest rate. In this example we are not using an annuity, so we are going to set the Annuity Payment to zero.

6 N
7 I/Y
10,000 PV
0 PMT
FV -15,007.30

Thus, you will have $15,007.30 at the end of the 6th year. Notice that the answer came out negative instead of positive. This is due to the way the calculator "thinks" when it is solving TVM problems. The calculator needs to keep track not only of the dollar amounts, but which way the money is flowing. Because you entered the Present Value (PV) as $10,000, the calculator assumed you were receiving $10,000. If you receive $10,000 today, the only way for the problem to "balance out" is for you to give back $15,007.30 at the end of the 6th year. In a problem like this you can just ignore the negative sign in front of the $15,007.30. However, there are certain problems where this is important. Specifically – IF YOU ENTER NON-ZERO VALUES FOR TWO OR MORE OF THE CASH FLOW KEYS (THE CASH FLOW KEYS IN THE 5-KEY APPROACH ARE THE PV, PMT, AND FV KEYS), YOU MUST BE CAREFUL OF CASH FLOW SIGNS. In our example, we only entered 1 non-zero value for a cash flow (the $10,000 PV), so the sign doesn't matter. We will reintroduce this in a little bit.

PRACTICE PROBLEM ONE

You are investing $400 today and want to know how much you will have after 45 years if you earn a 9.5% rate of return over the 45-year time period. The solution to this and other practice problems can be found at the end of this tutorial.

EXAMPLE TWO – Present Value of a Single Cash Flow

You are going to receive $6000 in 5 years. Assuming a 9% discount rate, what is this worth to you today?

5 N
9 I/Y
0 PMT
6000 FV
PV -3899.59

Again, we can ignore the negative sign in the answer (since the only non-zero cash flow that we entered was the $6000 Future Value). Thus, $6000 received in 5 years is only worth $3899.59 today (assuming a 9% discount rate). In other words, we are indifferent between receiving $3899.59 today and receiving $6000 in 5 years – they both are worth the same to us. Alternatively, we would be willing to pay $3899.59 or less to receive $6000 in 5 years, but we would NOT be willing to pay any more than $3899.59. The reason for this is that if we invested $3899.59 today and let it compound for 5 years at 9%, it would grow to $6000 at the end of the 5th year. Present value will be an important concept in valuation because most investments are structured in a manner that we pay a set amount today to receive cash flows in the future. Once we know what those future cash flows are worth to us today, we can evaluate the investment.

PRACTICE PROBLEM TWO

You are offered an opportunity to make an investment today that will pay you $100,000 in 20-years. Assuming a 5% discount rate, what is the most you would be willing to pay for that investment today?

ANNUITIES

An annuity is a sequence of equal, periodic cash flows. Many financial situations can be modeled as an annuity. For instance, calculating a mortgage payment on a home is an annuity. Simple retirement analysis can be structured as an annuity. Also, bond valuation is partially modeled as an annuity since we receive a fixed coupon payment each year. With annuities, we assume cash flows come at the end of each period. Note that there is a variation referred to as an “Annuity Due” that assumes cash flows come at the BEGINNING of the period. We will not work with Annuity Due situations in this text, however it is relatively simple to do so by making a simple adjustment to your calculator. We will include a sample example to illustrate this, however, in this textbook we will assume cash flows come at the end of each period in all of our annuity problems.

EXAMPLE THREE – Lottery Jackpot

Assume you have just won a $10 Million Lottery Jackpot. However, instead of paying you the $10 Million up front, you have the choice of receiving $5 Million today or $400,000 per year at the end of each year for the next 25 years. Assuming a 6% discount rate, which would you prefer? In order to answer this, you need to find the PV of the $400,000 per year for 25 years. This is done as follows:

25 N
6 I/Y
400,000 PMT
0 FV
PV 5,113,342.46 (Note that we dropped the negative sign)

Since the annuity is worth more than $5 Million to us, we would prefer to take the $400,000 per year for the next 25 years.

EXAMPLE THREE A – Lottery Jackpot Annuity Due (OPTIONAL)

Since many lotteries actually give you your first installment TODAY if you take the installment plan, we could make the example more realistic by assuming the prize was paid as $400,000 per year at the BEGINNING of each year for the next 25 years and leave

everything else the same. To adjust your calculator for this, you need to set it up to work with beginning of period payments. To do so, do the following:

SHIFT BEG/END

When you do this, you should see the word “BEGIN” show up on the bottom of your calculator screen to show you that your calculator is set for beginning of period payments. Now repeat the calculation from the Example Three

25 N
6 I/Y
400,000 PMT
0 FV
PV 5,420,143.01 (Note that we dropped the negative sign)

So, with beginning of period payments the jackpot is worth more to us (since we start receiving our money earlier). Now, set your calculator back to end of period payments so that you don’t end up with the wrong answer on all your other problems. To set it back, just toggle the BEG/END mode again as follows:

SHIFT BEG/END

PRACTICE PROBLEM THREE

You are offered an investment that pays you $1000 per year for the next 30 years. Assuming a 10% discount rate, what is this investment worth to you today?

EXAMPLE FOUR – I want to be a Millionaire

You want to become a millionaire and plan to do so through a savings/investment plan. Assuming you want to reach your goal in 20 years and anticipate earning a 10% rate of return, how much must you save at the end of each year in order to reach your goal?

20 N
10 I/Y
0 PV
1,000,000 FV
PMT $17,459.62

This means you will need to save $17,459.62 per year in order to achieve your goal.

PRACTICE PROBLEM FOUR

Since saving $17,459.62 per year is not realistic for most of us, let’s try some adjustments. Calculate how much you would need to save under the following conditions

1. 30 years at 10%
2. 40 years at 10%
3. 30 years at 7.5%
4. 30 years at 5%

Note the large difference that time and rate of return make on savings. Having a short savings horizon or earning a low rate of return mean you must save considerably more each year to reach the same goal. This is especially important for retirement planning.

EXAMPLE FIVE – Changing Periods per Year

Now assume that you want to accumulate $1 million in 30 years, but instead of saving each year, you are going to save every two weeks (we will earn a 10% annual rate of return). There are 26 2-week periods in each year, so now you have to adjust your calculator to work with 26 periods per year. You can do this as follows:

26 SHIFT P/YR

Now your calculator will recognize that you are not making annual contributions to your savings plan, but instead making a contribution every other week. Another issue when you change the number of periods per year is to recognize that the N key stands for periods and not necessarily years. Since all of our previous examples were done using 1 P/YR, the number of periods and years were the same. However, now 1 year will have 26 periods. Therefore, 30 years is equivalent to 780 periods (calculated by taking 26 times 30). Now that our adjustments have been made, we are ready to enter the problem into our calculator.

780 N
10 I/Y
0 PV
1,000,000 FV
PMT $202.75

If we save $202.75 every two weeks for the next 30 years and earn a 10% rate of return, we will have $1,000,000 at the end of the 30th year.

PRACTICE PROBLEM FIVE

Repeat the above example, but now assume weekly payments (52 weeks per year) instead of payments every two weeks. Once you are done, figure out how much you are saving per year under both the once per week and once every other week alternatives and compare this to the answer we got in Practice Problem Four-1. Why are the answers different? (NOTE – Remember to reset your calculator to 1 period per year after you finish this problem).

EXAMPLE SIX – Solving for Interest Rates

Let's keep working with the goal of becoming a millionaire. However, instead of calculating how much you must save, we'll assume you can save $3000 per year and want to find the rate of return you will need to earn to reach your goal. This time we will give ourselves 35 years of saving $3000 per year.

35 N
0 PV
-3000 PMT
1,000,000 FV
I/Y 10.89%

If we can save $3000 per year at the end of each year for the next 35 years, we will need to earn a 10.89% rate of return in order to become a millionaire. There is a very important step in this that must be done in order to get the right answer. Note that we made the annuity payment equal NEGATIVE 3000 instead of 3000. This is because we are now entering 2 non-zero values into our cash flow keys (PV, PMT, FV). When enter 2 or 3 non-zero values into our cash flow keys, we need to be careful with the signs of the cash flows. The signs indicate the direction of the cash flow. A negative sign indicates that the cash flow is flowing away from us. In this case, we are saving $3000 per year so we are giving up that amount and making it negative. At the end of the 35 years, we will receive back $1,000,000 so that is positive.

PRACTICE PROBLEM SIX

What rate of return would you need to earn if you were able to save $4500 per year each year for the next 35 years in order to become a millionaire?

EXAMPLE SEVEN – Combining PMT, FV, and PV

Here is one last variation on our millionaire example. This time, instead of starting with nothing, let's assume that we already have $40,000 and plan to save an additional $3000 per year over the next 35 years. Now, what rate of return must we earn in order to accumulate $1,000,000 at the end of the 35th year?

35 N
-40,000 PV
-3000 PMT

1,000,000 FV
I/Y 7.63%

Note that here, we must make both the Present Value and the Annuity Payment negative as they both are flowing away from us into the savings plan. The Future Value will flow back to us at the end of the time period so it is positive.

PRACTICE PROBLEM SEVEN

You want to retire a millionaire and have accumulated $20,000 which you are putting into your retirement plan. In addition, you plan to earn a 9% rate of return. How much must you save PER MONTH over the next 35 years in order to reach your goal?

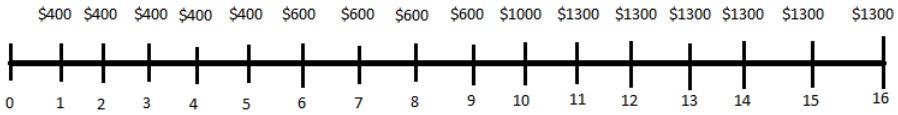
Video: [Introduction and 5-Key Approach (HP10BII)]





EXAMPLE EIGHT – Uneven Cash Flow Stream – Present Value

Assuming a 6.5% discount rate, solve for the present value of the following cash flow stream.



Here we can no longer use the 5-key approach (technically, we CAN…it would just be a lot more tedious). Instead we want to move to the cash flow worksheet on our financial calculator. The cash flow worksheet for the HP10BII follows a basic 4-step process:

1. Clear out any previous values in your cash flow worksheet
2. Enter the cash flows and frequencies in your cash flow worksheet starting with year 0
3. Enter the discount rate
4. Solve for present value

Let's walk through this process with keystrokes using the example above:

1. SHIFT C ALL (this clears out the previous values from the worksheet)

2. 0 CF_j (this enters the CF_0 which in this example is 0. Note that it will not always be zero and could have either a positive or negative value)
3. 400 CF_j (this enters the first cash flow sequence)
4. 5 SHIFT N_j (this enters the first cash flow frequency. The default value for this variable is 1, so you only need to enter an N_j value when the frequency is something other than 1.)
5. 600 CF_j (this enters the second cash flow sequence)
6. 4 SHIFT N_j (this enters the second cash flow frequency)
7. 1000 CF_j (this enters the third cash flow sequence. Note that there is no need to enter an N_j value here as the default frequency value is 1 – which is what we want – so we can skip the N_j and just go onto the next cash flow sequence.)
8. 1300 CF_j (this enters the fourth cash flow sequence)
9. 6 SHIFT N_j (this enters the fourth – and final – cash flow frequency)
10. 6.5 I/YR (this is where you put in the discount rate of 6.5%)
11. SHIFT NPV (this calculates the answer. Your final answer here should be $7,047.87.)

Note that the sum of your frequencies should add up to the length of the timeline (5+4+1+6 = 16). If not, you miscounted somewhere along the way.

EXAMPLE NINE – Uneven Cash Flow Stream – Future Value

We can use a similar process to solve for the future value of an uneven cash flow stream. However, we will start by doing the exact same steps we did to get the present value. The reason is that to get the future value of an uneven cash flow stream we first (A) solve for the present value of the cash flow stream and then (B) figure out what that value will grow to over the time horizon. So, if the problem would have given you the same cash flow stream as above, but instead asked what it would be worth as of year 16 (the end of the time horizon). As we found above, the present value of the cash flow stream (what is worth today) is $7047.87. So, if we want to know what the cash flow stream is worth in year 16, we just bring the present value ($7047.87) forward 16 years at the 6.5% rate of return using the 5 key approach as follows:

16 N
6.5 I/Y
7047.87 PV
0 PMT
FV -19,304.19

This tells us that the value of the cash flows will grow to $19,304.19 at the end of the 16 year time horizon if we can invest them to earn a 6.5% rate of return. Note that the PV of an uneven cash flow stream will always be less than the sum of all the individual cash flows ($13,200 in this example) and the FV of an uneven cash flow stream will always be more than the sum of all the individual cash flows.

EXAMPLE TEN – Uneven Cash Flow Stream – Rate of Return

Assume you could buy the cash flow stream in this example for $6000 today. Based on this, what would your rate of return be? To do this, we will use the IRR function on the calculator with the cash flow worksheet. This is similar to what we did above for NPV with two major changes. First, our CF0 is now the initial investment (-6000) and is negative because it is a cash flow. Second, instead of entering the discount rate and then solving for NPV, we solve for the discount rate by press the IRR/YR button. So, it looks like this:

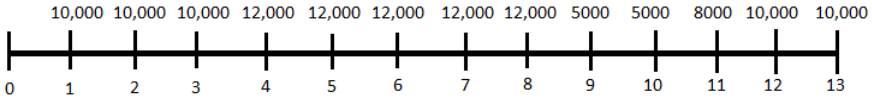
1. SHIFT C ALL
2. 0 CF_j
3. 400 CF_j
4. 5 SHIFT N_j
5. 600 CF_j
6. 4 SHIFT N_j
7. 1000 CF_j
8. 1300 CF_j

9. 6 SHIFT N_j
10. SHIFT IRR/YR (this calculates the answer. Your final answer here should be 8.39%.)

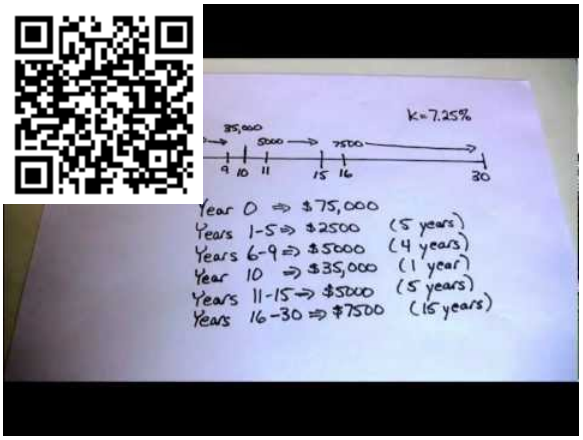
One of the most common mistakes we see on this type of problem is people putting the CF_0 in as a positive value which will result in an error (no solution). The 8.39% represents the average annualized rate of return we earn over the 16 year time horizon on our $6000 investment.

PRACTICE PROBLEMS EIGHT, NINE AND TEN

Assuming a 12.5% discount rate, solve for the present value and future value of the following time line. Also, assuming you could buy the cash flow stream for $80,000, what would your rate of return be?



Video: Uneven Cash Flows (HP10BII)



EXAMPLE ELEVEN – Effective Annual Rate

You are offered the choice of 7.8% compounded quarterly or 7.6% compounded daily. Which is a better investment (assuming both have the same risk)? In order to address whether we are better with the higher interest rate compounded less frequently or the lower interest rate compounded more frequently, we need to make them stable comparison by converting both to their annual compounding equivalent. We do this with the effective annual rate. It can be done with a formula or your financial calculator. If we use the formula, it looks like this:

keff=(1+knomm)m−1����=(1+�����)�−1

where

k_{eff} represents the annual equivalent
k_{nom} represents the nominal or stated interest rate
m represents the number of compounding periods per year

Plugging in our values for the 7.8% compounded quarterly we would get:

keff=(1+0.0784)4−1����=(1+0.0784)4−1
keff=(1.0195)4−1����=(1.0195)4−1
keff=1.0803−1����=1.0803−1
keff=0.0803����=0.0803
keff=8.03%����=8.03%

And for the 7.6% compounded daily we would get:

keff=(1+0.076365)365−1����=(1+0.076365)365−1
keff=(1.000208219)365−1����=(1.000208219)365−1
keff=1.0790−1����=1.0790−1
keff=0.0790����=0.0790
keff=7.90%����=7.90%

In this case, the 7.8% compounded quarterly is better. If using the formulas, be sure to (A) carry out your calculations to several decimal places (or better yet, don't round at all until you are done), (B) plug in rates into the formula as decimals, and (C) round your final answer to 2 decimal places in percentage terms. You can also do this with the financial calculator as follows:

4 SHIFT P/YR (this sets your periods per year to 4 for quarterly compounding. Be careful here as this means all your time value of money calculations will use 4 periods per year until you change your P/YR again…just like if you changed the P/YR for a 5-key problem.)

7.8 SHIFT NOM% (this enters the 7.8% nominal rate)

SHIFT EFF% (this solves for the effective annual rate to generate your final answer of 8.03%)

For the 7.6% compounded daily it is:

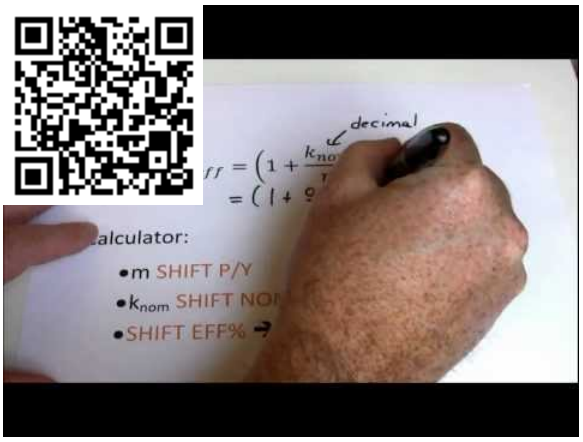
365 SHIFT P/YR
7.6 SHIFT NOM%
SHIFT EFF%

This will give you your answer of 7.90% indicating that it is better to take 7.8% compounded quarterly than 7.6% compounded daily.

PRACTICE PROBLEM ELEVEN

You are offered investments of 12% compounded annually, 11.75% compounded quarterly, or 11.5% compounded weekly. Assuming the same risk, which would you prefer?

Video: Effective Annual Rate (HP10BII)



Practice Problem Solutions

Practice Problem 1

45 N
9.5 I/Y
400 PV
0 PMT
FV $23,751.74

Practice Problem 2

20 N
5 I/Y
0 PMT
100,000 FV
PV $37,688.95

Practice Problem 3

30 N
10 I/Y
1000 PMT
0 FV
PV $9,426.91

Practice Problem 4A

30 N
10 I/Y
0 PV
1,000,000 FV
PMT $6,079.25

Practice Problem 4B

40 N
10 I/Y
0 PV
1,000,000 FV
PMT $2,259.41

Practice Problem 4C

30 N
7.5 I/Y
0 PV
1,000,000 FV
PMT $9,671.24

Practice Problem 4D

30 N
5 I/Y
0 PV
1,000,000 FV
PMT $15,051.44

Practice Problem 5

Set Calculator to 52 Periods Per Year ⇒ 52 SHIFT P/YR
Calculate Number of Periods ⇒ 52 x 30 = 1560
1560 N
10 I/Y
0 PV
1,000,000 FV
PMT $101.07

*Remember to set your calculator back to 1 period per year when you finish the calculation.

Annual Savings Required to Accumulate $1,000,000 in 30 years at 10%
A) Saving at the end of each year ⇒ $6,079.25
B) Saving at end of every 2 weeks ⇒ $202.75 x 26 = $5,271.50
C) Saving at end of each week ⇒ $101.07 x 52 = $5,255.64

The more frequently we make contributions, the less we have to save each year. This is because of the compounding effect. When we make annual contributions, we earn no return the first year. With weekly contributions we start earning a return during the second week.

Practice Problem 6

35 N
0 PV
-4500 PMT
1,000,000 FV
I/Y 9.13%

Practice Problem 7

420 N
9 I/Y
-20,000 PV
1,000,000 FV
PMT $183.13

Practice Problem 8

SHIFT C ALL
0 CF_j
10000 CF_j

3 N_j
12000 CF_j
5 N_j
5000 CFj
2 N_j
8000 CF_j
10000 CF_j
2 N_j
12.5 I/YR
SHIFT NPV ⇒ $63,878.58

Practice Problem 9

Step 1: Solve for Present Value (See solution to 8) ⇒ $63,878.58
Step 2: Bring forward to end of year 13
13 N
12.5 I/Y
63,878.58 PV
0 PMT
FV $295,350.73

Practice Problem 10

SHIFT C ALL
-80000 CF_j
10000 CF_j
3 N_j
12000 CF_j
5 N_j
5000 CF_j
2 N_j
8000 CF_j
10000 CF_j
2 N_j
SHIFT IRR/YR ⇒ 7.93%

Practice Problem 11

Since the 12% compounded annual is already annual, there is no need for an effective annual rate.

The 11.75% compounded quarterly is
4 SHIFT P/YR
11.75 SHIFT NOM%
SHIFT EFF% ⇒ 12.28%

The 11.5% compounded daily is
365 SHIFT P/YR
11.5 SHIFT NOM%
SHIFT EFF ⇒ 12.17%

Making the 11.75% quarterly the best deal.

13.8: TVM 5-Key Approach Guided Tutorial with HP10BII+ (CH3) is shared under a CC BY-NC 4.0 license and was authored, remixed, and/or curated by LibreTexts.

13.9: TVM 5-Key Approach Guided Tutorial with TI-83 or TI-84 (CH3)



Most of TVM analysis on your Financial Calculator can be done with the 5-key approach. The five keys are as follows

N ⇒ This key refers to the number of periods

I% ⇒ This key refers to the interest rate (do not enter as a decimal ⇒ 10% would be 10 not 0.10). Sometimes this interest rate is referred to as a discount rate or rate of return.

PV ⇒ This key refers to the Present Value

PMT ⇒ This key refers to the Annuity Payment

FV ⇒ This key refers to the Future Value

In the TI-83 and TI-84, the 5-key approach application is referred to as the TVM Solver. To access this, choose "APPS" and then "Finance". Once you've done this you will see a screen with several finance applications, choose the TVM Solver. When entering values into your financial calculator you enter a value for each of the "keys" that you know. For example, if we want to put in 10 periods, we would go to the N= line and put in 10. Sometimes you will need to enter a negative value. To do this, you must use the "(-)" key on your calculator instead of the "–" key. The order that you enter the variables doesn't matter as long as you enter the four that you know first, and then solve for the fifth. To solve, you just move the cursor to the line of the variable you are trying to find, then press the "alpha" shift and "solve". Now let's go through several examples.

EXAMPLE ONE – Future Value of a Single Cash Flow

You are investing $10,000 today and want to know how much you will have after 6 years if you earn a 7% rate of return over the 6-year time frame. Since you are starting with $10,000, that is your present value. You have 6 years, so the number of time periods is 6. The 7% rate of return means you have a 7% interest rate. In this example we are not using an annuity, so we are going to set the Annuity Payment to 0. Note that I/Y and C/Y should be set to 1 because we are dealing with annual periods.

N= 6
I%= 7
PV= 10000
PMT= 0
FV= -15,007.30
I/Y= 1
C/Y= 1

Thus, you will have $15,007.30 at the end of the 6th year. Notice that the answer came out negative instead of positive. This is due to the way the calculator "thinks" when it is solving TVM problems. The calculator needs to keep track not only of the dollar amounts, but which way the money is flowing. Because you entered the Present Value (PV) as $10,000, the calculator assumed you were receiving $10,000. If you receive $10,000 today, the only way for the problem to "balance out" is for you to give back $15,007.30 at the end of the 6th year. In a problem like this you can just ignore the negative sign in front of the $15,007.30. However, there are certain problems where this is important. Specifically – IF YOU ENTER NON-ZERO VALUES FOR TWO OR MORE OF THE CASH FLOW KEYS (THE CASH FLOW KEYS IN THE 5-KEY APPROACH ARE THE PV, PMT, AND FV

KEYS), YOU MUST BE CAREFUL OF CASH FLOW SIGNS. In our example, we only entered 1 non-zero value for a cash flow (the $10,000 PV), so the sign doesn't matter. We will reintroduce this in a little bit.

PRACTICE PROBLEM ONE

You are investing $400 today and want to know how much you will have after 45 years if you earn a 9.5% rate of return over the 45-year time period. The solution to this and other practice problems can be found at the end of this tutorial.

EXAMPLE TWO – Present Value of a Single Cash Flow

You are going to receive $6000 in 5 years. Assuming a 9% discount rate, what is this worth to you today?

N= 5
I%= 9
PMT= 0
FV= 6000
PV= -3899.59
I/Y= 1
C/Y= 1

Again, we can ignore the negative sign in the answer (since the only non-zero cash flow that we entered was the $6000 Future Value). Thus, $6000 received in 5 years is only worth $3899.59 today (assuming a 9% discount rate). In other words, we are indifferent between receiving $3899.59 today and receiving $6000 in 5 years – they both are worth the same to us. Alternatively, we would be willing to pay $3899.59 or less to receive $6000 in 5 years, but we would NOT be willing to pay any more than $3899.59. The reason for this is that if we invested $3899.59 today and let it compound for 5 years at 9%, it would grow to $6000 at the end of the 5th year. Present value will be an important concept in valuation because most investments are structured in a manner that we pay a set amount today to receive cash flows in the future. Once we know what those future cash flows are worth to us today, we can evaluate the investment.

PRACTICE PROBLEM TWO

You are offered an opportunity to make an investment today that will pay you $100,000 in 20-years. Assuming a 5% discount rate, what is the most you would be willing to pay for that investment today?

ANNUITIES

An annuity is a sequence of equal periodic cash flows. Many financial situations can be modeled as an annuity. For instance, calculating a mortgage payment on a home is an annuity. Simple retirement analysis can be structured as an annuity. Also, bond valuation is partially modeled as an annuity since we receive a fixed coupon payment each year. With annuities, we assume cash flows come at the end of each period. Note that there is a variation referred to as an "Annuity Due" that assumes cash flows come at the BEGINNING of the period. We will not work with Annuity Due situations in this text, however it is relatively simple to do so by making a simple adjustment to your calculator. We will include a sample example to illustrate this, however, in this textbook we will assume cash flows come at the end of each period in all of our annuity problems.

EXAMPLE THREE – Lottery Jackpot

Assume you have just won a $10 Million Lottery Jackpot. However, instead of paying you the $10 Million up front, you have the choice of receiving $5 Million today or $400,000 per year at the end of each year for the next 25 years. Assuming a 6% discount rate, which would you prefer? In order to answer this, you need to find the PV of the $400,000 per year for 25 years. This is done as follows:

N= 25
I%= 6
PMT= 400000
FV= 0
PV= 5,113,342.46 (Note that we dropped the negative sign)

P/Y= 1
C/Y= 1

Since the annuity is worth more than $5 Million to us, we would prefer to take the $400,000 per year for the next 25 years.

EXAMPLE THREE A – Lottery Jackpot Annuity Due (OPTIONAL)

Since many lotteries actually give you your first installment TODAY if you take the installment plan, we could make the example more realistic by assuming the prize was paid as $400,000 per year at the BEGINNING of each year for the next 25 years and leave everything else the same. To adjust your calculator for this, you just need to slide the highlight over to BEGIN at the bottom of the screen. Now repeat the calculation from the Example Three

N= 25
I%= 6
PMT= 400000
FV= 0
PV 5,420,143.01 (Note that we dropped the negative sign)
P/Y= 1
C/Y= 1
PMT: END BEGIN

To set it back, just toggle the slide the highlight back to END when you do the next problem on the bottom line. Remember, in class we will almost always use end of period payments.

PRACTICE PROBLEM THREE

You are offered an investment that pays you $1000 per year for the next 30 years. Assuming a 10% discount rate, what is this investment worth to you today?

EXAMPLE FOUR – I want to be a Millionaire

You want to become a millionaire and plan to do so through a savings/investment plan. Assuming you want to reach your goal in 20 years and anticipate earning a 10% rate of return, how much must you save at the end of each year in order to reach your goal?

N= 20
I%= 10
PV= 0
FV= 1000000
PMT $17,459.62
I/Y= 1
C/Y= 1

This means you will need to save $17,459.62 per year in order to achieve your goal.

PRACTICE PROBLEM FOUR

Since saving $17,459.62 per year is not realistic for most of us, let's try some adjustments. Calculate how much you would need to save under the following conditions

1. 30 years at 10%
2. 40 years at 10%
3. 30 years at 7.5%
4. 30 years at 5%

Note the large difference that time and rate of return make on savings. Having a short savings horizon or earning a low rate of return mean you must save considerably more each year to reach the same goal. This is especially important for retirement planning.

EXAMPLE FIVE – Changing Periods per Year

Now assume that you want to accumulate $1 million in 30 years, but instead of saving each year, you are going to save every two weeks (we will earn a 10% annual rate of return). There are 26 2-week periods in each year, so now you have to adjust your calculator to work with 26 periods per year. You can do this as follows by just putting 26 into the P/Y line (note that the C/Y line will automatically adjust to 26 as well after you put in the 26 for the P/Y line).

Now your calculator will recognize that you are not making annual contributions to your savings plan, but instead making a contribution every other week. Another issue when you change the number of periods per year is to recognize that the N key stands for periods and not necessarily years. Since all of our previous examples were done using 1 P/YR, the number of periods and years were the same. However, now 1 year will have 26 periods. Therefore, 30 years is equivalent to 780 periods (calculated by taking 26 times 30). Now that our adjustments have been made, we are ready to enter the problem into our calculator.

N= 780
I%= 10
PV= 0
FV= 1000000
PMT $202.75
P/Y= 26
C/Y= 26

If we save $202.75 every two weeks for the next 30 years and earn a 10% rate of return, we will have $1,000,000 at the end of the 30th year.

PRACTICE PROBLEM FIVE

Repeat the above example, but now assume weekly payments (52 weeks per year) instead of payments every two weeks. Once you are done, figure out how much you are saving per year under both the once per week and once every other week alternatives and compare this to the answer we got in Practice Problem Four-1. Why are the answers different?

EXAMPLE SIX – Solving for Interest Rates

Let's keep working with the goal of becoming a millionaire. However, instead of calculating how much you must save, we'll assume you can save $3000 per year and want to find the rate of return you will need to earn to reach your goal. This time we will give ourselves 35 years of saving $3000 per year.

N= 35
PV= 0
PMT= -3000
FV= 1000000
I%= 10.89%
P/Y= 1
C/Y= 1

If we can save $3000 per year at the end of each year for the next 35 years, we will need to earn a 10.89% rate of return in order to become a millionaire. There is a very important step in this that must be done in order to get the right answer. Note that we made the annuity payment equal NEGATIVE 3000 instead of 3000. This is because we are now entering 2 non-zero values into our cash flow keys (PV, PMT, FV). When enter 2 or 3 non-zero values into our cash flow keys, we need to be careful with the signs of the cash flows. The signs indicate the direction of the cash flow. A negative sign indicates that the cash flow is flowing away from us. In this case, we are saving $3000 per year so we are giving up that amount and making it negative. At the end of the 35 years, we will receive back $1,000,000 so that is positive.

PRACTICE PROBLEM SIX

What rate of return would you need to earn if you were able to save $4500 per year each year for the next 35 years in order to become a millionaire?

EXAMPLE SEVEN – Combining PMT, FV, and PV

Here is one last variation on our millionaire example. This time, instead of starting with nothing, let's assume that we already have $40,000 and plan to save an additional $3000 per year over the next 35 years. Now, what rate of return must we earn in order to accumulate $1,000,000 at the end of the 35th year?

