

FINC 3511

Corporate Finance

Lecture Supplement

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Chapter 1: An Overview of Financial Management

Introduction

Finance is a scientific-approach to the art of financial decision-making. Finance applies economic principles and concepts to business decision making and problem solving. This course is a study of corporate financial functions (often called financial management). Financial management focuses on the creation and maintenance of wealth. As a result, this course focuses on techniques and procedures that help financial managers make “good” decisions.

Business situations calling for financial decisions generally involve either investing (using funds) or financing (raising funds). The field of finance can be considered to comprise three broad categories: financial management, investments, and financial institutions (money and capital markets). Financial management (corporate finance) is primarily concerned with financial decision making within a business entity. Investments focuses on behavior of financial markets and the pricing securities. Financial institutions deals with banks and other firms that specialize in bringing the suppliers of funds together with the users of funds.

Career Opportunities in Finance

Career opportunities within each field are varied and numerous, but financial managers must have a knowledge of all three areas. Bank lending officers must be able to judge how well a business is being operated. Similarly, security analysts and stockbrokers need an understanding of general financial principles to provide customers intelligent advice regarding the best investment choices. Likewise, corporate financial managers need to know what their bankers are considering and how investors judge a firm’s performance. (For more information: www.careers-in-business.com.)

Finance is also important to students who do not plan to major in finance. Knowledge of finance is necessary for many personal decisions ranging from investing for your retirement to deciding whether to buy or lease a car. Most important business decisions have financial implications and non-financial managers need to understand how to work these implications into their own specialized analyses.

Alternative Forms of Business Organization

The three main forms of business organization are the sole proprietorship, the partnership, and the corporation. About 80 percent of businesses operate as sole proprietorships, but based on dollar value of sales, 80 percent of all business is conducted by corporations.

A sole proprietorship is an unincorporated business owned by one individual.

- Its advantages are it is easily and inexpensively formed, it is subject to few government regulations, and it avoids corporate income taxes. (However, all business earnings are taxed as personal income to the owner.)
- Its disadvantages are it is limited in its ability to raise large sums of capital, the proprietor has unlimited personal liability for business debts, and it has a life limited to the life of the individual who created it.

A partnership exists whenever two or more persons associate to conduct a non-corporate business.

- Its major advantage is its low cost and ease of formation.
- Its disadvantages are unlimited liability, limited life, difficulty of transferring ownership, and difficulty of raising large amounts of capital.

A corporation is a legal entity created by a state, and it is separate and distinct from its owners and managers.

- Its advantages are unlimited life, ownership that is easily transferred through the exchange of stock, and limited liability. *Because of these three factors, it is much easier for corporations than for proprietorships or partnerships to raise money in the capital markets.*
- Its disadvantages are corporate earnings may be subject to double taxation and setting up a corporation and filing required state and federal reports are more complex and time-consuming than for a sole proprietorship or partnership. A charter must be filed with the state where the firm is incorporated, and bylaws that govern the management of the company must be prepared.

The value of any business other than a very small one will probably be maximized if it is organized as a corporation for three reasons. (1) Limited liability reduces the risks borne by investors, and the lower the firm's risk, the higher its value. (2) A firm's value is dependent on its growth opportunities, which in turn are dependent on the firm's ability to attract capital. (3) The value of an asset also depends on its liquidity, which means the ease of selling the asset and converting it to cash at a "fair market value."

Agency Relationships

An agency relationship exists whenever a principal hires an agent to act on their behalf. Within a corporation, agency relationships exist between: shareholders and managers, and shareholders and creditors.

Managers are naturally inclined to act in their own best interests. They are likely to consume more perquisites and not work as hard as shareholders would prefer. For this reason, we must consider what steps are necessary to ensure that managers do as shareholders expect. Managerial behavior can be affected by many factors, but the following are the most common: managerial compensation plans, direct intervention by shareholders, the threat of firing, and the threat of takeover.

Shareholders (through managers) could take risky actions to maximize stock price, that are detrimental to creditors. In the short run these actions can transfer wealth from creditors to shareholders, but often in the long run, such actions will raise the cost of debt and ultimately lower stock price.

The Goals of the Corporation

Common stockholders are the owners of the firm. Managers "report" to shareholders, and should try to make decisions that satisfy (benefit) shareholders. As mentioned before, financial management focuses on the creation and maintenance of wealth. To maximize the "benefit" for

shareholders, the primary goal of the firm should be ***shareholder wealth maximization***. This roughly translates to maximizing stock price (although dividends must also be considered).

What do investors (shareholders) consider when analyzing a firm? Everything! They use the information they gather to determine what they believe is a fair price for investing in the firm. (They are trying to set the stock price they are willing to pay.)

How do investors set stock prices? They: estimate future cash flow amounts; estimate when cash flows will occur; and, assess the firm's risk. They then use all this information to determine a current value for the firm. Thus, as managers, to maximize shareholder wealth we have to simultaneously consider: expected cash flows; risk of the cash flows; and, timing of the cash flows.

Does profit maximization equal stock price maximization? No. While a growing number of analysts rely on cash flow projections to assess performance, at least as much attention is still paid to accounting measures, especially earnings per share (EPS). Traditional accounting performance measures are appealing because they are easy to use and understand; they are calculated on the basis of standardized accounting practices; and net income is supposed to be reflective of the firm's potential to produce cash flows over time. Although there is generally a high correlation between EPS, cash flow, and stock price, today's stock price relies not only on current earnings, but future earnings and cash flows. Some actions may increase earnings, yet cause stock price to decrease (and vice versa).

Other objectives, such as personal satisfaction, employee welfare, and the good of the community and of society at large, also have an influence, but for publicly-owned companies, they are less important than stock price maximization. Managers of a firm operating in a competitive market will be forced to undertake actions that are reasonably consistent with shareholder wealth maximization. If they depart from this goal, they run the risk of being removed from their jobs, either by the firm's board of directors or by outside forces.

Basic Concepts of Finance

Finance is an involved subject, but based on the discussion so far you probably can see that the main concepts are relatively simple. Let's list them again to make the point more clear.

- 1) Risk and return – investors will only take on additional risk if they expect to receive adequate compensation. How we measure risk and what we mean by “adequate” are the “complicated” parts of this concept.
- 2) Time value of money – money has a time value associated with it – a dollar today is worth more than a dollar tomorrow. This simply means that if you have the dollar today you can invest it so it will grow to be worth more over time.
- 3) Cash flow (not profit) – focus on the “cash” available for our use not accounting profits. We should be concerned with the amount of funds “in our hands” not the “profit” shown. It is also important to focus on “incremental cash flows” (the cash flows added to the firm by a project).

Social Responsibility and Business Ethics

Social responsibility is the concept that businesses should be actively concerned with the welfare of society at large. It raises the question of whether businesses should operate strictly in their stockholders' best interests or also be responsible for the welfare of their employees, customers, and the communities in which they operate. Any voluntary, socially responsible acts that raise costs will be difficult, if not impossible, in industries that are subject to keen competition. Even highly profitable firms are generally constrained in exercising social responsibility by capital market forces because investors will normally prefer a firm that concentrates on cash flows over one excessively devoted to social action. Socially responsible actions that increase costs may have to be put on a mandatory, rather than a voluntary, basis to ensure that the burden falls uniformly on all businesses. Industry and government must cooperate in establishing the rules of corporate behavior, and the costs as well as the benefits of such actions must be estimated accurately and then taken into account.

Most actions that help a firm increase the price of its stock also benefit society at large. To maximize stock price, a firm must provide a low-cost, high-quality product to consumers. This, in itself, is a benefit to society. Since financial management plays a crucial role in the operations of successful firms, and since successful firms are absolutely necessary for a healthy, productive economy, it is easy to see why finance is important from a social welfare standpoint.

Business ethics can be thought of as a company's attitude and conduct toward its employees, customers, community, and stockholders. Most firms today have in place strong codes of ethical behavior; however, it is imperative that top management be openly committed to ethical behavior and that they communicate this commitment through their own personal actions as well as company policies.

CHAPTER 1

An Overview of Financial Management

- What is finance?
- Career opportunities
- Forms of business organization
- Goals of the corporation
- Social responsibility

1

What is Finance?

- Finance is the application of economic principles and concepts to business decision making and problem solving.

2

Field of Finance

- The field of finance can be considered to comprise three broad categories:
 - financial management,
 - investments, and
 - financial institutions (money and capital markets).

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Areas of Finance

- Financial management (corporate finance) – primarily concerned with financial decision making within a business entity.
- Investments – focuses on behavior of financial markets and the pricing securities.
- Financial institutions – deals with banks and other firms that specialize in bringing the suppliers of funds together with the users of funds.

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Career Opportunities in Finance

- For more information:

www.careers-in-business.com

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Areas of Finance

- **It is important that we understand all three areas of finance.**
- Bank lending officers must be able to judge how well a business is being operated.
- Security analysts and stockbrokers need an understanding of general financial principles to provide customers intelligent advice regarding the best investment choices.
- Corporate financial managers need to know what their bankers are considering and how investors judge a firm's performance.

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Areas of Finance

- This course is corporate finance based, but covers topics from all three areas of finance.
- We discuss financial markets, security pricing, and corporate financial management techniques.
- Further, many of the topics and techniques covered are applicable to personal financial decisions.

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This Course

- In this course we primarily study corporate financial functions (often called financial management).
- Financial management focuses on the creation and maintenance of wealth.
- As a result, this course focuses on techniques and procedures that help financial managers make “good” decisions.

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Alternative Forms of Business Organization

- Financial choices are influenced by the type of business organization involved.
- There are three main types of business organizations.
 - Sole proprietorship
 - Partnership
 - Corporation

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Sole Proprietorship

- Advantages:
 - Ease of formation
 - Subject to few regulations
 - No corporate income taxes
- Disadvantages:
 - Limited life
 - Unlimited liability
 - Difficult to raise capital
- A partnership has roughly the same advantages and disadvantages as a sole proprietorship.

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Corporation

- Advantages:
 - Unlimited life
 - Easy transfer of ownership
 - Limited liability
 - Ease of raising capital *****
- Disadvantages:
 - Double taxation
 - Cost of set-up and report filing

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Agency relationships

- An agency relationship exists whenever a principal hires an agent to act on their behalf.
- Within a corporation, agency relationships exist between:
 - Shareholders and managers
 - Shareholders and creditors

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Shareholders versus Managers

- Managers are naturally inclined to act in their own best interests.
- But the following factors affect managerial behavior:
 - Managerial compensation plans
 - Direct intervention by shareholders
 - The threat of firing
 - The threat of takeover

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Shareholders versus Creditors

- Shareholders (through managers) could take actions to maximize stock price that are detrimental to creditors.
- In the long run, such actions will raise the cost of debt and ultimately lower stock price.

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Goal of the Corporation

- Common stockholders are the owners of the firm.
- Managers “report” to shareholders, and should try to make decisions that satisfy (benefit) shareholders.
- As mentioned before, financial management focuses on the creation and maintenance of wealth.

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Goal of the Corporation

- To maximize the “benefit” for shareholders, the primary goal of the firm should be:
shareholder wealth maximization.
- This roughly translates to maximizing stock price (although dividends must also be considered).

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Goal of the Corporation

- What do investors (shareholders) consider when analyzing a firm?

Everything!

- They use the information they gather to determine what they believe is a fair price for investing in the firm. (They are trying to set the stock price they are willing to pay.)

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Goal of the Corporation

- How do investors set stock prices?
- They:
 - estimate future cash flow amounts
 - estimate when cash flows will occur
 - assess the firm’s risk
- They then use all this information to determine a current value for the firm.

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Goal of the Corporation

- Thus, as managers, to maximize shareholder wealth we have to simultaneously consider:
 - expected cash flows
 - risk of the cash flows
 - timing of the cash flows

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Does profit maximization equal stock price maximization?

No, there is generally a high correlation between EPS, cash flow, and stock price, but today's stock price relies not only on current earnings, but future earnings and cash flows.

Some actions may increase earnings, yet cause stock price to decrease (and vice versa).

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Basic Concepts of Finance

■ Finance is an involved subject, but based on the discussion so far you probably can see that the main concepts are relatively simple.

■ Let's list them again to make the point more clear.

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Basic Concepts of Finance

■ 1. Risk and return

■ investors will only take on additional risk if they expect to receive adequate compensation

■ How we measure risk and what we mean by "adequate" are the "complicated" parts of this concept.

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Basic Concepts of Finance

■ 2. Time value of money

■ money has a time value associated with it – a dollar today is worth more than a dollar tomorrow.

■ This simply means that if you have the dollar today you can invest it so it will grow to be worth more over time.

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Basic Concepts of Finance

■ 3. Cash flow (not profit) –

■ focus on the "cash" available for our use not accounting profits.

■ We should be concerned with the amount of funds "in our hands" not the "profit" shown. It is also important to focus on "incremental cash flows" (the cash flows added to the firm by a project).

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Firm's Responsibilities to Others

- Maximization of shareholder wealth does not mean firms lack social responsibilities.
- Stock price maximization actually requires that firms provide socially desired services.
- Stockholder wealth maximization requires:
 - products to meet consumer needs and wants
 - efficient, low-cost plants
 - high quality goods
 - good service
 - adequate stocks of merchandise
 - well-located businesses

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Societal Concerns

- On the other hand, firms will find it difficult to unilaterally pursue socially responsible actions.
- Acting alone will likely increase costs and put the firm at a disadvantage relative to less socially responsible firms.

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Societal Concerns

- In such cases, it is either up to:
 - consumers to show a preference for socially responsible actions (buy only from socially responsible firms, etc.)
 - government to require socially responsible behavior through regulation and enforcement

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Chapters 2 & 6: The Financial Environment: Markets, Institutions, and Interest Rates

The Financial Markets

Financial markets bring together people and organizations wanting to borrow money with those having surplus funds. There are many different financial markets in a developed economy, each dealing with a different type of instrument, serving a different set of customers, or operating in a different part of the country.

The major types of financial markets include the following:

- Physical asset markets (also called "tangible" or "real" asset markets) are the markets for such products as wheat, autos, real estate, computers, and machinery.
- Financial asset markets deal with stocks, bonds, notes, mortgages, and other claims on real assets.
- Spot markets are markets in which assets are bought or sold for "on the spot" delivery.
- Futures markets are markets in which participants agree today to buy or sell an asset at a future date.
- Money markets are the markets for short-term, highly liquid debt securities, those securities that mature in less than one year.
- Capital markets are the markets for long-term debt and corporate stocks.
- Primary markets are the markets in which corporations sell newly issued securities to raise capital.
- Secondary markets are the markets in which existing (already outstanding) securities are traded among investors.
- The initial public offering (IPO) market is a subset of the primary market. Here firms "go public" by offering shares to the public for the first time.
- Private markets are the markets where transactions are worked out directly between two parties.
- Public markets are the markets where standardized contracts are traded on organized exchanges.

Financial Institutions

Transfers of capital between savers and borrowers take place in three different ways.

- Direct transfers of money and securities occur when a business sells its stocks or bonds directly to savers, without going through any type of financial institution.
- Transfers through an investment banking house occur when a brokerage firm, such as Merrill Lynch, serves as a middleman and facilitates the issuance of securities. These middlemen help corporations design securities that will be attractive to investors, buy these securities from the corporations, and then resell them to savers in the primary markets.
- Transfers through financial intermediaries occur when a bank or mutual fund obtains funds from savers, issues its own securities in exchange, and then uses these funds to purchase other securities. Intermediaries literally create new forms of capital. The existence of intermediaries greatly increases the efficiency of money and capital markets.

Some major classes of intermediaries include:

- commercial banks

- serve a wide variety of savers and borrowers handling checking accounts and an ever-widening range of services
- savings and loan (S&L) associations,
 - take the funds of many small savers and then lend this money to home buyers and other types of borrowers
- mutual savings banks,
 - similar to S&Ls operate primarily in northeastern states
- credit unions,
 - cooperative associations whose members are supposed to have a common bond (such as being employees of the same firm)
 - often the cheapest source of funds for individual borrowers
- pension funds,
 - retirement plans funded by corporations or government agencies for their workers
- life insurance companies,
 - take savings in the form of annual premiums, invest these funds in stocks, bonds, real estate, and mortgages, and then make payments to the beneficiaries of the insured parties
- mutual funds.
 - corporations that accept money from savers and then use these funds to buy stocks, long-term bonds, or short-term debt instruments issued by businesses or government units
 - A mutual fund that invests in short-term, low-risk securities and allows investors to write checks against their accounts is known as a money market fund.

The result of ongoing regulatory changes has been a blurring of the distinctions between the different types of financial institutions. As a result, in the United States the trend has been toward huge financial service corporations, that own any number of financial intermediaries with national and even global operations.

The Stock Market

The stock market is one of the most important markets to financial managers because it is here that the price of each stock, and hence the value of all publicly-owned firms, is established.

There are two basic types of stock markets.

- The physical location exchanges, typified by the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX), are tangible, physical entities.
- The electronic dealer markets include the Nasdaq stock market, the less formal over-the-counter market, and the recently developed electronic communications networks (ECNs).
 - They include all facilities that are needed to conduct security transactions not conducted on the physical location exchanges.
 - This has traditionally been referred to as the over-the-counter market (OTC).
 - Brokers and dealers who participate in the over-the-counter market are members of a self-regulating body known as the National Association of Securities Dealers (NASD), which licenses brokers and oversees trading practices.

The Cost of Money

Capital in a free economy is allocated through the price system. The interest rate is the price paid to borrow debt capital. With equity capital, investors expect to receive dividends and capital gains, whose sum is the cost of equity money.

There are four fundamental factors that affect the cost of money (the supply of, and demand for, investment capital).