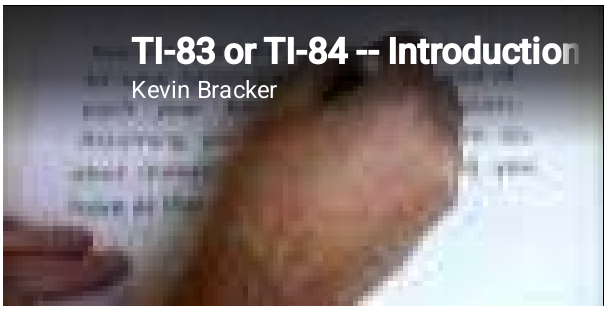
N= 35
PV= -40000
PMT= -3000
FV= 1000000
I%= 7.63%
P/Y= 1
C/Y= 1

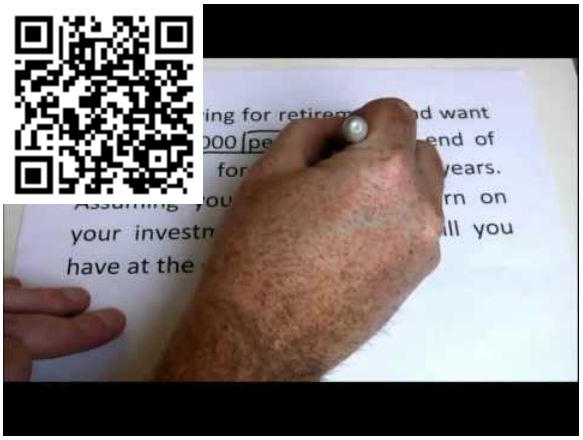
Note that here, we must make both the Present Value and the Annuity Payment negative as they both are flowing away from us into the savings plan. The Future Value will flow back to us at the end of the time period so it is positive.

PRACTICE PROBLEM SEVEN

You want to retire a millionaire and have accumulated $20,000 which you are putting into your retirement plan. In addition, you plan to earn a 9% rate of return. How much must you save PER MONTH over the next 35 years in order to reach your goal?

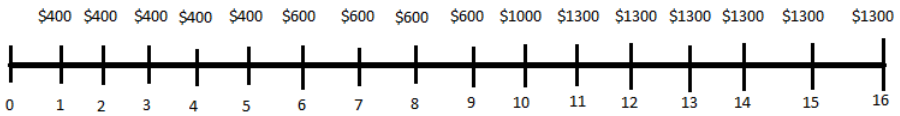
Video: [Introduction and 5-Key Approach (TI-83 or TI-84)]





EXAMPLE EIGHT – Uneven Cash Flow Stream – Present Value

Assuming a 6.5% discount rate, solve for the present value of the following cash flow stream.



Here we can no longer use the 5-key approach (technically, we CAN…it would just be a lot more tedious). Instead we want to move to the cash flow worksheets on our financial calculator. The cash flow worksheet for the TI-83/TI-84 is actually a finance application called the Net Present Value (NPV). You can access it buy going to your finance applications and scrolling down until you see the one labeled npv(. Once you select this, it is critical that you enter your data in the correct format. The format is npv(k, CF_0, {CF_{LIST}}, {$CF_{FREQUENCIES}$} and then you use the Solve (which is an Alpha shift) to get the solution. So, in this example, your k is 6.5%; CF_0 is 0 (there is no value for the year 0 cash flow – note that some problems WILL have a value there and it can be either positive or negative); CF_{LIST} is 400, 600, 1000, 1300 (there should be a value for each cash flow sequence); and $CF_{FREQUENCY}$ is 5, 4, 1, 6. This gives us: npv(6.5, 0, {400, 600, 1000, 1300}, {5, 4, 1,6} and when we solve we should get a value of $7047.87. If you get an error message, make sure that (A) everything is entered in the right order, (B) you've got all your commas in place, and (C) that you use the right brackets {}. Note that the frequencies add up to 16 which matches the length of the time line. If your frequencies do not add up to the length of the timeline, you miscounted.

EXAMPLE NINE – Uneven Cash Flow Stream – Future Value

We can use a similar process to solve for the future value of an uneven cash flow stream. However, we will start by doing the exact same steps we did to get the present value. The reason is that to get the future value of an uneven cash flow stream we first (A) solve for the present value of the cash flow stream and then (B) figure out what that value will grow to over the time horizon. So, if the problem would have given you the same cash flow stream as above, but instead asked what it would be worth as of year 16 (the end of the time horizon). As we found above, the present value of the cash flow stream (what is worth today) is $7047.87. So, if we want to know what the cash flow stream is worth in year 16, we just bring the present value ($7047.87) forward 16 years at the 6.5% rate of return using the 5 key approach as follows:

N= 16
I%= 6.5
PV= 7047.87
PMT= 0
FV= -19,304.19
I/Y= 1
C/Y= 1

This tells us that the value of the cash flows will grow to $19,304.19 at the end of the 16 year time horizon if we can invest them to earn a 6.5% rate of return. Note that the PV of an uneven cash flow stream will always be less than the sum of all the individual cash flows ($13,200 in this example) and the FV of an uneven cash flow stream will always be more than the sum of all the individual cash flows.

EXAMPLE TEN – Uneven Cash Flow Stream – Rate of Return

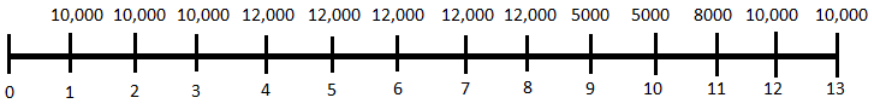
Assume you could buy the cash flow stream in this example for $6000 today. Based on this, what would your rate of return be? To do this, we will use the IRR application on the calculator. Go to the Applications ⇒ Finance and then scroll down until you find the irr(application. The format is irr(CF_0, {CF_{LIST}}, {$CF_{FREQUENCIES}$} and then you use the Solve (which is an Alpha shift) to get the solution. In any problem like this, your CF_0 must be negative (you are paying something today to buy the cash flow stream) – if you enter the CF_0 as positive, you will get an error. For this problem, we are paying $6000 today to buy the cash flow stream, so our CF_0 is -$6000 and we would set it up as follows:

irr(-6000, {400, 600, 1000, 1300}, {5, 4, 1,6} and when we solve we should get a value of 8.39%.

This is the average annualized rate of return we earn over the 16 year time horizon on our $6000 investment.

PRACTICE PROBLEMS EIGHT, NINE AND TEN

Assuming a 12.5% discount rate, solve for the present value and future value of the following time line. Also, assuming you could buy the cash flow stream for $80,000, what would your rate of return be?



Video: [Uneven Cash Flow Streams (TI-83 or TI-84)]



EXAMPLE ELEVEN – Effective Annual Rate

You are offered the choice of 7.8% compounded quarterly or 7.6% compounded daily. Which is a better investment (assuming both have the same risk)? In order to address whether we are better with the higher interest rate compounded less frequently or the lower interest rate compounded more frequently, we need to make them stable comparison by converting both to their annual compounding equivalent. We do this with the effective annual rate. It can be done with a formula or your financial calculator. If we use the formula, it looks like this:

keff=(1+knomm)m−1����=(1+�����)�−1

where

k_{eff} represents the annual equivalent
k_{nom} represents the nominal or stated interest rate
m represents the number of compounding periods per year

Plugging in our values for the 7.8% compounded quarterly we would get:

keff=(1+0.0784)4−1����=(1+0.0784)4−1
keff=(1.0195)4−1����=(1.0195)4−1
keff=1.0803−1����=1.0803−1
keff=0.0803����=0.0803
keff=8.03%����=8.03%

And for the 7.6% compounded daily we would get:

keff=(1+0.076365)365−1����=(1+0.076365)365−1
keff=(1.000208219)365−1����=(1.000208219)365−1

keff=1.0790−1=1.0790−1
keff=0.0790=0.0790
keff=7.90%=7.90%

In this case, the 7.8% compounded quarterly is better. If using the formulas, be sure to (A) carry out your calculations to several decimal places (or better yet, don't round at all until you are done), (B) plug in rates into the formula as decimals, and (C) round your final answer to 2 decimal places in percentage terms. You can also do this with the financial calculator as follows:

Go to your Applications, choose Finance and then scroll down until you get to the effective interest rate app ⇒ eff(.

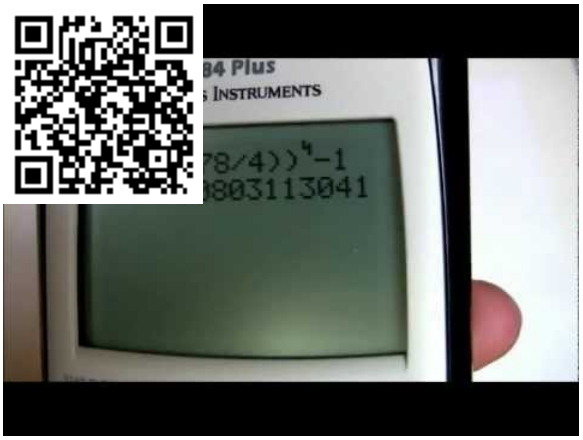
To enter values into this app, you use the format eff(NOM, C) where NOM is the nominal rate (as a percent, not decimal) and C is the compounding periods per year. This would give us:

eff(7.8, 4) SOLVE ⇒ 8.03% and eff(7.6,365) SOLVE ⇒ 7.90%

PRACTICE PROBLEM ELEVEN

You are offered investments of 12% compounded annually, 11.75% compounded quarterly, or 11.5% compounded weekly. Assuming the same risk, which would you prefer?

Video: Effective Annual Rate (TI-83 or TI-84)



Practice Problem Solutions

Practice Problem 1

N= 45
I%= 9.5
PV= 400
PMT= 0
FV= $23,751.74
P/Y= 1
C/Y= 1

Practice Problem 2

N= 20
I%= 5
PMT= 0
FV= 100000
PV= $37,688.95
P/Y= 1
C/Y= 1

Practice Problem 3

N= 30
I%= 10
PMT= 1000
FV= 0
PV= $9,426.91
P/Y= 1
C/Y= 1

Practice Problem 4A

N= 30
I%= 10
PV= 0
FV= 1000000
PMT= $6,079.25
P/Y= 1
C/Y= 1

Practice Problem 4B

N= 40
I%= 10
PV= 0
FV= 1000000
PMT= $2,259.41
P/Y= 1
C/Y= 1

Practice Problem 4C

N= 30
I%= 7.5
PV= 0
FV= 1000000
PMT= $9,671.24
P/Y= 1
C/Y= 1

Practice Problem 4D

N= 30
I%= 5
PV= 0
FV= 1000000

PMT= $15,051.44
P/Y= 1
C/Y= 1

Practice Problem 5

Calculate Number of Periods ⇒ 52 x 30 = 1560
N= 1560
I%= 10
PV= 0
FV= 1000000
PMT= $101.07
P/Y= 52
C/Y= 52

Annual Savings Required to Accumulate $1,000,000 in 30 years at 10%

A) Saving at the end of each year ⇒ $6,079.25
B) Saving at end of every 2 weeks ⇒ $202.75 x 26 = $5,271.50
C) Saving at end of each week ⇒ $101.07 x 52 = $5,255.64

The more frequently we make contributions, the less we have to save each year. This is because of the compounding effect. When we make annual contributions, we earn no return the first year. With weekly contributions we start earning a return during the second week.

Practice Problem 6

N= 35
PV= 0
PMT= -4500
FV= 1,000,000
I/YR= 9.13%
P/Y= 1
C/Y= 1

Practice Problem 7

N= 420
I/Y= 9
PV= -20,000
FV= 1,000,000
PMT= $183.13
P/Y= 1
C/Y= 1

Practice Problem 8

npv(12.5, 0, {10000, 12000, 5000, 8000, 10000}, {3, 5, 2, 1, 2} SOLVE ⇒ $63,878.58

Practice Problem 9

Step 1: Solve for Present Value (See solution to 8) ⇒ $63,878.58
Step 2: Bring forward to end of year 13
N= 13
I%= 12.5
PV= 63,878.58
PMT= 0
FV= $295,350.73

P/Y= 1
C/Y= 1

Practice Problem 10

irr(-80000, {10000, 12000, 5000, 8000, 10000}, {3, 5, 2, 1, 2} SOLVE ⇒ 7.93%

Practice Problem 11

Since the 12% compounded annual is already annual, there is no need for an effective annual rate. The 11.75% compounded quarterly is eff(11.75, 4) SOLVE ⇒ 12.28% and the 11.5% compounded weekly is eff(11.5, 52) SOLVE ⇒ 12.17%, making the 11.75% quarterly the best deal.

13.9: TVM 5-Key Approach Guided Tutorial with TI-83 or TI-84 (CH3) is shared under a CC BY-NC 4.0 license and was authored, remixed, and/or curated by LibreTexts.

13.10: Bond Rating Scales (CH 4)

Click on the link below to access Standard and Poor's Bond Rating Scale and Moody's Bond Rating Scale.

Bond Rating Scales

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13.11: Efficient Markets Hypothesis (CH 5)

The Efficient Markets Hypothesis (EMH) refers to the concept that all securities in a given market are accurately priced based on all currently available information and that prices will respond immediately and accurately to any new information that is released.

Forms of EMH

One of the key phrases in the above definition is "all currently available information." There are different levels on the EMH based on what is determined to be "currently available information."

1. Weak-form – Markets are efficient based on all past price and volume data. Trading "trends" will not allow us to spot stocks that are ready to decline or fall in the near future.
2. Semi-Strong form – Markets are efficient based on all publicly available information. Anything that we read in annual reports, the Wall Street Journal, CNBC, Yahoo!Finance, etc. is already factored into stock prices by the time we can respond. Using this information will not allow us to get a trading edge in identifying which stocks will do well and which will do poorly.
3. Strong form — Markets are efficient based on all information whether it is public or private. Even insiders in the corporation will not be able to generate above normal returns by using their inside information.

Remember that market efficiency implies that all securities are fairly valued at all times based on the available information. If I use publicly available information and consistently earn more than a fair risk-adjusted rate of return (in other words, I "outperform the market"), then I am providing evidence AGAINST semi-strong form market efficiency, not for it.

Implications (assuming EMH is true):

There is no such thing as an overvalued or undervalued stock. All stocks are always valued appropriately based on the information that is currently available. The only way to earn above average returns is to take above average risks (or to be lucky). For example, if the S&P 500 (a market index designed to capture how stocks are performing as a group) is up 5% over the past year and I have earned an 8% rate of return, this APPEARS to violate market efficiency (I have "outperformed" the market). However, I could have earned a higher return because I only invested in stocks that had higher than average risk (on average, taking higher risks should result in higher returns). Alternatively, given a relatively short time period of one year, I might just be lucky (the person that wins the Powerball jackpot isn't "better" at picking numbers than the rest of us, just luckier).

The impact of corporate decisions should be identifiable immediately. The "market" will analyze the decision and determine the new fair value for the firm immediately and accurately. If a pharmaceutical company announces a new drug that successfully treats diabetes, we should expect the stock to increase in value immediately (within a matter of minutes) and then level off. Changes after the initial reaction (in the following days/weeks) should be based on new information, not delayed response to the diabetes drug.

Corporations can't "trick" investors by changing accounting methods to make earnings appear higher or use flashy annual reports to make the company appear different than it really is. While corporations can use these tricks, investors in an efficient market will see through them so that these strategies will have no impact. If a firm changes its inventory accounting method and it results in an increase in earnings, this should not cause the stock to increase in value. The higher earnings don't reflect higher cash flows, just a change in accounting methodology and the firm has not gained any real value.

Seasonal factors should have no influence on stock prices. A retail company may do really well in August due to back-to-school sales. However, since everyone knows this pattern will exist, the expectation of higher sales/earnings in August will be factored into stock prices before they are realized and the company's stock price can only get a back-to-school bounce by doing better than expected not by doing better than they did in July. Similarly the summer should not cause the stock prices of soft drink companies to soar because people drink more pop in the summer. A tax preparation firm should not be a better investment in March/April (due to tax season) than it is in July/August. This information is already built into stock prices.

What matters for moving stock prices is not whether or not the news is good or bad, relative to a neutral baseline. Instead, the news needs to be judged relative to expectations, so that is "better than expected" news causes an increase in the stock price while "worse than expected" news causes a stock price decline. For example, if an airplane building firm announces earnings are up 20% from the previous year, we shouldn't automatically assume the stock will go up. If earnings were expected to be up 40%, up 20% is

bad news and the stock will likely decline. If earnings were expected to be up 10%, up 20% is good news and the stock will likely increase.

Are Markets Efficient?

This is open for debate, but the debate is based more on the degree of market efficiency rather than a yes/no answer. Most experts will agree that the market is not perfectly efficient. However, some feel that there are very few real examples of market inefficiencies to be found while others feel that there are several situations were stock prices do not fully reflect all currently available information which leads to overvalued stocks and undervalued stocks. After looking at lots of evidence on the subject, we feel that while market inefficiencies exist, they are not easily found. Most of us would be better off trying to own well-diversified portfolios (not just a variety of stocks, but a portfolio of stocks, bonds, and other assets with a global mix) that match our risk-return preferences, re-allocating annually (shifting towards stocks to increase risk or towards bonds to lower risk) to maintain or adjust those risk-return preferences and minimizing our transactions costs rather than spending lots of time and effort to choose the "correct" stocks. Studies show that, on average, most people do not add value by selecting good stocks and avoiding bad ones (unless they have access to private information). More importantly, market timing (trying to move out of stocks as a whole when they are "overpriced" and move into them when they are "underpriced") results in investors earning lower returns over time.

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13.12: Sample of Stock Information (CH 5)

Use the table below to access stock information for several companies.

Table: Sample of Stock Information

Name	Ticker Symbol	Market Cap	Shares Outstanding	Market Price as of 7/7/2017	Dividend & Yield	EPS	Beta
Wal-Mart Stores Inc.	WMT	$228.37B	3.03B	$75.33	2.04 (2.71%)	$4.40	0.07
Apple Inc.	AAPL	$751.73B	5.21B	$144.18	2.52 (1.77%)	$8.52	1.43
Starbucks Corp.	SBUX	$84.05B	1.45B	$58.04	1.00 (1.74%)	$2.02	0.65
Facebook, Inc.	FB	$438.9B	2.36B	$151.4	N/A (N/A)	$3.93	0.45
Bank of America Corp.	BAC	$247.11B	9.95B	$24.83	0.30 (1.21%)	$1.62	1.61
Chipotle Mexican Grill, Inc.	CMG	$11.86B	28.66M	$413.89	N/A (N/A)	$3.23	0.10
Ford Motor Co.	F	$44.84B	3.91B	$11.26	0.60 (5.37%)	$0.94	1.33
Exxon Mobil Corp.	XOM	$339.91B	4.24B	$80.22	3.08 (3.84%)	$2.40	0.65

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13.13: Stock Valuation Guided Tutorial with Calculations (CH 5)



Stock Valuation Conceptually: Stock Valuation follows the same basic concept of bond valuation. You are buying a security that will generate a cash flow stream over time. The value of that security is equal to the present value of the cash flows that are expected to be generated over the life of the security, discounted back to today at the appropriate risk adjusted rate of return.

3-Step Valuation Process

1. **Forecast all cash flows the security is expected to generate over its lifetime**. For stocks, the expected cash flows are dividends and capital gains (or losses). Unfortunately, dividends are variable (unlike coupon payments for bonds) and have an infinite timeline (also unlike bonds).
2. **Choose an appropriate discount rate**. In practice, this can be subjective based on current market rates of interest plus a risk premium to compensate for the increased risk of stocks over bonds. Many people will use a model called the Security Market Line (which we will introduce in Ch. 7) to estimate the appropriate discount rate. For now, this will be a given.
3. **Solve for present value**. Because we are dealing with a potentially variable and infinite cash flow stream, we can't use the 5-key approach as we did with bonds. Instead, we need to make assumptions about growth and use mathematical models (or combinations of forecasted dividends and models) to estimate present value.

Example One

You are considering the purchase of a stock that pays a $2.50 dividend. The dividend is expected to stay constant for the foreseeable future. Assuming a 10% required return, what is the stock worth to you today?

We can start by forecasting the dividends (step one – forecast all expected cash flows). Since the dividends are expected to stay constant for the foreseeable future, this is straightforward as they do not change, so our timeline will look like this:



Note that this is just a perpetuity (infinite annuity) which we introduced in our Time Value of Money Chapter. Remember that the formula for a perpetuity is

PV=PMTk��=����

We are going to use the same formula, but just change the notation to reflect stocks so it is:

P0=Dk�0=��

Our dividend (D) is $2.50 and our required return (k) is 10% (remember that we need to enter that into the formula as 0.10 and not 10). So, this will give us

P0=$2.500.10=$25�0=$2.500.10=$25

Example Two

Your firm is planning to raise $2,000,000 by issuing 5% preferred stock with a $40 par value. You anticipate that investors will have a 7% required return. How many shares must you issue if there are no issuance costs? What if the investment banking firm that helps us issue the shares charges us 4% of all proceeds?

While the no growth model (detailed above in example two) is rarely appropriate for common stock (as most companies do not pay out constant dividends over time), it is a good match for preferred stock. Since preferred stock tends to pay a constant dividend (as a percentage of par), it follows the no growth model. Here we need to (a) figure out how much we would receive per share and then (b) how many shares we would need to sell to receive $2,000,000.

P0=ParValue∗DividendRatek=$40∗0.050.07=$2.000.07=$28.57=∗=$40∗0.050.07=$2.000.07=$28.57

Assuming we can issue shares for $28.57, we would need to issue 70,004 shares ($2,000,000/$28.57) in order to raise $2,000,000.

If the investment banking firm charges us a 4% fee, then we will only get to keep 96% of our proceeds. This means that if we issue shares for $28.57, $1.14 would go to the investment bankers and $27.43 would go to us. So, we now would need to issue 72,913 shares ($2,000,000/$27.43) in order to raise our $2,000,000.

Example Three

You are considering the purchase of a stock that just paid a dividend (D_0) of $4.00 per share. You forecast that dividends will grow at 5% per year for the foreseeable future. Assuming a 9.5% required return, what is the most that you'd be willing to pay for this stock today?

This no longer fits the no-growth model, so we need to go back to the 3-step valuation process where step one is to forecast all the expected cash flows. Here, we need to introduce the formula to allow us to forecast dividends based on a given growth rate.

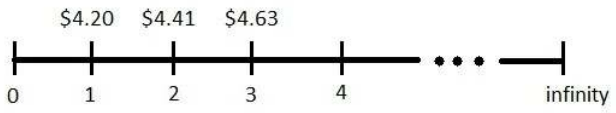
D1=D0(1+g)1=0(1+)

So, applying this, we get the following:

D1=$4.00∗(1+0.05)=$4.201=$4.00∗(1+0.05)=$4.20

D2=$4.20∗(1+0.05)=$4.412=$4.20∗(1+0.05)=$4.41

D3=$4.41∗(1+0.05)=$4.633=$4.41∗(1+0.05)=$4.63



The problem here is that because the timeline extends to infinity, we would never be able to stop forecasting dividends (note that all our stock valuation models assume we just missed the initial dividend – D_0 – so it is not part of our timeline). This is clearly not practical as if we never stop forecasting dividends, we never get beyond step 1 so we can't determine the value of the stock. Fortunately, mathematics comes to the rescue. Based on the mathematics of infinite series, we can derive a simple formula to solve for present value of this cash flow stream.

PV=D1(1+k)+D2(1+k)2+D3(1+k)3+...+D∞(1+k)∞=D1(k−g)=1(1+)+2(1+)2+3(1+)3+...+∞(1+)∞=1(−)

So, our constant growth valuation model is simply:

P0=D1k−g0=1−

Where D_1 is the forecasted dividend for next year, k is the required return (as a decimal) and g is the constant growth rate (also as a decimal). Applying this model to our example problem gives us:

P0=D1k−g=$4.00∗(1+0.05)0.095−0.05=$4.200.045=$93.330=1−=$4.00∗(1+0.05)0.095−0.05=$4.200.045=$93.33

In addition to just calculating the price like we do in this example, we can also use this model to look at what things influence stock prices. This is actually the strength of the model. Because few firms grow at a constant rate, it is not a very accurate guide to determining how much you should pay for a stock (the non-constant model introduced shortly is much better for that). However, it is a good tool for understanding what causes stock prices to rise or fall.

Stock Prices and Growth Rates

What happens when the growth rate increases from 5% to 6%? How about when it falls from 5% to 3%?

$P0=D1k−g=\$4.00∗(1+0.06)0.095−0.06=\$4.240.035=\$121.14$ $0=1−=\$4.00∗(1+0.06)0.095−0.06=\$4.240.035=\$121.14$

$P0=D1k−g=\$4.00∗(1+0.03)0.095−0.03=\$4.120.065=\$63.38$ $0=1−=\$4.00∗(1+0.03)0.095−0.03=\$4.120.065=\$63.38$

Note that when the growth rate goes up, so does the stock price (from $93.33 with a 5% constant growth rate to $121.14 at a 6% constant growth) and when the growth rate goes down, the stock price falls (from $93.33 with a 5% constant growth rate to $63.38 with a 3% constant growth rate). Stock prices are very sensitive to investors' forecasted growth rates. When companies announce that they anticipate their growth rates will be slower than previously expected, their stock prices will fall (and sometimes dramatically). The opposite is also true ⇒ increasing growth rates can be a major boost for stock prices. This makes sense from a present value of cash flows basis. If company is growing faster, that means the cash flow stream will get larger faster and increase the present value. If you go all the way back to chapter one, this increases the magnitude of expected cash flows AND improves the timeliness of expected cash flows (again…the cash flows are getting larger at a faster rate).

Stock Prices and Required Returns

What happens when the required return increases from 9.5% to 12%? How about when it falls to 8%?

$P0=D1k−g=\$4.00∗(1+0.05)0.12−0.05=\$4.200.07=\$60.00$ $0=1−=\$4.00∗(1+0.05)0.12−0.05=\$4.200.07=\$60.00$

$P0=D1k−g=\$4.00∗(1+0.05)0.08−0.05=\$4.200.03=\$140.00$ $0=1−=\$4.00∗(1+0.05)0.08−0.05=\$4.200.03=\$140.00$

Note that when the required return goes up, the stock price falls (from $93.33 with a 9.5% required return to $60 with a 12% required return). Alternatively, when the required return goes down (from 9.5% to 8%), the stock price goes up (from $93.33 to $140). Therefore, stock prices are inversely related to changes in the required return (just like bonds). Now, let's carry this a step further and look at what might lead to increases in the required return for a stock.

- Higher interest rates – as interest rates on bonds increase that means stocks will need to also offer higher returns to stay competitive. For example, if the current interest rate on bonds (which are less risky than stocks) is 6% and the required return for a stock is 8%, what happens when the interest rate on bonds rises to 8%? Now, no one wants the riskier stock for the same return, so the required return on the stock needs to rise to stay attractive to risk-averse investors. Therefore, all else equal, higher interest rates should cause stock prices to fall.
- Higher risk levels – If the risk for a particular stock (or the market as a whole) increases, the required return needs to increase as well due to the concept of risk aversion. Higher risks require higher returns to compensate investors.
- Increased risk aversion – In some cases, risk itself doesn't need to increase for the required return to rise, just the sensitivity of investors to risk. If investors become more risk-averse as a group, then they will need higher levels of return to compensate them for taking on the risk associated with stocks than they needed previously.

Note that all of the examples here reflected increases in the required return (leading to dropping stock prices), but the opposites hold as well ⇒ lower interest rates, lower risk levels and/or decreased risk aversion should cause required returns to drop and stock prices to go up. Also note that often times it may be a bit harder to see the clear direction if multiple things are changing at the same time. For example, higher interest rates should (all else equal) lead to lower stock prices. However, often higher interest rates may be a result of a stronger economy which could cause investors to revise their growth rates upward (creating upward pressure on the stock price) at the same time as increasing their required return (creating downward pressure on the stock price) and it won't be clear which will have the greater impact.

Consider the financial crisis of 2008-09. In the summer of 2008, it started to become apparent that many of the large financial institutions were struggling. By the fall of 2008, it became a full-blown crisis that continued to magnify until the spring of 2009 (by January/February 2009, many people were acting as if we were going to be living in something resembling a post-apocalyptic movie very shortly). As a result of this, stock prices dropped dramatically (losing about 50% of their value from their peak prices in 2007). If we look at this through the lens of the stock pricing model above, it makes sense. The collapse of many financial institutions led to a drastic slowdown in the global economy which caused investors to lower their forecasted growth rates. At the same time, the risk of a complete meltdown became more likely, increasing risk and required returns. Finally, investors who were watching the stock market drop regularly (and often very sharply) started to become more risk-averse and increased the required

return they felt was necessary to compensate them for owning stocks. All of these things caused stock prices to fall. Then, in the spring of 2009 (about the 2nd week of March), something started to turn around and the growth rates in the global economies went from negative back to positive. The risk of financial meltdown started to appear less likely. Investors saw stock prices didn't have to fall every day so they became a little less risk-averse. All of these things caused stock prices to rise back up.

Whenever you think of how things are going to impact stock prices think of them in terms of how they are going to impact growth rates and required returns (either for individual firms or the entire market). Be careful not to think of just whether or not the news is good/bad for growth rates and/or required returns, but how the news causes us to revise our expectations for these variables. For instance, news that the economy is expected to decline at 1% when it was expected to decline at 3% is good (growth rate is less negative than expected). Alternatively, news the economy is expected to grow at 4% when it was expected to grow at 6% is bad (growth is less positive than expected). Understanding what drives stock prices is one of the key benefits of the constant growth model.

Example 4

You are evaluating a stock and after doing some research have developed the following information and forecasts. The stock has just paid a dividend of $2.20. You anticipate that the firm will suffer negative growth initially due to problems in the economy and development of some new products. However, after a short down-turn, the growth should explode upward for a brief period before cooling back down. Specifically, you have made the following growth rate forecasts:

Year 1 = -25%
Year 2 = -10%
Year 3 = 50%
Year 4 = 150%
Year 5 = 60%
Year 6 = 30%
Year 7 = 15%
Years 8-infinity = 4%

You anticipate that this is a relatively high risk stock, so feel that a 16% required return is appropriate. Based on this, what is the stock worth today?

While the constant growth model is an improvement on the no-growth model for common stocks, it is still flawed as it assumes that firms grow at the same rate every year forever. This is quite unrealistic. Instead, firms grow fast sometimes (good new products, initial stages of their life cycle, high periods of growth in the economy, etc.) and slow (or even at negative) rates at other times (periods where the firm is poorly managed, new competition enters the field, markets get saturated, new product introductions flop, economic recessions, etc.). Therefore, we need a model that allows for growth rates to vary over time. We will introduce the non-constant (or sometimes called "supernormal") growth model. Note that we are still using the same 3-step valuation process introduced at the beginning of this handout as the framework, but we are (a) breaking step one into two parts – forecasting dividends and forecasting a terminal value – and (b) we are given the required return so we didn't include "choose an appropriate discount rate" as a separate step.

Step 1: Forecast dividends up to and including the first year of constant growth

D1 = $2.20*(1 + -0.25) = $2.20*(0.75) = $1.65
D2 = $1.65*(1 + -0.10) = $1.65*(0.90) = $1.49 ⇒ Note round to the nearest cent
D3 = $1.49*(1 + 0.50) = $1.49*(1.50) = $2.24
D4 = $2.24*(1 + 1.50) = $2.24*(2.50) = $5.60
D5 = $5.60*(1 + 0.60) = $5.60*(1.60) = $8.96
D6 = $8.96*(1 + 0.30) = $8.96*(1.30) = $11.65
D7 = $11.65*(1 + 0.15) = $11.65*(1.15) = $13.40
D8 = $13.40*(1 + 0.04) = $13.40*(1.04) = $13.94 ⇒ Note we stop forecasting here as constant growth is reached

Let us add a few comments on this process.

First, remember that we said a flaw of the constant growth model was that it assumed (unrealistically) that growth rates would grow at the same rate forever. However, what happens when we hit year 8? We assume a constant growth rate. If it is unrealistic today, it is equally unrealistic 8 years from now, so why is it better here? The answer is twofold. First, we have delayed the error by 8 years, so (once discounted back to today) it will have less impact on our final answer. Second, we can't keep forecasting forever and it is unrealistic to assume we will be able to make good forecasts about year-to-year growth rates several years into the future. Therefore, we forecast as far as we reasonably can and then just assume a constant growth rate for the remaining years, knowing it is only an approximation.

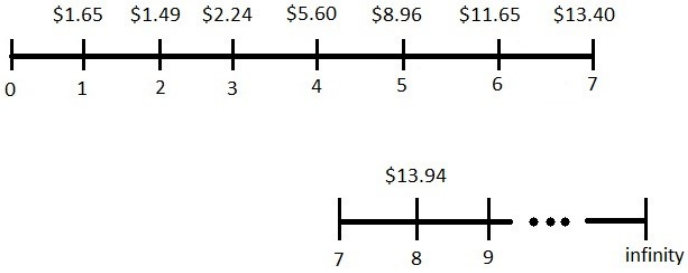
Second, in this example, it is also not very realistic to assume that we know the exact growth rates 6 or 7 years from now. However, what we are doing is just allowing growth to gradually slow from the peak growth in year 4 to the constant growth in year 8 which is probably more realistic than assuming it instantly drops to a constant rate.

Three, when you get to your constant growth rate it should probably be something in the low single digits. It is unrealistic to assume growth of 10-15% per year forever. If that happened, essentially the company would take over the global economy in 100 years. Instead, we see firms grow fast for awhile and then slow down as (a) competition, (b) technological changes, (c) market saturation, (d) poor management, or (e) some combination of the above slows growth down. Reasonable levels for the constant growth rate should probably be in the 0-5% range.

Four, while we stop forecasting dividends at the constant growth stage, it is important to remember that dividends don't stop here. Instead they keep growing at a constant rate. So, while we stopped forecasting at D_8, there is a D_9, D_{10}, D_{11}, etc.

Step 2: Use the constant growth model to find the value of all remaining dividends at the beginning of the constant growth stage

Because dividends keep going during the constant growth stage, we are going to use the constant growth model to figure out the value of these dividends as of the start of the constant growth stage. Think of two timelines at this point – one that covers years 0 through 7 and a second that covers years 7 through infinity.

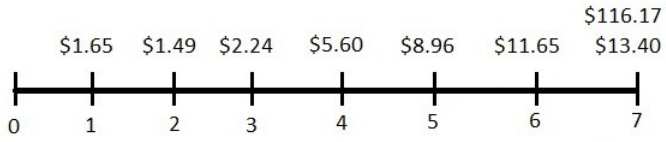


If we look only at the second timeline, this is just a constant growth with D_8 replacing D_1. Since the constant growth model normally uses D_1 to get the price today (P_0), when we substitute D_8 in, it will give us the price in year 7. So,

P7=D8k−g=$13.940.16−0.04=$116.17P7=D8k−g=$13.940.16−0.04=$116.17

Step 3: Solve for PV

We are now ready for the last step, solving for the present value of the expected cash flows. To help us visualize this, let's put all the cash flows on one final timeline.



Note that in year 7 there are two separate cash flows. First, we have the dividend in year 7 ($13.40) and second, we have the value of all the remaining dividends from years 8 through infinity ($116.17). Since both of these are year 7 cash flows, before we put

them into our financial calculator we have to add them together so that our year 7 cash flow is $129.57 ($13.40 + $116.17). Now, we just put them into our financial calculator (presented below for each of the three calculators).

Table: Calculator Steps for NPV

HP10BII	TI-BAII+	TI-83/84
Step 1: 2nd Clear All Step 2: 0 CFj Step 3: 1.65 CFj Step 4: 1.49 CFj Step 5: 2.24 CFj Step 6: 5.60 CFj Step 7: 8.96 CFj Step 8: 11.65 CFj Step 9: 129.57 CFj Step 10: 16 I/YR Step 11: 2nd NPV ⇒ $61.95	Step 1: CF 2nd CLR Work Step 2: 0 ENTER ↓ Step 3: 1.65 ENTER ↓↓ Step 4: 1.49 ENTER ↓↓ Step 5: 2.24 ENTER ↓↓ Step 6: 5.60 ENTER ↓↓ Step 7: 8.96 ENTER ↓↓ Step 8: 11.65 ENTER ↓↓ Step 9: 129.57 ENTER Step 10: NPV 16 ENTER ↓ Step 11: CPT ⇒ $61.95	Go to APPS⇒Finance⇒ Step 1: Select npv(Step 2: Enter the given information npv(16, 0, {1.65, 1.49, 2.24, 5.60, 8.96, 11.65, 129.57} *Note that we do not need to put in the CF frequencies as they are all 1 Step 3: Press the SOLVE key⇒$61.95

13.13: Stock Valuation Guided Tutorial with Calculations (CH 5) is shared under a CC BY-NC 4.0 license and was authored, remixed, and/or curated by LibreTexts.

13.14: Observed Correlations, Returns, Standard Deviations and Betas Table (CH 7)

Use the link below to access betas, correlations and standard deviations for several companies.

Betas Correlations and St Deviations

13.14: Observed Correlations, Returns, Standard Deviations and Betas Table (CH 7) is shared under a CC BY-NC 4.0 license and was authored, remixed, and/or curated by LibreTexts.

13.15: Risk and Return Guided Tutorial (CH 7)



The purpose of this guided tutorial is to walk through the process of calculating and interpreting several of the concepts from Chapter Seven on Risk and Return. Please note that this is not a substitute for the chapter in the text, but a complement to it.

We are going to start by estimating the expected return and standard deviation of a single security. This is used when evaluating investments in isolation (sometimes referred to as “stand alone” situations). In order to do these calculations, we are going to start with a probability distribution of possible outcomes. Our probability distributions (referred to as discrete probability distributions because there are a limited number of outcomes) are not designed to capture every possible event that could happen in the real world (as there are potentially infinite outcomes), but instead just to provide a quick overview of some possible scenarios. Once we calculate the expected return and standard deviation, we can evaluate which investment is better by itself.

The next step is to look at the portfolio impacts. While in practice, many people hold portfolios of tens (or hundreds) of different investments, we are going to limit our calculations to a two-stock portfolio to keep things “simple” (the standard deviation formula really blows up as we add more and more securities to the portfolio to the point where it can be very time consuming to do by hand once we get more than a handful of securities). Here we will introduce correlation (how the returns from a pair of securities move together) and consider how it impacts the risk of our portfolio. Portfolios (and the concept of diversification) are a critical element to investing and your personal financial decisions as you manage your real-world finances throughout your life.

Once we’ve gone over the portfolio, we will introduce another measure of risk (beta) that becomes critical once we’ve moved on to larger, well-diversified portfolios. Beta gives us a measure of market risk (which we introduced earlier). When we are evaluating securities in isolation, we want to use standard deviation (total risk ⇒ firm-specific risk PLUS market risk). However, when we are adding stocks to a well-diversified portfolio, we no longer worry about the firm-specific risk (as it has been diversified away) and now must focus on the market risk (beta).

From there, we will introduce the Security Market Line which attempts to integrate the concept of market risk (beta) and required return for a security. In other words, what rate of return do we need in order to compensate us for the risk of investing in the stock? We can then tie that back into expected returns and stock valuation issues.

Please **actively** work through this guided tutorial (doing the calculations and thinking about the issues) instead of just reading through it. You will get a lot more out of it if you do so.

Example One: Big Oil, Inc.

Scenario	Probability	Return
Oil Falls to $35	0.05	-40%
Oil Falls to $55	0.20	-20%
Oil Goes to $80	0.50	12%
Oil Goes to $100	0.25	36%

Calculate the Expected Return and Standard Deviation for Big Oil, Inc. given this probability distribution.

As Big Oil, Inc. is an oil producer/refiner, it stands to reason that their stock price will be partially dependent on the price of oil. As oil increases in value, the stock price should go up as the value of Big Oil’s oil assets increases (and vice-versa). Note that Big Oil is impacted by a lot more than the price of oil (labor costs, regulations, economic growth, etc.) A real-world analysis would be more complex and have several more scenarios. However, for the purposes of this class, we wanted to keep the process relatively

straight-forward. Here, this probability distribution is telling us that there is a 5% chance that we will lose 40% of our investment over the next year; a 20% chance that we will lose 20% of our investment over the next year and so on. Also note that for any probability distribution you use to get expected return and standard deviation, your probabilities need to sum to 1.00.

Calculate Expected Return for Big Oil Example

To calculate the expected return, we just take the probability times the return for each possible outcome and then sum them up. Specifically for this problem, we get

$$\bar{k}=\sum_{i=1}^{n} P_i k_i$$
$$\bar{k}=0.05(-40)+0.20(-20)+0.50(12)+0.25(36)$$
$$\bar{k}=-2\%+-4\%+6\%+9\%$$
$$\bar{k}=9\%$$

So, our expected return is 9%. This does not mean we will get 9% as our rate of return. It also does not mean that 9% is our most likely return. As a matter of fact, based on our probability distribution, 9% isn't even a possible outcome and 12% is our most likely return. Instead, what this means is that if you could repeat next year an infinite number of times, sometimes you'd do better than 9% and sometimes you'd do worse, but on average you would have a 9% rate of return.

However, knowing that 9% is your expected return is only part of the story. An analogy that works here is to imagine that you don't know how to swim, but must walk across a lake that is, on average, 3-feet deep. While you may be perfectly fine standing in 3 feet of water, it is pretty easy to see the problem here. The average depth doesn't help you when you get to the spot where the water is 15-feet deep. It is not enough to know the average depth, you need to know the variation in depth. We can get a feel for this through the standard deviation.

While it is not a statistically precise definition, think of standard deviation as a measure of how reliable the expected return is. When you have a low standard deviation, that means that most of the time your actual return will end up close to your expected return. When you have a high standard deviation, that means that you are likely to have an actual return that is significantly higher or lower than your actual return. Note that stock returns are not normally distributed, so don't think of standard deviation as a precise confidence interval. As standard deviation is a measure of how reliable our expected return is, we can think of it as a measure of risk.

Calculate Standard Deviation for Big Oil Example

To calculate the standard deviation, we (1) take the forecasted return for that outcome less the expected return, (2) square that, (3) multiply by the probability of that outcome, (4) sum up for all possible outcomes, and (5) take the square root. Specifically, for this problem we get

$$\sigma=\sqrt{\sum_{i=1}^{n} P_i(k_i-\bar{k})^2}$$
$$\sigma=\sqrt{0.05(-40-9)^2+0.20(-20-9)^2+0.50(12-9)^2+0.25(36-9)^2}=\sqrt{0.05(-40-9)^2+0.20(-20-9)^2+0.50(12-9)^2+0.25(36-9)^2}$$
$$\sigma=\sqrt{0.05(-49)^2+0.20(-29)^2+0.50(3)^2+0.25(27)^2}=\sqrt{0.05(-49)^2+0.20(-29)^2+0.50(3)^2+0.25(27)^2}$$
$$\sigma=\sqrt{0.05(2401)+0.20(841)+0.50(9)+0.25(729)}=\sqrt{0.05(2401)+0.20(841)+0.50(9)+0.25(729)}$$
$$\sigma=\sqrt{120.05+168.2+4.5+182.25}=\sqrt{120.05+168.2+4.5+182.25}$$
$$\sigma=\sqrt{475}=\sqrt{475}$$
$$\sigma=21.79\%=21.79\%$$

So our standard deviation is 21.79%. Remember, that the higher this number is, the more likely our actual return is to be significantly higher or lower than our expected return. To see some actual standard deviations for real companies, take a look at the Appendix 1 from Chapter Seven that gives you some comparisons. For example, Pepsi has a standard deviation of just under 12% from Jan. 2013 through Dec. 2017 while Boston Beer's (the maker of Samuel Adams beer) is about 30% over that same time frame.

Let me take a moment to tie standard deviation into our earlier discussion of risk where I stated that the degree of risk is a function of the interaction between (a) the likelihood of an unfavorable event and (b) the degree of the unfavorable event. We can see that in the standard deviation formula. The $(k - \bar{k})$ segment of the formula captures the degree of the unfavorable event – the further from our expected return the greater this value will be. The probability captures the likelihood of the unfavorable event. If one (or

both) of these values is small, it will have little impact on the standard deviation. On the other hand if they are both larger, it will lead to a larger standard deviation (more risk).

In order to evaluate where Big Oil ranks in terms of risk and return, we need to compare it to an alternative. So, next let's move on to our next example.

Example Two: Stag Tractors

Scenario	Probability	Return
Recession	0.15	-60%
Slow Economic Growth	0.50	9%
Strong Economic Growth	0.35	50%

Calculate the expected return and standard deviation for Stag Tractors given this probability distribution.

Please try to do these calculations on your own first before moving on.

Calculate Expected Return for Stag Tractors Example

$\bar{k}=\sum_{i=1}^{n} P_i k_i \quad \bar{k}=\sum_{i=1}^{5} P_i k_i$
$\bar{k}=0.15(-60)+0.50(9)+0.35(50) \quad \bar{k}=0.15(-60)+0.50(9)+0.35(50)$
$\bar{k}=-9\%+4.5\%+17.5\% \quad \bar{k}=-9\%+4.5\%+17.5\%$
$\bar{k}=13\% \quad \bar{k}=13\%$

Calculate Standard Deviation for Stag Tractors Example

$\sigma=\sqrt{\sum_{i=1}^{n} P_i(k_i-\bar{k})^2} \quad \sigma=\sqrt{\sum_{i=1}^{5} P_i(k_i-\bar{k})^2}$
$\sigma=\sqrt{0.15(-60-13)^2+0.50(9-13)^2+0.35(50-13)^2} \quad \sigma=\sqrt{0.15(-60-13)^2+0.50(9-13)^2+0.35(50-13)^2}$
$\sigma=\sqrt{0.15(-73)^2+0.50(-4)^2+0.35(37)^2} \quad \sigma=\sqrt{0.15(-73)^2+0.50(-4)^2+0.35(37)^2}$
$\sigma=\sqrt{0.15(5329)+0.50(16)+0.35(1369)} \quad \sigma=\sqrt{0.15(5329)+0.50(16)+0.35(1369)}$
$\sigma=\sqrt{799.35+8+479.15} \quad \sigma=\sqrt{799.35+8+479.15}$
$\sigma=\sqrt{1286.5} \quad \sigma=\sqrt{1286.5}$
$\sigma=35.87\% \quad \sigma=35.87\%$

Based on our calculations, Stag Tractors has an expected return of 13% and a standard deviation of 35.87%.

Big Oil vs. Stag Tractors

Now, let's compare these two stocks. Assuming you are a risk-averse investor, which should you choose? The answer is either one, depending on your degree of risk aversion. Big Oil is less risky (lower standard deviation), but it also has a lower expected return. Stag Tractors is riskier, but you are compensated for that additional risk with an extra 4% expected return. Is that additional 4% expected return enough extra compensation for the extra risk? The answer depends on the person. People that are more risk averse (more sensitive to risk) will likely prefer Big Oil. People that are less risk averse will likely prefer Stag Tractors.

What if the expected return for Stag Tractors was only 10%, would some risk-averse investors still choose it? The answer is yes – although the number choosing Stag Tractors would be fewer in this case as fewer people would find the extra compensation (now only 1%) adequate to compensate for the extra risk. As long as the higher risk alternative pays a higher expected return, there should be some people that will choose it. However, the number that choose the higher risk stock will increase as the extra compensation (difference in expected returns) increases.

What if the expected return for Stag Tractors was only 9% (the same as Big Oil) or lower? Now, all risk-averse investors would choose Big Oil as there is no additional compensation for taking on the higher level of risk.

A quick side note. One factor that might influence your decision is your time horizon. Let's say that I have $10,000 to invest. If I earn a 9% return, I will earn $900 compared to the $1300 I would earn at a 13% return. This is a difference of $400 (keep in mind that is based on expected returns – on average – not actual returns). That $400 difference is probably not very significant when you

consider the possible upsides/downsides. However, what if my time horizon was 35 years? If I start with $10,000 and earn 9% for 35 years, I will have $204,140. If I earned 13%, I would have $720,685. Now I end up with about 3.5 times as much wealth. Four percent is not much in one year, but compounded over 35 years it is massive. Therefore, it may make more sense to be willing to take high-risk, high expected-return investments over a longer time frame than if you only have a short time for the return to work in your favor.

Asking you to choose between Big Oil and Stag Tractors (or any two stocks) is really a bit of a false choice. You do not have to choose one or the other…you can choose both. Let's now move from looking at stocks individually to looking at a two-stock portfolio.

Correlation

Before we can do the analysis of a two-stock portfolio, we need to talk about correlations. Correlations represent the degree to which any two variables move together. In finance, we often focus on the correlation between returns for a pair of securities (note – returns are our focus, not the prices of the securities). Correlations can range from -1.0 (perfect negative correlation) to 1.0 (perfect positive correlation). It is extremely rare for any two variables to have perfect negative, perfect positive, or no correlation (a correlation of exactly zero would be no correlation). Let's look at a few general examples.

Consider if we took a look at two variables ⇒ (1) Hours per week studying and (2) Average test score for each student in the business finance classes over the past few years. We would likely see a positive correlation – but not a perfect positive correlation. Some students study quite a bit and still struggle with the material for a variety of reasons. Other students may not study much, but find the material intuitive and still do well. However, for most students, studying harder will lead to higher test scores. We might expect a correlation probably in the range of 0.6-0.8 (assuming honest answers to hours studied).

Now, let's look at two other variables ⇒ (1) Number of absences during the semester and (2) Average test score for each student in the business finance class over the past few years (physical classes). We would likely see a negative correlation – but not a perfect negative correlation. Some students show up to class, but don't pay attention or just find the material difficult. Some students miss classes, but spend a lot of time outside of class making it up or find the material intuitive. However, in general, the more often people miss class, the lower their test scores tend to be. We might expect the correlation would probably be somewhere around -0.5 to -0.8.

Finally, let's look at two more variables ⇒ (1) Height and (2) Average test score for each student in the business finance class over the past few years. We might expect that there would be no relationship between these two variables (no correlation). However, it is likely that the chance of the correlation being exactly zero would be small. Instead it would likely (by chance) be slightly negative or slightly positive – probably somewhere in the range of -0.10 to 0.10.

For stocks, correlations tend to be small positive values (between 0.10 and 0.50) due to general economic conditions (market risk factors) that impact all stocks. However, firm-specific risk factors keep the correlations from getting too high as they impact each stock independently. Typically, firms in the same industry tend to have higher correlations. Again, refer to the data in Appendix 1 which captures some sample correlations based on monthly returns over the 2013-2017 time frame. A few quick examples would be Pepsi-Coke (same industry) with a correlation 0.69 or Caterpillar-Molson Coors (very different industries) with a correlation of 0.03. Note that in this sample, all but nine (out of 66) of the paired stock correlations are positive and average 0.20. The Aggregate Bond ETF is a portfolio of bonds, not an actual company. This allows us to see how stocks are correlated to the overall bond market. The S&P 500 is a measure of the overall stock market (500 individual companies in one large portfolio) and also not a company. Both the Aggregate Bond and S&P 500 are represented by Exchange Traded Funds (ETFs) which are a type of mutual fund. These allow individuals to own a broad portfolio of securities as if they were a single stock and can be important investment tools. We will come back to the S&P 500 later in this chapter as well.

Now that we understand correlation, we can move to the expected return and standard deviation for a two-stock portfolio.

Example Three: 2-Stock Portfolio

The formula for expected return of a two-stock portfolio is:

$$\bar{}kp=w1\bar{}k1+w2\bar{}k2\bar{}\bar{}=\bar{}1\bar{}1+\bar{}2\bar{}2$$

Where the w stands for weight (proportion of our portfolio in that stock) and $\bar{k}$ stands for the expected return. In our example, Big Oil is stock 1 and Stag Tractors is stock 2. Since we are investing $4000 into Big Oil and $6000 into Stag Tractors, our total portfolio value is $10,000. That means the proportion of our portfolio into Big Oil is 0.4 ($4000/$10,000) and the proportion of our portfolio in Stag Tractors is 0.6 ($6000/$10,000). Note that our weights should be expressed as decimals and should add to 1.0. Remember from Examples One and Two that the expected return for Big Oil was 9% and the expected Return for Stag Tractors was 13% (I recommend writing these as 9 and 13 in the formula instead of 0.09 and 0.13, but you can take either approach as long as you are consistent – don't mix and match). This gives us

$\bar{k}p=(0.4)(9\%)+(0.6)(13\%)\bar{k}=(0.4)(9\%)+(0.6)(13\%)$
$\bar{k}p=3.6\%+7.8\%\bar{k}=3.6\%+7.8\%$
$\bar{k}p=11.4\%\bar{k}=11.4\%$

So, the expected return for our two-stock portfolio is 11.4%.

The standard deviation is a bit more complicated. The formula for this

$\sigma p=\sqrt{W21\sigma21+W22\sigma22+2W1W2\sigma1\sigma2corr1,2}\sigma=\sigma12\sigma12+\sigma22\sigma22+2\sigma1\sigma2\sigma1\sigma2\sigma1,2$

Our weights are still 0.4 for Big Oil and 0.6 for Stag Tractors. Remember from Examples One and Two that the standard deviation for Big Oil is 21.79% and the standard deviation for Stag Tractors is 35.87%. Like the returns, you can either express these as 21.79 and 35.87 or as 0.2179 and 0.3587 in your calculations. I recommend 21.79 and 35.87, but it is up to you…just don't mix and match. Again, make sure the weights are expressed as decimals and add to 1. The correlation given here is -0.5. So, when we plug these into the formula we get

$\sigma p=\sqrt{(0.4)2(21.79)2+(0.6)2(35.87)2+2(0.4)(0.6)(21.79)(35.87)(-0.5)}\sigma=(0.4)2(21.79)2+(0.6)2(35.87)2+2(0.4)(0.6)(21.79)(35.87)(-0.5)$
$\sigma p=\sqrt{75.97+463.20+(-187.59)}\sigma=75.97+463.20+(-187.59)$
$\sigma p=\sqrt{351.58}\sigma=351.58$
$\sigma p=18.75\%\sigma=18.75\%$

Note that in this example, the standard deviation of the two-stock portfolio is actually less than the standard deviation of either stock individually. That is due to the extremely low (actually negative) correlation which means that these stocks have a tendency to move in opposite directions. When Big Oil is doing poorly, Stag Tractors tends to do better. When Stag Tractors is doing poorly, Big Oil tends to do better. While this is a bit of an extreme example (remember, negative correlations are rare), we can diversify (reduce) our overall risk any time the correlation is less than 1.0 (which is almost always going to be the case). By reducing our risk, we mean that the risk of the portfolio will be less than the weighted average of the individual stocks. Two clichés come to mind. The first – "there is no free lunch" – is made false by the second – "don't put all your eggs in one basket". Because diversification does not lower our expected return (it is a simple weighted average that is not affected by the correlation), our "free lunch" is that by holding stocks in a portfolio, we can reduce our risk without lowering our expected return. While we demonstrated this with a two-stock portfolio (to keep the calculations manageable), the more stocks we add to the portfolio (up to a point), the more benefits we get from diversification.

Because of the idea of diversification, we can virtually eliminate the impact of firm-specific risk by holding a large portfolio of 50+ stocks from a variety of different industries (and even countries). However, no matter how many stocks we own we still are faced with market risk. While all stocks are subject to market risk, some stocks are more sensitive to market risk than others. If we have a portfolio of all high market risk stocks, we will have diversified away most of our firm-specific risk, but still have a high risk (and high expected return) portfolio. Alternatively, if we have a portfolio of all low market risk stocks, we will have diversified away most of our firm-specific risk, but now will have a lower risk (and lower expected return) portfolio. Since we can eliminate most of our firm-specific risk it becomes less relevant. However, since we can not eliminate market risk, we need to be able to measure it. It also should be the primary factor that systematically drives returns. We will measure market risk with a concept referred to as beta.

Example Four: Beta

Next, you estimate the expected return and standard deviation for the S&P 500 (The S&P 500 is a portfolio of 500 large-company stocks) and find that it has an expected return of 10% and a standard deviation of 14%. Big Oil has a correlation with the S&P 500 of 0.75 while Stag Tractors has a correlation with the market of 0.32. Calculate the beta of each stock.

The formula for beta is

β=(σstock)(corrstock,market)σmarket=()(,)

Looking at the formula, you see the word “market”. Theoretically, “the market” refers to a value-weighted portfolio of all investible assets that one can buy. This would include all stocks across the globe, all bonds across the globe, all real estate, precious metals, precious gems, commodities, collectibles (paintings, antiques, etc.) and anything else that someone could purchase as an investment. From a practical perspective, “the market” is too broad to measure. Therefore, we often see people use a simple approximation such as the S&P 500. The S&P 500 is a “market portfolio” of 500 larger firms grouped together as one large portfolio (with the largest companies making up a larger portion of the portfolio). On the handout with the sample correlations and standard deviations, I’ve included the S&P 500 as a measure of the market. Here, all the necessary values are provided in the example. This allows us to calculate the beta of Big Oil and Stag Tractors as follows (remember that the standard deviation of Big Oil was 21.79% and the standard deviation of Stag Tractors was 35.87%):

βBigOil=(21.79)(0.75)14=1.17=(21.79)(0.75)14=1.17

βStagTractors=(35.87)(0.32)14=0.82=(35.87)(0.32)14=0.82

Note that we do not use the expected return on the market here (we will come back to that in the next example). Also, note that while we previously stated that Stag Tractors was riskier than Big Oil when we were evaluating with standard deviation, beta tells us a different story. The reason that standard deviation can give us a different result than beta is that they are measuring two different types of risk. Standard deviation measured total risk (firm-specific risk plus market risk). This was important when evaluating investments on their own as the firm-specific risk had not been diversified away. Beta measures market risk, which is critical when evaluating stocks as part of a well-diversified portfolio because then firm-specific risk is no longer relevant. While Stag Tractors is riskier by itself, its lower correlation to the market (again, remember these are our hypothetical example numbers from these practice problems) allows it to have less market risk and be less risky as part of a well-diversified portfolio.

The average risk level for market risk is 1.0. The further the beta falls below 1.0, the lower the market risk. The higher the beta rises above 1.0, the greater the market risk. The data from Appendix 1 gives some sample betas for the time frame of 2013-2017. For example, the beta for Boston Beer is a low 0.51 indicating very low market risk. This makes sense as we would not expect Boston Beer’s cash flows to be very sensitive to overall economic factors – indicating lower market risk. Alternatively, Amazon has a high beta of 1.47. Again, this makes sense as Amazon (an online retailer and technology company) will see it’s returns be very sensitive to the overall market – indicating higher market risk. While beta is estimated off of past data, what we really need is the beta for the upcoming period. Given that beta changes over time, we need to think of beta as a rough approximation, not an exact value.

Because investors know that they can simply diversify away firm-specific risk, the critical risk that they want to focus on (and get compensated for) should be market risk – measured by beta. Since market risk drives investors required returns (higher betas should have higher required returns as they are riskier) we need a way to formalize this process. Fortunately, this was developed in the 1960’s within a theory referred to as the Capital Asset Pricing Model (CAPM). The CAPM is a broader theory relating risk and return, but the practical application component of the CAPM is the Security Market Line (SML). While technically they are not the same thing (the SML is a part of the CAPM theory), many people use the terms interchangeably. The next example walks us through the SML and its implications.

Example Five: Security Market Line and Required Return

Then, assuming the current risk-free rate of interest is 4.7%, calculate the required return of each stock.

Based on this, should you buy either (or both) of these stocks as part of a well-diversified portfolio?

The formula for the SML is as follows:

k=kRF+β(¯km−kRF)=+(¯−)

Where k represents the required return for the specific stock (or portfolio) in question, k_{RF} represents the risk-free rate of return, β refers to beta, and ¯km¯ refers to the expected return on the market. Oftentimes, people will refer to the portion (¯km−kRF¯−) as the market risk premium as it reflects the additional compensation (beyond the risk-free rate) that investors need to compensate them for the risk of owning stocks. The idea is that we know stocks are risky investments and

investors don't like risk. Therefore, investors need additional compensation (beyond a risk-free rate) to make it worthwhile to own stocks. However, different stocks have different levels of (market) risk – measured by beta. Higher risk stocks (those with higher betas) should get more than average additional compensation. Alternatively, lower risk stocks (those with lower betas) should get less than average additional compensation. Therefore, we multiply the market risk premium by beta to adjust for the risk of that specific stock and get the proper amount of additional compensation for that specific stock. Then, we add back in the risk-free rate to get the total required return for that specific stock.

If we apply it to our specific stocks, we get the following (remember from example four that the beta for Big Oil was 1.17, the beta for Stag Tractors was 0.82 and the expected return for the S&P 500 was 10%):

kBigOil=4.7%+1.17(10%−4.7%)$\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare$=4.7%+1.17(10%−4.7%)
kBigOil=4.7%+1.17(5.3%)$\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare$=4.7%+1.17(5.3%)
kBigOil=4.7%+6.20%$\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare$=4.7%+6.20%
kBigOil=10.90%$\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare$=10.90%

kStagTractors=4.7%+0.82(10%−4.7%)$\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare$=4.7%+0.82(10%−4.7%)
kStagTractors=4.7%+0.82(5.3%)$\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare$=4.7%+0.82(5.3%)
kStagTractors=4.7%+4.35%$\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare$=4.7%+4.35%
kStagTractors=9.05%$\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare\blacksquare$=9.05%

Thus, our required return for Big Oil is 10.90% and our required return for Stag Tractors is 9.05%. Remember from Examples One and Two that the expected return for Big Oil was 9% and the expected return for Stag Tractors was 13%. For Big Oil, the expected return (9%) is less than the required return (10.90%) meaning that we will not (on average) earn enough to compensate us for the risk. Therefore, we should not buy Big Oil (assuming we don't already own it) or we should sell Big Oil (assuming we do already own it). Alternatively, the expected return for Deere (13%) is more than the required return (9.05%) meaning that we will (on average) earn more than enough to compensate us for the risk. Therefore, we should buy Deere stock. We could also use these required returns in the stock valuation models introduced in Chapter Five (remember that back then, the required return was given).

There are a couple of challenges in using the Security Market Line. First, there is no truly risk-free rate. All investments have some level of risk. However, typically the yield on Treasury securities (debt issued by the US Federal Government) is used as the risk-free rate. There is some debate about whether short-term debt (3-month Treasury bills) should be used (as shorter-term securities are less sensitive to changes in the market rate of interest and thus less risky) or long-term (10-year Treasury bonds) should be used (as stocks are a long-term investment and using 3-month securities introduces reinvestment risk as we don't know what rate will be in place after the first 3 months has gone by). I prefer the 10-year Treasury. In addition, there is some debate about the appropriateness of using Treasury debt in today's economic environment as the US no longer has a AAA rating from S&P and the increasing levels of US Federal Debt may introduce some default risk. However, at least for now, investors are accepting incredibly low yields on US Treasury debt which indicates that, while it may not be 100% risk-free, it is still viewed as a very low risk investment.

A second problem was referred to earlier which is that ideally we need the beta for the future time horizon and we can only estimate the past. As this estimation risk means we do not know the true beta, our SML results will be subject to estimation error as well.

A third problem is that the market risk premium is unknown as there is no way to determine exactly what the expected return on the market is. We know that the market risk premium needs to be positive (risk-averse investors would not take on the risk of holding stocks if they expected to earn less than the risk-free rate), but we don't know whether it should be 3%, 5%, 7% or some other value. Historically, it has been estimated to range from about 3% to 7% depending on economic conditions and recent performance of the stock market. When the economy is strong and the recent performance is strong, investors are more willing to hold stocks and the market risk premium shrinks. When the economy is weak and the recent performance of stocks has been strong, investors are hesitant to hold stocks and need more compensation to get them to do so – making the market risk premium larger.