- Production opportunities are the returns available within an economy from investments in productive (cash-generating) assets.
- A consumer's time preference for consumption is his/her preference for current versus future consumption.
- Risk is the chance that an investment will provide a low or negative return.
- Inflation is the tendency of prices to increase over time.

Interest Rate Levels

Capital is allocated among borrowers by interest rates: Firms with the most profitable investment opportunities are willing and able to pay the most for capital, so they tend to attract it away from inefficient firms or from those whose products are not in demand. Supply and demand interact to determine interest rates in capital markets. If the demand for funds declines, as it typically does during business recessions, the market-clearing, or equilibrium, interest rate declines. If the Federal Reserve tightens credit, lowering the supply of funds, interest rates rise and the level of borrowing in the economy declines.

Capital markets are interdependent. Investors are willing to accept higher risk in exchange for a risk premium. There are many capital markets in the U.S. U.S. firms also invest and raise capital throughout the world, and foreigners both borrow and lend in the U.S. There is a price for each type of capital, and these prices change over time as shifts occur in supply and demand conditions. Short-term interest rates are especially prone to rise during booms, as the demand for capital increases and inflationary pressures push rates up. Conditions are reversed during recessions due to a drop in interest rates, as demand for credit is reduced and the inflation rate falls. The Federal Reserve often lowers rates during recessions to help stimulate the economy. Tendencies in interest rate fluctuations do not hold exactly. The level of interest rates varies with changes in the current rate of inflation and changes in expectations about future inflation.

The Determinants of Market Interest Rates

The quoted (or nominal) interest rate on a debt security, k , is composed of a real risk-free rate of interest, k^* , plus several premiums that reflect inflation, the riskiness of the security, and the security's marketability (or liquidity).

$$\begin{aligned}\text{Quoted interest rate} = k &= k^* + IP + DRP + LP + MRP \\ &= k = k_{RF} + DRP + LP + MRP\end{aligned}$$

- The real risk-free rate of interest (k^*) is the interest rate that would exist on a riskless security if no inflation were expected. It may be thought of as the rate of interest on short-term U.S. Treasury securities in an inflation-free world.

- The real risk-free rate is not static. It changes over time depending on economic conditions, especially on the rate of return corporations and other borrowers expect to earn on productive assets, and on time preferences for current versus future consumption.
- The nominal (quoted) risk-free rate of interest (k_{RF}) on a security such as a U.S. Treasury bill is the real risk-free rate plus a premium for expected inflation: $k_{RF} = k^* + IP$.
- The inflation premium (IP) is the average inflation rate expected over the life of the security and compensates investors for the expected loss of purchasing power.
 - It is important to note that the inflation rate built into interest rates is the inflation rate expected in the future, not the rate experienced in the past.
- The default risk premium (DRP) compensates investors for the risk that a borrower will default and hence not pay the interest or principal on a loan. DRP is zero for U.S. Treasury securities, but it rises as the riskiness of issuers increases.
 - The greater the default risk, the higher the interest rate.
 - For corporate bonds, the higher the bond's rating, the lower its default risk, and, consequently, the lower its interest rate.
 - The difference between the quoted interest rate on a T-bond and that on a corporate bond with similar maturity, liquidity, and other features is the default risk premium.
- A security that can be converted to cash on short notice at a "reasonable" price is said to be liquid. A liquidity premium (LP), also known as a marketability premium, is also added to the real rate for securities that are not liquid.
- Long-term securities are more price sensitive to interest rate changes than are short-term securities, so all long-term bonds have an element of risk called interest rate risk. Therefore, a maturity risk premium (MRP) is added to longer-term securities to compensate investors for interest rate risk.
 - The MRP is higher the longer the years to maturity.
 - This premium, like the others, is difficult to measure, but it varies somewhat over time, rising when interest rates are more volatile and uncertain, then falling when interest rates are more stable.

Although long-term bonds are heavily exposed to interest rate risk, short-term bills are heavily exposed to reinvestment rate risk. This is the risk that a decline in interest rates will lead to lower income when bonds mature and funds are reinvested. Although "investing short" preserves one's principal, the interest income provided by short-term T-bills is less stable than the interest income on long-term bonds.

The Term Structure of Interest Rates

The term structure of interest rates is the relationship between bond yields and maturities. When plotted, this relationship produces a yield curve. Yield curves have different shapes depending on expected inflation rates and perceptions about the relative riskiness of securities with different maturities. The "normal" yield curve is upward sloping because investors charge higher rates on longer-term bonds, even when inflation is expected to remain constant. An inverted, or "abnormal" yield curve is downward sloping, and signifies that investors expect inflation to decrease. A "humped" yield curve occurs when interest rates on medium-term maturities are higher than rates on both short- and long-term maturities.

Interest Rates and Business Decisions

Interest rate movements have a significant impact on business decisions. Wrong decisions, such as using short-term debt to finance long-term projects just before interest rates rise, can be very costly. It is extremely difficult, if not impossible, to predict future interest rate levels. Interest rates will fluctuate. They always have, and they always will. Sound financial policy calls for using a mix of long- and short-term debt and equity, to position the firm so that it can survive in almost any interest rate environment. The optimal financial policy depends in an important way on the nature of the firm's assets. If it is easier to sell off assets to generate cash, it is more feasible to use large amounts of short-term debt.

Inflation, Interest Rates, and Exchange Rates

Relative inflation rates, or the rates of inflation in foreign countries compared with that in the home country, have many implications for multinational financial decisions. Relative inflation rates will greatly influence future production costs at home and abroad. Equally important, inflation has a dominant influence on relative interest rates and exchange rates. Both of these factors influence the methods chosen by multinational corporations for financing their foreign investments, and both have an important effect on the profitability of foreign investments.

- A foreign currency, on average, will depreciate at a percentage rate approximately equal to the amount by which its country's inflation rate exceeds the U.S. inflation rate. Conversely, foreign currencies in countries with less inflation than the U.S. will, on average, appreciate relative to the U.S. dollar.
- Countries experiencing higher rates of inflation tend to have higher interest rates. The reverse is true for countries with lower inflation rates.
- Gains from borrowing in countries with low interest rates can be offset by losses from currency appreciation in those countries.

Chapters 2 and 6

The Financial Environment: Markets, Institutions, and Interest Rates

- Financial markets
- Types of financial institutions
- Determinants of interest rates
- Yield curves

1

What is a market?

- A market is a “place” where goods and services are exchanged.
- A financial market is a place where individuals and organizations wanting to borrow funds are brought together with those having a surplus of funds.

2

Financial Markets

- Financial markets bring together people and organizations wanting to borrow money with those having surplus funds.
- There are many different financial markets in a developed economy, each dealing with a different type of instrument, serving a different set of customers, or operating in a different part of the country.

3

Markets

- Physical assets vs. Financial assets
 - Physical asset markets (also called "tangible" or "real" asset markets) are the markets for such products as wheat, autos, real estate, computers, and machinery.
 - Financial asset markets deal with stocks, bonds, notes, mortgages, and other claims on real assets.

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Markets

- Spot vs. Futures
 - Spot markets are markets in which assets are bought or sold for “on the spot” delivery
 - Futures markets are markets in which participants agree today to buy or sell an asset at a future date.

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Markets

- Money vs. Capital
 - Money markets are the markets for short-term, highly liquid debt securities, those securities that mature in less than one year.
 - Capital markets are the markets for long-term debt and corporate stocks.

6

Markets

- Primary vs. Secondary
 - Primary markets are the markets in which corporations sell newly issued securities to raise capital.
 - Secondary markets are the markets in which existing (already outstanding) securities are traded among investors.

7

What is an Initial Public Offering (IPO) market?

An IPO Market is a subset of the primary market. Firms “go public” by offering shares of their stock to the public for the first time.

8

Markets

- Public vs. Private
 - Private markets are the markets where transactions are worked out directly between two parties.
 - Public markets are the markets where standardized contracts are traded on organized exchanges.

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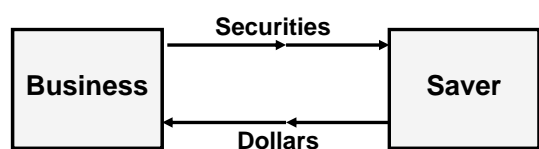
Three Primary Ways Capital Is Transferred Between Savers and Borrowers

- Direct transfer
- Investment banking house
- Financial intermediary

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Direct transfer

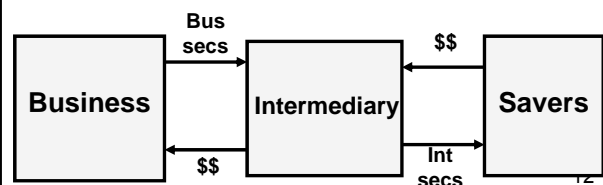
- Direct transfers of money and securities occur when a business sells its stocks or bonds directly to savers, without going through any type of financial institution.



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Financial Intermediary

- Transfers through financial intermediaries occur when a bank or mutual fund obtains funds from savers, issues its own securities in exchange, and then uses these funds to purchase other securities.
- Intermediaries literally create new forms of capital. The existence of intermediaries greatly increases the efficiency of money and capital markets.



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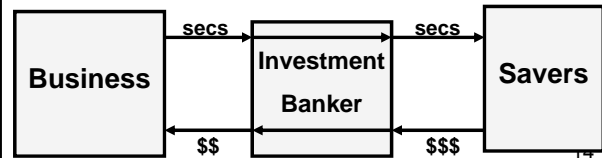
Types of Financial Intermediaries

- Commercial banks
- Savings and loan associations
- Mutual savings banks
- Credit unions
- Pension funds
- Life insurance companies
- Mutual funds

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Investment Bankers

- Transfers through an investment banking house occur when a brokerage firm, such as Merrill Lynch, serves as a middleman and facilitates the issuance of securities.
- These middlemen help corporations design securities that will be attractive to investors, buy these securities from the corporations, and then resell them to savers in the primary markets.



14

Stock Markets

- The stock market is one of the most important markets to financial managers because it is here that the price of each stock, and hence the value of all publicly-owned firms, is established. There are two basic types of stock markets.
 - The physical location exchanges, typified by the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX), are tangible, physical entities.
 - The electronic dealer markets include the Nasdaq stock market, the less formal over-the-counter market, and the recently developed electronic communications networks (ECNs).

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- What do we call the price, or cost, of debt capital?

The interest rate

- What do we call the price, or cost, of equity capital?

$$\text{Required return} = \text{Dividend yield} + \text{Capital gain}$$

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What four factors affect the cost of money?

- Production opportunities
- Time preferences for consumption
- Risk
- Expected inflation

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"Real" Versus "Nominal" Rates

k^* = Real risk-free rate.
T-bond rate if no inflation;
1% to 4%.

k = Any nominal (quoted) rate.

k_{RF} = Rate on Treasury securities.

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$$k = k^* + IP + DRP + LP + MRP.$$

Here:

- k = required rate of return on a debt security.
- k^* = real risk-free rate.
- IP = inflation premium.
- DRP = default risk premium.
- LP = liquidity premium.
- MRP = maturity risk premium.

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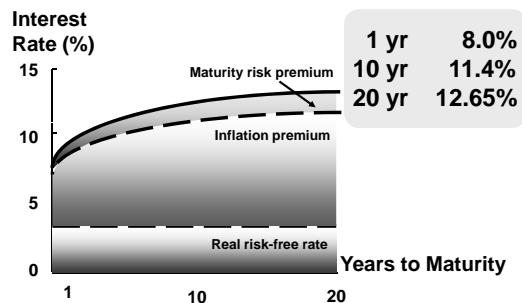
Yield Curve

The term structure of interest rates describes the relationship between long- and short-term interest rates.

The yield curve is the graph of interest rates for similar risk securities for different maturities.

20

Hypothetical Treasury Yield Curve



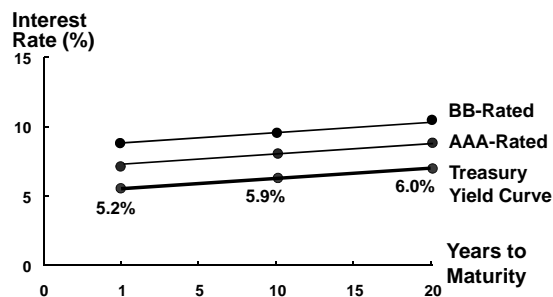
21

What kind of relationship exists between the Treasury yield curve and the yield curves for corporate issues?

- Corporate yield curves are higher than that of the Treasury bond. However, corporate yield curves are not necessarily parallel to the Treasury curve.
- The spread between a corporate yield curve and the Treasury curve widens as the corporate bond rating decreases.

22

Hypothetical Treasury and Corporate Yield Curves



23

Pure Expectations Hypothesis

- The PEH contends that the shape of the yield curve depends on investor's expectations about future interest rates.
- If interest rates are expected to increase, L-T rates will be higher than S-T rates, and vice-versa. Thus, the yield curve can slope up, down, or even bow.

24

Assumptions of the PEH

- Assumes that the maturity risk premium for Treasury securities is zero.
- Long-term rates are an average of current and future short-term rates.
- If PEH is correct, you can use the yield curve to “back out” expected future interest rates.

25

Conclusions about PEH

- Some would argue that the MRP $\neq 0$, and hence the PEH is incorrect.
- Most evidence supports the general view that lenders prefer S-T securities, and view L-T securities as riskier.
- Thus, investors demand a MRP to get them to hold L-T securities (i.e., MRP > 0).

26

Other factors that influence interest rate levels

- Federal reserve policy
- Federal budget surplus or deficit
- Level of business activity
- International factors

27

Risks associated with investing overseas

- Exchange rate risk – If an investment is denominated in a currency other than U.S. dollars, the investment's value will depend on what happens to exchange rates.
- Country risk – Arises from investing or doing business in a particular country and depends on the country's economic, political, and social environment.

28

Factors that cause exchange rates to fluctuate

- Changes in relative inflation
- Changes in country risk

29

Chapter 3: Financial Statement, Cash Flow, and Taxes

Putting Things in Perspective

Finance focuses heavily on valuation. We often are trying to decide what an asset (stock, bond, company, project, etc.) is worth to us. When valuing corporations, we need information about what the firm owns, where it got the money to buy those items, and how it uses those items. If you think back to basic accounting, you will remember that one of the purposes of accounting is to keep track of the firm's activities. Thus, to do any type of corporate financial analysis, it is necessary to have some understanding of accounting information.

A Brief History of Accounting and Financial Statements

Financial statements are pieces of paper with numbers written on them. These numbers refer to underlying real assets. When the first loans were made, lenders could physically inspect borrowers' assets. As lending (and investing) became more complex, physical inspection was no longer possible so a need arose for financial statements to summarize financial position. Although the economic system has grown enormously since the early days of the barter system, the original reasons for accounting and financial statements still apply. Investors need them to make intelligent decisions, managers need them to see how effectively their enterprises are being run, and taxing authorities need them to assess taxes in a reasonable manner.

Financial Statements and Reports

A firm's annual report to shareholders presents two equally important types of information. The first is a verbal statement of the company's recent operating results and its expectations for the coming year. The second is a set of quantitative financial statements that report what actually happened to the firm's financial position, earnings, and dividends over the past few years.

The Balance Sheet

The balance sheet is a statement of the firm's financial position at a specific point in time. It shows the firm's assets and the claims against those assets. Assets are what the company owns (all physical items and rights that have a monetary value). Liabilities are debts owed to outsiders and equity is the capital provided to the firm by its owners, the shareholders. Assets, found on the left-hand side of the balance sheet, are typically shown in the order of their liquidity. Claims (debt and equity) are found on the right-hand side and are generally listed in the order in which they must be paid.

Assets are divided into two basic categories

Current assets are those assets that can be relatively easily converted into cash (include cash and marketable securities, accounts receivable, and inventory)

Fixed assets are those assets of a more "permanent" or "fixed" nature (include equipment, machinery, buildings, and land). Fixed assets are generally depreciated over time. Net fixed assets indicates the value of assets that has not been depreciated.

Keep in mind that assets are generally listed on the balance sheet on the basis of historical cost. The actual value of the assets if sold may vary tremendously from the value shown. Thus, although the assets are all listed with dollar values, their actual value is sometimes difficult to determine.

Liabilities are also generally divided into two basic categories. Current liabilities are those due within a short period of time (usually less than one year); examples include accounts payable and accrued expenses. Long-term liabilities (long-term debt) are not due for a longer time period (include longer-term notes, loans and bonds).

The equity accounts indicate the amount of funds that shareholders have contributed to the firm. Common stock is the par value of all shares outstanding. Paid-in-capital is the value paid above par for shares outstanding. Retained earnings is the amount of income that has been reinvested in the firm. Note that the retained earnings account on the balance sheet represents the total since the inception of the firm of all income reinvested in the company. These funds do not indicate cash available for use. They have already been used to purchase the assets shown.

There are several points about the balance sheet that should be noted.

- Only cash represents actual money. Non-cash assets should produce cash flows eventually, but they do not represent cash in hand.
- Claims against the assets consist of liabilities (money the company owes) and stockholders' equity (the ownership position of shareholders). Common stockholders' equity (net worth) is the residual value of the firm after all other claims are satisfied: $\text{Assets} - \text{Liabilities} - \text{Preferred stock} = \text{Common stockholders' equity (Net worth)}$. Common stockholders' equity is capital supplied by common stockholders.
- Preferred stock is a hybrid, or a cross, between common stock and debt.
- The common equity section of the balance sheet is divided into different accounts. The common stock account arises from the issuance of stock to raise capital. Retained earnings are built up over time as the firm "saves" a part of its earnings rather than paying all earnings out as dividends.
- Different methods, such as FIFO and LIFO, can be used to determine the value of inventory. These methods, in turn, affect the reported cost of goods sold, profits, and EPS.
- Companies often use the most accelerated method permitted under the law to calculate depreciation for tax purposes but use straight-line depreciation, which results in a lower depreciation expense, for stockholder reporting.