There are two important implications of the Security Market Line (assuming it is valid):

1. The only factor that should systematically differentiate returns across portfolios is beta. This is because the only factor that is different from one stock to the next is beta (both the risk-free rate and the expected return on the market are not dependent on

what stock we are looking at).
2. High beta stocks should (on average) earn higher returns over time while low beta stocks should (on average) earn lower returns over time due to the risk differential.

Note that this does not say firm specific factors (company X gets hit with a lawsuit or company Y develops a great new product) don't influence stock returns, just that they aren't systematic. Instead, they will cancel out in larger portfolios and become irrelevant. It also doesn't say every high beta stock will outperform every low beta stock (again, firm specific issues can impact individual stocks) or that high beta stocks as a group will always outperform low beta stocks (actually high beta stocks should do worse in periods where the market as a whole does poorly).

Unfortunately, studies indicate that neither of these implications holds consistently. First, other factors (listed below) have been shown to impact returns on a systematic basis. Second, it is not clear that high beta stocks do (on average) earn higher returns over time.

Other factors that have been shown to influence stock prices include:

1. Firm Size – small firms tend to earn higher returns than large firms even after controlling for beta
2. MV/BV ratio – "value" firms (firms with low MV/BV ratios) tend to earn higher returns than "glamour" or "growth" firms (firms with high MV/BV ratios) even after controlling for beta
3. Momentum – stocks that have outperformed the market over the last six months are likely to earn higher returns over the next six months than stocks that have underperformed the market over the last six months, even after controlling for beta.

These issues have led to the development of alternative asset pricing models (which go beyond the scope of this course).

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13.16: Table- Correlations, Returns and St. Deviations Across National Equity Markets (CH11)

The calculations made in the main body of Chapter Ten assume that there are no additional costs to raising money other than paying the investors' their required return. However, this is often not the case. When issuing new debt or selling additional shares of stock, most firms use (and must pay for) the services of an investment banker. There also may be some other additional costs of issuing new securities. The investment banking fees and other costs of issuing securities are referred to as flotation costs. To accurately capture the cost of capital it would be appropriate to consider flotation costs when appropriate.

When are flotation costs appropriate? Well, any additional debt financing or preferred stock financing needs to be generated by issuing more bonds or preferred stock. Thus, debt financing and preferred stock financing should consider flotation costs. Common stock financing on the other hand can come from two sources — (A) retained earnings and/or (B) newly issued securities. If the firm can generate all of its equity financing from retained earnings, then it doesn't have to issue new stock and can avoid flotation costs. On the other hand, if the company needs more equity financing than can be supplied by retained earnings, then it must issue new stock and pay flotation costs. This leads to breakpoints in the firm's cost of capital.

Consider a firm that has market value weights of 40% debt, 10% preferred, and 50% common stock. Also, the firm has $1,000,000 in retained earnings being generated this year. Since 50% of the firm's financing is coming from common equity, it can spend $2,000,000 on capital budgeting projects before it runs out of retained earnings and must issue new shares of common stock. Thus, there will be a cost of capital breakpoint at $2,000,000 where the Marginal Cost of Capital will increase to reflect the impact of flotation costs associated with issuing new common stock financing. Additional breakpoints could also happen if the company issues so much debt that investors feel the firm has become more risky and increase their required return.

To include flotation costs in the cost of debt financing, we would re-estimate the Yield-to-Maturity on the bonds. Specifically, instead of using the market price of the bond we would replace it with the amount that would be received after flotation costs. For example, consider a situation where the firm estimates flotation costs on debt to be 3%. If we currently have bonds outstanding with a price of $888, 6% coupon rate and 12 years to maturity, then the current YTM would be 7.44%. However, with flotation costs, we would use a price of $861.36 [($888)*(1 – .03)] to calculate the YTM and instead have a before tax cost of 7.82%.

To include flotation costs in the cost of preferred stock, we would re-estimate the cost. Specifically, instead of using the market price of preferred stock, we would replace it with the amount that would be received after flotation costs. For example, consider a situation where the firm estimates flotation costs on preferred stock to be 4.5%. If we currently have preferred stock outstanding with a 9% dividend rate, a $50 par value and a $45 market price, then the current cost of preferred stock would be 10%. However, with flotation costs, we would use a price of $42.98 [($45)*(1 – .045)] to calculate the cost of preferred and would get k_p to be 10.47%.

To include flotation costs in the cost of common stock, we would re-estimate the cost. Specifically, instead of using the market price of common stock, we would replace it with the amount that would be received after flotation costs. For example, consider a situation where the firm estimates flotation costs on common stock to be 7%. If we currently have common stock outstanding with a forecasted dividend (D_1) of $2.50, a $25 market price and a 5% growth rate, then the current cost of common stock would be 15%. However, with flotation costs, we would use a price of $23.25 [($25)*(1 – .07)] to calculate the cost of common and would get k_s to be 15.75%. Note that this only works with the dividend valuation approach. To adjust the cost of common stock financing using the SML or Bond Yield Plus Risk Premium approach would require a subjective adjustment. Also, remember that we would only include flotation costs in estimating the cost of common after we have used up all of our retained earnings financing.

13.16: Table- Correlations, Returns and St. Deviations Across National Equity Markets (CH11) is shared under a CC BY-NC 4.0 license and was authored, remixed, and/or curated by LibreTexts.

13.17: Table- Foreign currency relative to US dollar in 2020 (CH11)

Use the table below to review correlations, returns and standard deviations across national equity markets.

Table: Correlations, Returns and St. Deviations Across National Equity Markets from Jan. 2011 – Dec. 2020

Markets	US	Japan	UK	Canada	France	China	Brazil	S. Korea	Taiwan	S. Africa
US	1.00									
Japan	0.67	1.00								
UK	0.84	0.66	1.00							
Canada	0.85	0.56	0.84	1.00						
France	0.80	0.63	0.90	0.78	1.00					
China	0.65	0.51	0.66	0.67	0.62	1.00				
Brazil	0.55	0.40	0.63	0.71	0.60	0.56	1.00			
S. Korea	0.68	0.56	0.73	0.71	0.73	0.78	0.63	1.00		
Taiwan	0.70	0.58	0.64	0.67	0.66	0.73	0.61	0.81	1.00	
S. Africa	0.64	0.53	0.67	0.72	0.64	0.62	0.76	0.73	0.67	1.00
Annual Return	13.79%	6.17%	2.26%	2.13%	5.77%	7.65%	-4.36%	5.01%	8.21%	-1.37%
St. Deviation	14.43%	14.32%	16.86%	17.41%	19.43%	21.25%	33.96%	21.85%	17.89%	24.23%

The data is based on monthly returns from Exchange Traded Funds. Specifically, the Vanguard Total Market Index (VTI) for the US, the SPDR S&P China (GXC), and the iShares MSCI Country ETFs for each of the other countries (EWJ, EWU, EWC, EWQ, EWZ, EWY, EWT, EZA).

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CHAPTER OVERVIEW

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14.1: Solutions to CH 1 Exercises

 Solutions

Question 1

A corporation is a type of business organization that separates the management and ownership of the business. Ownership of the corporation is based on owning stock (or equity) in the firm. Owners have a right to the income that the business generates, a claim against the assets of the business (secondary to creditors), and then hire (through a board of directors) a management team to operate the business and make the strategic decisions. An example would be Ford. If you buy 100 shares of Ford, you are a part owner of the firm but you are not involved in the process of running the business. Because of this separation between ownership and management, there are some unique characteristics of a corporation.

Limited Liability – Owners' losses are limited to their initial investment. If you invest $1000 into Ford stock, that is the most you can lose. Even if the firm goes bankrupt and cannot pay all of its bills, your investment may become worthless but you will not owe additional money.

Double Taxation – Because the owners and the business are separated legally, they are separated in the eyes of the tax code as well. This means the business is taxed on its income (corporate income tax) and then owners are taxed on any profits they earn on their investments into the corporation (dividends and capital gains taxes).

There are several other forms of business organization (sole proprietorships, partnerships, etc.) and many other technical legal issues related to business organization but these are beyond the scope of our class. We will focus on the basic corporate form of organization for the purpose of this class.

Question 2

The concepts of Limited Liability and Double Taxation are explained in the previous answer. In addition to understanding the concepts, it is important to understand their impact on investors and the corporation. Limited liability is critical due to the separation of ownership and decision-making. Not many investors would be willing to supply capital to the firm if they were not part of the decision-making process AND could be held liable for all of the firm's actions. Consider a situation where you invest in restaurant chain by buying 100 shares of stock for $20. You are investing $2000. Now imagine that this restaurant chain (without your knowledge or approval) used non-inspected meat that caused several deaths. With unlimited liability, it would be conceivable that you (as a passive investor) could lose everything and be forced into bankruptcy for actions that you had no influence on. If this were the legal environment, very few people would be willing to purchase shares of stock (becoming owners) in corporations. This would greatly restrict the amount of capital and make it harder for firms to raise the necessary money to build plants, develop new products, hire employees, etc. Limited liability is essential to creating an environment where investors are willing to the necessary capital to allow corporations to operate.

Double-taxation also impacts the ability of corporations to attract capital, although negatively. When investors purchase stocks and invest in ownership of a corporation, they are doing so in order to earn a profit. In investing, this profit is often referred to as a rate of return. The rate of return is what compensates the investor for both undertaking risk and for tying up the investor's money for a period of time. The investor is concerned with the rate of return after taxes as that is what will be left over for the investor to spend. Double-taxation lowers the after-tax rate of return and means investors must demand a higher before-tax rate of return. This makes it more expensive for firms to raise money and also means that some projects may no longer be worth pursuing. The more that firms must pay to raise money (referred to as the cost of capital), the less productive the economy will be. This is why things like capital gains and dividend tax cuts are often thought to be something that can stimulate the economy.

Question 3

Because of the separation between ownership and management in the corporate form of ownership, it is critical that the passive owners get the necessary information regarding the firm's financial performance in order to evaluate their investment. Without accurate and reliable information, the owners cannot make good decisions about which corporations to invest in. Also, unethical managers could use misinformation to take advantage of investors. If there were not audited financial statements, managers could

exaggerate their performance in order to get more pay and other perks as shareholders would think that management was more productive than it actually was. This scenario occasionally occurs even with audited financial statements as some managers are able to commit fraud and trick the auditors. In the late-1990/early-2000 time period there were several instances of this occurring. These financial scandals severely eroded investor confidence and were one of the factors in stock prices plunging during 2001-2003. As a response, a series of enhanced financial reporting regulations called Sarbanes-Oxley were passed to improve the accuracy of information. While this has resulted in much better information for owners to use in evaluating investment decisions and which corporations to invest in, it is also quite costly for the corporations. As these higher costs lower profitability, ultimately it is the stockholders (owners) themselves that are paying for this better information. Is it worthwhile? There is much debate about that. It is clear that too little information is problematic, but spending too much on information can also be bad. If a firm losses too much of their profits in preparing the information, there may not be enough left over to make the investment worthwhile. Finding the balance is a challenging proposition.

Question 4

The two primary instruments corporations issue to raise money are stocks (equity) and bonds (debt). Stocks are an ownership interest in the firm and bonds are a structured loan made to the firm. (Note – there are many other forms of debt financing other than bonds {bank loans, leases, accounts payable, etc.} but bonds are a primary source of long-term debt financing for many corporations). When comparing stocks and bonds it is important to think of the primary characteristics of each.

Cash Flows Paid to Investors

Stocks pay a variable cash flow stream called dividends. Dividends can increase or decrease over time and firms are not required to pay them (many stocks currently pay no dividends). In addition to profiting from dividends, stockholders may also see a capital gain when the value of their stock goes up (or a capital loss if the value of the stock goes down). The change in the value of the stock will be related to the prospects of the business. In general, the more successful the business the greater the value of the stock since a share of stock represents a small ownership in the business.

Bonds make two primary payments to investors. First is the coupon payment. This is a fixed annual interest payment to bondholders. Unlike dividends, coupon payments do not increase or decrease over time and the firm must make promised payments or it can be forced into bankruptcy. The second form of cash flow paid to investors is the par value. At the end of the bonds life, the firm will pay the bondholders a par value (or sometimes called maturity value) to retire the bond. The coupon payment represents the interest and the par value represents the return of the borrowed money. (Side Note – the value of a bond can also fluctuate based on changes in market rates of interest as we will see later in the semester).

Lifespan

Stocks have an infinite time horizon. The ownership interests exists as long as the firm does. If the firm goes bankrupt or is purchased (takeover) by another firm, then the stock may cease to exist. However, the stock never matures. Your ownership interest generated by buying 100 shares of PepsiCo until (A) you sell it to someone else, (B) PepsiCo ceases to exist as a public company.
Bonds have a finite time horizon. A bond's maturity (for example 5 years) is set at the time the bond is issued and once that maturity is reached the bondholder is paid the par value and will no longer receive coupon interest payments.

Note that both stocks and bonds can be sold at any time in the financial markets, so purchasing a stock does not commit you to holding it forever and purchasing a bond does not commit you to holding it until maturity.

Control

Stockholders are not involved in running the firm or making strategic decisions for the firm. However, they have limited control through their election of the board of directors. The board of directors is in turn responsible for hiring, firing, and compensating management. For practical purposes, most stockholders have very little control of the firm.
Bondholders have no control over the firm as they are creditors rather than owners. However, bondholders will usually include provisions that protect their interests to some extent in the legal agreement created when the bonds were issued.

Risk

Stocks are riskier from the investors' perspective. Because dividends are variable, investors do not know what they will receive in terms of cash flows. Also, stockholders have a lower priority of claims than do bondholders. This means bondholders must be paid in full before stockholders get anything.
Bonds are less risky from the investors' perspective. The cash flows (coupon payments and par value) are known in advance and bondholders have a higher priority of claim than stockholders making it more likely they will receive most of their money back if things go wrong. As we will see later in the semester, long-term bonds are riskier than short-term bonds and some types of bonds are riskier than others based on who issued them.

Return

Risk and return are closely related. Since stocks are riskier, they typically offer investors higher rates of return than do bonds.

Question 5

The goal of financial management is to maximize shareholder wealth (the value of the firm). Management accomplishes this goal by focusing on

The Magnitude of expected cash flows
The Timeliness of expected cash flows
The Riskiness of expected cash flows

There are a few important observations to remember with this.

- In general, shareholder wealth is increased when the stock price increases so that maximizing shareholder wealth is the same thing as maximizing firm value.
- The value of the firm should be based on long-term value creation, not short-term stock price manipulation.
- Assuming the number of shares is held constant, increases in the stock price represent progress towards value maximization.
- Expectations mean that investors must be forward looking. The impact of what will happen over the next year is far more important than what has happened over the last year. Also, financial results need to be compared to what was expected to happen in order to be understood.
- The three elements of value maximization need to be considered as a whole, not independently. Our goal is not to minimize risk (doing so would mean never starting any new projects), but to maximize the value of the firm (shareholder wealth). It is not to maximize cash flows (as that may entail too much risk), but to maximize firm value (shareholder wealth). It is not to get money into the firm as soon as possible (as many valuable projects may require several years to be generate value), but to maximize firm value (shareholder wealth). Only when we consider all three factors as a whole can we achieve our primary goal.

Question 6

There are several reasons to focus on cash flows over earnings per share (or net income).
First, accounting earnings distort timeliness issues. In finance it is critical to recognize when cash flows are received or paid out as the value of those cash flows is dependent on when we receive them (it is better to get $1 today then the same $1 nine months from now).
Second, accounting earnings are easily distorted. There are several different ways to recognize various revenues and expenses (LIFO vs FIFO, depreciation, etc.). Changing the accounting method can change net income, but it doesn't affect value. Focusing on cash flows reduces this problem.
Third, it is possible to generate accounting profits and not have enough money to pay the bills. Firms need healthy cash flows in order to stay in business.
The vast majority of the time, earnings per share and cash flows will tell us the same thing. When they differ, we want to focus on the cash flows.

Question 7

Risk Aversion means that, everything else equal, investors prefer less risk. In order to get people to invest in riskier investments they need to anticipate higher rates of returns. A few important points on risk aversion:

Risk Aversion does not mean the same thing as risk minimization. A risk minimizer will always choose the lowest risk alternative. A risk-averse (NOTE: That is risk-averse, not risk-a**d**verse) individual may choose the higher risk alternative if he/she is receiving enough compensation to offset the higher risk.

The degree of risk aversion is very personal and varies based on a number of factors (age, wealth, income, personality, etc.). One individual may be willing to take a higher risk for a very small increase in anticipated return while another individual may require a significantly higher anticipated return to undertake the same risk.

Risk aversion is a valid assumption for most people despite a few common exceptions. While many people love to gamble (Las Vegas, lotteries, etc.) which typically has negative expected returns, this can be explained by two factors. First, most people consider this an entertainment expense rather than an investment. Second, most people gamble with small stakes. When evaluating investment decisions, most people exhibit risk-averse behavior.

Question 8

Half the time you flip the coin, you will get heads and get $2. The other half the time you will get tails and get $0. This means on average, you will get $1. Since you are paying $1 for the opportunity, your expected value is $0. On average, you won't make anything or lose anything on the flip. However, you are undertaking risk (since you could flip the coin, get tails and lose $1). A risk-averse person will not want to undertake risk without a payoff, so should not take the coin toss.

However, if you are able to buy the coin flip for only $0.90, you will be making an average profit of $0.10 every time you flip the coin. Since you are earning a profit, a risk-averse person might choose to undertake the coin flip. On the other hand, not all risk-averse people will. Some people will find the $0.10 profit high enough to take the risk while others (that are MORE risk-averse) will think $0.10 is not enough to take the risk. The amount of profit YOU need to earn in order to justify taking the risk is dependent on you as an individual. Different people will have different degrees of risk aversion.

Question 9

Globalization impacts firm value through both the magnitude of expected cash flows and the riskiness of expected cash flows. Globalization opens up more markets which can increase expected cash flows. This is because approximately only 5% of the global population and 25% of the global GDP belong to the US. That implies that 95% of our potential market in terms of customers and 75% of our potential market in terms of dollars lies outside the US.

Globalization also exposes firms to more risk factors (currency risk, political risk, cultural risk, etc.). In most cases, the benefits of the higher potential expected cash flows more than offset the negatives of the increased risk.

Question 10

Social Responsibility – Being proactively concerned with the welfare of society
Ethics – A standard of conduct or moral behavior

Social responsibility and ethics are factors that help us achieve our goal of maximizing firm value over the long run. Ethics adds value through a concept known as "reputational capital." When employees, customers, suppliers, etc. feel that our firm is ethical and trustworthy, this will help us in many ways. For instance, a firm that has a reputation of treating its employees in a fair and respectful way will likely have an easier time recruiting and keeping high quality employees. Firms that treat suppliers in an unethical manner may find those suppliers unwilling to do business with them in the future. Social responsibility can help add value through both a marketing perspective as well as through employee relationships. Customers feel better about spending money with firms that have a positive image and employees feel better about working for companies with a positive image.

One note about social responsibility though is that it should not be the primary goal of the firm. For instance, a firm that donated 100% of their profits to a specific charity would be treating their stockholders in an unethical manner. The management of the firm is essentially allocating the stockholders' money. To the extent that social responsibility adds value, it is a win-win situation as both society and the shareholder benefit. However, spending too much on social responsibility (to the point that it lowers firm value) is merely a situation of management taking money from shareholders.

Question 11

An agency relationship exists when one party (the principle) hires another party (the agent) to perform a task and then grants that agent decision making authority. In the context of finance, the primary agency relationship exists between managers and stockholders. Stockholders are the principles and management is the agent. If both the principle and the agent have the same goal, the agency relationship is strong. If not, there is potential for an agency conflict. The corporate form of business organization introduces an agency conflict as stockholders want managers to maximize firm value and managers want to maximize their own happiness. Oftentimes these goals do not align. In order to align these goals, a compensation system needs to be designed that compensates management for engaging in value maximizing behavior. One tool for this is to make a significant portion of management compensation in the form of company stock. This makes managers into stockholders and helps align their goals.

Question 12

Executive pay is a controversial issue as the level of executive pay has exploded over the past decades. In 2016, the average total compensation for CEOs of the S&P 500 firms was $13.1 million. This is 347 times the average compensation to production and nonsupervisory workers (instructor's note – notice that the comparison is not to all other employees, but to a specific subset of employees). The CEO of Alphabet topped the list with a total compensation of $100.6 million. A recent study by MSCI found that – "On a 10-year cumulative basis, total shareholder returns of those companies whose total summary pay (the level that must be disclosed in the summary tables of proxy statements) was below their sector median outperformed those companies where pay exceeded the sector median by as much as 39%." In other words, the greater the compensation to the CEO the LOWER the performance!

Some people will argue that the high level of executive compensation is merely a reflection of market forces. The job of CEO is demanding and consuming. A top quality hire may be able to make significant gains for shareholders and the number of qualified candidates is relatively small. No one is forcing firms to pay these high levels of compensation. If there are a billion shares of stock outstanding (Wal-Mart has approximately 3 billion shares as an example) and the CEO can make the value of each share increase by $0.50 a share more than the next most qualified person, he or she would be worth $500 million more to shareholders. For large firms, the value of the CEO can easily be in the hundreds of millions or more. Thus, maybe the large compensation packages are justified.

On the other hand, are executive salaries really operating on a free market? Do the boards of directors that are responsible for setting salaries and hiring executives really have the shareholders best interests at heart? For instance, let's say you were on the board of directors for XYZ corp. Might you be more willing to pay whatever it takes to get the person you want for the job (or retain the person currently in the job)? After all, you are not spending your money. Also, if you are currently an executive elsewhere or have the potential to be one in the future, isn't it in your best interest to push the market price of CEOs higher? Do you think it will be easier to work with the CEO (who is often interacting with and usually a member of the board) when the CEO is well compensated? There are several arguments that call into question whether or not the board of directors is ideally suited to determine optimal CEO salaries.

There are arguments that suggest CEO salaries are justifiably high and those that suggest that they are artificially high. You can make a rational argument for each side of the debate. I will not share my final opinion (although you may be able to infer it) as I don't want to artificially influence yours. However, I would encourage you to consider the arguments instead of making your decision solely based on emotion.

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14.2: Solutions to CH 2 Exercises

Question 1

The income statement captures all activity related to revenues and expenses over a particular time period. For instance, the quarterly income statement includes all revenue and expense items for that quarter. The beginning of the quarter is treated the same as the end of the quarter. The same applies for annual income statements. However, balance sheets represent a firm's assets, liabilities, and owners' equity at a particular point in time. The quarterly balance sheet only reflects the last day of that quarter and the annual balance sheet only reflects the last day of the year. As such, the balance sheet is more open to seasonality issues and short-term fluctuations. For instance, if the balance sheet is prepared 1 day prior to a large cash payment the cash account will appear artificially large. On the other hand, if it is prepared 1 day after the payment the cash account will appear artificially small.

Question 2

The firm has $60 million in total liabilities.

A = L + OE
$100M = L + $40M
$60M = L

Question 3

Depreciation is a noncash expense. While it lowers net income, the firm is not actually paying anything for depreciation so it has no impact on cash flows (ignoring taxes…when considering taxes, depreciation lowers net income but increases cash flows as less cash is paid in taxes). The cash flow impact of an asset purchase from a finance perspective occurs when the asset is purchased. Spreading the cost equally over the assets useful life ignores the time value of money and understates the true cost of the purchase. A few other issues that may create a difference between cash flows and earnings include (this is not a complete list) –

- Revenue recognition
- Inventory accounting method
- Prepaid expenses
- Accounts Payable/Receivable

Question 4

While many people use ratio analysis, the primary parties interested are

- Management
- Competitors
- Stockholders (and potential stockholders)
- Long-Term Creditors
- Short-Term Creditors

When analyzing **Liquidity Ratios**, the most interested parties are management and short-term creditors. Management needs to understand the firm's liquidity position in order to properly manage the firm. Short-term creditors typically do not care much about the long-term health of the firm, but only if they have enough liquid capital to meet the short-term obligations. Long-term creditors and stockholders would also be interested, but primarily only if the liquidity ratios were weak enough to damage the long-term health of the firm.

When analyzing **Asset Management Ratios**, the most interested parties are management, competitors, and stockholders. Again, management must be interested in all the ratios as they must manage all aspects of the firms operations. Competitors are interested as a gauge of their own performance. If our competition has a total asset turnover of 2.50 and ours is only 1.95 we must understand what they are doing to outperform us in this measure. By identifying our weaknesses, we can address them. Stockholders have some interest in that often asset management ratios impact a firm's ability to generate profits and increase firm value. Long-term

and short-term creditors are typically not significantly concerned with these measures as they do not share in any "extra" profits the company generates. As long as the firm is able to meet interest and principle obligations, debt holders are happy.

Management, long-term creditors, short-term creditors, and stockholders are all focused on **Debt Management Ratios**. These ratios measure a firm's ability to meet their debt obligations, so creditors want to see these ratios strong in order to be confident of receiving their full interest and principle payments. Long-term creditors are probably more focused on this as short-term creditors hope to be repaid quickly enough that they are more concerned about the liquidity issues. Stockholders are concerned because if the firm is unable to meet its debt obligations it will be forced into bankruptcy and the stockholders will likely lose all of their investment.

Profitability Ratios are a concern primarily for management, competitors, and stockholders. Creditors, both LT and ST, do not participate in profits so their only concern with profitability ratios is if they are negative and threaten the ability of the firm to meet interest and principal payments. Like asset management ratios, competitors use profitability ratios as a method to gauge their strengths and weaknesses. Since stockholders "own" the business, the profits belong to them. Therefore, the stronger the profitability ratios, the happier the stockholders are.

Market Value Ratios are looked at by stockholders and management. These ratios measure how "cheap" or "expensive" the stock is. Management typically wants these ratios to be high as it is a sign that they are maximizing firm value. Potential stockholders typically want them low as that is an indication that the stock may be cheap (except for dividend yield). As a side note, market value ratios are often much more difficult to analyze than many people would like.

Question 5

The key to this question recognizing the role of the equation A = L + OE in these two ratios. Because all firms use some degree of liabilities (long-term debt, accounts payable, accruals, etc.), we know that Assets must be larger than Owners' Equity. The greater the amount of debt financing (liabilities), the greater the difference between Assets and Owners Equity will be. Also, since the difference between ROA and ROE is the denominator (ROA is NI/Assets while ROE is NI/OE), ROE will always be higher than ROE (for firms with positive NI). Finally, the greater the amount of debt financing (liabilities), the greater the difference between ROA and ROE will be.

When considering the above paragraph, we can now comment on the specific ROA and ROE numbers for Company A and B. Since Company B has a lower ROA and a higher ROE (relative to Company A), we know that Company B is using more leverage (debt financing) than Company A.

Neither approach is necessarily "better" or "worse" than the other. They are just different. Company B is using a more aggressive (riskier) strategy of financing. The higher level of debt increases the risk, but also means stockholders earn a greater return on their money when the company does well. However, if the company does poorly, the higher leverage (debt financing) will magnify the losses (as the interest must still be paid and the loss is spread over less shareholder capital). Thus, higher amounts of debt financing are riskier, but also increase the potential return. Which approach is better depends on the level of risk aversion for each shareholder.

Question 6

The DSO ratio does provide an indication of how long it is taking a firm to collect its credit sales. Thus, a high DSO ratio can be an indication of a problem in managing a firm's accounts receivables. However, one must be very careful in jumping to conclusions. First, DSO can be very industry dependent. Second, and the issue in this question, is that DSO uses both balance sheet and income statement values to calculate the ratio. As the Annual Income statement is not subject to seasonality while the Annual Balance Sheet is, there is the potential for seasonality issues to distort the ratio. Specifically, Company A has larger accounts receivable on their annual balance sheet due to the seasonal nature of their sales. This inflates their DSO ratio. Company B has had plenty of time to collect their accounts receivable. This is a prime example of why you need to consider seasonality when evaluating ratios.

If we think of the inventory turnover ratio, Company A should appear to be doing better. Specifically, they will have less inventory on hand at the end of the year (as their heavy sales season is winding down and they approach seasonally lower sales). Alternatively, Company B's inventory will be high to meet their seasonally high 1st and 2nd quarter sales that are right around the corner.

Question 7

Subject to Seasonality – Quarterly Income Statement, Quarterly Balance Sheet, Annual Balance Sheet

Not Subject to Seasonality – Annual Income Statement

Question 8

This is a FALSE statement. While it is true that everything else equal, a higher profit margin is better than a lower profit margin there is not enough information to make this a true statement. We are ignoring both trend analysis and comparative analysis, so we don't have the necessary context to evaluate the profit margin number. For instance company A could be in a low profit margin industry (such as banking or retail) while company B could be in a high profit margin industry (such as software or pharmaceuticals). Also, profit margin is only one ratio and to label one company as outperforming another based on a single ratio is shortsighted. We need to consider the larger picture before making such a statement. The purpose of this question is to illustrate that one ratio without context is close to meaningless.

Question 9

Trend Analysis refers to looking at a firm's ratios over a period of 3-5 years to identify whether specific areas are strengthening or weakening. Comparative analysis refers to looking at a firm's ratios relative to other firms in the same industry to evaluate whether they are better or worse than industry averages. Trend/comparative analysis provides us some of the necessary context to properly interpret the ratios.

Question 10

Potential problems with trend analysis include

Trends can change abruptly	While it is important to identify trends, we should remember that these are past trends. Volatile business conditions can cause trends to stop or reverse unexpectedly.
Some patterns are not trends	If ROA increases from year 1 to year 2, this is not a trend but a one-year change. Often it is hard to distinguish between true strengthening/weakening trends and just random noise.
Past data may be irrelevant	Structural/strategic changes in firms may make comparisons to past years virtually meaningless.

Potential problems with comparative analysis include

Finding a comparison industry	Conglomerate companies such as General Electric are often involved in several industries making it hard to compare their ratios to an industry average.
Few competitors	Some large firms such as Microsoft dominate an industry to the extent that it is often hard to make comparisons to industry averages.

Question 11

A very low quick ratio may be cause for concern because it could indicate liquidity concerns. A low level of cash and accounts receivable relative to our current liabilities could indicate that we will have a hard time paying those current liabilities when they are due. A very high quick ratio may be cause for concern because it indicates an inefficient allocation of resources. Cash and accounts receivable are not high return assets. We would likely be better off allocating our assets to areas with higher rates of return.

Question 12

The primary objective of financial statement analysis from the perspective of management is to identify potential strengths and weaknesses of our firm relative to our competitors so we can take full advantage of our strengths and work on fixing our weaknesses.

There are several difficulties that management might encounter in conducting a complete financial statement analysis. Some are mentioned in the question on potential problems with trend analysis and comparative analysis above. Other problems include comparability of financial statements across firms in the industry due to different fiscal years and/or different accounting procedures. Also, the need to dig beyond the numbers is critical. For example, is a high ROE due to a well-run company or due to too much leverage that could cause significant problems if we hit a small rough patch? Another issue is that financial statement analysis may help us identify potential strengths and weaknesses. However, even after confirming them by digging deeper, the financial statement analysis often does not recommend HOW we can fix the weakness or exploit the strength.

The primary objective of financial statement analysis from the perspective or the stockholder is to identify companies to invest in (potential stockholders) or evaluate the companies the stockholder currently owns (current stockholders).

Stockholders face many of the same problems discussed above with management. However, an important challenge for stockholders is that they must not only analyze the company's financial health, but also evaluate how much they are paying for it. There may be situations where buying stock in a company with poor financial health is a good opportunity (the stock price is "cheap" enough and there is a chance for the company to rebound). There may also be situations where selling shares of stock in a company with strong financial health is good (the stock price is so expensive that the firm's success is already more than fully reflected in the stock price). Too often stockholders get caught up in what they are buying and don't think enough about how much they are paying for it.