The balance sheet may be thought of as a snapshot of the firm's financial position at a point in time (for example, end of year). The balance sheet changes every day as inventory is increased or decreased, as fixed assets are added or retired, as bank loans are increased or decreased, and so on.

The Income Statement

The income statement shows the revenue generated by the firm and the costs necessary to create that revenue. Costs include items such as cost of goods sold, other operating expenses, depreciation, interest, and taxes. The net income figure represents profit remaining after all obligations are met. Profit belongs to the common shareholders.

Earnings per share (EPS) is called "the bottom line" denoting that of all the items on the income statement, EPS is the most important. Depreciation is an annual noncash charge against income that reflects the estimated dollar cost of the capital equipment used up in the production process. It applies to tangible assets, whereas amortization applies to intangible assets. They are often

lumped together on the income statement. EBITDA represents earnings before interest, taxes, depreciation, and amortization.

Statement of Retained Earnings

The statement of retained earnings reports changes in the equity accounts between balance sheet dates. Changes in retained earnings occur because common stockholders allow the firm to reinvest funds that otherwise could be distributed as dividends.

The balance sheet account "retained earnings" represents a claim against assets, not assets per se. Retained earnings as reported on the balance sheet do not represent cash and are not "available" for the payment of dividends or anything else. Retained earnings represent funds that have already been reinvested in the firm's operating assets.

Profit versus After-tax Cash Flow

Profit is an accounting term. It is derived based on accepted practices. It may not indicate the true "value" of a firm or project to an investor. This is primarily true because there are various non-cash flow expenses. These expenses are taken for various reasons (many tax related) but do not represent actual cash drains for the firm. Examples of non-cash flow expenses include amortization and depreciation. Depreciation is meant to represent the value of an asset consumed due to the passage of time. However, you don't pay this amount to anyone. This means that amounts shown as depreciation expense are merely book entries. The cash remains in your hands.

In valuing assets, it is important to determine the cash flow it generates (the amount of money the investor has available to use). Since most of finance deals with valuation, it is this cash-flow that matters to us. Therefore, we usually convert "profit" to "after-tax cash flows" before using the numbers. In general, after-tax cash flows equal the net income plus non-cash flow expenses. (In later chapters we will see that you must calculate the net income value based on the firm if it had no interest expense.)

Statement of Cash Flows

The statement of cash flows reports the impact of a firm's operating, investing, and financing activities on cash flows over an accounting period.

- Net cash flow represents the amount of cash a business generates for its shareholders in a given year.
- The company's cash position as reported on the balance sheet is affected by many factors, including cash flow, changes in working capital, fixed assets, and security transactions.
- The statement separates activities into three categories:
 - Operating activities, which includes net income, depreciation, and changes in current assets and current liabilities other than cash and short-term debt.
 - Investing activities, which includes investments in or sales of fixed assets.
 - Financing activities, which includes cash raised during the year by issuing debt or stock, and dividends paid or cash buy-backs of outstanding stock or bonds.
- Financial managers generally use this statement, along with the cash budget, when forecasting their companies' cash positions.

Modifying Accounting Data for Managerial Decisions

Traditional financial statements are designed more for use by creditors and tax collectors than for use by managers and equity analysts. Certain modifications are used for corporate decision making and stock valuation purposes. To judge managerial performance one needs to compare managers' ability to generate operating income (EBIT) with the operating assets under their control. Operating assets consist of cash, marketable securities, accounts receivable, inventories, and fixed assets necessary to operate the business. Nonoperating assets include cash and marketable securities above the level required for normal operations, investments in subsidiaries, land held for future use, and other nonessential assets. Operating assets can be further divided into working capital and fixed assets such as plant and equipment. Those current assets used in operations are called operating working capital, and operating working capital less accounts payable and accruals is called net operating working capital (NOWC). Net operating working capital is the working capital acquired with investor-supplied funds. Total investor-supplied operating capital is the sum of net operating working capital and net fixed assets.

Net income does not always reflect the true performance of a company's operations or the effectiveness of its managers and employees. A better measurement for comparing managers' performance is net operating profit after taxes (NOPAT), which is the amount of profit a company would generate if it had no debt and held no nonoperating assets.

$$\text{NOPAT} = \text{EBIT}(1 - \text{Tax rate}).$$

MVA and EVA

Neither traditional accounting data nor the modified data discussed above deal with stock prices. Since the primary goal of management is to maximize the firm's stock price, financial analysts have come up with adjustments that provide alternative measures of performance. Two of these measures are Market Value Added (MVA) and Economic Value Added (EVA).

Shareholders' wealth is maximized by maximizing the difference between the market value of the firm's stock and the amount of equity capital that was supplied by shareholders. This difference is called the Market Value Added (MVA). The higher its MVA, the better the job management is doing for the firm's shareholders.

$\text{MVA} = \text{Market value of stock} - \text{Equity capital supplied by shareholders}$

$$\text{MVA} = (\text{Shares outstanding})(\text{Stock price}) - \text{Total common equity}.$$

Whereas MVA measures the effects of managerial actions since the very inception of a company, Economic Value Added (EVA) focuses on managerial effectiveness in a given year.

$\text{EVA} = \text{NOPAT} - \text{After-tax dollar cost of capital used to support operations}$

$$\text{EVA} = \text{EBIT} (1 - T) - (\text{Total investor supplied operating capital})(\text{After-tax percentage cost of capital})$$

EVA is an estimate of a business's true economic profit for the year. EVA differs sharply from accounting profit. EVA represents the residual income that remains after the cost of all capital, including equity capital, has been deducted, whereas accounting profit is determined without imposing a charge for equity capital. EVA provides a good measure of the extent to which the

firm has added to shareholder value. EVA can be determined for divisions as well as for the company as a whole, so it provides a useful basis for determining managerial compensation at all levels.

There is a relationship between MVA and EVA, but it is not a direct one. If a company has a history of negative EVAs, then its MVA will probably be negative, and vice versa if it has a history of positive EVAs. A firm with a history of negative EVAs could have a positive MVA, if investors expect a future turnaround. Stock price, the key ingredient in the MVA calculation, depends more on expected future performance than on historical performance. When EVAs or MVAs are used to evaluate managerial performance as part of an incentive compensation program, EVA is the measure that is typically used. MVA is used primarily to evaluate top corporate officers over periods of five to 10 years, or longer.

The Federal Income Tax System

Because of the magnitude of the tax bite, taxes play a critical role in many financial decisions, and business managers and investors usually rely on tax specialists.

Individuals pay taxes on wages and salaries, on investment income (dividends, interest, and profits from the sale of securities), and on the profits of proprietorships and partnerships. U.S. income taxes are a progressive tax; that is, the higher the income, the larger the percentage paid in taxes. The marginal tax rate is the tax applicable to the last unit of income. The average tax rate is calculated as taxes paid divided by taxable income. Taxable income is gross income minus exemptions and allowable deductions as set forth in the Tax Code. A capital gain or loss on the sale of capital assets such as stocks, bonds, and real estate have historically received special tax treatment. Short-term capital gains, in which the asset is sold within one year of the time it was purchased, are added to such ordinary income as wages, dividends, and interest and then are taxed at the same rate as ordinary income. An asset held for more than a year produces a long-term capital gain, and its rate is capped at 20 percent. The lower capital gains tax rate stimulates capital formation and investment, hence economic growth.

- Corporations pay taxes on profits. Corporate tax rates are also progressive up to \$18,333,333 of taxable income, but are constant thereafter. Marginal tax rates range from 15 to 39 percent. The tax system favors debt financing over equity financing. Interest paid is a tax-deductible business expense. Dividends on common and preferred stock are not deductible. Depreciation plays an important role in income tax calculations-the larger it is, the lower taxable income and tax bill, hence the higher cash flow from operations. Congress specifies in the Tax Code both the life over which assets can be depreciated for tax purposes and the methods of depreciation to be used.

CHAPTER 3

Financial Statements and Cash Flow

Financial Decisions

- Finance focuses heavily on valuation. We often are trying to decide what an asset (stock, bond, company, project, etc.) is worth to us.
- When valuing corporations, we need information about what the firm owns, where it got the money to buy those items, and how it uses those items.

2

Accounting Information

- If you think back to basic accounting, you will remember that one of the purposes of accounting is to keep track of the firm's activities.
- Thus, to do any type of corporate financial analysis, it is necessary to have some understanding of accounting information.

3

Financial Reports

- Financial reports provide information about the firm and its operations.
- They represent a method of "keeping score" that allow you to "see" the various components of the firm and how they are used.

4

Financial Reports

- The most important financial report the firm provides is the annual report.
- The annual report provides:
 - A verbal description of the firm's operating results for the past year.
 - A discussion of new developments.
 - Financial statements.

5

Verbal portion of annual report

- The verbal portion of the annual report is just as important as the numbers. Here you will find management's discussion of strengths, weaknesses, and opportunities of the firm. This information can give you great insight into where the company is headed in the future.

6

Financial Statements

- Balance sheet - a snapshot of the firm's position at a given time (assets, liabilities, and equity)
- Income statement - shows the results of the firm over a given time period (profit)
- Statement of cash flows - indicates the flow of cash in and out of the firm during a time period

7

Balance Sheet

- Assets - what the company owns (all physical items and rights that have a monetary value)
- Liabilities - debts owed to outsiders
- Equity - capital provided to the firm by its owners, the shareholders

8

Balance Sheet

- Assets are divided into two basic categories
 - Current assets are those assets that can be relatively easily converted into cash (include cash and marketable securities, accounts receivable, and inventory)
 - Fixed assets are those assets of a more "permanent" or "fixed" nature (include equipment, machinery, buildings, and land). Fixed assets are generally depreciated over time. Net fixed assets indicates the value of assets that has not been depreciated.

9

Assets

- Keep in mind that assets are generally listed on the balance sheet on the basis of historical cost.
- The actual value of the assets if sold may vary tremendously from the value shown.
- Thus, although the assets are all listed with dollar values, their actual value is sometimes difficult to determine.

10

Cash Versus Other Assets

- Although assets are all stated in terms of dollars, only cash represent actual money available to be spent.
 - Receivables are bills owed to the firm.
 - Inventory shows the dollar amount the firm has invested in materials.
 - Net plant and equipment reflects the amount the firm paid for its fixed assets minus the accumulated depreciation.

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Balance Sheet: Assets

	<u>2007</u>	<u>2006</u>
Cash	7,282	57,600
AR	632,160	351,200
Inventories	<u>1,287,360</u>	<u>715,200</u>
Total CA	1,926,802	1,124,000
Gross FA	1,202,950	491,000
Less: Deprec.	<u>263,160</u>	<u>146,200</u>
Net FA	<u>939,790</u>	<u>344,800</u>
Total Assets	<u>2,866,592</u>	<u>1,468,800</u>

Liabilities

- Liabilities are also generally divided into two basic categories.
 - Current liabilities are those due within a short period of time (usually less than one year); examples include accounts payable and accrued expenses.
 - Long-term liabilities (long-term debt) are not due for a longer time period (include longer-term notes, loans and bonds).

13

Equity

- The equity accounts indicate the amount of funds that shareholders have contributed to the firm.
- Common stock - par value of all shares out
- Paid-in-capital - value paid above par for shares outstanding
- Retained earnings - the amount of income that has been reinvested in the firm

14

Retained earnings

- Note that the retained earnings account on the balance sheet represents the total since the inception of the firm of all income reinvested in the company.
- These funds do not indicate cash available for use. They have already been used to purchase the assets shown.

15

Liabilities and Equity

	<u>2007</u>	<u>2006</u>
Accts payable	524,160	145,600
Notes payable	636,808	200,000
Accruals	489,600	136,000
Total CL	<u>1,650,568</u>	<u>481,600</u>
Long-term debt	723,432	323,432
Common stock	460,000	460,000
Retained earnings	32,592	203,768
Total equity	<u>492,592</u>	<u>663,768</u>
Total L&E	<u>2,866,592</u>	<u>1,468,800</u>

Income Statement

- The income statement shows the revenue generated by the firm and the costs necessary to create that revenue. Costs include items such as cost of goods sold, other operating expenses, depreciation, interest, and taxes. The net income figure represents profit remaining after all obligations are met. Profit belongs to the common shareholders.

17

Income Statement

	<u>2007</u>	<u>2006</u>
Sales	6,034,000	3,432,000
COGS	5,528,000	2,864,000
Other expenses	519,988	358,672
EBITDA	(13,988)	209,328
Depr. & Amort.	116,960	18,900
EBIT	(130,948)	190,428
Interest exp.	136,012	43,828
EBT	(266,960)	146,600
Taxes (40%)	(106,784)	58,640
Net income	<u>(160,176)</u>	<u>87,960</u>

Income Statement

- Depreciation is a charge to reflect the cost of assets used in the production process. It does NOT represent a cash outlay.
- EBITDA – Earnings before interest, taxes, and depreciation and amortization.
- EBIT – Earnings before interest and taxes.
- EBT – Earnings before taxes (taxable income).

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Financial Statement Measures

- Earnings per share = $(NI)/(\text{shares outstanding})$
- DIVs per share = $(DIV)/(\text{shares outstanding})$
- Book value per share = $(\text{Total common equity})/(\text{shares outstanding})$
- Total Market value = $(\text{Stock price per share}) * (\text{shares outstanding})$

20

Profit versus After-tax Cash Flow

- Profit is an accounting term. It is derived based on accepted practices. It may not indicate the true “value” of a firm or project to an investor.
- This is primarily true because there are various non-cash flow expenses. These expenses are taken for various reasons (many tax related) but do not represent actual cash drains for the firm.

21

Profit versus After-tax Cash Flow

- Profit is an accounting term. It is derived based on accepted practices. It may not indicate the true “value” of a firm or project to an investor.
- This is primarily true because there are various non-cash flow expenses. These expenses are taken for various reasons (many tax related) but do not represent actual cash drains for the firm.

22

After-tax cash flows

- In valuing assets, it is important to determine the cash flow it generates (the amount of money the investor has available to use).
- Since most of finance deals with valuation, it is this cash-flow that matters to us.
- Therefore, we usually convert “profit” to “after-tax cash flows” before using the numbers.

23

After-tax cash flows

- In general,
 - After-tax cash flows equal the net income plus non-cash flow expenses.
 - (In this book, this is the definition of net cash flow.)
- (In later chapters we will see that you must calculate the net income value based on the firm if it had no interest expense.)

24

Modifying Accounting Data for Managerial Decisions

- Traditional financial statements are designed more for use by creditors and tax collectors than for use by managers and equity analysts.
- To judge managerial performance one needs to compare managers' ability to generate operating income (EBIT) with the operating assets under their control.

25

Operating/Non-operating assets

- Operating assets consist of cash, marketable securities, accounts receivable, inventories, and fixed assets necessary to operate the business.
- Non-operating assets include cash and marketable securities above the level required for normal operations, investments in subsidiaries, land held for future use, and other nonessential assets.

26

Net operating profit after taxes

- Net income does not always reflect the true performance of a company's operations or the effectiveness of its managers.
- A better measurement for comparing managers' performance is net operating profit after taxes (NOPAT) (the amount of profit a company would generate if it had no debt and held no non-operating assets).
 - $NOPAT = EBIT(1 - \text{Tax rate})$.

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Free Cash Flow

- Free cash flow is the cash flow actually available for distribution to all investors (stockholders and debtholders) after the company has made all the investments in fixed assets, new products, and working capital necessary to sustain ongoing operations.
- Note that the value of a company depends on its expected future free cash flows (FCF).

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Free Cash Flow

Operating cash flow =
NOPAT + Depreciation and amortization

Gross investment in operating capital =
Net investment + Depreciation and amort.

29

Free Cash Flow

FCF = Operating cash flow –
gross investment in operating capital

FCF = NOPAT –
Net investment in operating capital

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Including stock prices

- Traditional accounting data does not deal with stock prices.
- Since the primary goal of management is to maximize the firm's stock price, analysts have come up with adjustments that provide alternative measures of performance.
- Market Value Added (MVA) and Economic Value Added (EVA) are two of the measures.

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Market Value Added (MVA)

- Managers try to maximize the difference between the market value of the firm's stock and the amount of equity capital supplied by shareholders.
- This difference is called the Market Value Added.
- $MVA = \text{Mkt value of stock} - \text{Eq supplied by shareholders}$
- $MVA = (\text{Shares out})(\text{Stock price}) - \text{Total common equity.}$
- The higher its MVA, the better the job management has done for the firm's shareholders.

32

Economic Value Added (EVA)

- EVA is an estimate of a business's true economic profit for the year.
- EVA differs from accounting profit.
 - EVA represents the residual income that remains after the cost of all capital, **including equity capital**, has been deducted.
 - Accounting profit is determined without imposing a charge for equity.

33

Economic Value Added (EVA)

- EVA provides a good measure of the extent to which the firm has added to shareholder value.
- EVA can be determined for divisions as well as for the company as a whole, so it provides a useful basis for determining managerial compensation at all levels.
- $EVA = \text{NOPAT} - \text{After-tax dollar cost of capital}$
- $EVA = \text{EBIT} (1 - T) - (\text{inv supplied op cap})(\text{after-tax \% cost of cap})$

34

MVA and EVA

- MVA measures the effects of managerial actions since the very inception of a company.
- Economic Value Added (EVA) focuses on managerial effectiveness in a given year.