Problem 1

2016

CR = CA/CL = 7,000,000/4,500,000 = 1.56
QR = (CA – Inv)/CL = (7,000,000 – 2,000,000)/4,500,000 = 1.11
ITR = CGS/Inv = 6,000,000/2,000,000 = 3 times
DSO = AR/(Sales/365) = 2,000,000/(15,000,000/365) = 48.67 days
FAT = Sales/Fixed Asst = 15,000,000/10,000,000 = 1.5 times
TAT = Sales/Total Asst = 15,000,000/17,000,000 = 0.88 times
TD/TA = 10,000,000/17,000,000 = 58.8%
TD/OE = 10,000,000/7,000,000 = 142.86%
TIE = EBIT/Int = 4,000,000/1,000,000 = 4 times
GPM = (Sales – CGS)/Sales = (15,000,000 – 6,000,000)/15,000,000 = 60%
NPM = NI/Sales = 2,100,000/15,000,000 = 14.0%
ROA = NI/Asst = 2,100,000/17,000,000 = 12.4%
ROE = NI/OE = 2,100,000/7,000,000 = 30.0%
PE = Price/EPS = 25/1.05 = 23.81
M/B = Price/BV = 25/(7,000,000/2,000,000) = 7.14
DY = Div/Price = $0.50/$25 = 2.00%

2017

CR = CA/CL = 11,050,000/7,000,000 = 1.58
QR = (CA – Inv)/CL = (11,050,000 – 4,000,000)/7,000,000 = 1.01
ITR = CGS/Inv = 11,000,000/4,000,000 = 2.75 times
DSO = AR/(Sales/365) = 4,000,000/(20,000,000/365) = 73 days
FAT = Sales/Fixed Asst = 20,000,000/11,000,000 = 1.82 times
TAT = Sales/Total Asst = 20,000,000/22,050,000 = 0.91 times

TD/TA = 15,000,000/22,050,000 = 68.0%
TD/OE = 15,000,000/7,050,000 = 212.77%
TIE = EBIT/Int = 3,000,000/1,500,000 = 2 times
GPM = (Sales – CGS)/Sales = (20,000,000 – 11,000,000)/20,000,000 = 45%
NPM = NI/Sales = 1,050,000/20,000,000 = 5.25%
ROA = NI/Asst = 1,050,000/22,050,000 = 4.76%
ROE = NI/OE = 1,050,000/7,050,000 = 14.89%
PE = Price/EPS = 17.5/0.525 = 33.33
M/B = Price/BV = 17.5/(7,050,000/2,000,000) = 4.96
DY = Div/Price = $0.50/$17.50 = 2.86%

Problem 2

Each item in the income statement is expressed as a percentage of sales (revenues) and each item in the balance sheet is presented as a percentage of total assets.

	2016	16CS	2017	17CS
Sales	15,000,000	100.0%	20,000,000	100.0%
CGS	6,000,000	40.0%	11,000,000	55.0%
S&A Exp.	3,000,000	20.0%	3,500,000	17.5%
Depreciation	2,000,000	13.3%	2,500,000	12.5%
EBIT	4,000,000	26.7%	3,000,000	15.0%
Interest	1,000,000	6.7%	1,500,000	7.5%
EBT	3,000,000	20.0%	1,500,000	7.5%
Taxes (30%)	900,000	6.0%	450,000	2.2%
Net Income	2,100,000	14.0%	1,050,000	5.2%
Num. of Shares	2,000,000		2,000,000	
EPS	$1.05		$0.525	
Div. per Share	$0.50		$0.50	
Stock Price	$25		$17.50	
Cash	3,000,000	17.6%	3,050,000	13.8%
A/R	2,000,000	11.8%	4,000,000	18.1%
Inv.	2,000,000	11.8%	4,000,000	18.1%
Cur. Assets	7,000,000	41.2%	11,050,000	50.1%
Net Prp, Plant & Equip	10,000,000	58.8%	11,000,000	49.9%
Total Assets	17,000,000	100%	22,050,000	100.0%
A/P	2,500,000	14.7%	3,500,000	15.9%
Accruals	1,500,000	8.8%	2,000,000	9.1%
Notes Payable	500,000	2.9%	1,500,000	6.8%
Cur Liabilities	4,500,000	26.5%	7,000,000	31.7%
Long-Term Debt	5,500,000	32.4%	8,000,000	36.3%
Total Libilities	10,000,000	58.8%	15,000,000	68.0%
Common Stock	1,000,000	5.9%	1,000,000	4.5%
Retained Earnings	6,000,000	35.3%	6,050,000	27.4%
Owners' Equity	7,000,000	41.2%	7,050,000	32.0%
Tot. Liab. & O.E.	17,000,000	100.0%	22,050,00	100.0%

Problem 3

To start the analysis of finding strengths and weaknesses, I started with the common size statements. The first thing that I noticed was the increase in Cost of Goods Sold from 40% of sales in 2015 to 55% of sales in 2017. This indicates that our production costs

jumped significantly and will act to lower our net income. Selling and Administrative expenses dropped slightly from 20% of sales to 17.5% of sales. This is a strength, but is not a very large change so I don't place much emphasis on it. The declines in EBIT and Net Income as a % of sales are due to the increase in CGS, so do not need further analysis. Thus, from the Common Size Income statement, I focus on the increase in CGS as a significant weakness and would classify the decline in S&A Expenses as a small strength.

Next I proceed to the Common Size balance sheet. The first things I notice are the increases in accounts receivable and inventory as a % of total assets. This is a concern that needs more analysis before I declare it a weakness. Consider accounts receivable first. AR could increase due to higher sales levels. If 25% of my sales are done on credit and sales increase, my AR will automatically increase as well. This could result in AR being a bigger portion of my firm's assets and would not be seen as a negative. On the other hand, AR may be increasing because fewer customers are paying their bills on time. This could lead to more bad debt expense or higher collection costs. I can not tell which explanation is causing the increase in AR from the CS balance sheet, so I will make a note of it and look more at the issue as I move through my analysis. Like AR, inventory increases may or may not be a weakness. If sales increase, I will need more inventory on hand to handle the increase in sales which is likely to cause inventory to make up a larger portion of my firm's assets. Alternatively, if I am getting stuck with more out-of-date inventory it will also make up a larger portion of my firm's assets until I am forced to do a write down and take the loss. From the CS balance sheet I can't tell which scenario is taking place so this is also something to investigate further.

Net PPE shows a large drop in the CS Balance sheet, but that is primarily a result of the increase in current assets caused by the jump in AR and Inv which have already been discussed, so I will not pay much attention to the decline in Net PPE. Notes Payable shows a large jump, however that could just be a function of me financing some of my increase in current assets so again that is not something that would concern me too much. I would probably want to note it and make sure I find out the reason for the increase but it likely is not a strength/weakness. The jump in Total Liabilities as a % of total assets is something that might concern me. Higher levels of liabilities as a % of total assets indicates higher risk levels. The firm has a greater chance of serious financial problems is there is a slowdown. This is not necessarily bad as the higher debt levels also have the chance to increase our profits if things go well, however it is something to note with a degree of caution due to the higher risk. Finally, the drop in OE is merely the flip side to the increase in TL, so needs no further analysis.

Next I move on to the ratio analysis. My liquidity ratios appear to be sound as both are stable from year to year and similar to the industry averages. Next is my Inv. Turnover Ratio. This, combined with the increase in inventory on the CS balance sheet indicates a problem. If my inventory increase was merely a result of increased sales, the inventory turnover ratio would hold steady or increase slightly. Instead it has decreased slightly and is noticeably lower than the industry average. This means that I am tying up more of my capital as inventory and probably ending up with older inventory that will need to be marked down and sold at a loss.

I also notice problems with my Days Sales Outstanding ratio. The significant jump in the DSO ratio tells me its taking me an about 24 days longer on average to collect each dollar in sales. Since this is also much higher than the industry average it means one of two things. Either I have a lot of customers that aren't paying on time and may end up with higher levels of bad debts or that I have to offer more favorable credit terms to my customers to keep sales from dropping. Both of these possibilities are bad, so my accounts receivable situation is a definite cause for concern.

Fixed Asset Turnover and Total Asset Turnover both look good. FAT is up and both are higher than the industry average. This is a sign that I am doing a good job overall of using my assets (especially my LT assets) to generate sales.

The debt management ratios are troublesome. My TD/TA and TD/OE ratios have increased by quite a bit and are higher than the industry averages. Also, my TIE ratio has dropped and is lower than the industry average. This means that our firm is using more debt financing and has less margin for error. If we experience an off year or two our firm is likely to run into severe financial problems and could face bankruptcy. On the other hand, if we have a couple of strong years, we will make higher returns for our shareholders due to the leverage provided by debt. This is not necessarily a strength/weakness but is a sign of high financial risk.

The profitability ratios are all showing an interesting pattern that ties back into my CGS observation from the CS income statement. My profitability (PM, ROA, ROE) is down due to the increase in CGS. However, all three ratios are consistent with the industry average. This might be an indication that the increase in CGS is more of an industry issue rather than firm specific. If a key input had a price increase, this is likely to impact all firms in the industry equally. For example, if grain prices jumped significantly both Kellogg's and General Mills may see a jump in their CGS and a decline in their profit margins. It doesn't indicate a management

problem, but an industry issue. If my profitability ratios declined significantly AND were lower than the industry average I would be more concerned about company specific problems.

Finally we have the market value ratios which are difficult to interpret in this instance. The PE ratio has increased significantly as my stock price fell, but earnings fell faster. It is also higher than the industry average which indicates the stock is more expensive in terms of what investors pay for each dollar of earnings (possibly indicating that they believe the earnings drop is not permanent). The MV/BV ratio has decreased significantly which indicates the stock is cheaper. This is because book value is less sensitive to the recent earnings decline which lowered the stock price (making the stock cheaper relative to its book value). However, the stock is still slightly more expensive than the industry average. While our dividend yield increased and is higher than the industry average (which is good), there is a danger sign here. If earnings drop any further, we may have to cut our dividend which would cause the yield to drop.

To summarize, our financial statement analysis indicates

- The firm needs to address the CGS issue, but that it is probably an industry issue instead of a company specific problem. This doesn't mean we can ignore it, just that it will be more difficult to fix.
- The firm needs to get control of its credit policies and improve its collections process.
- The firm needs to get control of its inventory concerns
- The firm is doing a good job at generating sales from its LT Assets.
- The firm has a high degree of financial risk
- The firm does not appear to have any major liquidity constraints.
- The stock is relatively expensive relative to the industry average and the dividend yield (while attractive) should be viewed with caution as it may not be sustainable.

Problem 4

You know that you need the current stock price and the book value per share in order to get the MV/BV ratio. To get current stock price, you can use the PE ratio:
PE = Price/EPS ⇒ Price = (PE)×(EPS)

To get EPS, you need Net Income which you can get from the net profit margin:
Net Profit Margin = Net Income/Sales ⇒ Net Income = Net Profit Margin×Sales

You have the Profit Margin, so you need Sales. You can get Sales from the Total Asset Turnover Ratio:
Total Asset Turnover = Sales /Assets ⇒ Sales = TA Turnover×Assets

Sales = (1.5)×($6,000,000) = $9,000,000
Net Income = (0.05)×($9,000,000) = $450,000
EPS = ($450,000)/(600,000 shares) = $0.75 per share
Stock Price = (13)×(0.75) = $9.75

Now you need to solve for Book Value which is Owners' Equity per Share. We know the Return on Equity, so we can use that (along with Net Income) to get Owners' Equity:
ROE = Net Income/Owners Equity ⇒ Owners Equity = NI/ROE

Owners' Equity = ($450,000)/(0.14) = $3,214,285.71
Book Value = $3,214,285.71)/(600,000 shares) = $5.36 per share
MV/BV = ($9.75)/($5.36) = 1.82

Our MV/BV ratio is 1.82. This is a tough problem as it not only tests your knowledge of ratios, but your problem solving skills. Don't worry if you didn't get it at first, but hopefully once you see the solution it makes sense.

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14.3: Solutions to CH 3 Exercises

Question 1

$1 received today is worth more than $1 received one year today because as soon as we have the money we can start making it work for us earning a positive rate of return. If I earn 5% interest, then having the $1 today means I get an extra 5 cents. The earlier I get the money, the more time I have to make it work in my favor.

Question 2

An annuity refers to an equal periodic cash flow stream. While the equal cash flows arrive at the END of each period for an annuity, they arrive at the BEGINNING of each period for an annuity due.

Question 3

Present Value and Future values are just flip sides of the same coin. Present value tells us what the cash flow is worth to us today while future value tells us what the cash flow will grow to over time. Once we have one, we can find the other.

Question 4

The appropriate discount rate to use when finding present value is the rate of return we can earn on other investments of similar risk. The idea of present value is that it tells us how much a future cash flow is worth to us today. The value of this future cash flow is exactly equal to what we would have to invest today to duplicate it. However, we need to control for risk. Riskier cash flows should be discounted at a higher rate because they are worth less to us. Note that the appropriate discount may change over time as market rates of interest change over time. This will play a large part in our valuation chapters starting with Chapter 6 on bond valuation.

Question 5

Compounding on a monthly basis is better than annual because it allows us to start earning interest on interest sooner. Not only does the principle work for us, but so does the interest.

Reminder for calculation exercises: When using the 5-key approach with the TI-BAII+ , you must press CPT and then what you want to solve – for instance in Problem 1a, your last step would be CPT FV. With the HP, you just press what you want to solve – for instance in Problem 1a, your last step would be FV. With the TI-83/84 move the cursor to highlight the variable you want to find and then press SOLVE.

Problem 1

Part 1a

Step 1: 10 N
Step 2: 11 I/Y
Step 3: 2500 PV
Step 4: 0 PMT
Step 5: FV⇒ $7,098.55

Part 1b

Step 1: 30 N
Step 2: 11 I/Y
Step 3: 2500 PV
Step 4: 0 PMT
Step 5: FV⇒ $57,230.74

Part 1c

Step 1: 10 N
Step 2: 5 I/Y
Step 3: 6000 FV
Step 4: 0 PMT
Step 5: PV⇒ $3,683.48

Part 1d

Step 1: 10 N
Step 2: 10 I/Y
Step 3: 6000 FV
Step 4: 0 PMT
Step 5: PV⇒ $2,313.26

Part 1e

Step 1: 30 N
Step 2: 6 I/Y
Step 3: 0 PV
Step 4: 3000 PMT
Step 5: FV⇒ $237,174.56

Part 1f

Step 1: 30 N
Step 2: 12 I/Y
Step 3: 0 PV
Step 4: 3000 PMT
Step 5: FV⇒ $723,998.05

Part 1g

Step 1: 20 N
Step 2: 15 I/Y
Step 3: 4000 PMT
Step 4: 0 FV
Step 5: PV⇒ $25,037.33

Part 1h

Step 1: 40 N
Step 2: 15 I/Y
Step 3: 4000 PMT
Step 4: 0 FV
Step 5: PV⇒ $26,567.11

Problem 2

Part 2a

Step 1: 5 N
Step 2: 2114 FV
Step 3: -1500 PV

Step 4: 0 PMT
Step 5: I/Y ⇒ 7.10%

Part 2b

Step 1: 4 N
Step 2: 0 FV
Step 3: -500 PV
Step 4: 193.50 PMT
Step 5: I/Y ⇒ 20.10%

Problem 3

Part 3a

Step 1: 15 N
Step 2: 12 I/Y
Step 3: 2000 PV
Step 4: 0 PMT
Step 5: FV⇒ $10,947.13

Part 3b

Step 1: Set P/YR to 4
Step 2: 60 N
Step 3: 12 I/Y
Step 4: 2000 PV
Step 5: 0 PMT
Step 6: FV⇒ $11,783.21

Part 3c

Step 1: Set P/YR to 12
Step 2: 180 N
Step 3: 12 I/Y
Step 4: 2000 PV
Step 5: 0 PMT
Step 6: FV⇒ $11,991.60

Part 3d

Step 1: Set P/YR to 365
Step 2: 5475 N
Step 3: 12 I/Y
Step 4: 2000 PV
Step 5: 0 PMT
Step 6: FV⇒ $12,095.72
Remember to Set P/YR back to 1.

Problem 4

Part 4a

Step 1: 3 FV
Step 2: 5 I/Y
Step 3: -1 PV

Step 4: 0 PMT
Step 5: N⇒ 22.52 years

Part 4b

Step 1: 3 FV
Step 2: 10 I/Y
Step 3: -1 PV
Step 4: 0 PMT
Step 5: N⇒ 11.53 years

Part 4c

Step 1: 3 FV
Step 2: 15 I/Y
Step 3: -1 PV
Step 4: 0 PMT
Step 5: N⇒ 7.86 years

Problem 5

Part 5a

PV=PMT/k
PV=$5000/.10
PV=$50,000

Part 5b

Now, the first payment is in year 6, so when we solve for the perpetuity we get the amount we need to have at the end of year 5 ⇒ $50,000. In order to find out how much we need to invest now to have $50,000 at the end of year 5, we solve for PV

Step 1: 5 N
Step 2: 10 I/Y
Step 3: 50000 FV
Step 4: 0 PMT
Step 5: PV⇒ $31,046.07

Problem 6

Solution: $34,833.37. Calculator steps are below.

HP10BII+	TI-BAII+	TI-83/84
Step 1: Clear All Step 2: 0 CFj Step 3: 4000 CFj Step 4: 10 Nj Step 5: 6000 CFj Step 6: 5 Nj Step 7: 8000 CFj Step 8: 5 Nj Step 9: 12 I/YR Step 10: NPV	Step 1: CF CLR Work Step 2: 0 Enter ↓ Step 3: 4000 Enter ↓ Step 4: 10 Enter ↓ Step 5: 6000 Enter ↓ Step 6: 5 Enter ↓ Step 7: 8000 Enter ↓ Step 8: 5 Enter Step 9: NPV 12 Enter ↓Step 10: CPT	Go to APPS⇒Finance⇒ Step 1: Select npv(Step 2: Enter the given information in the following format: npv(InterestRate, CF0, {CF Stream}, {CF Frequencies} npv(12,0,{4000,6000,8000},{10,5,5} Step 3: Press the SOLVE key

Problem 7

Solution: $77,129.07. Calculator steps are below.

HP10BII+	TI-BAII+	TI-83/84
Step 1: Clear All Step 2: 0 CFj Step 3: 3000 CFj Step 4: 5 Nj Step 5: 7500 CFj Step 6: 9000 CFj Step 7: 9 Nj Step 8: 12,000 CFj Step 9: 15 Nj Step 10: 8.75 I/YR Step 11: NPV	Step 1: CF CLR Work Step 2: 0 Enter ↓ Step 3: 3000 Enter ↓ Step 4: 5 Enter ↓ Step 5: 7500 Enter ↓↓ Step 6: 9000 Enter ↓ Step 7: 9 Enter ↓ Step 8: 12,000 Enter ↓ Step 9: 15 Enter Step 10: NPV 8.75 Enter ↓ Step 11: CPT	Go to APPS⇒Finance⇒ Step 1: Select npv(Step 2: Enter the given information in the following format: npv(InterestRate, CF0, {CF Stream}, {CF Frequencies} npv(8.75,0,{3000,7500,9000,12000}, {5,1,9,15} Step 3: Press the SOLVE key

Second, solve for FV using 5-key approach:

Step 1: 30 N
Step 2: 8.75 I/Y
Step 3: 77,129.07 PV
Step 4: 0 PMT
Step 5: FV⇒ $955,203.85

Problem 8

Part 8a

k_{eff}=9.00%

Part 8b

Solution: 9.31%

Formula: $k_{eff}=[1+(.09/4)]^4-1=9.31\%$ or
Calculator:

HP10BII+	TI-BAII+	TI-83/84
Step 1: 4 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I Conv Step 2: 9 Enter ↓↓ Step 3: 4 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF(Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(9,4) Step 3: Press SOLVE

Part 8c

Solution: 9.38%

Formula: $k_{eff}=[1+(.09/12)]^{12}-1=9.38\%$ or
Calculator:

HP10BII+	TI-BAII+	TI-83/84
Step 1: 12 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I Conv Step 2: 9 Enter ↓↓ Step 3: 12 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF(Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(9,12) Step 3: Press SOLVE

Part 8d

Solution: 9.42%

Formula: $k_{eff}=[1+(.09/365)]^{365}-1=9.42\%$ or
Calculator:

HP10BII+	TI-BAII+	TI-83/84
Step 1: 365 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I ConvI Step 2: 9 Enter ↓↓ Step 3: 365 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF(Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(9,365) Step 3: Press SOLVE

Note: If you are using the HP, be sure to set P/YR back to 1 after finishing 8d.

Problem 9

Company Plan	Do-it-Yourself Plan
Step 1: 25 N Step 2: 9 I/Y Step 3: 0 PV Step 4: 4500 PMT Step 5: FV⇒ $381,154.03	Step 1: 25 N Step 2: 12 I/Y Step 3: 0 PV Step 4: 3000 PMT Step 5: FV⇒ $400,001.61

Problem 10

Step 1 ⇒ How much will Jen have saved immediately before purchasing vacation home?

15 N
9 I/Y
-15000 PV
-6000 PMT
FV⇒ $230,802.73

Note that I made both the 15,000 and the 6000 negative. That is because Jen's 15,000 that she has already saved is equivalent to a cash outflow (set aside today so it can compound) and the $6000 she is saving at the end of each year are also effectively outflows (set aside so they can compound until 15 years from now). After 15 years, we will have $230,802.73 available for us to withdraw (equivalent to a cash inflow). While I made the $15,000 and $6000 negative, you could also leave them both positive…just make sure the both are the same sign.

Step 2 ⇒ How much will Jen have immediately after withdrawing $100,000 for the purchase of a vacation home?

$230,802.73 – $100,000 = $130,802.73

Step 3 ⇒ How much will Jen have to save at the end of each year for the remaining years (17) to accumulate $750,000?

17 N
9 I/Y
-130,802.73 PV
750,000 FV
PMT ⇒ $4,974.72

Note that it is 17 years (not 16) as we have the initial 15 + the subsequent 17 to give us 32 years (the full time horizon). Also, note that the PV needs to be negative (we are setting aside the 130,802.73 at the start of the last 17 years) and the FV positive (so we can get $750,000 at the end of our time horizon). While I didn't put a negative sign in front of it, you should note that your PMT is also negative as you are giving up the $4974.72 per year (along with the $130,802.73) in order to get the $750,000 at the end.

Problem 11

Step 1 ⇒ How much will you have at the end of year 15?

15 N
9.5 I/Y
0 PV
2000 PMT
FV ⇒ 61,080.46

Step 2 ⇒ How much will this $61,080.46 grow to over the remaining 20 years?

20 N
9.5 I/Y
61,080.46 PV
0 PMT
FV 375,132.49

Step 3 ⇒ Since your brother will save nothing for the first 10 years, he will start at the end of year 10 with nothing and have 25 years to accumulate $375,132.49. How much must he save each year to accomplish this?

25 N
9.5 I/Y
0 PV
375,132.49 FV
PMT ⇒ $4,111.22

Problem 12

Part 12a

15-Year Mortgage	30-Year Mortgage
Set P/YR to 12 Step 1: 180 N Step 2: 6.25 I/Y Step 3: 108,000 PV Step 4: 0 FV Step 5: PMT ⇒ $926.02	Set P/YR to 12 Step 1: 360 N Step 2: 6.5 I/Y Step 3: 108,000 PV Step 4: 0 FV Step 5: PMT ⇒ $682.63

Part 12b

15-Year Mortgage ⇒ $926.02×180 = $166,683.60
30-Year Mortgage ⇒ $682.63×360 = $245,746.80

Part 12c

15-Year Mortgage	30-Year Mortgage
Set P/YR to 12 Step 1: 168 N Step 2: 6.25 I/Y Step 3: 926.02 PMT Step 4: 0 FV Step 5: PV ⇒ $103,511.02	Set P/YR to 12 Step 1: 348 N Step 2: 6.5 I/Y Step 3: 682.63 PMT Step 4: 0 FV Step 5: PV ⇒ $106,792.31

Part 12d

15-Year Mortgage

Total First Year Payments (15-Year) = $926.02×12 = $11,112.24
Principal Paid (15-Year) = $108,000 – $103,511.02 = $4488.98
Interest Paid (15-Year) = $11,112.24 – $4488.98 = $6623.26

30-Year Mortgage

Total First Year Payments (30-Year) = $682.63×12 = $8191.56
Principal Paid (30-Year) = $108,000 – $106,792.31 = $1207.69
Interest Paid (30-Year) = $8191.56 – $1207.69 = $6983.87

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14.4: Solutions to CH 4 Exercises

Question 1

The three step approach for security valuation is:

Step 1: Forecast all expected cash flows associated with that security over its lifetime
Step 2: Choose an appropriate discount rate
Step 3: Solve for the PV

When applying this to bond valuation, we start with step 1. The cash flows associated with a bond are (A) the coupon payments and (B) the par value. The coupon payments are an annuity, paid twice each year. The annual coupon payments are calculated by taking the coupon rate times the par value (which we assume is always $1000). Therefore, a 5% coupon bond will pay $50 coupon payments annually as 5% of $1000 is $50. Since coupon payments are made semi-annually, this will generate a $25 coupon payment every six months. The par value is a single cash flow ($1000) paid at maturity.

Next, we must choose an appropriate discount rate. In class, this will be a given. However, it is an important step in practice. The riskier the bond, the higher the discount rate that you must use. Also, as expected inflation increases you will want to increase the discount rate. A common practice is to estimate the discount rate by starting with the interest rate (yield) on Treasury bonds of similar maturity and then adding in a risk premium to reflect how much riskier the bond you are valuing is relative to the Treasury bond.

Finally, we solve for PV. This step is easy with bonds. Convert your calculator to 2 Periods per Year. N represents the number of periods (years*2) the bond has remaining until maturity. I/Y represents the discount rate we estimated in step 2. PMT is the coupon payment we calculated in step 1. FV is the par value ($1000). Once we enter these four values into our financial calculator, we then solve for PV.

Question 2

Market rates of interest and bond prices have an inverse relationship. When market rates of interest increase, bond prices decline. When market rates of interest decrease, bond prices go up. The reason for this is that the cash flow stream associated with the bond does not change and the market rate of interest represents the discount rate. So, if we discount the same cash flow stream at a higher rate of interest it will be worth less while if we discount it at a lower rate of interest it will be worth more.

Question 3

The longer the time to maturity, the more sensitive the bond price will be to changes in the market rate of interest. Long-term bond prices will increase by a greater amount when interest rates go down and will fall by a greater amount when interest rates go up.

Question 4

I would be willing to pay a premium for a bond if the cash flow stream that it generates is higher than I can get elsewhere. For instance, if the current market rate of interest is 7%, that implies that newly issued bonds will be paying 7% coupon payments. If I can find a bond with a 9% coupon rate, I will receive an extra $20 per year in coupon payments. If that coupon stream will last for 10 years, then the premium that I am willing to pay is the present value of $20 per year for 10 years.

Question 5

A call provision is a feature in the bond indenture that allows the issuing party to repurchase the bond for a preset price prior to maturity. For instance, a firm may issue a 20-year 8% coupon bond that is callable in 5 years for $1040. Then, if interest rates have declined significantly after five years the firm will find it cheaper to call back the bond rather than to continue paying interest payments for the next 15 years. If they still need additional financing, the will be able to issue new bonds with a lower interest rate. On the other hand, if interest rates go up, the firm will decide not to call back the bond as it would cost them more to refinance it. If they no longer needed the financing, they could buy the bonds back in the open market for less than the call price (since bond prices decline when rates go up.)

Note that, everything else equal, call provisions are good for the issuer but bad for the investor. That is because if interest rates go down, the company is likely to call the bond and the investor won't get the full benefit of declining interest rates. On the other hand, if interest rates go up the company is not likely to call which leaves the investor feeling the full downside of increasing interest rates. Because of this, the only way to get investors to buy callable bonds is to pay them slightly more. Therefore, callable bonds will typically offer investors a slightly higher yield in order to offset the call risk.

Question 6

Part 6a

The Yield-to-Maturity (YTM) is more relevant to an investor than the coupon rate. The coupon rate determines the coupon payments, so it tells us what the cash flow stream looks like, but doesn't take into account what we pay for it. For instance, which would you rather buy…a 3-year 5% coupon bond or a 3-year 10% coupon bond? At first glance, the 10% coupon bond seems better because we will get $100 per year in coupon payments instead of $50. However, how much are we paying for these bonds? What if the 5% bond is selling for $700 and the 10% bond is selling for $1300? We will get a much higher rate of return on the 5% bond making it a better purchase (assuming similar risk levels). Thus, the YTM provides a better measure of what we will earn on a bond because it takes into account more information. Not only does it consider coupon payment, but how much we are paying today and how long we will receive the coupon payment. Another simple way to look at this question is if the coupon rate was a more relevant measure, no one would ever buy a zero coupon bond.

Part 6b

Sometimes the Yield-to-Maturity (YTM) is more relevant than the Yield-to-Call (YTC) and sometimes the YTC is more relevant than the YTM. It depends on the situation. To understand this, we first must remember what the numbers represent. We defined the YTM as the expected rate of return we would earn on the bond if we bought it today and held it until maturity and the YTC as the expected rate of return if we bought it today and it got called at the first call date. Those definitions come from the viewpoint of the bondholder. However, someone has to pay the bondholder those rates of return and it is the issuer. Therefore, the bondholders expected rate of return is the issuers expected cost. Now, remember who makes the call decision – the issuer. Since the issuer would prefer to face a lower cost, it will likely call the bonds back if the YTC is less than the YTM. Alternatively, if the YTM is less than the YTC, the issuer will not want to call the bond back early. Thus, the investor is likely to receive whichever is lower between the YTM and YTC and that means whichever one is lower is the more relevant number.

Question 7

Bond ratings are important because they provide a measure of the default risk associated with investing in bonds. The worse the bond rating, the greater the default risk. Everything else being equal, investors will demand higher returns (YTMs) for bonds with bad bond ratings. From a firm's perspective, that means a bad bond rating is going to translate into paying more to raise additional debt financing. One important point to remember about bond ratings though is that they only measure DEFAULT risk, and not total risk. There are several other risk factors associated with bonds (such as interest rate risk and liquidity risk) that also must be considered when evaluating the total risk of a particular bond.

Question 8

Part 8a

A 20-year bond with a BB rating should have a higher YTM than a 20-year bond with a AA rating. The reason for this is that the lower bond rating indicates more default risk. Since the bonds have the same time to maturity, the primary risk differential is default risk. The greater the risk, the higher the YTM should be.

Part 8b

There is not enough information to answer this question. The problem is we are changing two important factors – time to maturity and bond rating. The YTM will depend on inflationary expectations (over the 5-year and 30-year periods respectively), maturity risk, and default risk.

Question 9

FALSE. While it is true that junk bonds have a higher probability of default than investment grade bonds, that does not mean that they are a poor investment or that we should expect low rates of return. The higher probability of default means that they are riskier. Riskier investments should offer higher expected returns to compensate investors for the additional risk (if they were riskier and offered lower expected returns, no one would purchase them). This higher expected returns may make them good investments for some people. Whether or not junk bonds are a good investment depends on the individual. For people with low risk tolerances, junk bonds are likely to be a poor investment (although there could even be some situations where they make sense as part of the overall portfolio for someone with a low risk tolerance as long as they are a very small portion). For people with greater risk tolerance the risk-return tradeoff may be attractive. However, they should always offer higher expected returns than investment grade bonds. Note that higher expected returns do not mean that an investor will earn a higher return. Instead, it means that ON AVERAGE junk bonds will offer higher returns, but that there will be periods where most junk bonds earn low (or negative) returns and in virtually all periods there will be some junk bonds that see large negative returns.

Question 10

The zero-coupon bond will be more sensitive to changes in interest rates than the 10% coupon bond (in terms of % differences). The reason for this is that the coupon payments start returning some of our investment quicker, so the bond's value is not impacted as much by changes in interest rates. For instance, part of the value of the 10% bond is the $100 in coupon payments during the first year ($50 every ½ year). Since, it is only one year away, its present value will not be changed much by changing the discount rate. However, the zero coupon bond has no coupon payments (the entire cash flow will not be received until maturity which is several years out), so its value will be impacted significantly by changes in the interest rate. Consider the following two bonds.