35

MVA and EVA

- A company with a history of negative EVAs will probably have a negative MVA, and vice versa if it has a history of positive EVAs.
- Although, a firm with a history of negative EVAs could have a positive MVA, if investors expect a future turnaround. The key reason is that stock price depends more on expected future performance than on historical performance.

36

Federal Taxes

- The marginal tax rate is the tax applicable to the last unit of income.
- The average tax rate is calculated as taxes paid divided by taxable income.
- A capital gain or loss on the sale of capital assets (such as stocks, bonds, and real estate) have historically received special tax treatment.

37

Federal Taxes

- The tax system favors debt financing over equity financing.
 - Interest paid is a tax-deductible business expense. Dividends on common and preferred stock are not deductible.
- Depreciation plays an important role in income tax calculations-the larger it is, the lower taxable income and tax bill, hence the higher cash flow from operations.

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What's ahead

- Now that you've refreshed your knowledge of accounting and understand some of the changes necessary for financial analysis, you are ready to start using the data to analyze firms.
- The next section of the course examines financial ratios and how they are used to determine the financial health of a company.

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Chapter 3 – Sample Problems

1. In its recent income statement, Smith Software Inc. reported \$26 million of net income, and in its year-end balance sheet, Smith reported \$353 million of retained earnings. The previous year, its balance sheet showed \$339 million of retained earnings. What were the total dividends paid to shareholders during the most recent year? (Answers are in \$ millions.)

- a. \$14.00
- b. \$12.00
- c. \$26.00
- d. \$10.00
- e. \$33.00

2. In its recent income statement, Smith Software Inc. reported paying \$10 million in dividends to common shareholders, and in its year-end balance sheet, Smith reported \$365 million of retained earnings. The previous year, its balance sheet showed \$354 million of retained earnings. What was the firm's net income during the most recent year? (Answers are in \$ millions.)

- a. \$10.00
- b. \$11.00
- c. \$21.00
- d. \$8.00
- e. \$28.00

3. Cox Corporation recently reported an EBITDA of \$66 million and \$8 million of net income. The company has \$11 million interest expense and the corporate tax rate is 40.0% percent. What was the company's depreciation and amortization expense? (Answers are in \$ millions.)

- a. \$63.00
- b. \$55.00
- c. \$58.00
- d. \$47.00
- e. \$41.67

4. Hayes Corporation has \$405 million of common equity on its balance sheet and 9,000,000 shares of common stock outstanding. The company's Market Value Added (MVA) is \$81 million. What is the company's stock price? (Answers are in \$ millions.)

- a. \$6.87
- b. \$45.00
- c. \$9.00
- d. \$59.42
- e. \$54.00

5. Brooks Sisters' operating income (EBIT) is \$140 million. The company's tax rate is 40.0%, and its operating cash flow is \$115.3 million. The company's interest expense is \$28 million. What is the company's net cash flow? (Assume that depreciation is the only non-cash item in the firm's financial statements.) (Answers are in \$ millions.)

- a. \$31.30
- b. \$67.20
- c. \$98.50
- d. \$84.00
- e. \$112.00

6. Casey Motors recently reported net income of \$84 million. The firm's tax rate was 40.0% and interest expense was \$27 million. The company's after-tax cost of capital is 12.0% and the firm's total investor supplied operating capital employed equals \$420 million. What is the company's EVA? (Answers are in \$ millions.)

- a. \$84.00
- b. \$49.80
- c. \$140.00
- d. \$100.20
- e. \$50.40

Answers:

- 1. b
- 2. c
- 3. e
- 4. e
- 5. c
- 6. b

$$\begin{array}{lcl}
 1. & & \\
 \text{RE(new)} & = & \$353,000,000 \\
 \text{RE(old)} & = & \$339,000,000 \\
 \hline
 \text{Change} & = & \$14,000,000
 \end{array}$$

$$\begin{aligned}
 \text{Change in RE} &= \text{Net income} - \text{Dividends} \\
 \$14,000,000 &= \$26,000,000 - \text{Dividends} \\
 \text{Dividends} &= \$12,000,000
 \end{aligned}$$

$$\begin{array}{lcl}
 2. & & \\
 \text{RE(new)} & = & \$365,000,000 \\
 \text{RE(old)} & = & \$354,000,000 \\
 \hline
 \text{Change} & = & \$11,000,000
 \end{array}$$

$$\begin{aligned}
 \text{Change in RE} &= \text{Net income} - \text{Dividends} \\
 \$11,000,000 &= \text{Net income} - \$10,000,000 \\
 \text{Net income} &= \$21,000,000
 \end{aligned}$$

$$\begin{aligned}
 3. \text{ Net income} &= (\text{EBIT} - \text{interest})(1 - \text{tax rate}) \\
 \$8,000,000 &= (\text{EBIT} - \$11,000,000)(1 - 0.40) \\
 \$13,333,333 &= \text{EBIT} - \$11,000,000 \\
 \text{EBIT} &= \$24,333,333
 \end{aligned}$$

$$\begin{aligned}
 \text{EBIT} &= \text{EBITDA} - (\text{Depreciation and amortization}) \\
 \$24,333,333 &= \$66,000,000 - (\text{Depreciation and amortization}) \\
 \text{Depreciation and amortization} &= \$41,666,667 = \$41.67 \text{ million}
 \end{aligned}$$

$$\begin{aligned}
 4. & \\
 \text{MVA} &= (\text{shares outstanding})(\text{stock price}) - \text{book value of common equity} \\
 \$81,000,000 &= (9,000,000)(\text{stock price}) - \$405,000,000
 \end{aligned}$$

$$\begin{aligned} \$486,000,000 &= (9,000,000)(\text{stock price}) \\ \text{stock price} &= \$54.00 \end{aligned}$$

5.

$$\text{Net cash flow} = \text{Net income} + (\text{Depreciation and amortization})$$

First, find net income.

EBIT	\$140,000,000
Interest	\$ 28,000,000
EBT	\$112,000,000
Taxes (40%)	\$ 44,800,000
Net income	\$ 67,200,000

Now find depreciation.

$$\begin{aligned} \text{NOPAT} &= \text{EBIT}(1 - \text{tax rate}) \\ \text{NOPAT} &= \$140,000,000(1 - 0.40) \\ \text{NOPAT} &= \$84,000,000 \end{aligned}$$

$$\begin{aligned} \text{Operating cash flow} &= \text{NOPAT} + \text{Depreciation} \\ \$115,300,000 &= \$84,000,000 + \text{Depreciation} \\ \text{Depreciation} &= \$31,300,000 \end{aligned}$$

$$\text{Net cash flow} = \text{Net income} + (\text{Depreciation and amortization})$$

Depreciation is the only non-cash item in the firm's financial statements, so there is no amortization to consider.

$$\begin{aligned} \text{Net cash flow} &= \$67,200,000 + \$31,300,000 \\ \text{Net cash flow} &= \$98,500,000 \end{aligned}$$

6.

$$\begin{aligned} \text{EVA} &= \text{NOPAT} - \text{After-tax dollar cost of capital} \\ \text{EVA} &= \text{EBIT}(1 - \text{tax rate}) - (\% \text{ cost of capital})(\text{total investor supplied capital}) \end{aligned}$$

$$\begin{aligned} \text{Net income} &= (\text{EBIT} - \text{interest})(1 - \text{tax rate}) \\ \$84,000,000 &= (\text{EBIT} - \$27,000,000)(1 - 0.40) \\ \$140,000,000 &= \text{EBIT} - \$27,000,000 \\ \text{EBIT} &= \$167,000,000 \end{aligned}$$

$$\begin{aligned} \text{EVA} &= \text{EBIT}(1 - \text{tax rate}) - (\% \text{ cost of capital})(\text{total investor supplied capital}) \\ \text{EVA} &= (\$167,000,000)(1 - 0.40) - (0.12)(\$420 \text{ million}) \\ \text{EVA} &= \$49,800,000 = \$49.80 \text{ million} \end{aligned}$$

Chapter 4: Analysis of Financial Statements

Putting Things in Perspective

Financial analysis is designed to determine the relative strengths and weaknesses of a company. Investors need this information to estimate both future cash flows from the firm and the riskiness of those cash flows. Financial managers need the information provided by analysis both to evaluate the firm's past performance and to map future plans.

Financial analysis concentrates on financial statement analysis, which highlights the key aspects of a firm's operations. Financial statement analysis involves a study of the relationships between income statement and balance sheet accounts, how these relationships change over time (trend analysis), and how a particular firm compares with other firms in its industry (benchmarking). Although financial analysis has limitations, when used with care and judgment, it can provide some very useful insights into a company's operations.

Ratio Analysis

Financial statements are used to help predict the firm's future earnings and dividends. From an investor's standpoint, predicting the future is what financial statement analysis is all about. From management's standpoint, financial statement analysis is useful both to help anticipate future conditions and, more important, as a starting point for planning actions that will influence the future course of events. Financial ratios are designed to help one evaluate a firm's financial statements. For example, the burden of debt, and the company's ability to repay, can be best evaluated (1) by comparing the company's debt to its assets and (2) by comparing the interest it must pay to the income it has available for payment of interest. Such comparisons are made by ratio analysis.

Liquidity Ratios

A liquid asset is an asset that can be converted to cash quickly without losing much of the asset's value. Liquidity ratios are used to measure a firm's ability to meet its current obligations. Two commonly used liquidity ratios are the current ratio and the quick, or acid test, ratio.

- The current ratio measures the extent to which current liabilities are covered by current assets. It is calculated by dividing current assets by current liabilities. It is the most commonly used measure of short-term solvency.

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabs}}$$

- The quick (acid test) ratio is calculated by deducting inventory from current assets and then dividing the remainder by current liabilities. Inventories are excluded because they are typically the least liquid of a firm's current assets; hence, they are the assets on which losses are most likely to occur in the event of liquidation.

$$\text{Quick (acid test) ratio} = \frac{\text{Current assets} - \text{inventory}}{\text{Current liabs}}$$

Asset Management Ratios

Asset management ratios measure how effectively a firm is managing its assets and whether the level of those assets is properly related to the level of operations as measured by sales.

- The inventory turnover ratio is defined as sales divided by inventories. It is often necessary to use average inventories rather than year-end inventories, especially if a firm's business is highly seasonal, or if there has been a strong upward or downward sales trend during the

$$\text{Inventory turnover} = \frac{\text{Sales}}{\text{Inventory}}$$

year.

- Days sales outstanding (DSO), also called the "average collection period" (ACP), is used to appraise accounts receivable, and it is calculated by dividing accounts receivable by average daily sales to find the number of days' sales tied up in receivables. The DSO represents the average length of time that the firm must wait after making a sale before receiving cash. The DSO can also be evaluated by comparison with the terms on which the firm sells its goods. If the trend in DSO over the past few years has been rising, but the credit policy has not been changed, this would be strong evidence that steps should be taken to expedite the collection of accounts receivable.

$$\text{Days sales outstanding} = \frac{\text{Receivables}}{\text{Average sales per day}} = \frac{\text{Receivables}}{(\text{Annual sales}/365)}$$

- The fixed assets turnover ratio is the ratio of sales to net fixed assets. It measures how effectively the firm uses its plant and equipment.

$$\text{Fixed assets turnover ratio} = \frac{\text{Sales}}{\text{Net fixed assets}}$$

- The total assets turnover ratio is calculated by dividing sales by total assets. It measures the utilization, or turnover, of all the firm's assets.

$$\text{Total assets turnover ratio} = \frac{\text{Sales}}{\text{Total assets}}$$

Debt Management Ratios

Debt management ratios measure the extent to which a firm is using debt financing, or financial leverage, and the degree of safety afforded to creditors.

Financial leverage has three important implications: (1) by raising funds through debt, stockholders can maintain control of a firm while limiting their investment; (2) creditors look to the equity, or owner-supplied funds, to provide a margin of safety, so if the stockholders have provided only a small proportion of the total financing, the firm's risks are borne mainly by its creditors; and, (3) if the firm earns more on investments financed with borrowed funds than it pays in interest, the return on the owners' capital is magnified, or "leveraged."

Firms with relatively high debt ratios have higher expected returns when the economy is normal, but they are exposed to risk of loss when the economy goes into a recession. Firms with low debt ratios are less risky, but also forgo the opportunity to leverage up their returns on equity. Decisions about the use of debt require firms to balance higher expected returns against increased risk.

Analysts use two procedures to examine the firm's debt: (1) they check the balance sheet to determine the extent to which borrowed funds have been used to finance assets, and they review the income statement to see the extent to which fixed charges are covered by operating profits.

The debt ratio, or ratio of total debt to total assets, measures the percentage of funds provided by creditors. Total debt includes both current liabilities and long-term debt. The lower the ratio, the greater the protection afforded creditors in the event of liquidation. Stockholders, on the other hand, may want more leverage because it magnifies expected earnings.

$$\text{Debt ratio} = \frac{\text{Total debt}}{\text{Total assets}}$$

The times-interest-earned (TIE) ratio is determined by dividing earnings before interest and taxes (EBIT) by the interest charges. The TIE measures the extent to which operating income can decline before the firm is unable to meet its annual interest costs.

$$\text{Times interest earned ratio} = \frac{\text{EBIT}}{\text{Interest charges}}$$

Note that EBIT, rather than net income, is used in the numerator. Because interest is paid with pre-tax dollars, the firm's ability to pay current interest is not affected by taxes.

The TIE ratio has two shortcomings: interest is not the only fixed financial charge; and EBIT does not represent all the cash flow available to service debt, especially if a firm has high depreciation and/or amortization charges. To account for the deficiencies of the TIE ratio, bankers and other have developed the EBITDA coverage ratio. It is calculated as EBITDA plus lease payments divided by the sum of interest, principal payments, and lease payments.

$$\text{EBITDA coverage ratio} = \frac{\text{EBITDA} + \text{Lease payments}}{\text{Interest} + \text{Principal payments} + \text{Lease payments}}$$

The EBITDA coverage ratio is most useful for relatively short-term lenders such as banks, which rarely make loans (except real estate-backed loans) for longer than about five years. Over a relatively short period, depreciation-generated funds can be used to service debt. Over a longer time, depreciation-generated funds must be reinvested to maintain the plant and equipment or else the company cannot remain in business. Therefore, banks and other relatively short-term lenders focus on the EBITDA coverage ratio, whereas long-term bondholders focus on the TIE ratio.

Profitability Ratios

Profitability ratios show the combined effects of liquidity, asset management, and debt on operating results.

- The profit margin on sales is net income divided sales. It gives the profit per dollar of sales.

$$\text{Profit margin on sales} = \frac{\text{Net income available to common shareholders}}{\text{Sales}}$$

- The basic earning power (BEP) ratio is earnings before interest and taxes (EBIT) divided by total assets. It shows the raw earning power of the firm's assets, before the influence of taxes and leverage, and it is useful for comparing firms with different tax situations and degrees of

$$\text{Basic Earning Power} = \frac{\text{EBIT}}{\text{Total assets}}$$

financial leverage.

- The return on total assets (ROA) is the ratio of net income to total assets; it measures the return on all the firm's assets after interest and taxes.

$$\text{Return on total assets} = \frac{\text{Net income available to common stockholders}}{\text{Total assets}}$$

- The return on common equity (ROE) measures the rate of return on the stockholders' investment. It is equal to net income divided by common equity. Stockholders invest to get a return on their money, and this ratio tells how well they are doing in an accounting sense.

$$\text{Return on common equity} = \frac{\text{Net income available to common stockholders}}{\text{Common equity}}$$

Market Value Ratios

Market value ratios relate the firm's stock price to its earnings, cash flow, and book value per share, and thus give management an indication of what investors think of the company's past performance and future prospects. If the liquidity, asset management, debt management, and profitability ratios all look good, since the stock price will probably as high as can be expected the market value ratios will be high.

- The price/earnings (P/E) ratio, or price per share divided by earnings per share, shows how much investors are willing to pay per dollar of current earnings. P/E ratios are higher for firms with strong growth prospects, other things held constant, but they are lower for more

$$\text{Price/earnings ratio} = \frac{\text{Price per share}}{\text{Earnings per share}}$$

risky firms.

- The price/cash flow ratio is the ratio of price per share divided by cash flow per share. It shows the dollar amount investors will pay for \$1 of cash flow.

$$\text{Price/cash flow ratio} = \frac{\text{Price per share}}{\text{Cash flow per share}}$$

- The market/book (M/B) ratio, defined as market price per share divided by book value per share (book value per share equals common equity divided by the number of shares outstanding), gives another indication of how investors regard the company. Higher M/B ratios are generally associated with firms with relatively high rates of return on common

$$\text{Market/book ratio} = \frac{\text{Market price per share}}{\text{Book value per share}}$$

equity.

Trend Analysis

It is important to analyze trends in ratios as well as their absolute levels. Trend analysis is simply a plot of a ratio over time. Trend analysis can show how the firm's financial situation has changed over time and provide clues as to whether it is likely to improve or to deteriorate.

Tying the Ratios Together: The Du Pont Chart and Equation

A modified Du Pont chart shows how return on equity is affected by assets turnover, profit margin, and leverage. Du Pont managers developed the chart for evaluating performance and analyzing ways of improving performance.