Bond A – 10% coupon bond with 10-years remaining and a 10% market rate of interest
Bond B – Zero-coupon bond with 10-years remaining and a 10% market rate of interest

Calculate the percentage increase in the bond prices if the market rate of interest drops to 8%.

Bond A starting value (at 10%): $1000.00
Bond A new value (at 8%): $1135.90
Percent Increase: 13.59%

Bond B starting value (at 10%): $376.89
Bond B new value (at 8%): $456.39
Percent Increase: 21.09%

Calculation for Bond Values

Starting Value 10% coupon bond at 10% ⇒ No calculation needed, when coupon rate and market rate of interest are the same, the bond price will always be par value ($1000).

New Value 10% coupon bond at 8%
Step 1: 2 P/Y
Step 2: 20 N
Step 3: 8 I/Y
Step 4: 1000 FV
Step 5: 50 PMT
Step 6: PV⇒ $1,135.90

Starting Value zero coupon bond at 10%
Step 1: 2 P/Y
Step 2: 20 N
Step 3: 10 I/Y
Step 4: 1000 FV
Step 5: 0 PMT
Step 6: PV⇒ $376.89

New Value zero coupon bond at 8%
Step 1: 2 P/Y
Step 2: 20 N
Step 3: 8 I/Y
Step 4: 1000 FV
Step 5: 0 PMT
Step 6: PV⇒ $456.39

Question 11

No. A non-convertible zero-coupon bond will only pay par value at maturity. There will be no other payments. Therefore, a $1000 par value zero-coupon, non-convertible bond will pay exactly $1000 at maturity. Let's say the bond matures in 4 years. There is never a good reason to pay more than $1000 today to receive $1000 four years later. Even if the market rate of interest was zero, it would make more sense to just hold onto our money rather than pay more than $1000 today to receive $1000 at a later date.

Reminder: For all bond exercises, your calculator should be set to 2 P/Y to reflect semi-annual coupon payments. Also, the payment is equal to the annual coupon divided by 2.

Problem 1

Part 1a

Step 1: 60 N
Step 2: 9 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $845.21

Part 1b

Step 1: 60 N
Step 2: 7.5 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,000.00

Part 1c

Step 1: 60 N
Step 2: 6 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,207.57

Part 1d

Step 1: 20 N
Step 2: 9 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $902.44

Part 1e

Step 1: 20 N
Step 2: 7.5 I/Y

Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,000.00

Part 1f

Step 1: 20 N
Step 2: 6 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,111.58

Part 1g

Step 1: 4 N
Step 2: 9 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $973.09

Part 1h

Step 1: 4 N
Step 2: 7.5 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,000.00

Part 1i

Step 1: 4 N
Step 2: 6 I/Y
Step 3: 1000 FV
Step 4: 37.50 PMT
Step 5: PV⇒ $1,027.88

Problem 2

Step 1: 20 N
Step 2: -918.23 PV
Step 3: 1000 FV
Step 4: 21.25 PMT
Step 5: I/Y⇒ 5.31%

Problem 3

Yield to Maturity

Step 1: 40 N
Step 2: -1318 PV
Step 3: 1000 FV
Step 4: 48.75 PMT
Step 5: I/Y⇒ 6.81%

Yield to Call

Step 1: 14 N
Step 2: -1318 PV
Step 3: 1050 FV
Step 4: 48.75 PMT
Step 5: I/Y⇒ 4.93%

Since the YTC is less than the YTM, this bond is likely to be called based on information available today. Note that the interest rate environment may change before the call date arrives in 7 years which may cause the YTC and YTM to change. Therefore, we are not saying the bond WILL be called, only that it is LIKELY to be called. An investor should buy this bond only if he or she is happy with the 4.89% rate of return that would be earned if the bond was called in 7 years.

Problem 4

NOTE – Even though zero coupons don't pay a semi-annual coupon payment (they actually pay no coupon payment) we are using the semi-annual convention – 2 P/Y – to keep consistent with regular coupon bond valuation.

Price with a 12% required return

Step 1: 40 N
Step 2: 12 I/Y
Step 3: 1000 FV
Step 4: 0 PMT
Step 5: PV ⇒ $97.22

Price with a 10% required return

Step 1: 40 N
Step 2: 10 I/Y
Step 3: 1000 FV
Step 4: 0 PMT
Step 5: PV ⇒ $142.05

Problem 5

Part 5a

It is important to recognize that the value of the bond is the present value of remaining cash flows. At the time of purchase, the bond had 30 years until maturity and this is when we purchased it. This means the value at the time it was purchased should be based on the 30 years until maturity (60 semi-annual periods).

Step 1: 60 N
Step 2: 6.5 I/Y
Step 3: 1000 FV
Step 4: 45 PMT
Step 5: PV ⇒ $1,328.17

Part 5b

Since you purchased the bond 10 years ago when it had 30 years to maturity, there are now 20 years (40 semi-annual periods) remaining until maturity.

Step 1: 40 N
Step 2: 10.5 I/Y
Step 3: 1000 FV

Step 4: 45 PMT
Step 5: PV ⇒ $875.59

Part 5c

Now, it is no longer a bond pricing problem, but a time value of money problem. You paid $1328.17 ten years (20 periods) ago, you received $45 twice per year in coupon payments, and today you sold the bond for $875.59 ⇒ Solve for your return.

Step 1: 20 N
Step 2: -1328.17 PV
Step 3: 875.59 FV
Step 4: 45 PMT
Step 5: I/Y ⇒ 3.97%

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14.5: Solutions to CH 5 Exercises

Question 1

The three-step valuation process for stocks differs from bonds due to the differences in the structure of the cash flow stream. Conceptually, the process is different. However, the cash flow stream for stocks (dividends) has a variable, infinite time horizon which makes forecasting all expected cash flows impossible to do without some simplifying assumptions.

When forecasting dividends, we use one of three assumptions. First, we can assume that dividends exhibit no growth over time. The dividend will remain the same forever. Second, we can assume dividends grow at a constant rate over time. Third, we can assume dividends will grow at a non-constant rate for a specific number of years and then a constant rate after that. The assumption that we make about the dividend stream will determine how we solve for present value in step three of the 3-step valuation method.

The process of choosing an appropriate discount rate is similar (at least until we introduce the Security Market Line in Ch. 8). We need to determine the riskiness of the security and then select a discount rate based on the rate of return we can earn on other similar risk investments. One item of note is that the discount rate for stocks will tend to be higher than the discount rate for bonds due to the fact that stocks (on average) are riskier than bonds.With bonds, solving for PV was simply to use the 5-key approach to find PV.

With stocks, we need to either use a formula (for dividend assumptions one and two) or a process involving the CF worksheet (for dividend assumption three). The formula for the no-growth model is:

$P_0=D/k$

The formula for the constant growth model is:

$P_0=D_1/(k-g)$

Question 2

Par value is the value stated on the stock certificate and is essentially a meaningless number. This reflects the minimum amount of capital that must be supplied by stockholders to meet the limited liability characteristic of stock ownership. If the stock is originally issued for less than par value, the stockholders are liable for the difference in the event of bankruptcy. However, in practice, most firms set par value for common stock so low (often $0.01 per share or less) that it is no practical meaning.

Book value represents the accounting value of each share of stock based on the balance sheet. Book value per share can be found by solving for one of the following two equations (note – both equations are identical since A = L + OE):

BV = (A – L)/(number of common shares outstanding) or
BV = (OE)/(number of common shares outstanding)

Book value tends to understate the true value of the firm because of the historical cost bias and the omission of most intangible assets.

Market value represents the “true” (sometimes called “economic” or “financial”) value of the share of stock. This is the price at which investors are willing to buy and sell shares.

No one individual determines market value, instead it is set by the equilibrium price in the financial markets (in other words, the price at which both buyers and sellers agree that they are getting their best price). Market value changes constantly based on new information. Any information that causes investors to change their perception on the magnitude, riskiness, or timeliness of expected cash flows will result in changes in the market value. When you look at a stock quote in the Wall Street Journal or online, this represents the market value.

Market value is the most important measure of value for a common stock because it reflects the current price at which people are willing to buy/sell the stock.

Question 3

The right to information – Stockholders have a right to know what is going on in the firm. At a minimum, firms must prepare quarterly and annual audited financial statements that are made available to the stockholders and have annual meetings which stockholders can attend. Most firms make significant information available on their company web page in an investor relations section. Most of the information made available is detailed financial performance information and general firm strategy information.

Limited Liability – Stockholders can lose no more than their initial investment in common stock. This is a function of the separation of ownership and decision making within the corporate form of ownership. Since the stockholders are not making the management decisions, they are not liable for the results. The stock price can fall to zero and the investor can lose their entire investment made in the stock, but the investor can not be required to supply more money beyond that to meet creditor obligations.

The right to "control" – Stockholders get voting rights. These voting rights allow them to elect the board of directors who are responsible for hiring and compensating management as well as approving major strategic decisions. Stockholders also have voting rights on a limited set of corporate decisions such as authorizing additional shares of stock to be created and issued. However, for most practical purposes, the average stockholder has no real control over corporate activities. The way that board of director votes are handled are designed to keep current boards in place and unless there is a very significant amount of shareholder dissatisfaction their will not be any board shakeups. Also, shareholders do not vote or influence day-to-day corporate decisions or even larger corporate strategies. Finally, some firms issue dual-class shares where the public holds non-voting shares or shares with drastically diluted voting rights while the firm founders hold the shares with voting or super-voting rights.

The right to transfer – Stockholders can sell their shares in the open market whenever they choose. Thus, most stockholders will "vote with their feet" when they don't like the way a company is running its business. Since they know their ability to influence company policy through voting rights is minimal at best, simply selling shares is often the best strategy. However, selling stock does not have to be due to dissatisfaction with the way the company is doing business. Shareholders may sell for many reasons including diversifying their holdings, taking profits, raising cash, cutting losses, etc. However, this ability to sell shares whenever one wants is critical to the success of corporate form of ownership as it creates liquidity which is necessary to get people to buy stock.

The right to residual income – this is the most important right associated with common stock and is the principle reason why people invest in common stock. When you buy common stock you are buying ownership into the company and with that ownership comes a right to your proportion of the profits. Residual income refers to income left over after preferred stockholders are paid. It is important to note that the right to residual income is NOT the same as the right to dividends. Firms can choose to pay out the residual income to investors in the form of dividends or they can reinvest into the firm. If the residual income is invested wisely, this will result in even more profits for stockholders later on. However, if it is invested poorly, it may all be lost before the stockholders receive any in dividends. Ultimately, if you bought every share of stock outstanding, you would own all of the firm's profits and would be able to decide for yourself whether to pay dividends or reinvest in the firm.

Question 4

The holding period of a stock is irrelevant to determining its value. The value is based on the present value of all future dividends. The reason holding period is irrelevant is that when I sell the stock, I will be able to sell it for all the future dividends at that point. Whether I actually receive the dividends or sell the stock for the value of those dividends doesn't matter. Another way to look at this is with the constant growth pricing model $\Rightarrow P_0 = (D_1)/(k - g)$. Note that no where in that model do you plug in your holding period. Since it is not part of the formula, it can't have an influence on the price of the stock.

Question 5

No, it is not a realistic assumption. Dividends will grow at varying rates over time depending on the success of the firm and the new products it introduces. However, we know that our predictive ability is limited. How fast is Wal-Mart going to grow 16 years from now? How about 17 years? Since we know that there is no way to make precise forecasts, we assume that after a certain time, the firm will grow at approximately the same rate as the economy (or maybe a bit slower) and use this as our constant growth rate. This allows us to use what information we can to forecast growth rates (and dividends) as far as we can and then approximate the

rest with a constant growth assumption. Is it 100% accurate? No. Is it more reasonable than trying to forecast year- by-year growth rates for the next 1000 years? Definitely!

Question 6

Market efficiency refers to the concept that all relevant information that influences a firm's value is already reflected into its stock prices. As new information comes out, the stock price will respond immediately to reflect that new information. There are no "undervalued" stocks to buy that will earn us higher than a fair, risk-adjusted rate of return and there are no "overvalued" stocks that we should sell. Instead (assuming market efficiency is valid), the best that we can do is own a diversified portfolio of stocks and expect to earn a fair, risk-adjusted rate of return.

The three types of market efficiency are weak form, semi-strong form, and strong form and the difference between the three is based on the definition of "relevant information."

1. Weak Form Market Efficiency assumes all information related to past price data is already reflected in the current market price. Whether the stock is in an "uptrend" or "downtrend" is merely coincidence and doesn't tell us anything about the future direction of the stock. If the stock increased in value for the past three days or decreased in value for the past three days, it is equally likely to increase or decrease the next day. Stock prices have no "memory." If markets are weak-form efficient, technical analysis (a process of trying to identify stocks to buy or sell based primarily on charts and other forms of past price trends) is not going to work. A chart of a stock's past price information is meaningless in helping us identify its future price information.
2. Semi-strong Form Market Efficiency assumes all publicly available information is already reflected in the current market price. This means that there can be no "edge" gained from evaluating a firm's financial statements or trying to project its future cash flows based on economic, demographic, or firm specific factors that might influence the success (or lack of success) in a firm's product line. Reading the Wall Street Journal, Business Week, financial statements, etc. will not allow you to identify which stocks to buy or sell. This process of trying to value stocks based on projecting future cash flows is referred to as fundamental analysis. If markets are semi-strong form efficient, fundamental analysis will not serve as a worthwhile tool for picking stocks other than to find a risk level that you are comfortable with. While new "fundamental" information will influence stock prices, it is only the "surprise" portion that will drive the stock price up or down. For instance, if a company was expected to report earnings of $1.00 per share and a 15% growth rate from the previous year and instead reported earnings of $0.90 per share and a 10% growth rate from the previous year, this would be a negative surprise (even though both earnings and growth were positive) and would cause the stock price to decline. However, the decline would be so immediate that you would not be able to respond to the news and sell before the price declined.
3. Strong Form Market Efficiency assumes all information, public or private, is already reflected in the current market price. Based on this, not even having access to inside information would allow you to identify good/bad stocks ahead of time.

Question 7

This would be evidence AGAINST semi-strong form market efficiency. If markets were semi-strong form efficient, the only way I would be able to earn a higher rate of return than the market with publicly available information would be if I (A) only (or primarily) invested in high risk stocks or (B) was lucky. Since the statement says that I've not faced higher than average risks, (A) is not valid. Also, since this is over a 10-year time horizon, it is not likely just luck (although that is still a possibility). Finally, I've done this using publicly available information. Therefore, this would be evidence AGAINST semi-strong form market efficiency.

Question 8

There are a couple of reasons why we would like to see markets be efficient. First, is that if markets were NOT efficient, then it would be difficult for management to know if they were maximizing firm value. If stock prices reflect all available information and management engages in value maximizing activities, the stock price should go up. If markets were not efficient, there would be no predictable relationship between management activities and stock price response so it would be hard for management to maximize value. As a side note, this is a very important issue. The more efficient markets are, the more focus management will place on long-term value maximization instead of short-term manipulation and accounting gimmickry. This is because investors will see through

the manipulation and not "reward" management's trickery. Instead, management that operates with a clear, long-term strategy will see higher stock prices.

A second reason has to do with a concept called allocational efficiency. Allocational efficiency means money flows to the "right" places (right ⇒ productive). Thus, if scientists are working for a cure for a major disease and have a real shot at producing it, markets will recognize this as a profitable opportunity and fund it. While it may seem cold-hearted to define the "correct" places to spend capital as those that produce the best risk-adjusted returns, it actually is just society "voting" on what is the best use of their dollars (as that spending is what produces profits). We may not individually agree with those decisions, but it is a much better system for allocating capital than any other.

Question 9

We expect markets to be efficient for the same reason we don't expect to find $20 bills laying all over the hallways. People do not like to leave money on the table. There are a large number of extremely intelligent individuals with large budgets for information and information processing power constantly looking for opportunities to make money in the financial markets. As soon as they find those opportunities, the take advantage of them (pick up the $20 bills). As such, we should not expect to see any unexploited opportunities. The profit motive creates a strong incentive to drive markets towards efficiency.

On the other hand, if people do not see the $20 bills laying in the hallway, they will not pick them up. Despite the apparent precision of our stock valuation models, predicting prices is not a precise process. Given all the uncertainties involved in estimating growth rates, future cash flows, and discount rates it is hard to place 100% confidence in our final results. Let's say we found the stock value was $50 and the current stock price was $49. This means we get a free $1 for every share we buy. Theoretically we would keep buying as much stock as possible until the stock price increased to $50. However, how much are you willing to commit to your $50 forecast being right?

Another argument against market efficiency (also related to us not "seeing" the opportunities) is that there may be behavioral biases built in to human nature that prevent us from being able to "pick up the free money." For instance, we tend to over-react to news and place too much weight on new evidence in some cases and in others we tend to under-react and place to much weight on our previous views. For instance, if Apple reports a bad quarter, we are apt to dismiss it as we "know" Apple is a good investment in the long-run. How do we know this? Because we rely on the past performance. On the other hand, when the Internet boom was underway in the late 1990's, we over-reacted to how that was going to make EVERY company related to the Internet profitable. We also do not process information very well and can easily be tricked by the way the information is presented. This is referred to as framing. The exact same information can be presented in two different ways and we will interpret it differently each time. How do these behavioral biases relate to market efficiency? Well, one way is that individuals tend to sell their winners too soon and hold their losers too long. The way the tax code is written, there is an advantage to hold on to winning stocks longer and to sell losing stocks quicker…however, there is strong evidence that people do the opposite which costs them money.

There are reasons why we should expect markets to be efficient and reasons why we should expect them to NOT be efficient, so which is it? Ask 100 different finance professors and you'll probably get 50 different answers ranging from markets are 100% efficient to markets are not even close to efficient. My view is that market inefficiencies exist, but taking advantage of them is not easy. For most individual investors (and institutional investors as well), attempting to "outperform the market" is not only a waste of time, but a costly waste of time. However, there are a few people that have both the ability and effort to earn higher than risk-adjusted rates of return. It requires two factors. One, being extremely intelligent (you have to outthink everyone else that is searching for those $20 bills on the ground so that you can either "see" them more easily or grab them quicker). Two, you must be committed. Keep in mind that the more trading you do to outperform the market, the harder it is. That is because transaction costs (brokerage commissions, taxes, other costs) add up with each trade.

Problem 1

P_0 = D/k = (Dividend Rate * Par Value)/k
P_0 = (0.06×$80)/.07
P_0 = $4.80/.07
P_0 = $68.57

Problem 2

$P_0 = D_1/(k - g)$
$P_0 = 3.50/(0.13 - 0.04)$
$P_0 = \$38.89$

Problem 3

Part 3a

$P_0 = D/k$
$P_0 = 2.00/0.12$
$P_0 = \$16.67$

Part 3b

$P_0 = D_1/(k - g)$
$P_0 = (2.00 \times 1.05)/(0.12 - 0.05)$
$P_0 = 2.10/0.07$
$P_0 = \$30.00$

Part 3c

$P_0 = D_1/(k - g)$
$P_0 = (2.00 \times 1.10)/(0.12 - 0.10)$
$P_0 = 2.20/0.02$
$P_0 = \$110.00$

Part 3d

$P_0 = D_1/(k - g)$
$P_0 = (2.00 \times 1.15)/(0.12 - 0.15)$
$P_0 = 2.30/-0.03$
$P_0 = -\$76.67$

Part 3e

No, the answer to part 4 does not make sense. As we can see from part 1-3, increases in the growth rate make the stock more valuable. Also, due to the limited liability feature of corporations, the lowest value a stock can take is $0.00. Therefore, it makes no sense to say that as growth increases from 10% to 15%, the stock price not only declines, it turns negative. The problem is that the formula we developed for solving for the present value of dividends when the growth rate is constant only works if the required return is greater than the growth rate (k>g). If that does not hold, the formula is no longer solving for present value, but instead is generating a meaningless number.

While this may appear to be a significant flaw at first glance, it really isn't as bad as it seems. Remember that the model assumes that the growth rate will continue not for a short time, but forever. How likely is it for a company to grow at 15% forever? Since the overall economy only grows at about a 3-4% annual rate, this company would overtake the world before too long. When companies exhibit extremely high growth rates, we know that their growth must decline over time because of (A) they will have no new areas of growth after the control their entire market or (B) new competition will enter the market. Consider Wal-Mart. It is unreasonable to assume they will grow at the same rate over the next 20 years as they have over the past 20 because they don't have as many untapped markets to expand into. When companies exhibit high growth rates, we must use the non-constant dividend growth model.

Problem 4

Step 1 – Forecast all dividends up to and including the first year of constant growth

$D_1 = 3.00 \times (1.35) = \$4.05$
$D_2 = 4.05 \times (1.25) = \$5.06$
$D_3 = 5.06 \times (1.20) = \$6.07$
$D_4 = 6.07 \times (1.10) = \$6.68$

Step 2 – Solve for the value of all dividends during the constant growth stage

$P_3 = D_4/(k - g) = 6.68/(0.18 - 0.10) = \$83.50$

Step 3 – Solve for PV

$CF_0 = 0$
$CF_1 = 4.05$
$CF_2 = 5.06$
$CF_3 = 89.57 \Leftarrow \$6.07 + \$83.50$
$I = 18$
$NPV = P_0 = \$61.58$

Problem 5

Step 1 – Forecast all dividends up to and including the first year of constant growth

$D_1 = 1.50*(0.90) = \$1.35$
$D_2 = 1.35*(1.00) = \$1.35$
$D_3 = 1.35*(1.20) = \$1.62$
$D_4 = 1.62*(1.20) = \$1.94$
$D_5 = 1.94*(2.50) = \$4.85$
$D_6 = 4.85*(1.03) = \$5.00$

Step 2 – Solve for the value of all dividends during the constant growth stage

$P_5 = D_6/(k - g) = 5.00/(0.15 - 0.03) = \$41.67$

Step 3 – Solve for PV

$CF_0 = 0$
$CF_1 = 1.35$
$CF_2 = 1.35$
$CF_3 = 1.62$
$CF_4 = 1.94$
$CF_5 = 46.52 \Leftarrow \$4.85 + \$41.67$
$I = 15$
$NPV = P_0 = \$27.50$

Problem 6

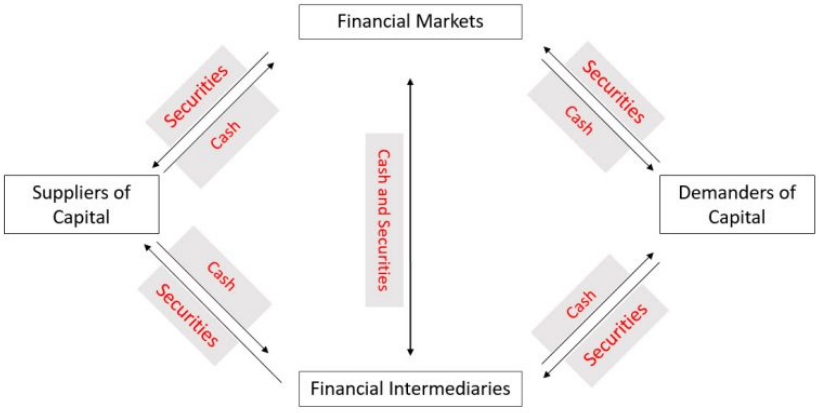
The key for this problem is to remember the concept that the value of the stock is equal to the present value of the remaining cash flows. The cash flows are the same as the ones we forecasted to solve for problem 5, except that we have moved through the first three years and the first three dividends are no longer associated with the stock. The person buying the stock is going to receive all of the dividends from year 4 on (but remember that since we are in year three, the year 4 dividend is only 1 year out).

$CF_0 = 0$
$CF_1 = 1.94$
$CF_2 = 46.52$
$I = 15$
$NPV = P_3 = \$36.86$

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14.6: Solutions to CH 6 Exercises

Question 1



Question 2

A supplier of capital refers to an individual, business, or government that has excess capital at a point in time that they would like to invest. The investment period could be as short as overnight or it could be several years. A couple of examples where I have acted as a supplier of capital in the past year would include investments into my retirement account and deposits into a checking account at my bank.

Question 3

A demander of capital refers to an individual, business, or government that needs additional capital at a point in time. It also includes situations where an individual uses previous capital (acquired as a supplier of capital) for a purchase (or purchases) in this time period. The period for using that capital could be as short as overnight or it could be several years. A couple of examples where I have acted as a demander of capital in the past year would include credit card purchases and obtaining a loan for the purchase of a van.

Question 4

Yes, most of us will act as both suppliers and demanders of capital within a given time period. If you make a deposit into a checking account (supplier of capital) and, within the same period, use a credit card (demander of capital) you are engaging in both activities. If you add money to a retirement plan at work (supplier of capital) and borrow money to purchase a home (demander of capital) you are engaging in both activities. You can probably think of several different situations from your own experience where you operated on both sides of the system within a given time period.

Question 5

First, imagine a situation where there was no financial system in place. If you wanted to borrow money to purchase a new home, you would have to approach friends and family, take out a classified ad, or set up a web page asking to borrow money. Now imagine if you were doing this as a large business needing to raise $50 million for a new production facility. Or consider the flip side. You are working and earning a good salary. You want to set aside some money for retirement. Without a financial system, you can go dig holes in the back yard and start burying your extra money in jars. Or you could go around to local businesses asking if they wanted to borrow money from you or let you invest in their business. Or possibly even hang out at car dealerships seeing if someone needed a loan to buy a new car. Obviously none of these are very attractive options.

Having an efficient financial system in place allows you to approach a financial intermediary (such as a bank) when you need to obtain a loan. It allows you to pool purchases on a credit card (and if you pay your cards off on time without carrying a balance, you can earn rewards such as cash back). It allows you to become a part owner in attractive businesses by purchasing shares of

stock or set aside money for retirement through a mutual fund. Essentially, by having a system in place that allows convenient trading of securities (the financial markets) and processing of transactions that require special structuring or credit evaluation (financial intermediaries), both suppliers and demanders of capital benefit. The reduced costs of finding someone to take the other have of the transaction and the specialization of financial institutions mean that suppliers of capital receive higher effective returns on their investments while at the same time demanders of capital are able to raise money at lower effective rates. This win-win situation is caused by the huge reduction in transaction costs (monetary costs and time costs) along with the availability of far more opportunities provided by financial markets and financial intermediaries.

Question 6

Stocks are what we refer to as homogeneous securities. What that means is that one share of stock in Google is the same as the next. It doesn't matter which share I buy or who I buy it from. This homogeneity is one of the primary reasons why financial markets are efficient for stock transactions. I do not need to evaluate the quality of the particular share of stock I'm receiving or the creditworthiness of the person selling it to me. All I need to know is (A) what company am I buying stock in, (B) how many shares do I want to buy, and (C) how much am I willing to pay.

The second important characteristic of stocks is that most publicly traded stocks have several million (in some cases billions) of shares outstanding and many different people (both individuals and institutions) willing to buy/sell those shares at any given time. That means that by having a central location (either a physical location or even a network) where buyers and sellers are brought together, I can find someone willing to take the other side of my transaction very quickly.

When we have homogeneous securities and a large number of potential buyers and sellers, we have ideal conditions for financial markets. Give the potential buyers and sellers access to each other and they will collectively determine the optimal pricing.

Question 7

An auto loan is a very specialized security. The borrower (demander of capital) is seeking a loan (typically in the $10,000 – $25,000 range). The appropriate rate of return is dependent on the specific borrower (what is his credit history, employment history, income, other debts, etc.). Remember that one of the characteristics of securities that work well in financial markets is their homogeneity (it doesn't matter who I am buying the security from). Also, important to financial markets is that there are many buyers and sellers of the identical security. However, since each auto loan is individualized, neither of these characteristics are present. As a supplier of capital, you would need to run a complete credit background on the borrower and prepare a binding, legal note (the document backing the loan) for repayment. As most of us do not engage in these activities on a regular basis, the cost of doing so would eat up most of the return. However, for a financial institution that makes several similar loans each day, the process of credit checks and documentation are relatively low-cost items. Specialization allows the financial institutions to process these loans at a low cost (and diversify some of the risk by holding many different auto loans) so that they can lend the money at a relatively low rate. If the financial intermediary is a bank, it gets the necessary capital from the many depositors at the bank.

Question 8

This was partially discussed in the above question. Consider a bank. Banks obtain capital from hundreds (thousands or even hundreds of thousands depending on the size of the bank) of depositors. These people have checking accounts, savings accounts, certificates of deposits, etc. at the bank. The bank then takes all of this money on deposit and lends it out in the form of business loans, personal loans, mortgage loans, etc. They may also use the money to purchase Treasury bonds. By pooling capital in a financial intermediary, the bank is able to provide securities to the suppliers of capital that have a very different risk/return profile than the securities issued by the demanders of capital. This process helps increase the amount of money available in the financial system and allows both suppliers and demanders to benefit by better matching their needs.

Another example would be mutual funds. Many people invest in stocks and bonds through mutual funds. The mutual fund acts as a financial intermediary. As a supplier of capital, I send money to the mutual fund to invest in stocks and/or bonds. The mutual fund issues me shares of its portfolio. It then pools my money with thousands of other investors and goes into the financial markets to buy stocks and bonds from demanders of capital. The advantage to me as a supplier of capital is I get better diversification, the ability to invest less capital, and professional investment management to pick the stocks and bonds. Without the mutual fund as the

financial intermediary, I would have to evaluate each stock and/or bond in my portfolio myself and have enough money to purchase enough different stocks/bonds to be diversified.

Question 9

The mutual fund example above meets this criteria. Another would be a life insurance company. When you purchase life insurance, the insurance company pools the premiums paid by you and the thousands of other customers. Instead of just holding onto this money and waiting to pay our benefits, the insurance company invests those premiums in stocks and bonds purchased in the financial markets. Because the insurance company is able to earn a return on these premiums paid in while they are waiting to pay out benefits, it lowers the cost of the insurance for customers. Many life insurance policies combine the life insurance with an investment policy so that the supplier of capital is buying life insurance and saving for retirement at the same time. (Note – this is not necessarily the best way to save money for retirement for everyone).

Question 10

Money market securities refer to securities that mature in one year or less. These include Treasury Bills (short-term "bonds" issued by the US Federal Government), Commercial Paper (short-term "bonds" issued by corporations), Re-purchase Agreements, and several other types of short-term securities.

Capital market securities refer to securities that mature in more than one year. These include Treasury Notes ("bonds" issued by the US Federal Government that mature in 2-10 years), Treasury Bonds (bonds issued by the US Federal Government that mature in 11-30 years) , Corporate Notes and Bonds, Preferred Stock, Common Stock and many other securities.

Question 11

The primary markets are where firms (or governments) issue securities to raise capital. For instance, Initial Public Offerings (IPOs) refer to situations where a corporation "goes public". When a firm has an IPO, it is selling its stock to the public for the first time (prior to this, the corporation was typically owned by the founders and venture capitalists). In the IPO, the firm works with investment bankers to set the initial price and find investors that want to buy the shares. It is common for a firm to have more interested buyers than shares available. When this happens, the investors that were able to participate in the IPO often can sell their shares in the secondary markets later in that same day for 10%-100% more than they paid in the IPO. Consider the Snap (parent company of Snapchat) IPO from 2017. On March 2nd, 2017, Snap became a publicly traded company through an IPO. The stock was issued through the IPO at $17. Because the demand for the stock was so high on the IPO, not everyone that wanted to buy at the initial offering price of $17 could buy. When shares started trading in the secondary market, the price was $24 (about 40% above the IPO price). By the end of the day, the stock closed at $24.48 after trading as high as $26.05 during the day. Note that the increase in price beyond the IPO price of $17 was a return to the investors in the IPO and did not raise any additional capital for LinkedIn. LinkedIn's capital raised was based on the $17 IPO price.

Another type of primary market activity is referred to as a secondary (or "seasoned equity") offering. The secondary offering is NOT TO BE CONFUSED with the secondary market. A secondary ("seasoned equity") offering refers to a company that already is publicly traded, but issues additional shares of stock to raise money. Typically when firms issue additional shares in a secondary offering, the price of the stock will fall by a small amount (1-3%).

A third type of primary market activity occurs when corporations and/or governments issue new bonds. The US Treasury auctions new bonds on a regular basis where investors engage in an auction process to determine the price that they are willing to pay the US Treasury for these bonds. Corporations and State/Local governments will typically use investment bankers to help them price and sell their bonds in the primary markets instead of the auction process used by the Treasury.

Question 12

There are multiple ways in which the secondary market benefits firms. First, without an active secondary market, the primary market would be much more limited. When investors buy stocks and bonds from the issuers in the primary market, the investors want to have the option to resell those stocks and bonds later on in the secondary markets. If there was no secondary market, many investors would be less willing to participate in the primary markets. Would you want to buy a 30-year Treasury bond if you knew there was no convenient way to sell it before maturity? How about buying stock in a new company? Without the liquidity provided

by the secondary market, very few firms would be able to find investors to purchase primary market transactions. Even those that were able to still find investors in the primary markets would likely need to pay those investors much higher rates of return.

The second way the secondary markets benefit firms is through information. When bonds are actively traded in the secondary markets, we get information about what investors are demanding for interest rates. When stocks are actively traded in the secondary market, firms get information about the health of their company and their competitors (a falling stock price indicates perceived problems while a rising stock price indicates perceived strength).

Secondary markets also provide sources of acquisitions (allowing companies to grow), ways to reduce agency costs (through stock-based compensation) and many other benefits.

Question 13

Part 13a

$k = k_{rf} + IP + DRP + LP + MRP + SCP$
$k = 2\% + 3\% + 0\% + 0\% + 0\% + 0\% = 5\%$

Part 13b

$k = k_{rf} + IP + DRP + LP + MRP + SCP$
$k = 2\% + 2.5\% + 0\% + 0\% + 0.6\% + 0\% = 5.1\%$

Part 13c

$k = k_{rf} + IP + DRP + LP + MRP + SCP$
$k = 2\% + 3.5\% + 0.3\% + 0.1\% + 0.15\% + 0.6\% = 6.65\%$

Part 13d

$k = k_{rf} + IP + DRP + LP + MRP + SCP$
$k = 2\% + 2.5\% + 1.2\% + 0.2\% + 0.5\% + -0.8\% = 5.60\%$

Question 14

Part 14a

6.14a Yield Curve

Part 14b

6.14b Yield Curve

Part 14c

6.14c Yield Curve

Part 14d

In Yield Curve A, we have an upward-sloping yield curve (longer-term securities offer higher returns). The differences in yields are based on two factors – the inflation premium and the maturity premium. We know longer-term bonds are riskier and have a higher maturity premium. This is likely accounting for some of the upward slope. However, it is also likely that inflation expectations are slightly higher over the long-term than the short-term.

In Yield Curve B, we have a downward-sloping yield curve. As the maturity premium should increase with longer-term securities, the only way for a long-term bond to offer a lower yield than a shorter-term bond is if inflation expectations are higher for the short-term bonds. This typically will occur when the economy is expected to enter an economic slowdown in the near future.

Part 14e

Yield Curve B is based on Treasury bonds while Yield Curve C is based on BB-rated corporate bonds. Since the yield curves are taken at the same point in time, the inflation premiums should be the same in both curves. This means that the difference (the higher yields at every level in Yield Curve C) are based on the higher levels of default risk premium associated with BB-rated bonds and (to a lesser extent) the slightly higher liquidity premium on the corporate bonds (Treasury bonds tend to be more liquid than corporate bonds).

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14.7: Solutions to CH 7 Exercises

Question 1

In Finance terms, risk refers to the possibility of earning less than expected on a particular investment over a given time period. For instance, if I make an investment an anticipate earning a 5% rate of return over the next year, I am exposed to risk if there is any chance that I earn less than that 5%. The two factors that determine the degree of risk are (A) the extent to which I can earn less than expected and (B) the likelihood that I will earn less than expected. For instance, if my expected return is 5% and the worst possible outcome is that I earn 4%, there is not a lot of risk involved. On the other hand, if there is a chance that I will lose 60%, my risk is much higher. Also, if I will make 5% 99.5% of the time and lose 50% only 0.5% of the time, my risk is also not very great because the chance of a bad outcome is very small. A high risk investment means that there is both a significant chance of earning less than expected and the amount less that I can earn is relatively large.

Question 2

This is a false comment. You can avoid losing money and still earn less than expected. Very small rates of return over long periods of time are still “bad” outcomes and the chance of that happening means you are exposed to risk even if you can’t lose money.

Question 3

While both activities use risk in an attempt to earn a profit, there are several important differences. First, the risk-return profile is different. Most forms of gambling have a negative expected return (the “house edge”). Even games where you might argue that some people have a positive expected return (sports betting, poker, etc.), the average individual will lose money due to the fixed cost of paying the gambling institution offering the wager. On the other hand, investing typically offers a positive rate of return. While stocks and bonds have both had periods of negative returns, the long-run rate of return on both is significantly positive.

Another difference is that investing provides capital to a variety of businesses. Without stock and bond markets, there would be far fewer jobs and product innovation as the stock and bond markets provide the capital for businesses to operate. Gambling on the other hand tends to transfer wealth instead of create it.

Note that the above discussion does not imply that gambling is wrong and investing is right. Instead, the point is to illustrate that the combination of positive expected returns to investors and providing capital to businesses makes investing a net positive to society while gambling tends to transfer wealth from gamblers to gambling institutions and is thus neutral in creating wealth.

Question 4

Correlation measures the extent to which two variables (returns) move together. If two securities have a high positive correlation (say somewhere between 0.5 and 0.99) that means that they have a strong tendency to move in the same direction. When one security increases in value, it is likely that the other will as well. When one decreases in value, it is likely that the other will as well. However, since the correlation is less than 1.0, the will not ALWAYS move in the same direction. Two securities with high positive correlations could be any two securities in the same industry. Industry pressures will lead the securities to move in a similar direction most of the time. However, firm specific factors will keep the correlation less than 1.0.

If two securities have a low positive correlation (0.01 to 0.49) that means that they have a weak tendency to move in the same direction. While they move in the same direction (up or down) more frequently than not, it is not uncommon for one to be up while the other is down. Two securities with low positive correlations could be any two companies without a specific connection (for instance, Amazon and Exxon). Both will be exposed to the same general economic factors (leading to a positive correlation), but the different industry and firm specific issues will keep the correlations low. In general, most stocks should have low positive correlations.

If two securities have a negative correlation, that means that they tend to move in opposite directions (the closer to -1.0, the stronger the inverse relationship). Due to general economic factors, few stocks will have negative correlations (at least as an expectation). One possible example might be oil producers and trucking firms. Since an increase in oil prices will improve the value of assets and profits for the oil firms and lower profits for trucking firms, we might see negative correlations. However, the

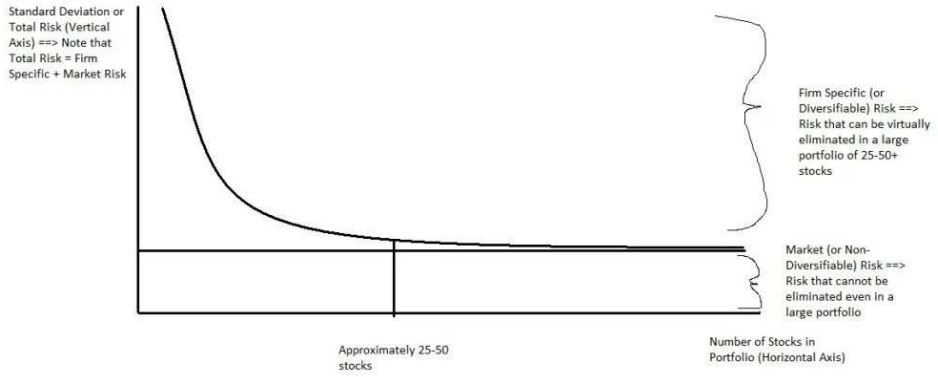
ability of trucking firms to pass along higher prices and periods with low oil price volatility will mean that even here we may not see that significant of an inverse relationship.

Question 5

Diversifiable (Firm Specific) risk is risk that can be virtually eliminated by holding a large portfolio of securities from a variety of industries. An example of a diversifiable risk would be the success or failure of a new product introduction by a firm. For instance, if Ford's new auto line is poorly received and results in a bad year or two for the automaker, this will not impact the other stocks in my portfolio. Thus, as long as I own several other stocks in a variety of industries, my overall portfolio will not be hurt much by Ford's problems.

Non-Diversifiable (Market or General Economic) risk is risk that can NOT be eliminated by holding a large portfolio of securities from a variety of industries. An example of a non-diversifiable risk would be a sudden surge in inflation. This would result in most stocks declining and I couldn't eliminate this risk regardless of how many stocks were in my portfolio.

The diagram below indicates how we can diversify away most of our firm specific risk in a large portfolio (25-50+ stocks), but market risk remains.



Question 6

Standard Deviation measures total risk. Total risk is both firm specific and market risk combined. Standard deviation is important when I am considering putting all of my money into a single security or a non-diversified portfolio. The reason total risk needs to be considered in these situations is that we have not diversified away our firm-specific risk so that it is still relevant. On the other hand, if we are adding a security to a well- diversified portfolio, the standard deviation of that stock is not important. Because we own a well-diversified portfolio, the firm specific risk of the stock will be unimportant and we only need to focus on the market risk.

Question 7

Beta is a measure of market risk. While every firm has market risk and it can not be eliminated in a portfolio, some firms are more sensitive to market (general economic) factors than others. Therefore, the market risk of some stocks will be higher than the market risk of others. A portfolio of stocks with high market risk can still be diversified (so that firm specific issues are not relevant) and yet increase at a rate faster than the market or decrease at a rate faster than the market. When we are adding a security to a well-diversified portfolio, we no longer need to be concerned about firm-specific risk, but only about market risk and how it will affect our portfolio's sensitivity to general economic/market forces. When we are considering investing all of our money into a single stock, beta is not relevant because we need to focus on the total risk instead of just the market risk factors.

Question 8

When we are comparing two well-diversified portfolios, either beta or standard deviation will work. That is because since both portfolios have essentially zero firm-specific risk, the total risk of the portfolio will effectively equal the market risk of the portfolio. Whichever portfolio has more market risk (higher beta) will also have more total risk (higher standard deviation).

The table below illustrates when we should focus on standard deviation (σ) as a measure of risk and when we should focus on beta (β) as a the appropriate measure of risk.

	Evaluating the risk of a single security in isolation or comparing two poorly diversified portfolios	Evaluating the risk of a security to add to a well-diversified portfolio	Comparing the risk level of two well-diversified portfolios
σ	X		X
β		X	X

Question 9

The stock should increase by 12.5% ⇒ (1.25×10%). While in reality it will likely increase by either more or less than 12.5%, my best guess today would be for an increase of 12.5%. If it increased by more than 12.5%, it would be because firm specific factors turned out positive and if it increased by less than 12.5% (or dropped), it would be because firm specific factor turned out to be negative. The 12.5% is based on the firm's sensitivity to market factors. If I thought the stock market was going to decline by 5%, I would expect my stock to decrease in value by 6.25% ⇒ (1.25×-5%). For a stock with a beta of 0.6, it should increase by 6% if the market climbs by 10% and fall by 3% if the market declines by 5%.

Question 10

True. High beta stocks imply higher than average risk. Higher than average risk implies higher than average expected returns. We can also see this by looking at the security market line. If we have a beta of more than one, the required return will be greater than the expected return on the market. Note that this relationship is based on expected returns and not actual returns. The nature of risk is that sometimes we will lose money and with high risk we may lose a lot. While our expected returns are greater than the average return on the market, our realized returns may be higher or lower. Over long periods of time with well diversified portfolios, we should earn higher than average returns if beta is a good measurement of risk.

Question 11

False. Expected return does not mean realized return. While ON AVERAGE, we would make more money from stock B over the course of the next year, we don't get to repeat next year 10,000 times to reach our average. Instead, we only get one shot. Its possible that stock B will earn quite a bit less than its expected return and stock A will earn quite a bit more.

Question 12

In equilibrium, expected return should equal required return. If this is not true, the price will adjust until we move back into equilibrium. In this example, the expected return moves to 18%, while the required return stays at 13%. This means investors anticipate earning an 18% return on average while a 13% return is enough to compensate them for the risk they are taking. Since they can earn 5% more than they need to compensate them for the risk, they will buy the stock. As a large number of investors start buying the stock, the price will increase. Since the expected cash flows associated with the stock are not changing, the higher price means that there will be a lower expected return (see a more detailed explanation of this below). The price will continue to go up until the expected return falls to 13%. At that point, there is no reason for people to keep buying the stock and pushing up the price because they are only earning the required return. At this new price, the stock is worth buying, but at any higher price it would not be. Thus, we are back in equilibrium.

This process should happen instantaneously if markets are efficient. People will see the discrepancy between expected return and required return and start buying immediately. With everyone wanting to buy at the same time, the price will respond immediately.

A lot of people struggle with the idea that an increasing price leads to a lower expected return. At first glance, it seems counter-intuitive as if we see the stock price going up we might think that it is a “good” stock and expect it to continue to go up more in the future. However, if you think of a stock as the present value of all expected cash flows AND we increase the price while holding cash flows constant, you can see that you are paying more for the same set of cash flows. Since you are paying more for the same set of cash flows, you should expect to get a lower rate of return on your investment.

Problem 1

Exp Ret A = 0.20(-30%) + 0.40(15%) + 0.40(30%) = -6% + 6% + 12% = 12%

Exp Ret B = 0.30(-5%) + 0.40(10%) + 0.30(20%) = -1.5% + 4% + 6% = 8.5%

St.Dev.A=√0.20(−30%−12%)2+0.40(15%−12%)2+0.40(30%−12%)2$��.���.�=0.20(−30%−12%)2+0.40(15%−12%)2+0.40(30%−12%)2$
St.Dev.A=√352.8+3.6+129.6��.���.�=352.8+3.6+129.6
St.Dev.A=22.05%��.���.�=22.05%

St.Dev.B=√0.30(−5%−8.5%)2+0.40(10%−8.5%)2+0.30(20%−8.5%)2��.���.�=0.30(−5%−8.5%)2+0.40(10%−8.5%)2+0.30(20%−8.5%)2
St.Dev.B=√54.68+0.90+39.68��.���.�=54.68+0.90+39.68
St.Dev.B=9.76%��.���.�=9.76%

If you are going to put all of your money into one stock, you could choose either one. People that are more risk-averse will choose stock B while people that are less risk-averse will choose stock A. Note that both choices are consistent with risk aversion because the stock with the higher risk (stock A) also has a higher expected return.

Problem 2

Part 2a

Exp Ret C = 0.30(-10%) + 0.50(15%) + 0.20(40%) = -3% + 7.5% + 8% = 12.5%

Exp Ret D = 0.30(25%) + 0.50(10%) + 0.20(0%) = 7.5% + 5% + 0% = 12.5%

St.Dev.C=√0.30(−10%−12.5%)2+0.50(15%−12.5%)2+0.20(40%−12.5%)2��.���.�=0.30(−10%−12.5%)2+0.50(15%−12.5%)2+0.20(40%−12.5%)2
St.Dev.C=√151.88+3.13+151.25��.���.�=151.88+3.13+151.25
St.Dev.C=17.50%��.���.�=17.50%

St.Dev.D=√0.30(25%−12.5%)2+0.50(10%−12.5%)2+0.20(0%−12.5%)2��.���.�=0.30(25%−12.5%)2+0.50(10%−12.5%)2+0.20(0%−12.5%)2
St.Dev.D=√46.88+3.13+31.25��.���.�=46.88+3.13+31.25
St.Dev.D=9.01%��.���.�=9.01%

Part 2b

Exp Ret Port = 0.5(12.5%) + 0.5(12.5%) = 12.5%

St.Dev.Port=√(0.5)2(17.5%)2+(0.5)2(9.01%)2+2(0.5)(0.5)(17.5%)(9.01%)(−.75)��.���.����=(0.5)2(17.5%)2+(0.5)2(9.01%)2+2(0.5)(0.5)(17.5%)(9.01%)(−.75)
St.Dev.Port=√76.56+20.30+−59.13��.���.����=76.56+20.30+−59.13
St.Dev.Port=6.14%��.���.����=6.14%

Part 2c

We should choose the portfolio because all three choices have the same expected return, but the portfolio has the lowest risk. All risk-averse investors will choose the portfolio over either stock individually in this situation.

Problem 3

Part 3a

Exp Ret Port = 0.65(20%) + 0.35(15%) = 18.25%

St.Dev.Port=√(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(1.0)��.���.����=(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(1.0)
St.Dev.Port=√264.06+49+227.5��.���.����=264.06+49+227.5
St.Dev.Port=23.25%��.���.����=23.25%

Part 3b

Exp Ret Port = 0.65(20%) + 0.35(15%) = 18.25%

St.Dev.Port=√(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(0.5)��.���.����=(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(0.5)
St.Dev.Port=√264.06+49+113.75��.���.����=264.06+49+113.75
St.Dev.Port=20.66%��.���.����=20.66%

Part 3c

Exp Ret Port = 0.65(20%) + 0.35(15%) = 18.25%

St.Dev.Port=√(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(0)��.���.����=(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(0)
St.Dev.Port=√264.06+49+0��.���.����=264.06+49+0
St.Dev.Port=17.69%��.���.����=17.69%

Part 3d

Exp Ret Port = 0.65(20%) + 0.35(15%) = 18.25%

St.Dev.Port=√(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(−0.5)��.���.����=(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(−0.5)
St.Dev.Port=√264.06+49+−113.75��.���.����=264.06+49+−113.75
St.Dev.Port=14.12%��.���.����=14.12%

Part 3e

Exp Ret Port = 0.65(20%) + 0.35(15%) = 18.25%

St.Dev.Port=√(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(−1.0)��.���.����=(0.65)2(25%)2+(0.35)2(20%)2+2(0.65)(0.35)(25%)(20%)(−1.0)
St.Dev.Port=√264.06+49+−227.5��.���.����=264.06+49+−227.5
St.Dev.Port=9.25%��.���.����=9.25%

Note that the expected return is not a function of the correlation while the standard deviation declines as the correlation drops. This is the “free lunch” of diversification – as long as we invest in securities with a correlation of less than one, we will lower our risk (st. deviation will be less than the weighted average of each stock’s st. deviation) without lowering our expected return (the exp. return will be the weighted average of each stock’s expected return).

Problem 4

Part 4a

Beta=(70)(0.40)20=1.40����=(70)(0.40)20=1.40

Part 4b

Req. Return = 5% + 1.40(13% – 5%) = 5% + 11.2% = 16.2%

Part 4c

In equilibrium, expected return equals required return. Since the required return is 16.2%, the expected return should be 16.2% as well.

Problem 5

First, we know that the stock price should be found by using the following formula

$P_0 = D_1/(k - g)$

Now, we need to find each of the three inputs.

g is given at 4%.

$D_1 = D_0(1 + g)$, so $D_1 = 1.50(1.04) = \$1.56$.

k=krf+β(¯km−krf)=+(¯−)
k=7%+1.3(12%−7%)=7%+1.3(12%−7%)
k=13.5%=13.5%

Once we get all the inputs, we plug them back into the pricing model

$P_0 = 1.56/(.135 - .04) = \$16.42$.

The most we should pay for the stock today is $16.42.

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14.8: Solutions to CH 8 Exercises

Question 1

1. The decision rule should consider all relevant cash flows
2. The decision rule should recognize the riskiness of the relevant cash flows
3. The decision rule should recognize the time value of money
4. The decision rule should rank the projects so that those projects that increase the firm's value the most are ranked the highest.

Note that rule four can not be shortened to rank projects. Any decision rule will rank the projects, but we want our "optimal" decision rule to rank by value added. Also, a decision rule that does not meet all four criteria is not necessarily worthless. Instead it means that it has some obvious flaws that must be recognized.

Question 2

The Payback Period

1. may not consider all relevant cash flows,
2. does not consider TVM,
3. does not rank by value added, and
4. has an arbitrary decision rule.

Consider each in order. First, consider two projects as follows:

	Project A	Project B
Year 0	-$100,000	-$100,000
Year 1	50,000	49,000
Year 2	50,000	49,000
Year 3	5,000	90,000

According to PP, we would prefer project A as it has a shorter PP. However, clearly Project B is superior. The problem is that we fail to consider any cash flows that come in after the PP. Now consider another two projects.

	Project A	Project B
Year 0	-$100,000	-$100,000
Year 1	98,000	1,000
Year 2	1,000	99,000
Year 3	75,000	75,000

According to PP, we would prefer project B as it has a shorter PP. However, Project A is superior (NPV_A = $41,681 vs. NPV_B = $33,199 when k=12%). The problem is that PP fails to recognize the advantage of getting $98,000 in year 1 as opposed to $99,000 in year 2. Because of TVM, the $98,000 is much more valuable. The third problem does not need an example. Our goal is to maximize value not get our initial investment back as soon as possible. Following PP distracts us from our primary goal and can lead to bad decision making. Finally, consider the arbitrary cutoff point. Lets say management chooses 3 years for the cutoff. What is special about 3 years vs. 2.5 or 3.5? Nothing really. There is no theoretical basis for any specific cutoff level.

The second part of the question is why bother with PP since it has so many flaws? The answer is twofold. First, one recent survey estimates that over 50% of firms (see Ch. 8) use PP either always or often in their capital budgeting process. Since so many firms use this decision rule, it is important to know how to calculate PP and what it is telling us. It is also important to know its flaws so we know its limitations as a decision rule. The second reason to know PP is that there are two specific situations where PP can be

useful. One is for extremely risky projects where there is a significant chance that the project life will be shorter than anticipated. Under this scenario a quick payback may be critical. That way even if the firm has to kill the project early it may still be able to recover most (or all) of their costs. Two, firms that are extremely weak financially may pay extra attention to PP. If the project has a high NPV, but will not start generating positive cash flows for several years it may not be appropriate to firms in financial distress. They need projects that pay off quickly in order to stay in business.

Question 3

Yes, when projects are independent NPV and IRR will make the same accept/reject decision. The reason for this can be thought of mathematically or intuitively. Mathematically, IRR is the discount rate at which NPV is equal to zero. Any higher discount rate causes NPV to be less than zero and any lower discount rate would cause NPV to be positive. Thus at all positive NPVs, the IRR is higher than the required return and at all negative NPVs the IRR is lower than the required return. Intuitively we can consider that the IRR tells us the expected return on our initial investment. If the expected return is greater than the required return we should be adding value (and vice-versa). Thus, whenever the IRR is higher than the required return the NPV will be positive and whenever the IRR is less than the required return the NPV will be negative. Because IRR and NPV make the same accept reject decision, either can be used for independent projects. It is only for mutually exclusive projects where we will have problems due to different rankings of which project is best.

Question 4

The first two IRR problems are both ranking issues. One (the size problem) has to do with the initial investment sizes and the second (the reinvestment rate problem) has to do with cash flow timing issues. Before I go into explaining these problems, it is important to note that both are ONLY problems with mutually exclusive projects. For independent projects, they will alter the ranking of projects, but not the accept/reject decision and are therefore irrelevant. Let's start with the size problem. If we must choose only one project from a list of projects, we want to make sure we select the one that adds the most to firm value. Typically it is easier to do this with a larger project. Consider the following two projects (both with a 15% required return):

	Project A	Project B
Year 0	-$10,000	-$100,000
Year 1	6,000	50,000
Year 2	6,000	50,000
Year 3	6,000	50,000
IRR	36.31%	23.38%
NPV	$3,699	$14,161

Project A looks better according to IRR and has a higher return. However, if we can choose only one, we'd rather earn a little lower percentage return on a lot larger investment. Project B will increase firm value by over $10,000 more than project A would. The difference in sizes for the initial investment leads to different rankings. The second ranking issue with IRR is the reinvestment rate problem. The calculation process of the IRR assumes that all intermediate cash flows will get to be reinvested at the IRR. For projects with high IRRs, this can distort the true return. For instance, in project A above, it assumes that we can reinvest each of the $6000 cash flows and earn over 36% on those investments. It is unlikely that we will be able to do so. This reinvestment rate problem shows up primarily in projects that have significantly different cash flow timing issues. For instance, front-loaded projects

(where a large % of cash flows come in early) are more susceptible to the reinvestment rate problem than are back-loaded projects. Again, consider two projects (both with a 13% required return):

	Project A	Project B
Year 0	-$100,000	-$100,000
Year 1	80,000	0
Year 2	50,000	25,000
Year 3	20,000	160,000
IRR	30.20%	24.08%
NPV	$23,815	$30,467

According to IRR, Project A looks better but Project B increases firm value by around $7000 more than Project A. This is because the IRR calculation assumes that the $80,000 cash flow in year 1 will be reinvested at 30% for two years which is unlikely. Since most of the cash flows in Project B are at the end of the time, they are not greatly affected by the reinvestment rate assumption. We know that this problem is due to reinvestment and not size as the initial investments are the same, but the timing of cash flows is different.

The third IRR problem is relatively rare. It is referred to as the Multiple IRR (or Crossover) Problem and occurs when the cash flows change signs more than once. For each sign change (from negative to positive or from positive to negative) there will be a unique IRR. Therefore, for a project that has two sign changes (crossovers) there are two IRRs. Three crossovers mean 3 IRRs. When this happens, the IRR is unreliable and shouldn't be used.

The final issue is why know about IRR given its flaws? The answer is that it is commonly used in practice (more than 75% use IRR according to the survey mentioned in the Ch. 8). The reason it is so commonly used is twofold. First, it is easily understood. Since many people involved in capital budgeting may not be finance people it is important to be able to communicate the results in a manner that is easy to follow. Most people are comfortable with rate of return analysis and intuitively understand what a 25% IRR means. On the other hand, without some training fewer people understand a $3567 NPV. This in itself is not enough reason to use IRR – five minutes can explain the basic NPV framework. However, in most cases IRR is sufficient. As long as the projects are not mutually exclusive and there is no crossover problem, IRR and NPV will give the same results. So NPV is only needed when a problem exists.

Question 5

PP – increase T for low risk projects and decrease T for high risk projects.

IRR, NPV – decrease k for low risk projects and increase k for high risk projects.

Question 6

No, it does not mean the process is flawed. Capital budgeting analysis gives us a framework for analyzing the value of long-term investment projects. However, two important problems remain. First, the results can only be as good as the inputs into the calculations. If we don't have reasonable forecasts of the cash flows associated with a new project, the expected lifespan, and the risk involved, then the NPV analysis is not helpful. This would be a case of "Garbage In, Garbage Out." Our calculated values are only as good as our inputs. However, we can still have reasonable forecasts and bad results. Anytime we are forecasting future cash flows, we need to remember that they are only forecasts. If we KNEW the outcomes with certainty, life would be a lot easier (but much more boring). Any tool for making decisions about the future (such as NPV analysis) is going to include error. However, it is still useful. If we have a good process, we will be right more often than we are wrong. As an analogy, assume you must pick a basketball player to make one basket. Player A makes 90% of his shots and Player B makes 20%. If you pick Player A and he misses, does that mean you made a bad choice? No! Given the available information, IN THE LONG RUN, you will do far better by choosing Player A. However, in any specific trial, there is a large random factor. Judging your decision process based on short-term results is results-oriented thinking and can lead to a major problem. If we have a good process for estimating cash flows,

project life, and risk, then NPV will allow us to accept projects that OVER TIME will add value to our firm. While we may have a few bad outcomes, the process will lead to us being right more than we are wrong.

Problem 1

PP_A = 2.89 years
PP_B = 3.26 years
PP_C = 2.33 years
PP_D = 3.39 years

IRR_A = 9.99%
IRR_B = 15.40%
IRR_C = 17.07%
IRR_D = 12.94%

NPV_A = -$71,051
NPV_B = $38,622
NPV_C = $28,259
NPV_D = -$14,437

If Independent

Choose Projects B and C as both have positive NPVs. While the PP exceeds T for project B, unless the company has significant financial problems and/or is severely concerned about the project lasting the four years. NPV is the best decision rule, so when the decision rules give conflicting results, go with NPV.

If Mutually Exclusive

Choose Project B as it has the highest NPV. The higher IRR for project C is irrelevant and is caused by the different sizes of the projects. Again, when there are conflicts among the rules always follow NPV.

Problem 2

We identify the size problem by looking for different initial investments. Projects AC, AD, BC, and BD all are pairs with different initial investments. However, we also want to find a pair of projects without the reinvestment rate problem. Since A and C are both frontloaded while B and D are both backloaded, they should not suffer from the reinvestment rate problem. Therefore, you could select either AC or BD as an answer for a pair of projects that could suffer from the size problem, but not the reinvestment rate problem.

When looking for pairs of projects that might suffer from the reinvestment rate problem, we have AB, AD, BC, and CD. However, we also want to find a pair of projects without the size problem. Since both AB and CD have the same initial investments, they will not suffer from the size problem. Therefore, you could select either AB or CD as an answer for a pair of projects that could suffer from the reinvestment rate problem, but not the size problem.

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14.9: Solutions to CH 9 Exercises

Question 1

An expense ratio refers to an annual charge (taken out on a daily basis) for the company that manages the mutual fund. For example, a mutual fund with a 1% expense ratio would charge investors 1% of their assets each year for managing the fund (note: assuming 250 trading days, that would work out to 0.004% per day). This is designed to cover the mutual funds expenses (mutual fund managers, cost of gathering information, cost of presenting information to investors, earning a profit, etc.) and does not factor in actual trading costs (brokerage commissions paid by the mutual fund, etc.). A load charge refers to an upfront charge based on investments into the fund. For example, if I decide to invest $100 a month into a fund with a 4% load charge, then $4 each month will go to the fund for the load and $96 will actually get invested into the fund. Typically load charges are designed to cover compensation to financial advisors and other marketing costs.

For a short-term investor, load charges are typically more important while for long-term investors expense ratios are more critical. The crossover point in terms of how long depends on the relative size of expense ratios and load charges. You can estimate the impact of load charges and expense ratios as follows:

- Estimate your future value based on contributions to the mutual fund and anticipated rate of return without expenses.
- Estimate your future value based on contributions to the mutual fund and anticipated rate of return with expenses.

For example, what is the impact of a 5% load charge and a 0.8% expense ratio for an investor who plans to initially contribute $2000 today and make additional contributions of $200 per month for the next 40 years if the mutual fund anticipates earning 6.5% before expenses?

Baseline

480 N
6.5 I/Y
-2000 PV
-200 PMT
FV⇒$483,462.99

With Expenses

480 N
5.7 I/Y
-1900 PV
-190 PMT
FV⇒$367,437.65

The baseline (without expenses) results in you having an additional $116,025.34 at retirement, so this is your net cost for the expenses. Note that reducing the expense ratio from 0.8 to 0.4 would have allowed you to accumulate an extra $43,035.87 at retirement. Small changes in the expense ratio don't amount to much in a given year, but are big over a long time-frame.

Question 2

The prospectus provides all the important information to a potential investor on the fund. It details the fund objective, talks about investment strategy, details who the fund manager is, breaks down expenses, discusses risk, looks at past returns, etc. In addition, it talks about minimum initial investments and looks at portfolio holdings for the most recent quarter. While the prospectus can't tell you if a fund will perform well in the future, it is an important document to look through to get a feel if the fund is right fit for you.