The profit margin times the total assets turnover is called the Du Pont equation. This equation gives the rate of return on assets (ROA).

$$\begin{aligned}\text{ROA} &= (\text{Profit margin}) \times (\text{Total assets turnover}) \\ &= \left(\frac{\text{Net income}}{\text{Sales}} \right) \left(\frac{\text{Sales}}{\text{Total assets}} \right)\end{aligned}$$

The ROA times the equity multiplier (total assets divided by common equity) yields the return on equity (ROE). This equation is referred to as the extended Du Pont equation.

$$\begin{aligned}\text{ROE} &= \text{ROA} \times \text{Equity Multiplier} \\ &= \text{ROA} \times \left(\frac{\text{Total assets}}{\text{Common equity}} \right) \\ &= \left(\frac{\text{Net Income}}{\text{Sales}} \right) \left(\frac{\text{Sales}}{\text{Total assets}} \right) \left(\frac{\text{Total assets}}{\text{Common Equity}} \right)\end{aligned}$$

- o Note: Ignoring preferred stock: Equity multiplier = $(1)/(1 - \text{debt ratio})$.

If a company is financed only with common equity, the return on assets (ROA) and the return on equity (ROE) are the same because total assets will equal common equity. This equality holds only if the company uses no debt.

Comparative Ratios and “Benchmarking”

Ratio analysis involves comparisons because a company's ratios are compared with those of other firms in the same industry, that is, to industry average figures. Comparative ratios are available from a number of sources including ValueLine, Dun & Bradstreet, Robert Morris Associates, and the U.S. Commerce Department. Benchmarking is the process of comparing the ratios of a particular company with those of a smaller group of "benchmark" (or target,) companies, rather than with the entire industry. Benchmarking makes it easy for a firm to see exactly where the company stands relative to its competition.

Uses and Limitations of Ratio Analysis

There are some inherent problems and limitations to ratio analysis that necessitate care and judgment. Ratio analysis conducted in a mechanical, unthinking manner is dangerous, but used intelligently and with good judgment, it can provide useful insights into a firm's operations.

Financial ratios are used by three main groups:

- Managers, who employ ratios to help analyze, control, and improve their firm's operations.
- Credit analysts, such as bank loan officers or bond rating analysts, who analyze ratios to help ascertain a company's ability to pay its debts.
- Stock analysts, who are interested in a company's efficiency, risk, and growth prospects.

While ratio analysis can provide useful information concerning a company's operations and financial condition, it does have limitations.

- Ratios are often hard to use for analyzing the operations of large firms that operate in many different industries because meaningful comparative ratios are difficult to develop.
- The use of industry averages may not provide a very challenging target.
- Inflation affects depreciation charges, inventory costs, and therefore, the value of both balance sheet items and net income. For this reason, the analysis of a firm over time, or a comparative analysis of firms of different ages, can be misleading.
- Ratios may be distorted by seasonal factors, or manipulated by management to give the impression of a sound financial condition
- Firms may employ “window dressing” techniques to make their financial statements look stronger.
- Different operating policies and accounting practices, such as the decision to lease rather than to buy equipment, can distort comparisons.
- It is difficult to generalize about whether a particular ratio is “good” or “bad.”
- A firm will likely have some ratios that look “good” and others that look “bad,” making it difficult to tell whether the company is, on balance, strong or weak.

Problems with ROE

Despite its widespread use and the fact that ROE and shareholder wealth are often highly correlated, some problems can arise when firms use ROE as the sole measure of performance.

- ROE does not consider risk.
- ROE does not consider the amount of invested capital.
- A project's return, risk, and size combine to determine its impact on shareholder value.
- To the extent that ROE focuses only on rate of return and ignores risk and size, increasing ROE may in some cases be inconsistent with increasing shareholder wealth.

- Alternative measures of performance have been developed, including Market Value Added (MVA) and Economic Value Added (EVA).

Looking Beyond the Numbers

While it is important to understand and interpret financial statements, sound financial analysis involves more than just calculating and interpreting numbers.

Good analysts recognize that certain qualitative factors must be considered when evaluating a company. Some of these factors are:

- The extent to which the company's revenues are tied to one key customer.
- The extent to which the company's revenues are tied to one key product.
- The extent to which the company relies on a single supplier.
- The percentage of the company's business generated overseas.
- Competition.
- Future prospects.
- Legal and regulatory environment.

CHAPTER 4

Analysis of Financial Statements

- Ratio analysis
- Du Pont equation
- Limitations of ratio analysis
- Qualitative factors

1

Why are ratios useful?

- Standardize numbers; facilitate comparisons
- Highlight weaknesses and strengths

2

Comparison Norms

- Ratios by themselves do not mean much. They take on meaning when compared to various benchmarks.
- Usually, we are concerned with how the firm has changed over time and how it compares to other “similar” firms.

3

Comparison Norms

- The most common comparison norms are:
 - past performance of the firm itself
 - other firms in the same industry (industry averages/medians or “target” firms)
- We often look at the trends in ratios over time (trend analysis) for clues to whether a firm’s financial condition is likely to improve or to deteriorate.

4

Financial statements/ratios are used to:

- Try to improve performance
 - measure past performance
 - give starting point for planning
 - anticipation of future performance (What-ifs?)
- Set values (predict cashflows and determine risk)

5

What are the five major categories of ratios, and what questions do they answer?

- **Liquidity:** Measures the firm’s ability to meet short-term obligations
- **Asset management:** Measures how effectively managers use the firm’s assets (usually considers revenue generation -- sales)

6

- **Debt management:** Measures how much financial leverage a firm uses and the firm's ability to service its debt
- **Profitability:** Measures the "bottom-line;" shows the combined effect of the other categories
- **Market value:** Measures what investors think about the firm's performance

7

Liquidity Measures

$$\text{Current Ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$\text{Quick Ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$$

(Acid Test)

8

Comments on CR and QR

Higher values for CR and QR mean more liquid (more current assets relative to current liabilities).

Higher values are not necessarily "better" values.

9

Asset Management Ratios

- **Inventory Turnover Ratio** = $\frac{\text{Sales}}{\text{Inventory}}$
- **Days Sales Outstanding (DSO)** = $\frac{\text{Receivables}}{\text{Annual Sales}/365}$
- **Fixed Assets Turnover** = $\frac{\text{Sales}}{\text{Net fixed assets}}$
- **Total Assets Turnover** = $\frac{\text{Sales}}{\text{Total Assets}}$

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Comments on Asset Mgmt Ratios

- All of the turnover ratios indicate how effectively management uses assets to generate sales. (larger values are generally preferred)
- DSO indicates how quickly credit sales are converted to "cash-in-hand." (smaller values are generally preferred)

11

Debt Management Ratios:

$$\text{Debt Ratio} = \frac{\text{Total Debt}}{\text{Total Assets}}$$

$$\text{Times-Interest-Earned (TIE)} = \frac{\text{EBIT}}{\text{Interest Charges}}$$

$$\text{EBITDA coverage ratio} = \frac{\text{EBITDA} + \text{lease pmts}}{\text{Interest} + \text{principal} + \text{lease payments}} \quad \text{pmts}$$

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Debt management ratios measure:

1. How much debt is used.
2. The ability of the firm to meet interest payments.

13

How do the debt management ratios compare with industry averages?

A larger debt ratio means more leverage is being used.

A larger times interest earned ratio indicates that the firm is better able to pay the interest charges.

14

Interpreting debt mgmt ratios

Increased use of leverage usually increase EPS, but at the same time increases risk. Thus, the use of more or less debt can be either good or bad.

A larger times interest earned ratio is generally preferred.

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$$\text{Debt-to-Equity Ratio} = \frac{\text{Total Debt}}{\text{Total Equity}}$$

There are other measures of the amount of debt used. They all measure the same characteristics – just in slightly different ways.

A debt ratio of 0.40 is the same as a debt-to-equity ratio of 0.6667.

$$\begin{aligned} A &= L + E & DR &= 0.4/1 = 0.4 \\ 1 &= 0.4 + 0.6 & D/EQ &= 0.4/0.6 = 0.6667 \end{aligned}$$

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Profitability Ratios

$$\text{Profit margin (PM)} = \frac{\text{Net Income}}{\text{Sales}}$$

$$\text{Basic earning power (BEP)} = \frac{\text{EBIT}}{\text{Total Assets}}$$

17

$$\text{Return on total assets (ROA)} = \frac{\text{Net Income}}{\text{Total assets}}$$

$$\text{Return on equity (ROE)} = \frac{\text{Net Income}}{\text{Common equity}}$$

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Profit margin interpretation

Since profit margin ratios are indicators of “bottom-line” performance, it is true that higher values are preferred *holding all else constant*.

The problem is that to generate higher profits, you must often take on more risk. If this is true, then a higher profit value may not be *preferred*.

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Market Value Ratios:

$$\text{Price/Earnings (P/E ratio)} = \frac{\text{Price/Share}}{\text{Earnings/Share}}$$

$$\text{Price/Cash flow} = \frac{\text{Price/share}}{\text{CF per share}}$$

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

20

Market value ratios give an indication of what investors think about the firm

Since market value ratios include the current stock price, they allow you to determine what investors think about the firm's performance.

What value has been added?

21

The extended DuPont equation provides an overview of:

1. Profitability measured by ROE
2. Expense control measured by PM
3. Asset utilization measured by TATO
4. Financial leverage measured by EM (Debt utilization) EM=1/(1-debt ratio)
5. The interaction between the determinants of ROE

22

Extended DuPont Equation

$$\left(\text{Profit margin} \right) \left(\text{TA turnover} \right) \left(\text{Equity multiplier} \right) = \text{ROE}$$

$$\frac{\text{NI}}{\text{Sales}} \times \frac{\text{Sales}}{\text{TA}} \times \frac{(1)}{(1-\text{DR})} = \text{ROE}$$

23

Return on Assets: NOTE

$$\left(\text{Profit margin} \right) \left(\text{TA turnover} \right) = \text{ROA}$$

$$\frac{\text{NI}}{\text{Sales}} \times \frac{\text{Sales}}{\text{TA}} = \text{ROA}$$

24

Return on Assets: NOTE

$$\left(\text{ROA} \right) \left(\text{Equity multiplier} \right) = \text{ROE}$$

$$\text{ROA} \times \frac{(1)}{(1-\text{DR})} = \text{ROE}$$

25

Problems with ROE

- Despite its widespread use and the fact that ROE and shareholder wealth are often highly correlated, some problems can arise when firms use ROE as the sole measure of performance.
- ROE does not consider risk.
- ROE does not consider the amount of invested capital.

26

Problems with ROE

- A project's return, risk, and size combine to determine its impact on shareholder value.
- To the extent that ROE focuses only on rate of return and ignores risk and size, increasing ROE may in some cases be inconsistent with increasing shareholder wealth.
- Alternative measures of performance have been developed, including Market Value Added (MVA) and Economic Value Added (EVA).

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What are some potential problems and limitations of financial ratio analysis?

- Comparison with industry averages is difficult if the firm operates many different divisions.
- "Average" performance not necessarily good.
- Seasonal factors can distort ratios.
- "Window dressing" techniques can make statements and ratios look better.

28

- Different operating and accounting practices distort comparisons.
- Sometimes hard to tell if a ratio is "good" or "bad."
- Difficult to tell whether company is, on balance, in strong or weak position.

29

What are some qualitative factors analysts should consider when evaluating a company's likely future financial performance?

- Are the company's revenues tied to 1 key customer?
- To what extent are the company's revenues tied to 1 key product?
- To what extent does the company rely on a single supplier?

(More...)

30

- **What percentage of the company's business is generated overseas?**
- **Competition**
- **Future prospects**
- **Legal and regulatory environment**

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CHAPTER 4 Financial Ratio Problems

Types of problems and the
approach to ratio problem solving

1

Overall

- There are several steps that should be followed for all ratio problems.
- Following these steps will make it easier to correctly solve each problem.
- These steps provide a way to approach all ratio problems.

2

- First, always identify all ratios mentioned in the problem and write the formulas down.
- Second, determine what you are trying to find.
- Third, identify the data that you have available and try to determine the type of problem you are facing (see next page).
- Fourth, enter the data in the ratios and solve for your answer.

3

Types of problems

- Ratio problems are hard to classify since there are many combinations and many ways to solve them.
- However, in general there are three basic types of ratio problems you will see.
 - Plug-n-chug
 - multiplicative
 - now-and-later

4

Plug-n-chug

- The plug-n-chug problems are the easiest.
- Such a problem is one where all but one item in a ratio is given to you, and all you have to do is solve for the remaining one.

Example:

Your firm had net income of \$1,000,000 last year and had total assets of \$5,000,000. What was the firm's return on assets?

5

The only ratio mentioned is return on assets so we write that formula. (ROA is what we are finding.)

$$\text{ROA} = (\text{net income}) / (\text{total assets})$$

We next identify what we know.

$$\text{Net income} = \$1,000,000 \quad \text{Total assets} = \$5,000,000$$

This is a plug-n-chug problem since we know all entries for the ratio except the ROA which we can solve for.

$$\text{ROA} = (1,000,000) / (5,000,000) = .20 = 20\%$$

6

Multiplicative

- I call the next type multiplicative problems.
- These types of problems generally require you to multiply or divide several ratios to get a solution.
- Example: Your return on assets was 20% last year. You financed 30% of your assets with debt. What was your return on common equity?

7

Two ratios are directly mentioned. ROA and ROE.

$$ROA = NI/TA$$

$$ROE = NI/CE \text{ or } ROE = (NPM)(TATR)(1/(1-DR))$$

We are looking for the ROE. We know:

$$ROA = 20\%$$

30% of assets were financed with debt (this is actually telling us the debt ratio since the debt ratio's definition is that it tells us the percentage of assets financed with debt (debt ratio = (total liabilities) / (total assets))

8

To solve the problem, we also need to recognize the relationship of the various ratios.

NOTE:

$$NPM = (\text{net income}) / (\text{sales})$$

$$TATR = (\text{sales}) / (\text{total assets})$$

Thus,

$$NPM * TATR = \frac{\text{net income}}{\text{sales}} * \frac{\text{sales}}{\text{total assets}}$$

$$NPM * TATR = (\text{net income}) / (\text{total assets}) = ROA$$

9

Thus,

$$ROE = (ROA)(1/(1 - \text{debt ratio}))$$

$$ROE = (.20) (1/(1 - .30)) = 0.2857 = 28.57\%$$

This is actually an example of the DuPont Equation that we discussed earlier in the lecture notes.

10

Now-and-later

- The third type of problem is the now-and-later. It usually gives you information about the firm at one time, and then wants you to solve for information for a different period.
- EX: RRR's target current ratio is 3.0. Presently, the current ratio is 4.0 based on current assets of \$10 million. If RRR expands its current assets using current liabilities, how much additional financing can it get before it reaches its target current ratio?

11

The only ratio mentioned is the current ratio.

$$CR = CA / CL$$

To solve one of these types of problems we always need to know everything about the present situation before trying to solve for future information.

Currently,

$$CR = 4.0 \quad \text{Current assets (CA)} = 10$$

Thus,

$$4 = (10) / CL \quad \text{so} \quad 4CL = 10 \quad \text{and} \quad CL = 2.5$$

12

After we know all present information, we can focus on the future information.

We know that the target current ratio is 3.0.
To change to CR=3.0 from CR=4.0 we must change the CL and/or CA accounts (we will be either adding or subtracting).

In this case the problem says we are increasing CA by using CL. Thus, however much CL goes up is the same amount CA goes up.

13

We must start with the current balances for CA and CL and determine the change.

$$CR = CA / CL \quad \text{target CR}=3.0$$

$$3 = \frac{10 + x}{2.5 + x}$$

$$3(2.5 + x) = 10 + x$$

$$7.5 + 3x = 10 + x$$

$$2x = 2.5$$

$$X = 1.25$$

$$\text{CHECK: } CR = (10 + 1.25) / (2.5 + 1.25) = 3$$

14

OVERALL

- Always remember to write the formulas down first, and then identify what you are looking for, what you have, and the type of problem you are facing.
- If you follow these steps, the problem are much easier.

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Chapter 4 – Sample Problems

1. TCBW last year had an average collection period (days sales outstanding) of 35 days based on accounts receivable of \$460,000. All of the firm's sales are made on credit. The firm expects sales this year to be the same as last year. However, the company has begun a new credit policy that should lower the average collection period to 28 days. If the new average collection period is attained, what will the firm's accounts receivable balance equal?
 - a. \$427,800
 - b. \$460,000
 - c. \$338,928
 - d. \$368,000
 - e. \$505,632

2. The RRR Company has a target current ratio of 3.2. Presently, the current ratio is 4.4 based on current assets of \$6,556,000. If RRR expands its inventory using short-term liabilities (maturities less than one year), how much additional funding can it obtain before its target current ratio is reached?
 - a. \$855,802
 - b. \$558,750
 - c. \$666,182
 - d. \$812,727
 - e. \$913,749

3. AAA's inventory turnover ratio is 22.30 based on sales of \$25,200,000. The firm's current ratio equals 10.21 with current liabilities equal to \$290,000. If the firm's cash and marketable securities equal \$732,342, what is the firm's days sales outstanding?
 - a. 26.52
 - b. 32.28
 - c. 42.89
 - d. 15.91
 - e. 14.53

4. U KNO, Inc. uses only debt and common equity funds to finance its assets. This past year the firm's return on total assets was 19%. The firm financed 39% percent of its assets using equity. What was the firm's return on common equity?
 - a. 38.95%
 - b. 31.15%
 - c. 48.72%
 - d. 53.46%
 - e. 27.95%

5. Last year YYY Company had a 5.00% net profit margin based on \$21,000,000 in sales and \$14,000,000 of total assets. During the coming year, the president has set a goal of attaining a 8% return on total assets. If YYY finances 56% of its assets by borrowing, what will its return on common equity be next year if the return on assets goal is achieved?
 - a. 19.95%
 - b. 14.29%
 - c. 16.02%
 - d. 18.18%
 - e. 12.82%

6. The RRR Company has a target current ratio of 3.6. Presently, the current ratio is 4.5 based on current assets of \$8,505,000. If RRR expands its fixed assets using short-term liabilities (maturities less than one year), how much additional funding can it obtain before its target current ratio is reached?
- \$654,231
 - \$472,500
 - \$549,372
 - \$688,905
 - \$735,552
7. AAA's inventory turnover ratio is 22.30 based on sales of \$25,200,000. The firm's current ratio equals 10.21 with current liabilities equal to \$290,000. What is the firm's quick ratio?
- 10.21
 - 6.31
 - 8.57
 - 3.58
 - 12.60
8. Use the information below to calculate the firm's return on common equity. (State your answer as a percentage with two decimal places.) Net profit margin = 11.88%; Debt ratio = 44.29%; Fixed asset turnover = 7.54; Total asset turnover = 3.50 ; Inventory turnover = 22.3.
- 38.88%
 - 41.58%
 - 56.46%
 - 32.14%
 - 74.64%
9. U KNO, Inc. uses only debt and common equity funds to finance its assets. This past year the firm's return on total assets was 19%. The firm financed 30% percent of its assets using debt. What was the firm's return on common equity?
- 24.36%
 - 63.33%
 - 47.26%
 - 69.50%
 - 27.14%
10. Last year YYY Company had a 7.00% net profit margin based on \$24,000,000 in sales and \$13,000,000 of total assets. During the coming year, the president has set a goal of attaining a 14% return on total assets. How much must firm sales equal, other things being the same, for the goal to be achieved?
- \$28,529,800
 - \$24,000,000
 - \$29,777,020
 - \$26,000,000
 - \$21,535,200
11. Russell Securities has \$267 million in total assets and its corporate tax rate is 40%. The company recently reported that its basic earning power (BEP) ratio was 50% and its return on assets (ROA) was 13%. What was the company's interest expense? (Answers are in millions.)
- \$98.79
 - \$75.65
 - \$133.50
 - \$160.20
 - \$23.14

12. You are given the following information: Stockholders' equity = \$205 million; price/earnings ratio = 43; shares outstanding = 11,080,000; and market/book ratio = 6.75. Calculate the market price of a share of the company's stock..

- a. \$133.93
- b. \$18.50
- c. \$106.39
- d. \$124.89
- e. \$17.05

13. Strack Houseware Supplies Inc. has \$866 million in total assets. The other side of its balance sheet consists of \$95.26 million in current liabilities, \$251.14 million in long-term debt, and \$519.60 million in common equity. The company has 16,100,000 shares of common stock outstanding, and its stock price is \$59 per share. What is Strack's market-to-book ratio?

- a. 9.63
- b. 8.81
- c. 1.67
- d. 1.83
- e. 1.37

14. Moss Motors has \$108 million in assets, and its tax rate is 40%. The company's basic earning power (BEP) ratio is 42%, and its return on assets (ROA) is 11%. What is Moss' times-interest-earned (TIE) ratio?

- a. 0.77
- b. 0.46
- c. 1.77
- d. 2.00
- e. 0.36

15. The Wilson Corporation has the following relationships: Sales/Total assets = 3; Return on assets (ROA) = 15%; Return on equity (ROE) = 17%. What is Wilson's profit margin?

- a. 7.16%
- b. 5.67%
- c. 5.00%
- d. 8.89%
- e. 4.66%

16. Cleveland Corporation has 13,240,000 shares of common stock outstanding, its net income is \$241 million, and its P/E is 15.1. What is the company's stock price?

- a. \$13.37
- b. \$3,639.10
- c. \$15.96
- d. \$4,379.29
- e. \$274.86

17. A fire has destroyed a large percentage of the financial records of the Carter Company. You have the task of piecing together information in order to release a financial report. You have found the return on equity to be 25%. If sales were \$61,000,000, the debt ratio was 40%, and total liabilities were \$12,000,000, what would be the return on assets (ROA)?

- a. 8.33%
- b. 10.00%
- c. 16.56%
- d. 19.94%
- e. 15.00%

18. Peterson Packaging Corp. has \$2,072 million in total assets. The company's basic earning power (BEP) ratio is 13%, and its times-interest-earned ratio is 4.32. Peterson's depreciation and amortization expense totals \$73 million. It has \$55 million in lease payments and \$39 million must go towards principal payments on outstanding loans and long-term debt. What is Peterson's EBITDA coverage ratio?

- a. 1.94
- b. 7.03
- c. 4.11
- d. 2.54
- e. 3.45

19. The Wilson Corporation has the following relationships: Sales/Total assets = 5; Return on total assets (ROA) = 13%; Return on common equity (ROE) = 16%. What is Wilson's debt ratio?

- a. 93.25%
- b. 81.25%
- c. 6.75%
- d. 18.75%
- e. 103.51%

Use the following information to answer questions 20, 21, 22, and 23.

Balance Sheet

Current assets	
Cash	960,000
Acc receivable	
Inventories	1,440,000
Fixed assets	4,800,000
TOTAL ASSETS	8,000,000

Current liabilities	
Acc payable	
Long-term debt	3,200,000
Common stock	640,000
Retained earnings	3,160,000
TOTAL LIAB and EQUITY	8,000,000

Income Statement

Sales	24,000,000
Operating expense	18,240,000
EBIT	5,760,000
Interest expense	416,000
EBT	5,344,000
Taxes	2,138,000
Net income	3,206,000

20. What is the firm's days sales outstanding?

- a. 9.53
- b. 36.50
- c. 48.67
- d. 12.17
- e. 43.29

21. What is the firm's debt ratio?

- a. 87.50%
- b. 40.00%
- c. 47.50%
- d. 52.50%
- e. 92.00%

22. What is the firm's quick ratio?

- a. 0.42
- b. 3.20
- c. 2.40
- d. 1.76
- e. 0.76

23. What is the firm's return on common equity?

- a. 40.08%
- b. 500.94%
- c. 101.46%
- d. 84.37%
- e. 45.80%

Answers:

- 1. d
- 2. d
- 3. d
- 4. c
- 5. d
- 6. b
- 7. b
- 8. e
- 9. e
- 10. d
- 11. b
- 12. d
- 13. d
- 14. c
- 15. c
- 16. e
- 17. e
- 18. d
- 19. d
- 20. d
- 21. d
- 22. d
- 23. d

$$1. DSO = REC / (Sales / 365)$$

Last year

$$35 = (460,000) / (Sales / 365)$$

$$35(Sales / 365) = 460,000$$

$$(35 / 365)(Sales) = 460,000$$

$$Sales = 460,000 / (35 / 365)$$

$$Sales = 4,797,143$$

New

$$28 = (REC) / [(4,797,143) / (365)]$$

$$(28)[(4,797,143) / (365)] = REC$$

$$368,000 = REC$$

$$2. CR = CA / CL$$

Presently

$$4.4 = (6,556,000) / CL$$

$$4.4CL = 6,556,000$$

$$CL = (6,556,000) / (4.4)$$

$$CL = 1,490,000$$

Expand inventory (so current assets go up by X)

Using short-term liabilities (current liabilities) so CL go up by same amount (X)

Target

$$3.2 = (6,556,000 + X) / (1,490,000 + X)$$

$$3.2(1,490,000 + X) = 6,556,000 + X$$

$$4,768,000 + 3.2X = 6,556,000 + X$$

$$2.2X = 1,788,000$$

$$X = (1,788,000) / (2.2) = 812,727$$

$$3. ITR = Sales / INV$$

$$22.3 = (25,200,000) / (INV)$$

$$22.3INV = 25,200,000$$

$$INV = (25,200,000) / (22.3) = 1,130,045$$

$$CR = CA / CL$$

$$10.21 = CA / (290,000)$$

$$(10.21)(290,000) = 2,960,900$$

We are given that cash and marketable securities = 732,342

Current assets = cash and marketable securities + receivables + inventory

$$2,960,900 = 732,342 + REC + 1,130,045$$

$$REC = 1,098,513$$

$$DSO = REC / (Sales / 365)$$

$$DSO = (1,098,513) / (25,200,000 / 365)$$

$$DSO = 15.91$$

$$4. ROE = ROA(1/(1-DR))$$

39% of assets financed with equity, so 61% of assets financed with debt.

The debt ratio tells us what % of assets are financed with debt – so debt ratio = 61%.

$$ROE = (19\%)(1/(1-0.61)) = 48.72\%$$

$$5. ROE = ROA(1/(1-DR))$$

56% of assets are financed with debt (this is the debt ratio)

$$ROE = (8\%)(1/(1-0.56)) = 18.18\%$$

$$6. CR = CA/CL$$

Presently

$$4.5 = (8,505,000)/CL$$

$$4.5CL = 8,505,000$$

$$CL = (8,505,000)/(4.5)$$

$$CL = 1,890,000$$

Expand fixed assets (so current assets do not change)

Using short-term liabilities (current liabilities) so CL go up by X

Target

$$3.6 = (8,505,000)/(1,890,000+X)$$

$$3.6(1,890,000+X) = 8,505,000$$

$$6,804,000 + 3.6X = 8,505,000$$

$$3.6X = 1,701,000$$

$$X = (1,701,000)/(3.6) = 472,500$$

$$7. ITR = Sales/INV$$

$$22.30 = (25,200,000)/(INV)$$

$$22.30INV = 25,200,000$$

$$INV = 1,130,045$$

$$CR = CR/CL$$

$$10.21 = CA/(290,000)$$

$$CA = 2,960,900$$

$$QR = (CA - INV)/(CL)$$

$$QR = (2,960,900 - 1,130,045)/(290,000)$$

$$QR = 6.31$$

$$8. ROE = (NPM)(TATR)(1/(1-DR))$$

$$ROE = (11.88\%)(3.50)(1/(1-0.4429)) = ROE = 74.64\%$$

$$9. ROE = ROA(1/(1-DR))$$

Debt ratio = 30% since that % of assets are financed with debt

$$ROE = (19\%)(1/(1-0.30)) = 27.14\%$$

$$10. ROA = NI/TA$$

$$0.14 = (NI)/(13,000,000)$$

$$(0.14)(13,000,000) = NI$$

$$NI = 1,820,000$$

$$NPM = NI/Sales$$

$$0.07 = (1,820,000)/Sales$$

$$0.07Sales = 1,820,000$$

$$Sales = (1,820,000)/(0.07) = 26,000,000$$

$$11. ROA = NI/TA$$

$$0.13 = (NI)/(267,000,000)$$

$$NI = (0.13)(267,000,000) = 34,710,000$$

$$BEP = EBIT/TA$$

$$0.50 = (EBIT)/(267,000,000)$$

$$EBIT = (0.50)(267,000,000) = 133,500,000$$

$$NI = (EBIT - INT)(1 - T)$$

$$34,710,000 = (133,500,000 - INT)(1 - 0.40)$$

$$(34,710,000)/(1-0.40) = 133,500,000 - INT$$

$$57,850,000 = 133,500,000 - INT$$

$$75,650,000 = INT$$

$$12. \text{mkt-to-book} = (\text{market value of equity})/(\text{book value of equity})$$

Market value of equity = (shares outstanding)(price per share)

Book value of equity = total value of equity on balance sheet = stockholder's equity

$$\text{Mkt-to-book} = [(\text{shares})(\text{price})]/(\text{book value of equity})$$

$$6.75 = [(11,080,000)(\text{price})]/(205,000,000)$$

$$(6.75)(205,000,000) = (11,080,000)(\text{price})$$

$$1,383,750,000 = (11,080,000)(\text{price})$$

$$\text{Price} = (1,383,750,000)/(11,080,000) = 124.89$$

$$13. \text{mkt-to-book} = [(\text{shares})(\text{price})]/(\text{book value of equity})$$

$$\text{Mkt-to-book} = [(16,100,000)(59)]/(519,600,000) = 1.83$$

$$14. \text{BEP} = \text{EBIT}/\text{TA}$$

$$0.42 = (\text{EBIT})/(108,000,000)$$

$$\text{EBIT} = (0.42)(108,000,000) = 45,360,000$$

$$\text{ROA} = \text{NI}/\text{TA}$$

$$0.11 = (\text{NI})/(108,000,000)$$

$$\text{NI} = (0.11)(108,000,000) = 11,880,000$$

$$\text{NI} = (\text{EBIT} - \text{INT})(1 - T)$$

$$11,880,000 = (45,360,000 - \text{INT})(1 - 0.40)$$

$$(11,880,000)/(1 - 0.40) = 45,360,000 - \text{INT}$$

$$19,800,000 = 45,360,000 - \text{INT}$$

$$\text{INT} = 25,560,000$$

$$\text{TIE} = \text{EBIT}/\text{INT}$$

$$\text{TIE} = (45,360,000)/(25,560,000) = 1.77$$

$$15. \text{ROA} = (\text{NPM})(\text{TATR})$$

$$0.15 = (\text{NPM})(3)$$

$$\text{NPM} = (0.15)/(3) = 0.05 = 5\%$$

$$16. \text{PE ratio} = (\text{price per share})/(\text{earnings per share})$$

$$\text{Earnings per share} = \text{EPS} = (\text{net income})/(\text{shares outstanding})$$

$$\text{EPS} = (241,000,000)/(13,240,000) = 18.2024$$

$$\text{PE ratio} = (\text{price})/(\text{EPS})$$

$$15.1 = (\text{price})/(18.2024)$$

$$\text{Price} = (15.1)(18.2024) = 274.86$$

$$17. \text{ROE} = \text{ROA}(1/(1 - \text{DR}))$$

$$0.25 = \text{ROA}(1/(1 - 0.40))$$

$$\text{ROA} = (0.25)(1 - 0.40) = 0.15 = 15\%$$

$$18. \text{BEP} = \text{EBIT}/\text{TA}$$

$$0.13 = (\text{EBIT})/(2,072,000,000)$$

$$\text{EBIT} = (0.13)(2,072,000,000) = 269,360,000$$

$$\text{TIE} = \text{EBIT}/\text{INT}$$

$$4.32 = (269,360,000)/\text{INT}$$

$$4.32\text{INT} = 269,360,000$$

$$\text{INT} = (269,360,000)/(4.32) = 62,350,000$$

$$\text{EBITDA} = \text{EBIT} + \text{DA} = 269,360,000 + 73,000,000 = 342,360,000$$

$$\text{EBITDA coverage ratio} = (\text{EBITDA} + \text{lease pmts})/(\text{INT} + \text{prin pmts} + \text{lease pmts})$$

$$\text{EBITDA cov} = (342,360,000 + 55,000,000)/(62,350,000 + 39,000,000 + 55,000,000) = 2.54$$

$$\begin{aligned}
19. \text{ROE} &= \text{ROA}(1/(1-\text{DR})) \\
0.16 &= (0.13)(1/(1-\text{DR})) \\
(0.16)/(0.13) &= (1/(1-\text{DR})) \\
1.2308 &= (1/(1-\text{DR})) \\
(1.2308)(1-\text{DR}) &= 1 \\
1.2308 - 1.2308\text{DR} &= 1 \\
-1.2308\text{DR} &= -0.2308 \\
\text{DR} &= (-0.2308)/(-1.2308) = 0.1875 = 18.75\%
\end{aligned}$$

$$20. \text{DSO} = \text{REC}/(\text{Sales}/365)$$

In this problem:

$$\text{TA} = \text{Cash} + \text{REC} + \text{INV} + \text{FA}$$

$$8,000,000 = 960,000 + \text{REC} + 1,440,000 + 4,800,000$$

$$\text{REC} = 800,000$$

$$\text{DSO} = (800,000)/[(24,000,000)/(365)] = 12.17$$

$$21. \text{DR} = (\text{total debt})/(\text{total assets}) = (\text{total liabilities})/(\text{total assets})$$

In this problem:

$$\text{TL\&Eq} = \text{AccPay} + \text{LTD} + \text{Common stock} + \text{RE}$$

$$\text{Total liabilities} = \text{AccPay} + \text{LTD}$$

$$\text{TL\&Eq} = \text{total liabilities} + \text{Common stock} + \text{RE}$$

$$8,000,000 = \text{total liabilities} + 640,000 + 3,160,000$$

$$\text{Total liabilities} = 4,200,000$$

$$\text{DR} = (4,200,000)/(8,000,000) = 0.5250 = 52.50\%$$

$$22. \text{QR} = (\text{CA} - \text{INV})/\text{CL}$$

$$\text{Total assets} = \text{current assets} + \text{fixed assets}$$

$$8,000,000 = \text{current assets} + 4,800,000$$

$$\text{Current assets} = 3,200,000$$

$$\text{TL\&Eq} = \text{CL} + \text{LTD} + \text{total equity}$$

$$8,000,000 = \text{CL} + 3,200,000 + 640,000 + 3,160,000$$

$$\text{CL} = 1,000,000$$

$$\text{QR} = (3,200,000 - 1,440,000)/(1,000,000) = 1.76$$

$$23. \text{ROE} = \text{NI}/\text{CE}$$

$$\text{CE} = \text{total common equity} = \text{sum of all equity accounts}$$

In this problem:

$$\text{CE} = \text{common stock} + \text{RE} = 640,000 + 3,160,000 = 3,800,000$$

$$\text{ROE} = (3,206,000)/(3,800,000) = 0.8437 = 84.37\%$$

Chapter 5: Time Value of Money

Future Value

If you deposit \$100 in a savings account which pays 6% annual interest, what amount do you expect to have in the account at the end of the year?

\$100	(principal)
\$ 6	(interest=(.06)(100)=\$6)

\$106	(total)

How would we develop a general formula for determining future values of investments?

$$(\text{new}) = (\text{old})(1 + \% \text{change})$$

$$(\text{FV}) = (\text{PV})(1 + i)$$

Here: FV = future value (or new balance)
PV = present value (or initial balance)
i = interest rate (or % change)
For the example above,
 $\text{FV} = 100(1+.06) = \106

But what if we leave the money in the bank for two years?