Question 3

An ETF is an Exchange Traded Fund. It is a mutual fund that trades like an individual stock. Normally, mutual funds can only be bought/sold at the end of the trading day (NOT while markets are open). Also, mutual funds discourage investors from short-term trading. They don't want people buying one day and selling a week later. Instead they want them to invest and hold the fund for

multiple years. Finally, most mutual funds are actively managed. This means that mutual fund managers try to identify good stocks to own and bad stocks to avoid. They buy/sell stocks within the mutual funds portfolio regularly (most actively managed mutual funds have turnover of over 100% which means that they hold the average stock in their portfolio for less than one year). Active management is less tax-efficient (more short-term capital gains) and more expensive (more trading costs which lowers the funds returns unless they're able to find undervalued/overvalued stocks consistently…evidence suggests this doesn't happen). While some traditional mutual funds are passive (these are known as index funds and are among my favorite type of funds), they are in the minority. While most traditional mutual funds are actively-managed, most ETFs are passive. By passive, we mean that instead of trying to choose good stocks and avoid bad ones, they try to match a particular index. The index may be a broad market index (like the S&P 500), a sector (like energy stocks), international (like Brazil), or many other categories. This tendency for passive investment-strategies tends to result in lower expense ratios than traditional ETF. However, some ETFs can have exotic strategies (such as levered funds which are supposed to increase/decrease 2-3 times as fast as the overall market or levered inverse funds which are supposed to move in the opposite direction of the overall market AND at a faster pace) or focus on areas outside stocks such as gold. Because ETFs are bought like individual stocks, you need a brokerage account to trade them and pay brokerage commissions when you buy/sell. ETFs have become extremely popular and are one of the fastest growing areas of mutual funds over the last 10 years. Quick recap on ETFs:

- Purchased through a broker
- Trade like a stock (buy/sell during periods when the market is open) so better for active traders
- Tend to have lower expense ratios
- Tend to follow a passive investment management strategy
- Can have a wide variety of objectives to match the interests of a wide-variety of investors

Question 4

In class, we have often discussed the idea that risk-aversion is closely related to age (or years to retirement). As people are younger (20s – 40s), they can afford to take more risks for higher expected returns as they have more time to recover from losses and adjust their savings. However, as people get close to retirement (50s – 60s), they need to reduce their risk exposure. Lifecycle funds are designed to do this automatically by investors choosing a target date for their retirement (typically in 5 year increments). For example, a person like myself with about 10 years to retirement might choose a target-date of 2030. A person near retirement may choose a target date of 2020. Someone just graduating may choose a target date of 2055, 2060, or even 2065. Each of these different "target-dates" would be different mutual funds with noticeably different investment strategies. The 2020 fund would probably have about 50-55% stock exposure (with many of the stocks more conservative companies), 35-40% bond exposure, and 5-10% cash exposure for a less risky mix. The 2055 fund would probably have about 90% stock exposure (with more of it in aggressive growth stocks, emerging markets investments, etc.) and 10% bond exposure (including some junk bonds). Over time, the management team running the 2055 fund would slowly reduce the risk by moving to fewer, more conservative stocks and more (and safer) bonds. This way the investor does not need to worry about adjusting the risk over time. It is designed to maximize "ease of management" for the individual investor as risk is gradually reduced to match age.

The advantage is clearly simplicity for the average investor. Many people find reviewing/managing their investment funds as much fun as a trip to the dentist. This reduces the time that needs to be spent assessing the portfolio mix as it is taken care of for you by the fund managers. There are however a couple of disadvantages that one needs to be aware of before choosing this route. First, risk aversion is not solely dependent on time to retirement. It is also impacted by personality, income, wealth, job security, dependents, and many other factors. The lifecycle fund only controls for one factor (although typically one of the most critical factors), so may provide a risk mismatch for YOU if you do not fit the normal profile in all other areas. Second, each lifecycle fund is managed a bit differently. The 2030 fund offered by one firm may have 70% weighting in stocks while the 2030 fund offered by another may have 50% weighting. Because of this, even if an investor fits the normal profile and chooses the right target date, they may have a slightly riskier/higher expected return fund or a slightly safer/lower expected return fund depending on which mutual fund company he/she buys from. A third disadvantage is that these funds typically have higher expense ratios. Often they are formed not by individual securities, but essentially mutual funds within mutual funds. This can mean paying expenses for management of the lifecycle fund and paying expenses within the mutual funds the lifecycle fund holds. Check the prospectus of the lifecycle fund you are choosing to before buying to see about its risk profile and its expenses instead of just picking any fund with the appropriate target date.

Question 5

There are many things to consider when evaluating a mutual fund. However, a few simple ones that I would recommend are as follows:

- Eliminate any fund that is in the bottom 25% of its category over the last 3-5 years in performance. Often (not always), this is a sign that there are some structural problems with the fund.
- Look for funds with below average expense ratios. I prefer index funds because they have extremely low expense ratios and evidence suggests that mutual fund managers do not outperform the market on a risk-adjusted basis. If they don't have an edge over the market, why pay for them to try to outperform it? Instead, just get exposure to the assets you want through low-cost, passive funds.
- Focus on risk for you. Look at the risk of the funds you invest in and make sure you are comfortable with it. If losing 30% of your money is going to cause you to not sleep at night, don't expose yourself to that risk. There are thousands of funds with very different risk-return profiles, so choose ones that you are comfortable with.
- Closely related to the previous factor – choose a portfolio of funds that works for you. Even if you are more risk averse, you can put SOME of your funds into higher-risk, higher-return type funds as long as you have a portfolio. A portfolio doesn't mean 10 random mutual funds, but maybe 3-8 specific mutual funds with different objectives (such as 10% in an emerging market stock fund, 10% in an emerging market bond fund, 10% in a broader international stock fund, 10% in a broader international bond fund, 30% in a US stock index fund, 20% in a US bond fund, and 10% in a precious metals or real estate fund – note, this mix is meant as an example NOT a recommendation).
- Adjust your asset allocation (how much stocks, bonds, international, etc) at least annually to maintain an appropriate risk balance. Otherwise you will find yourself over-weighted towards areas that did well in the recent past and underweighted towards areas that did poorly. It also allows you to re-evaluate how much risk you feel comfortable with based on your current situation.

Question 6

The primary reasons mutual funds don't outperform the markets on a risk-adjusted basis are (a) markets are relatively efficient and (b) managing a fund entails costs which are not captured by market indices (such as the S&P 500). Even though mutual fund managers are professionals and typically very good at what they do, they are largely competing against other professionals who are typically very good at what they do. The vast majority of trading in the financial markets is among professional/institutional investors. They all are smart, have access to lots of information, etc. Because of this, it is rare for one to consistently outdo the others. The efficient markets hypothesis may not be 100% valid, but it is reasonably close. There are not a lot of easily exploitable opportunities out there because so many people are constantly seeking them out. Also, running a mutual fund involves costs. There are basic trading costs, costs to gathering information, cost to paying the portfolio manager and staff, cost to preparing/presenting information to investors, the fund company's profit, etc. These things are covered in the expense ratio (except for trading costs which lower pre-expense returns) and impact the return that the investor receives from the mutual fund (often these costs are around 1%). Because the index is not a managed portfolio, it doesn't have any of these costs to lower its performance. Studies show that after accounting for trading costs and expense ratios, mutual funds typically match the overall market returns.

This does not mean that mutual funds are a poor investment tool. If you tried to invest on your own through individual stocks/bonds, you also would likely not outperform the market due to investment skill (it's possible, but not likely). You would also be gathering information (dollar cost and time cost), paying brokerage commissions, and needing to have a large enough portfolio to adequately diversify (remember that you'd need at LEAST 15 different stocks – most mutual funds have over 100 different stocks in their portfolio). Between the time spent managing your portfolio, the initial investment required to have a diversified portfolio, and the trading costs you would encounter, most people find mutual funds far more efficient than managing their own stocks/bonds. I would argue that unless you had at least $50,000 (probably a low estimate) AND enjoyed doing investment research, you are better off with mutual funds (carefully selected mutual funds) than trying to manage your individual portfolio of stocks/bonds. However, if you really like investments, there can be other advantages other than pure cost efficiency (enjoyment of the challenge provided, learning experience, etc.). The vast majority of individuals are better served by mutual funds than opening a brokerage account to trade stocks.

Question 7

SIMILARITIES

- Both allow $6000 per person per year contribution ($7000 for people 50 and older under catch up IRA rules)
- Both allow investments to compound tax-free during the time period they are in the IRA (no taxes on investment income – dividends, interest, capital gains)
- Both allow a wide variety of investments (stocks, bonds, mutual funds, bank CDs, etc.) to be held within the IRA

DIFFERENCES

- The Traditional IRA has a tax incentive for your contribution. For every $1 you put in the IRA, the IRS allows you to lower your taxable income by $1. For someone in the 25% tax rate, this is essentially the same as getting an extra $0.25 for every $1 you contribute. This is a front-loaded tax incentive. The Roth IRA does not provide a tax incentive on your contribution (you don't pay any extra taxes than you would if you spent/invested the money elsewhere…you just don't get the tax break).
- The traditional IRA has more restrictive income guidelines for getting the full tax advantage. For example, if you are married and make $124,000 or more (2020) in joint adjusted gross income, neither you nor your spouse can take advantage of a traditional IRA (assuming you are covered by a retirement plan at work). However, you can take full advantage of a Roth IRA assuming you don't make more than $196,000 (2020). This allows more people to take advantage of Roth IRAs than Traditional IRAs
- With the Roth IRA, you do not pay any taxes on eligible withdraws (post-retirement). With a Traditional IRA, eligible withdraws are taxed as ordinary income. This creates a back-loaded tax incentive for Roth IRAs
- With the Roth IRA, you are not required to initiate withdraws at age 70½. This is because there is no tax payment necessary on withdraws, so the IRS has no incentive to make you initiate withdraws. This makes Roth IRAs better for estate planning purposes.
- With the Roth IRA, you can withdraw contributions (not investment income) prior to retirement without a tax penalty. This is because you did not get any tax break on your contribution (only the investment income) so there is no rationale for a penalty. However, I would strongly recommend avoiding early withdraws if possible as it limits your ability to use the IRA to accumulate significant wealth at retirement.

Question 8

This is an example of a poor question. The reason it is a poor question is because IRAs (like 401k plans) are not investments and therefore don't earn rates of returns. Instead they are tax shelters that we can put investments into to reduce the taxes associated with our investment income. Someone that is very conservative could put short-term bank CDs into their IRA. Right now (7-13-2020), most banks are paying approximately 1.00% on a 2-year CD, so if that was the investment you were holding in your IRA, you would earn a 1.00% return. You could invest your entire IRA into a single stock. If it did well, you'd have a great return. If it did poorly, you'd have a negative return. Within your IRA, you can choose a wide variety of investments (a few – such as collectibles – are typically off limits) and then your rate of return will depend on the rate of return from those investments. So, to answer this question for YOUR IRA (or 401k plan), think about what you are going to invest in within the tax shelter and that will provide you your anticipated rate of return.

Question 9

$6000 per person per year (this is the answer you need to know for the test). However, there are a few exceptions. One, you need to have earned income of that amount (so you can't start funding your kids IRA at $6000 per year when they are 2). Two is that you might be restricted by the income restrictions on eligibility (if you earn above certain amounts you will be able to contribute less – or even zero – to an IRA). Third is that if you are over 50, you are eligible to contribute $7000 per person per year. Note that those are individual levels, so a couple could contribute up to $12,000 per year by each contributing $6000 to their personal IRAs (remember that IRAs are individual accounts).

Question 10

This is based on the income restrictions. For people filing individual tax returns, only those earning under $65,000 in adjusted income are able to take full advantage of a Traditional IRA (and the ability to use the traditional IRA – assuming you are covered by a retirement plan at work – is phased out entirely for those making $75,000 or more). For a Roth IRA, individuals can participate fully at up to $124,000 in adjusted income and are not phased out entirely until $139,000. For couples, the Traditional IRA cutoff point kicks in at $104,000 and any couple with over $124,000 is not eligible. Again, Roth IRAs are less restrictive in that the cutoff point kicks in at $196,000 and eligibility is eliminated at $206,000 (note that these income limits are for the 2020 tax year). Therefore, while everyone at lower income points could choose either type of IRA, people at higher income points are limited to the Roth version.

Question 11

Mutual funds are probably the largest type of asset. However, individual stocks and bonds are also popular choices. Bank CDs are another popular investment that is held within IRAs. Under certain circumstances, real estate, precious metals, and other types of investments can also be held within IRAs. However, it is harder to find financial institutions that will fulfill a custodial agreement, so most people use traditional securities (mutual funds, stocks, bonds, and CDs). Some investment strategies (collectibles, using margin, and/or many derivatives such as options and futures are typically not approved IRA assets).

Question 12

A 401(k) plan is what we would describe as a DEFINED CONTRIBUTION pension plan. Defined contribution pension plans base their benefits on (a) how much is contributed and (b) what return on investment is generated. In other words, people that make significant contributions to their 401(k) plans over a long period of time and earn decent rates of return will have significantly more retirement assets (and, in turn, retirement income) than those that don't make many contributions or earn poor rates of return. This differs from a DEFINED BENEFIT plan where retirement benefits are based on years of service and average salary (or last year's salary). Due to longer life expectancies, companies realized that the traditional defined benefit plan was too expensive and most have moved to 401(k) plans. Many companies will provide a matching contribution. The level of the match varies significantly from firm to firm, but an example would be a 50% match on the first 6% contribution. So, assume you earn $1000 for your paycheck and contribute 6% ($60). Then your employer would match that at 50% ($30) and your total contribution to your 401(k) plan would be $90. Some employers match more, some less so it is one thing to evaluate as you look at potential job offers. Many firms cut or eliminated matching plans during the worst of the financial crisis, but a recent article noted that ¾ of those firms have reinstated their matching.

Once you decide how much you are going to contribute and what the match is, the next step is to figure out how you are going to invest it. Most 401(k) plans provide a variety of mutual-fund based alternatives within the plan. The better the plan, the more choices (and better choices) you will have to allocate your contribution dollars. It will be up to you to decide how much risk you are willing to take in search of higher expected returns and to monitor the allocations over time to make sure that you stay on track with your goals. Effectively, 401(k) plans have shifted the burden of retirement income from the employer to the employee. While they may help with that burden through matching contributions, if you don't contribute enough or don't earn enough on your investments, you will have less wealth/income during retirement. On the plus side, it also increases your ability to control that by letting you set how much you want to save and how you want to invest those savings.

The 401(k) plan has tax treatment similar to a Traditional IRA. Your taxable income is reduced by the amount you contribute and the investment income is not taxed while it is in the 401(k). However, when you withdraw money from your 401(k) in retirement, it is taxed as ordinary income. Recently, legislation was passed to allow Roth 401(k) plans. These may or may not be an option for you depending on your employer. The current maximum contribution to a 401(k) plan is $19,500 per person per year ($26,000 for those 50 and older).

Question 13

Vesting refers to your ability to take your firm's matching contributions (and the investment income from those contributions) with you when you leave the firm. If you are not vested, you can only take your contributions and investment income from those contributions. Contributions from the employer belong to the employer if you leave the firm. However, once you are vested, the

employer's contributions are officially yours even if you leave the firm. The sooner you are vested, the more valuable the employer's contribution is to you. If you are not vested, it may be an anchor that ties you to the firm and prevents you from taking an attractive opportunity with a different company because of the cost of giving up the employer's contribution. Vesting policies vary from firm to firm, but firms are required to meet minimum standards that have you fully vested within a 5-7 year time-frame (either fully vested at 5 years or gradually vested starting 20% in year 3 to 100% in year 7). Note that firms can vest quicker than this, but not slower.

Question 14

The less the better. Remember that not only are you investing your retirement funds, but your current earnings into the performance of your current employer. If the company does poorly you may be out of a job AND see your retirement assets shrink (especially if it goes bankrupt). An absolute upper ceiling should be 20%, but under 10% is better. This is essential, especially as you get older and your risk tolerance drops.

Question 15

Leave your money with the company – Most firms will allow you to leave the money in the plan and then access it when you retire. The downside of this is that you have less control and if you change jobs frequently you will have several accounts to keep track of.

Move your money to your new employer's 401(k) plan – Most employers will allow you to transfer your money to your new company's plan. The downside of this is that you are limited to the options available in your new plan.

Use a Rollover IRA – You can set up a special account called a "Rollover IRA" (discussed in the IRA handout), which allows you control over your investment decisions. If you put your money in a Rollover IRA it is important that your old employer transfer the money directly to the IRA account to avoid a 20% withholding penalty.

Cash Out – This will result in significant tax penalties and should only be done as a last resort if you desperately need the cash.

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14.10: Solutions to CH 10 Exercises

Question 1

Debt holders are paid through interest payments whereas preferred and common stockholders are paid through dividends. Interest is paid out of pre-tax income. This means that each dollar we pay our bondholders results in fewer taxes. Thus, interest is providing a "tax-shield" which we must account for when estimating the cost. On the other hand, dividends are paid out of after-tax income. Since dividends offer no tax shield, we do not have to make a conversion to after-tax cost. The after-tax cost of common and preferred stock is the same as the before-tax cost.

Question 2

There are two reasons for this. The first relates to risk. Investors determine our cost of financing by the required return that they demand for investing in our stocks and bonds. The more risk the investor faces, the higher the required return that the investor will demand (which means a higher cost of financing to the firm.) From an investors perspective, it is the least risky to hold bonds (as bonds have the most stable and predictable cash flow streams and are first in line in the event of bankruptcy.) The most risky is common stock (as common stock has a very unstable/unpredictable cash flow stream and is last in line in the event of bankruptcy. Preferred stock falls somewhere between the risk levels of bonds and common stock. The second reason has to do with the tax-shield discussed in Question 1. Because interest provides a tax-shield that is not provided by dividends, the effective cost of debt is lowered. To summarize, debt is the lowest cost source because it is the least risky to investors and has a tax-shield. Common stock is the most risky because it is the most risky to investors.

Question 3

Each method is flawed. Specifically, the dividend valuation method assumes (A) dividends are being paid and (B) those dividends are growing at a constant rate. When we violate those assumptions, it introduces error into our calculations. The more unstable the dividend growth rate the greater the error. The SML approach is useful in that every stock has a beta and it is reasonably easy to get estimates for the expected market return and risk-free rate. However, there is evidence that beta may not be a reliable indicator of return. This makes us question the accuracy of the SML approach. Finally, the bond yield plus risk premium approach is also flawed. It is difficult to estimate exactly what the risk premium should be and is difficult to apply to firms that do not use debt financing (as we have no YTM for these firms.) Since each method is flawed, we hope that an average of the three will result in a lower error than applying any of the models in isolation. It should also be noted that the SML approach is the only approach that can be used with all firms.

Question 4

The first reason for this is that the coupon rate can be misleading because it doesn't take into account whether the bond was issued at a discount or premium. A zero-coupon bond is not free financing. The YTM corrects for this. The second reason is that the coupon rate is historical. It is set when the bond is issued and doesn't change. If our firm last issued bonds 10 years ago, that would tell us little about what return investors are requiring to hold our bonds today. YTM is current (or forward-looking) in that it incorporates today's bond price and remaining interest payments to estimate what investors are demanding as a rate of return to hold our bonds today. The cost of capital needs to be current in order to be useful.

Question 5

Always use market values. Market values are based on all available information about our firms risk and prospects TODAY. Book values are historical and may miss several areas of intangible assets. Thus, market values better capture the true "economic" value of our financing weights. If we issue new stocks and bonds, today's market values are a better indicator of what we can expect to receive.

Question 6

The MCC tells us our cost of financing. It is impossible for a firm to maximize value if it doesn't know how much it is paying to finance its operations. The MCC provides us a baseline required return to use in our capital budgeting analysis. If a project does not

earn enough to pay for the financing it will not add value to the firm. On the other hand, a project that earns more than the cost of financing IS adding value to the firm. The lower the MCC, everything else being equal, the greater the value of the firm. This is because at a lower required return (MCC), each project will have a higher NPV meaning that every project the firm undertakes is worth more to them.

Question 7

The first condition is that the financing weights for the project are similar to the financing weights for the firm. For instance, if our firm uses a 20%/20%/60% mix of debt/preferred/common and we decide to finance our next project with 100% common, the MCC is not capturing the true cost of financing the project. The actual cost will probably be more expensive than the MCC (since common stock is our most expensive form of financing). A correction for this problem is to adjust our weights in the MCC calculation to reflect the financing weights for the project.

The second condition is that the risk of the project is similar to the average risk level for our firm. If we undertake high risk projects, this makes our firm riskier and investors will want more compensation. Thus, we have to increase the cost of capital to reflect this. If we undertake low-risk projects, this makes our firm less risky and investors will settle for less compensation. Thus, we can lower the cost of capital to reflect this.

Question 8

TRUE. Think of a firm as a series of past and present capital budgeting projects. All the different projects that the firm has undertaken in the past, is currently working on, and will initiate in the future are what make the firm what it is right now. All the expected cash flows that are going to be generated are based off of these various projects. The cost of capital determines the required return for capital budgeting projects. We know that if we lower the required return for a cash flow stream, the PV of that cash flow stream will increase. The value of the firm is just the PV of the cash flows it will generate. Therefore, lowering the cost of capital, all else equal, will increase the value of the firm.

Question 9

FALSE. While at first glance, this appears to be a logical statement, it ignores a key factor about using more and more debt. Because debt generates a fixed cost (interest payments and the return of par value at maturity) that must be repaid (or the firm will be forced into bankruptcy), increasing the amount of debt financing used will also increase the risk associated with the firm. As we know, when risk increases, investors want higher returns. Thus, as the amount of debt increases, both stockholders and bondholders will start wanting higher returns to compensate them for the additional risk. This means the cost of equity financing and cost of debt financing will both increase. For most firms, there is an additional benefit to using some debt financing. Having some debt does not increase the risk much and therefore the cheaper source of financing (debt) offsets the impact of higher risk. However, as more and more debt gets added, the risk increases at an increasing rate. At some point the benefits of a cheaper source of financing are more than offset by the increased risk.

This optimal point varies from firm to firm. Firms with more predictable cash flows are not as sensitive to higher levels of debt (in terms of risk) and can carry more debt. Also, one of the things that makes debt cheaper is the tax benefits. Firms in high tax brackets will have a more significant tax benefit and thus can carry more debt. Thus, we typically see firms with high tax rates and/or predictable cash flow streams use more debt financing while firms with volatile cash flow streams and/or low tax rates will use less debt financing. The issue of how much debt financing should be used is referred to as “CAPITAL STRUCTURE”. The following diagram illustrates the capital structure decision.


Target Cost of Capital

Problem 1

First we must find the YTM and then plug it into the formula:

$k_i = YTM(1 – T)$

Remember that bonds pay interest semi-annually so that we must set our calculators to 2 Periods per Year and adjust the N and PMT to reflect the semi-annual framework.

Part 1a

40 N
-1135 PV
37.50 PMT
1000 FV
I/Y ⇒ 6.30%

$k_i = 6.30\%(1 - 0.35) = 4.10\%$

Part 1b

40 N
-875 PV
37.50 PMT
1000 FV
I/Y ⇒ 8.84%

$k_i = 8.86\%(1 - 0.35) = 5.75\%$

Problem 2

$k_p = D/P = (0.05)(30)/16.50 = 1.50/16.50 = 9.09\%$

Problem 3

Dividend Valuation Approach
$k_s = (D_1/P) + g = [(0.75)\times(1.08)/25] + 0.08 = 11.24\%$

Security Market Line Approach
$k_s = k_{rf} + \beta(k_m - k_{rf}) = 5\% + 0.8(12\% - 5\%) = 5\% + 5.6\% = 10.60\%$

Bond Yield plus Risk Premium Approach
$k_s = YTM + RP = 9\% + 5\% = 14.00\%$

Average $k_s = (11.24\% + 10.60\% + 14.00\%)/3 = 11.95\%$

Problem 4

Part 4a

Step 1 ⇒ Solve for Market Value Weights

$MV_{debt} = 24{,}000{,}000$
$MV_{pref} = 5{,}000{,}000$
$\underline{MV_{com} = 35{,}000{,}000}$
$MV_{total} = 64{,}000{,}000$

$W_{debt} = 24{,}000{,}000/64{,}000{,}000 = 0.38$
$W_{pref} = 5{,}000{,}000/64{,}000{,}000 = 0.08$
$W_{com} = 35{,}000{,}000/64{,}000{,}000 = 0.55$

Step 2 ⇒ Solve for After-tax Cost of Debt

$k_i = YTM(1 - T) = 11\%(1 - 0.40) = 6.60\%$

Step 3 ⇒ Solve for Cost of Preferred Stock

$k_p = D/P = 6.50/50 = 13\%$

Note that the price per share for preferred stock is found by taking the total market value of preferred stock divided by the number of shares ⇒ $5,000,000/100,000 = $50

Step 4 ⇒ Solve for Cost of Common Stock

Dividend Valuation Approach
$k_s = (D_1/P) + g = (2.75/34) + 0.065 = 14.59\%$

Security Market Line Approach
$k_s = k_{rf} + \beta(k_m - k_{rf}) = 5\% + 1.35(12\% - 5\%) = 14.45\%$

Bond Yield Plus Risk Premium Approach
$k_s = YTM + RP = 11\% + 5\% = 16.00\%$

Cost of Common Stock Financing
$(14.59\% + 14.45\% + 16.00\%)/3 = 15.01\%$

Step 5 ⇒ Solve for Marginal Cost of Capital (MCC)

$MCC = W_{debt}(k_i) + W_{pref}(k_p) + W_{com}(k_s)$
$= (0.38)(6.60\%) + (0.08)(13.00\%) + (0.55)(15.01\%)$
$= 11.80\%$

Part 4b

Solve for IRR ⇒ IRR = 12.59% > 11.80% ⇒ Accept Project
Solve for NPV@11.80% ⇒ $1254.70 > $0 ⇒ Accept Project

Note – Since there is no crossover problem and it is a single project instead of mutually exclusive, we can use either IRR or NPV to make our decision.

Problem 5

Part 5a

$MV_{debt} = 10{,}000*1060 = \$10{,}600{,}000$
$MV_{pref} = 40{,}000*53 = \$\ 2{,}120{,}000$
$MV_{com} = 1{,}000{,}000*41.25 = \$41{,}250{,}000$
$MV_{total} = \$53{,}970{,}000$

$W_{debt} = 0.20$
$W_{pref} = 0.04$
$W_{com} = 0.76$

Part 5b

$k_i = YTM(1 - T) = 9.07\%(1 - 0.40) = 5.44\%$

Find YTM
20 N
-1060 PV
50 PMT
1000 FV
I/Y ⇒ 9.07%

$k_p = D/P = \$5/\$53 = 9.43\%$

Div Val Approach ⇒ $k_s = (D_1/P) + g = [(2.25)(1.10)/41.25] + 0.10 = 16.00\%$
SML Approach ⇒ $k_s = k_{rf} + \beta(k_m - k_{rf}) = 6\% + 1.3(13\% - 6\%) = 15.10\%$
BY + RP Approach ⇒ $k_s = YTM + RP = 9.06\% + 5\% = 14.06\%$
Average of Three Approaches ⇒ $(16.00\% + 15.10\% + 14.06\%)/3 = 15.05\%$

Part 5c

$MCC = W_{debt}(k_i) + W_{pref}(k_p) + W_{com}(k_s)$
$= (0.20)(5.44\%) + (0.04)(9.43\%) + 0.76(15.05\%)$
$= 12.90\%$

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14.11: Solutions to CH 11 Exercises

Question 1

See discussion in Ch 11.

Question 2

A managed floating system means that currency prices are predominantly determined by supply and demand conditions in an open market (the floating part). However, governments can (and do) occasionally intervene in the currency markets (either directly or indirectly) to try to support a currency that they believe is falling too rapidly or to pressure a currency that is rising too rapidly. Governments typically can't counter market forces for an infinite amount of time so usually this is a temporary tactic designed to reduce extreme swings. The "floating" part of the managed floating system is far more prevalent than the "managed" part as government intervention is usually minimal.

In addition, not all countries choose to follow the managed floating system. Instead, some operate on a fixed (pegged) exchange rate system while others adopt a policy (either officially or unofficially) of dollarization. The advantage of both of these systems is greater currency stability. However, in a policy of pegged exchange rates the country gives up the ability to use monetary policy as an economic tool and instead must use it as a currency tool. In an official dollarization policy, the country gives up control of a currency system (and their monetary policy is determined indirectly by the US).

Question 3

A spot rate of exchange is the exchange rate in place today for transactions that are taking place now. If I want to convert US Dollars into Euros today, I would be using the spot rate of exchange.

A forward rate of exchange is the exchange rate in place today for transactions that will take place at a later date. For instance, let's assume that I am selling material to a customer in Japan and the price is set in yen. If I give them 30-days to pay, I am exposed to currency risk. If the dollar gets weaker relative to the yen, the yen that they pay me will be worth more dollars and I will have a currency gain. On the other hand, if the dollar gets stronger relative to the yen, the yen that they pay me will be worth fewer dollars and I will have a currency loss. If I want to eliminate this currency risk, I can sell yen in the forward market (one month forward). I will agree to sell yen for dollars at a rate agreed upon today, but not actually carry out the transaction for one month. That way, when my customer pays me in yen, I already know what I will get in dollars and have eliminated the currency risk.

Question 4

Since Citi is lending in Euros and will receive interest and principal repayment in euros, they will benefit from a weaker US dollar. A weaker US dollar means each euro that they receive from the loan will buy more dollars when converted. They will earn the return from the loan, plus a bonus return from the exchange rate. On the other hand, a stronger US dollar would mean that each euro received would buy fewer dollars. Thus, the would earn the return from the loan, but lose money from the exchange rate.

Question 5

Part 5a

The US investor is primarily concerned with her return in US dollars. As the foreign investments would offer investment income (dividends, capital gains, interest) in foreign currency, this investment income would have to then be converted into dollars. With a stronger US dollar, the US investor would be able to purchase fewer dollars with the foreign currency earned on her investment and thus would make a lower return than anticipated. A stronger US dollar would have a negative impact on dollar-based returns from foreign investments.

Part 5b

This would work in an opposite manner as above. The foreign investor would be concerned with his return in his home currency. As his investment income would be in dollars, each dollar received would now buy more of the home currency. This would mean a

higher rate of return in his home currency. A stronger US dollar would have a positive impact on foreign- currency based returns from investments within the US.

Part 5c

A stronger US dollar means that foreign manufacturers would be able to charge less in US dollars and still get the same amount of foreign currency after currency conversion. US manufacturers would also feel price pressures on products sold in the US as they would need to keep prices down to stay competitive. Therefore, a stronger US dollar is likely to lead to lower inflation in the US.

Part 5d

As with the US-based investor, the US-based manufacturer is concerned about cash flows in dollars. As selling items outside the US results in receiving revenues in foreign currencies, these currencies must be converted to US dollars. A stronger US dollar means each unit of foreign currency will buy fewer dollars. Thus, a stronger US dollar will tend to hurt US-based manufacturers that sell their products internationally.

Part 5e

A foreign-based manufacturer is concerned about their cash flows in their home currency. A stronger US dollar means that each dollar earned in revenues will translate into more of their home currency. Thus, a stronger US dollar will tend to help foreign-based manufacturers that sell their products in the US.

Problem 1

(2,000,000 Euros)($1/0.7347 Euros) = $2,722,199.54

Problem 2

($455)(3.0875 Pesos/$) = 1404.81 pesos

Problem 3

Last year, $1 could buy 1.0422 Canadian Dollars. Now, $1 can buy 1.1304 Canadian Dollars. Since each $1 is buying more Canadian Dollars, then the US $ has gotten stronger relative to the Canadian Dollar.

Problem 4

Last year, 1 baht could buy $0.0267. Now, 1 baht can buy $0.0308. Since each baht is buying more dollars, the Thai baht is stronger relative to the US dollar ⇒ the US dollar is weaker relative to the Thai baht.

Problem 5

(118.43 yen/$)($1/10.998 pesos) = 10.768 yen/peso
(10.998 pesos/$)($1/118.43 yen) = 0.0929 peso/yen

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