Do we receive,	100	(principal)
	+ 6	(interest first year)
	<u>+ 6</u>	(interest second year)
	112	

!!!!!!! NO !!!!!!!! NO !!!!!!!! NO !!!!!!!! NO !!!!!!!! NO !!!!!!!!

In the second year, the interest received is based on the \$100 principal plus the interest already earned the first year. This is the notion of compound interest. In all periods after the first, we receive interest on the principal and interest on the previously earned interest.

So, at the end of the first year we would have:

$$\text{FV}_1 = (100)(1+.06) = \$106$$

and thus, at the end of the second year:

$$\text{FV}_2 = (106)(1+.06) = \$112.36$$

The additional \$0.36 is the amount of "interest-on-interest" we have earned. (6% of \$6.00)

For three years we would have: $\text{FV}_3 = (112.36)(1+.06) = \119.10

For four years: $\text{FV}_4 = (119.10)(1+.06) = \126.25

For five years: $\text{FV}_5 = (126.25)(1+.06) = \133.82

Think about what we are doing. To figure out what our balance will be at the end of any period, we just take what would have been in the bank one period earlier and multiply it times one plus the interest rate earned for the period. But to figure out what we had one period ago, we have to take what we had two periods ago and multiply it times one plus the interest rate, and so on ..., until we get back to the initial investment.

That's what we're saying with formulas below:

$$FV_5 = FV_4(1+i) = (126.25)(1+.06) = \$133.82$$

$$FV_4 = FV_3(1+i) = (119.10)(1+.06) = \$126.25$$

$$FV_3 = FV_2(1+i) = (112.36)(1+.06) = \$119.10$$

$$FV_2 = FV_1(1+i) = (106)(1+.06) = \$112.36$$

$$FV_1 = PV(1+i) = (100)(1+.06) = \$106$$

NOT TOO HARD, HUH? But what if we're going to leave the money in the bank for 20 or 30 years? Fortunately, we can develop a simple formula that's easy to use. First, let's start with the formula for five years.

$$FV_5 = FV_4(1+i) = (126.25)(1+.06) = \$133.82$$

But, $FV_4 = FV_3(1+i) = (119.10)(1+.06) = \126.25

So, $FV_5 = FV_3(1+i)(1+i) = (119.10)(1+.06)(1+.06)$

But, $FV_3 = FV_2(1+i) = (112.36)(1+.06) = \119.10

So, $FV_5 = FV_2(1+i)(1+i)(1+i) = (112.36)(1+.06)(1+.06)(1+.06)$

But, $FV_2 = FV_1(1+i) = (106)(1+.06) = \112.36

So, $FV_5 = FV_1(1+i)(1+i)(1+i)(1+i) = (106)(1+.06)(1+.06)(1+.06)(1+.06)$

But, $FV_1 = PV(1+i) = (100)(1+.06) = \106

So, $FV_5 = PV(1+i)(1+i)(1+i)(1+i)(1+i)$
 $= (100)(1+.06)(1+.06)(1+.06)(1+.06)(1+.06)$

$$FV_5 = PV(1+i)^5 = (100)(1+.06)^5 = (100)(1.3382) = \$133.82$$

What does the 1.3382 represent?

It equals 1 plus the % change for the entire five year period.

The general formula for determining a future value of a single amount is:

$$FV_n = PV(1+i)^n$$

where: FV_n = the future value at the end of n periods

PV = the amount initially invested

n = the number of periods

i = interest rate earned each period

The $(1+i)^n$ represents 1 plus the % change for the entire period the initial investment is allowed to grow.

Present Value

When we talk about present values of future cashflows, we will be using the same type analysis as previously. All we will do is rearrange the equation and solve for the present value (or initial amount) instead of the future value.

Now the question will be:

If we want to have \$106 in the bank at the end of one year and could get a 6% annual rate of interest, how much must we deposit today?

Remember, $FV_n = PV(1+i)^n$
 Here, $FV_1 = \$106$ and $i = 6\%$ and $n = 1$
 Thus,

$$106 = PV(1 + .06)^1$$

$$PV = (106) \left(\frac{1}{(1 + .06)^1} \right)$$

$$PV = (106)(.9434)$$

$$PV = \$100$$

This is the same as saying that at an annual discount rate (interest rate) of 6%, \$106 received one year from today is only worth \$100 in today's money because \$100 invested today would grow to be \$106 in one year. We can also say that the .9434 which we get by dividing 1 by one plus the interest rate tells us that \$1 received one year from now is only worth about 94¢ in today's money. Another way of interpreting this is to say that if we deposit 94¢ in the bank today earning 6% annual interest we will have approximately \$1 in the bank at the end of one year.

What if we wanted to know how much must be deposited now to have \$133.82 in the bank in five years?

$$FV_5 = PV(1+i)^5$$

$$133.82 = PV(1 + .06)^5$$

$$PV = (133.82) \left(\frac{1}{(1 + .06)^5} \right)$$

$$PV = (133.82)(.7473)$$

$$PV = \$100$$

All we do when we're solving for present values is rearrange the future value equation.

$$FV_n = PV(1+i)^n$$

$$PV = FV_n \left(\frac{1}{(1+i)^n} \right)$$

Non-annual Compounding

There is one other consideration of great importance. What happens when the interest is not compounded annually? What if the interest is compounded semi-annually? Well, first we need to define what compounding means. Compounding interest basically means paying the interest that is owed. So, if we deposit money in a bank that compounds interest semi-annually, that means that every six months they will pay into our account the amount of interest they owe us for that half of the year. Quarterly compounding means our account is credited with the interest earned each three months. Monthly compounding means the interest is credited every month, and so on.

The only problem with solving these type problems is that the interest rate is usually quoted on an annual basis. How do we figure out how much they owe us each compounding period. Well, if they're crediting our account every six months (semi-annual compounding), they would owe us six months out of the total twelve months worth of what they promised. If they tell us that the interest rate is 12% for the year, then they would owe us 6% every six months (or 3% every quarter for quarterly compounding, or 1% every month for monthly compounding).

This process requires that we determine how many times each year they will pay interest (e.g. quarterly compounding means every quarter, which is every three months, which means they will pay interest four times during the year). The number of times each year that interest will be paid is called the number of COMPOUNDING PERIODS each year. If we then divide the quoted annual interest rate (this is also called the NOMINAL INTEREST RATE) by the number of compounding periods during the year, we know how much interest should be paid each time interest is compounded. The interest paid each compounding period is known as the PERIODIC RATE OF INTEREST.

$$\text{periodic rate of interest} = \frac{\text{interest rate}}{\text{period}} = \frac{i_{\text{Nom}}}{m}$$

where : i_{Nom} = the quoted (nominal) annual interest rate

m = the number of compounding periods each year

But now when we compound interest more than once each year, we're using only a fraction of the promised annual interest in our calculations. How do we take care of this in our formulas we had earlier? Well, now we have to add up the TOTAL number of times interest will be paid. This number will be the number of years times the number of compounding periods EACH year. For example, what if we plan to leave our money in the bank for five years earning a quoted annual interest rate of 6%, but the interest will be compounded semi-annually. Well, that means that every six months (twice a year) the bank would credit our account with $(6\%)/2=3\%$ interest. But this 3% interest will be paid twice each year for all five years. So, what is really happening is that we're being paid 3% interest every six months for a total of $(5*2)=10$ times. In other words, there will be 10 compounding periods when our accounts would be credited with the 3% interest.

$$\text{total number of compounding periods} = n * m$$

where : n = number of years

m = number of compounding periods each year

Future value and present value problems, like we did earlier for annual compounding, can be easily adapted for non-annual compounding periods. We just have to remember to determine the INTEREST RATE PAID EACH COMPOUNDING PERIOD and the TOTAL NUMBER OF COMPOUNDING PERIODS.

$$FV_n = PV \left(1 + \frac{i}{m} \right)^{n*m}$$

$$PV = FV_n \left(\frac{1}{\left(1 + \frac{i}{m} \right)^{n*m}} \right)$$

where : i = the quoted annual interest rate

m = the number of compounding periods each year

n = the number of years

CALCULATOR

<u>calculator</u>	<u>formula</u>	<u>definition</u>
n	$n*m$	number of compounding periods
i	i/m	interest rate per compounding period
PV	PV	present (starting) value
FV	FV	future (ending) value

You can calculate any one of the four items if you know the other three.

To do so, enter any three and then:

- (a) **HP10B** - press the key for what you want to calculate
 (b) **BAII+** - press the CPT key and then the key for what you're calculating

*****NOTE*****

The calculators are programmed to accept PV to mean the amount you must "pay" now to receive a positive cashflow in the future (FV). For this reason when you calculate a PV the number you get will be negative. You should get in the habit of entering PV as a negative number. If you are calculating **i** or **n**, it is necessary to enter the **PV** as a negative number and the **FV** as a positive number.

EXAMPLES:

(A) calculate PV

What is the present value of \$2000 received 10 years from now if the interest rate you could have received is 7%?

keystrokes

2000	FV	
10	n	
7	i	
(BAII+)	CPT	PV)
(HP10B)	PV)	
Answer:	\$1016.70	

(B) calculate FV

What is the future value 10 years from now of \$2000 deposited today in an account which has a quoted annual interest rate of 10% with quarterly compounding of interest?

keystrokes

2000 **PV**
 40 **n** (10 years times 4 comp. periods per year)
 2.5 **i** (10% annually divided by 4 comp. periods per year)
 (BAII+ **CPT** **FV**)
 (HP10B **FV**)
 Answer: \$5370.13

(C) calculate i

What annual interest rate must you earn if you plan to deposit \$10,000 in the bank today and you want it to grow to be \$17,623.42 in 5 years?

keystrokes

-10000 **PV**
 5 **n**
 17623.42 **FV**
 (BAII+ **CPT** **i**)
 (HP10B **i**)
 Answer: 12%

(D) calculate n

If you deposit \$5000 in an account which earns 9% per year, how many years will it take for the investment to grow to be worth \$10,000?

keystrokes

-5000 **PV**
 9 **i**
 10000 **FV**
 (BAII+ **CPT** **n**)
 (HP10B **n**)
 Answer: 8.043 years

What happens to the actual interest rate earned each year if the interest is compounded more frequently than annually? Well, now we earn interest on interest quicker. Instead of having to wait an entire year to receive interest, we are paid part of the interest earlier in the year. Since that interest is earned, we will then in the next compounding period receive interest on the interest we just earned. For example, what if the bank offers us a quoted interest rate of 12% per year, but the interest will be compounded monthly. This means every month the bank will pay 1% interest on our account balance. But that means that the interest we receive at the end of the first month will have interest paid on it for the next eleven months, and the interest received at the end of the second month will have interest paid on it for the next ten months, and so on for the other interest payments. This means that we will actually receive more interest over the year than the quoted rate because we are receiving interest on interest during the year. To determine the EFFECTIVE ANNUAL INTEREST RATE (EAR):

$$\text{effective annual interest rate} = \left(1 + \frac{i_{\text{Nom}}}{m}\right)^m - 1$$

The effective annual interest rate will always be larger than the quoted interest rate whenever compounding of interest occurs more frequently than annually.

On the calculator:

n = the number of compounding periods in one year
i = interest rate per comp. period
PV = -100

Solve for **FV** and subtract 100 to get as the EAR.

Annuities

A compound annuity involves depositing a certain amount each period and letting it grow. What if we were to deposit \$500 at the end of each year in the bank and expect to earn 6% annual interest. What will the value of the account be at the end of five years?

First, let's draw a time-line to show the cashflows. (I recommend that you always do this when there is more than one cashflow involved.)

period	0	1	2	3	4	5
cashflows		500	500	500	500	500

How do we value these cashflows? We could value each one as we did earlier and then add the resulting values. But first, we have to determine how long each cashflow will earn interest.

How long will the \$500 deposited at the end of year one stay in the bank? Since it is not deposited until the end of the first year, it will only earn interest for four years. So, what is the future value of \$500 deposited for 4 years at 6% annual interest?

Using our FV formula it would be:

$$FV_4 = 500(1+.06)^4 = 500(1.262) = \$631.00$$

Similarly, the \$500 deposited at the end of year 2 will remain in the bank for only 3 years and so on, giving,

\$500 deposited at the end of year 2 (in bank 3 years)

$$FV_3 = 500(1+.06)^3 = 500(1.191) = \$595.50$$

\$500 deposited at the end of year 3 (in bank 2 years)

$$FV_2 = 500(1+.06)^2 = 500(1.124) = \$562.00$$

\$500 deposited at the end of year 4 (in bank 1 years)

$$FV_1 = 500(1+.06)^1 = 500(1.06) = \$530.00$$

\$500 deposited at the end of year 5 (in bank 0 years)

$$FV_0 = 500(1+.06)^0 = 500(1.000) = \$500.00$$

Thus, the future value of the annuity would be:

$$FV_{ann5} = 631 + 595.50 + 562 + 530 + 500 \\ = \$2818.50$$

This would be the same as adding all the various values together:

$$FV_{ann5} = 500(1+.06)^4 + 500(1+.06)^3 + 500(1+.06)^2 + 500(1+.06)^1 + 500(1+.06)^0$$

Factoring out the common value of \$500 we get:

$$FV_{ann5} = 500[(1+.06)^4 + (1+.06)^3 + (1+.06)^2 + (1+.06)^1 + (1+.06)^0]$$

Using the mathematical summation sign this can be written as:

$$FV_{\text{ann } 5} = 500 \left[\sum_{t=1}^5 (1+.06)^{5-t} \right]$$

Or in general,

$$FV_{\text{ann}}^n = \text{PMT} \left[\sum_{t=1}^n (1+i)^{n-t} \right]$$

where: PMT = amount deposited at the end of each year
 n = number of periods

NOTE: (The summation sequence has n-t as the power because the cash is assumed to always be deposited at the end of the year. In the above example the period is five years but the longest time any deposit is in the bank is 4 years (or 5-1 years).

Annuities in which the deposits (or payments) occur at the end of each period are called *ORDINARY ANNUITIES*.

What happens if the deposits occur at the beginning of each period? An annuity with payments that occur at the beginning of each period is called an *ANNUITY DUE*. Consider the following problem.

What is the future value at the end of year 5 of an annuity of \$500 per period if the deposits are made at the beginning of each period with the first deposit occurring today and the interest rate paid equals 6%?

period	0	1	2	3	4	5
cashflows		500	500	500	500	500

The only difference from the ordinary annuity is that with the annuity due each deposit will remain in the bank for an extra year and receive interest during that time.

Now with payments at the beginning of the year:

$$FV_{\text{ann due } 5} = 500(1+.06)^5 + 500(1+.06)^4 + 500(1+.06)^3 + 500(1+.06)^2 + 500(1+.06)^1$$

BEFORE, for the ordinary annuity with payments at the end of each period:

$$\begin{aligned} FV_{\text{ord ann } 5} &= 500(1+.06)^4 + 500(1+.06)^3 + 500(1+.06)^2 + 500(1+.06)^1 + 500(1+.06)^0 \\ &= 500 \left(\sum_{t=1}^5 (1+.06)^{5-t} \right) \end{aligned}$$

BUT, if we multiply the formula for the ordinary annuity by one plus the interest rate it will make each payment receive one more year of interest.

$$\begin{aligned} (FV_{\text{ord ann } 5})(1+.06) &= 500 \left(\sum_{t=1}^5 (1+.06)^{5-t} \right) (1+.06) \\ &= [500(1+.06)^4 + 500(1+.06)^3 + 500(1+.06)^2 + 500(1+.06)^1 + 500(1+.06)^0](1+.06) \\ &= 500(1+.06)^5 + 500(1+.06)^4 + 500(1+.06)^3 + 500(1+.06)^2 + 500(1+.06)^1 \\ &= FV_{\text{ann due } 5} \end{aligned}$$

Thus, the general formula for the future value of an annuity due is just the formula for an ordinary annuity multiplied by one plus the interest rate.

$$FV_{\text{ann due } n} = PMT \left(\sum_{t=1}^n (1+i)^{n-t} \right) (1+i)$$

Present values of annuities work very similarly. Use the same problem we started the annuity section with and determine the present value of the ordinary annuity.

period	0	1	2	3	4	5
cashflows		500	500	500	500	500

To determine the present value of the annuity, we simply need to determine the present value of each cashflow and add them together.

$$PV_{\text{ann}}^5 = 500 \left(\frac{1}{(1+.06)^1} \right) + 500 \left(\frac{1}{(1+.06)^2} \right) + 500 \left(\frac{1}{(1+.06)^3} \right) + 500 \left(\frac{1}{(1+.06)^4} \right) + 500 \left(\frac{1}{(1+.06)^5} \right)$$

OR,

$$PV_{\text{ann}}^5 = 500 \left(\sum_{t=1}^5 \left(\frac{1}{(1+.06)^t} \right) \right)$$

In general, the formula would be:

$$PV_{\text{ord ann}}^n = PMT \left(\sum_{t=1}^n \left(\frac{1}{(1+i)^t} \right) \right)$$

The only difference for the present value of an ANNUITY DUE is that since the payments occur at the beginning of each period, we will discount each payment one less year. We can change the formula to show this as we did before by multiplying the formula for the present value of an ordinary annuity by one plus the interest rate.

$$PV_{\text{ann due}}^n = PMT \left(\sum_{t=1}^n \left(\frac{1}{(1+i)^t} \right) \right) (1+i)$$

**** NOTE: The present value and future value of an annuity are related as a lump sum future or present value calculation.**

$$FV_{\text{ann}}^n = PV_{\text{ann}}^n (1+i)^n$$

For the ordinary annuity discussed previously,

$$FV_{\text{ord ann}}^5 = PV_{\text{ord ann}}^5 (1+.06)^5$$

Thus, $FV_{\text{ann}}^5 = 2106(1.338) = \2817.83

(The difference between this figure and the one found earlier is due to rounding error.)

CALCULATOR

n = number of payments
i = interest rate paid each payment period
PMT = payment (or deposit) amount
 SOLVE for either **PV** or **FV**

Your calculator allows you to solve for the PV or FV of either an ordinary annuity or an annuity due. You must make sure the calculator is in the correct "mode" for the type of annuity you are considering. The calculator has two annuities modes: Begin and End. The "begin" mode is used for an annuity due (begin means the payments are at the beginning of the period). The "end" mode is used for ordinary annuities (end means the payments are at the end of the period).

HP10B

To set the annuity mode, you press the **beg** key. If you are in the begin mode, the word begin will show up in the display.

BAII+

To set the annuity mode, you press:

2nd beg 2nd set

Uneven Cashflows

To get the future value of a stream of uneven cashflows, you simply add the future values of each separate cashflow. Likewise, this is true for present values.

EXAMPLES

1. What is the future value of the following stream of cash flows at the end of year 4 if the correct interest rate is 6%?

period	0	1	2	3	4
cashflows		100	200	-100	300

$$\begin{aligned}
 FV &= (100)(1+.06)^3 + (200)(1+.06)^2 + (-100)(1+.06)^1 + (300)(1+.06)^0 \\
 &= (100)(1.191) + (200)(1.124) + (-100)(1+.06) + (300)(1.0) \\
 &= \$537.90
 \end{aligned}$$

2. What is the present value of the above stream of cash flows?

$$\begin{aligned}
 PV &= 100 \left(\frac{1}{(1+.06)^1} \right) + 200 \left(\frac{1}{(1+.06)^2} \right) + (-100) \left(\frac{1}{(1+.06)^3} \right) + 300 \left(\frac{1}{(1+.06)^4} \right) \\
 &= 100(.943) + 200(.890) + (-100)(.840) + 300(.792) \\
 &= \$425.90
 \end{aligned}$$

CALCULATOR

The basic procedure for both calculators is to enter the cashflows, then the interest rate, and then use the net present value key (NPV) to get the answer.

HP10B

USE CF_j i NPV

EXAMPLE 1 from above

ENTRIES

2nd function Clear All (clears out cashflows)

0	CF _j	(nothing received now)	
100	CF _j	(year 1)	
200	CF _j	(year 2)	
100	+/- CF _j	(year 3)	
300	CF _j	(year 4)	
6	i	(interest rate)	
2 nd function	NPV	(answer)	\$426

(2nd function key is the solid yellow key)

BAIL+

USE CF CPT NPV
EXAMPLE 1 from above

ENTRIES			DISPLAY
CF	2 nd	CLR/Work	CF0=
0	ENTER	↓	C01=
100	ENTER	↓	F01=
1	ENTER	↓	C02=
200	ENTER	↓	F02=
1	ENTER	↓	C03=
100	+/- ENTER	↓	F03=
1	ENTER	↓	C04=
300	ENTER	↓	F04=
1	ENTER	↓	C05=
NPV			I=
6	ENTER	↓	NPV=
CPT		(answer)	\$426

The calculators have a shortcut method for entering equal CFs that occur several periods in a row. On the HP10B, you use the N_j (2nd function CF_j). On the BAIL+ you use the F0# entry to signify recurring equal CFs.

EXAMPLE 2: Suppose you are offered an investment which will pay you \$5000 per year for the next five years and then \$10,000 per year for the following ten years (years 6-15). If you believe the appropriate discount rate for this investment is 12%, what is the present value of the investment to you?

HP10B

ENTRIES		
2 nd function	Clear All	(clears out cashflows)
0	CF _j	(nothing received now)
5000	CF _j	(CF1)

5	2 nd function CF _j a row)	(N _j tells the calculator that the 5000 CF occurs five times in	
10000	CF _j	(CF2) (the calculator wants to know the next different CF)	
10	2 nd function CF _j in a row)	(N _j tells the calculator that the 10000 CF occurs ten times	
12	i	(interest rate)	
2 nd function	NPV	(answer)	\$50,084.76

(2nd function key is the solid yellow key)

BAIL+

ENTRIES			DISPLAY
CF	2 nd	CLR/Work	CF0=
0	ENTER	↓	C01=
5000	ENTER	↓	F01=
5	ENTER	↓	C02=
10000	ENTER	↓	F02=
10	ENTER	↓	C03=
NPV			I=
12	ENTER	↓	NPV=
CPT		(answer)	\$50,084.76

Finally, a *PERPETUITY* is an annuity that continues forever. These are the simplest cashflow streams to value. We simply divide the promised payment by the discount rate.

$$P_{v_{\text{perp}}} = \frac{\text{promised payment}}{\text{interest rate}}$$

EXAMPLE

Value a never ending annuity of \$100 per year if the correct interest rate (discount rate) is 10%.

$$P_{v_{\text{perp}}} = (100)/(.10) = \$1000$$

Amortized Loans

An important application of compound interest involves amortized loans, which are paid off in equal installments over time. Each payment consists partly of interest and partly of the repayment of principal. This breakdown is often developed in a loan amortization schedule.

- The interest component is largest in the first period, and it declines over the life of the loan.
- The repayment of principal is smallest in the first period, and it increases thereafter.
- Financial calculators are programmed to calculate amortization tables.

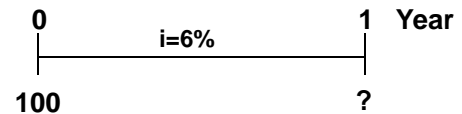
Spreadsheets are ideal for developing amortization tables

Chapter 5 Time Value of Money

- Future value
- Present value
- Rates of return

1

If you deposit \$100 in an account that pays 6% annual interest, what amount will you expect to have in the account at the end of the year.



2

Future value

\$100 (starting value = present value (PV))

6 (interest = $(0.06)(100) = 6$)

\$106 (ending value = future value (FV))

$$FV = PV + PV (\% \text{ change})$$

$$FV = PV (1 + \% \text{ change})$$

$$FV = PV (1 + i)$$

3

What if we leave the money for two years?

\$ 100 (present value (PV))

6 (interest = $100 \times 0.06 = 6$)

\$ 106 (future value year 1 (FV_1))

6.36 (interest = $106 \times 0.06 = 6.36$)

\$112.36 (future value year 2 (FV_2))

4

How do we come up with a formula for multiple periods?

$$106 = 100 (1 + 0.06)$$

$$FV_1 = PV (1 + i)$$

$$112.36 = 106 (1 + 0.06)$$

$$FV_2 = FV_1 (1 + i) \text{ (but from above)}$$

$$FV_2 = PV (1 + i) (1 + i)$$

$$FV_2 = PV (1 + i)^2$$

5

Future value

In general, for any number of periods:

$$FV_n = PV (1 + i)^n$$

If interest is compounded during the year, we change the formula to:

$$FV_n = PV (1 + i/m)^{n \times m}$$

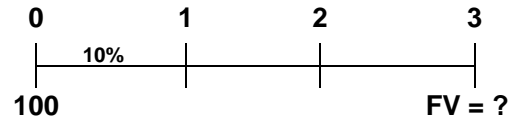
6

Four Ways to Find FVs

- Solve the equation (using a regular calculator).
- Use tables.
- Use a financial calculator.
- Use a spreadsheet.

7

What's the FV of an initial \$100 after 3 years if $i = 10\%$?



Finding FVs is **compounding**.

8

Solve Equation

$$\begin{aligned} FV_3 &= PV(1 + i)^3 \\ &= \$100(1.10)^3 = \$100(1.331) \\ &= \$133.10. \end{aligned}$$

On calculator:

$$\begin{aligned} 1.10 & \boxed{y^x} 3 \boxed{=} 1.331 \\ 100 & \boxed{\times} 1.331 \boxed{=} 133.10 \end{aligned}$$

9

Using tables

	2%	4%	6%	8%	10%
1	1.0200	1.0400	1.0600	1.0800	1.1000
2	1.0404	1.0816	1.1236	1.1664	1.2100
3	1.0612	1.1249	1.1910	1.2597	1.3310
4	1.0824	1.1699	1.2625	1.3605	1.4641
5	1.1041	1.2167	1.3382	1.4693	1.6105

$$FV_3 = PV (FVIF) = 100 (1.3310) = 133.10$$

10

Valuation using the calculator:

N = total number of periods

I = interest rate per period

PV = present value

FV = future value

11

BA II Plus

- **Initially:**
 - 2nd P/Y 1 ENTER CE/C
 - 2nd FORMAT 4 ENTER CE/C
- **To clear display:**
 - CE/C
- **To clear time value keys:**
 - 2nd CLR TVM
- **Enter values by typing the number and then pressing the key**

12

HP10BII

- (2nd indicates the second function key)
- Initially:
 - 1 2nd P/YR
 - 2nd DISP 4
- To clear display:
 - C
- To clear time value keys:
 - 2nd C ALL
- Enter values by typing the number and then pressing the key

13

TI-83

- Older versions:
 - 2nd Finance
- Newer versions:
 - APPS Finance
- Next Choose: TVM_Solver
- Be sure P/Y and C/Y at bottom are set equal to 1

14

Financial Calculator Solution

INPUTS 3 10 -100
N I/YR PV PMT FV
OUTPUT

Type numbers then hit key for BAII+ and HP10B Plus.
Type numbers beside corresponding item for TI-83 (use arrow keys to move)

15

Financial Calculator Solution

INPUTS 3 10 -100
N I/YR PV PMT FV
OUTPUT 133.10

To get answer:
BAII+: Press CPT and then key (FV)
HP10B Plus: Just press key (FV)
TI-83: Use arrow keys to put cursor next to item for which you are solving, then press Alpha Solve

16

Spreadsheet (Excel)

Formulas can be entered into spreadsheets to calculate the time value of money, or you can use available financial functions.

FV(rate,nper,pmt,pv,type)

- rate is the interest rate per period.
- nper is the number of periods.
- pmt is the payment amount per period.
- pv is the starting value.
- type indicates whether payments occur at the beginning or end of each period.

17

Spreadsheet (Excel)

- NOTE: pmt and type are for annuities. For lump sum problems set pmt equal to zero and ignore type.

Enter
=FV(0.1,3,0,-100)
\$133.10
Answer

18

Present value

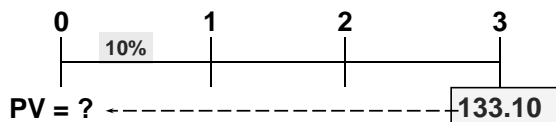
When we talk about present values of future cash flows, we use the same type of analysis.

All we do is rearrange the equation to solve for the present value.

19

What's the PV of \$133.10 due in 3 years if $i = 10\%$?

Finding PVs is discounting, and it's the reverse of compounding.



20

Solve $FV_n = PV(1 + i)^n$ for PV:

$$PV = \frac{FV_n}{(1 + i)^n} = FV_n \left(\frac{1}{1 + i} \right)^n$$

$$PV = \$133.10 \left(\frac{1}{1.10} \right)^3 = \$100(PVIF_{i,n})$$

$$= \$133.10(0.7513) = \$100$$

21

Financial Calculator Solution

INPUTS 3 10 0 133.10
N I/YR PV PMT FV
OUTPUT -100

This means that if you put in \$100 today earning 10% per year you would have \$133.10 after 3 years.

22

We will deal with 3 different rates:

i_{Nom} = nominal, or quoted, or stated rate per year.

i_{Per} = periodic rate.

EAR = EFF% = effective annual rate

23

What is the FV of \$100 after 3 years under 10% semiannual compounding?

INPUTS 3x2 10/2 -100
N I/YR PV PMT FV
OUTPUT 134.01

24

What is the PV of \$500 received in 3 years under 10% semiannual compounding?

INPUTS	3x2	10/2			500
	N	I/YR	PV	PMT	FV
OUTPUT			373.11		

25

- Effective Annual Rate (EAR = EFF%):
The annual rate that causes PV to grow to the same FV as under multi-period compounding.

$$EFF = \left(1 + \frac{i_{Nom}}{m}\right)^m - 1$$

$$= \left(1 + \frac{0.10}{2}\right)^2 - 1.0$$

$$= (1.05)^2 - 1.0$$

$$= 0.1025 = 10.25\%.$$

26

Will the FV of a lump sum be larger or smaller if we compound more often, holding the stated I% constant? Why?

LARGER! If compounding is more frequent than once a year--for example, semiannually, quarterly, or daily--interest is earned on interest more often.

27

Will the PV of a lump sum be larger or smaller if we compound more often, holding the stated I% constant? Why?

SMALLER! If compounding is more frequent than once a year--for example, semiannually, quarterly, or daily--interest is earned on interest more often so you can start with a smaller amount and reach the same goal in the same amount of time.

28

On a financial calculator:

INPUTS	2	10/2	-100		
	N	I/YR	PV	PMT	FV
OUTPUT					110.25

$$EAR = 110.25 - 100 = 10.25\%$$

Any PV would grow to same FV at 10.25% annually or 10% semiannually.

The EAR is used to compare returns on investments with different compounding.

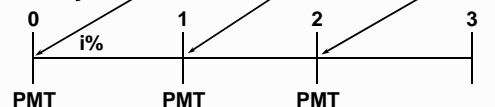
29

Annuities are sets of equal payments received at equal time intervals.

Ordinary Annuity

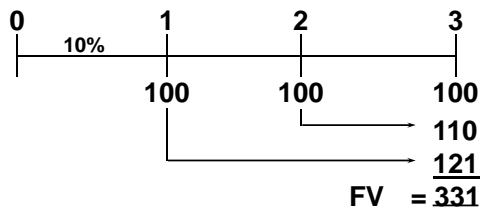


Annuity Due



30

What's the FV of a 3-year ordinary annuity of \$100 at 10%?



31

Annuity Valuation using the calculator:

N = total number of payments

I = interest rate per payment period

PV = present value

FV = future value

PMT = payment each period

END MODE for ordinary annuity

BEGIN MODE for annuity due

32

Begin/End Mode

- **BAII Plus:**
 - 2nd BGN 2nd Set CE/C
- **HP 10B Plus**
 - 2nd BEG/END
- **TI-83**
 - At bottom of time value screen:
 - Use arrows keys to highlight Begin or End and then press ENTER key

33

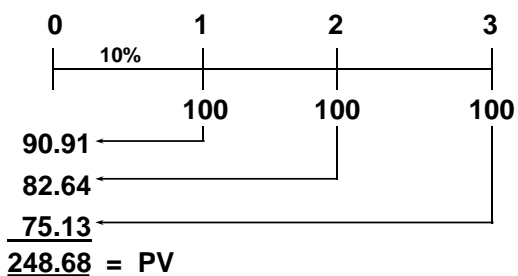
Financial Calculator Solution

INPUTS	3	10		-100	
	N	I/YR	PV	PMT	FV
OUTPUT					331.00

You should be in “end” mode when you calculate the answer.

34

What's the PV of this ordinary annuity?



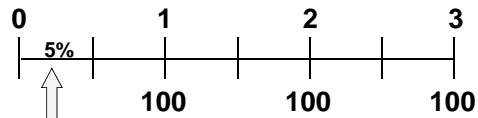
35

INPUTS	3	10		100	
	N	I/YR	PV	PMT	FV
OUTPUT			-248.69		

Again, make sure you are in “end” mode when you calculate the answer.

36

What's the value at the end of Year 3 of the following CF stream if the quoted interest rate is 10%, compounded semiannually?



10% compounded semiannually is 5% each ½ year.

37

a. The cash flow stream is an annual annuity. First find EAR.

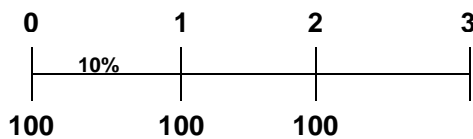
$$EAR = \left(1 + \frac{0.10}{2}\right)^2 - 1 = 10.25\%$$

b. Calculate FV using EAR as interest rate.

INPUTS	3	10.25	-100		
	N	I/YR	PV	PMT	FV
OUTPUT					331.80

38

Find the FV and PV if the annuity were an annuity due with annual compounding of interest.



39

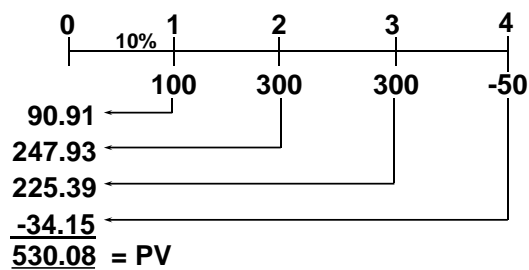
Switch from "End" to "Begin."

INPUTS	3	10	100		
	N	I/YR	PV	PMT	FV
OUTPUT					\$364.10

INPUTS	3	10	100		
	N	I/YR	PV	PMT	FV
OUTPUT			-273.55		

40

What is the PV of this uneven cash flow stream?



41

▪ Input in "CFLO" register:

$$CF_0 = 0$$

$$CF_1 = 100$$

$$CF_2 = 300$$

$$CF_3 = 300$$

$$CF_4 = -50$$

▪ Enter I = 10, then press NPV button to get NPV = \$530.09. (Here NPV = PV)

▪ TI-83:

▪ npv(10,0,{100,300,300,-50}) Enter

42

Uneven cashflows

- Suppose you are offered an investment that pays \$10,000 per year the first 8 years, \$20,000 per year the next 12 years, and \$30,000 per year the following 15 years. If the appropriate discount rate is 9%, what is the present value of the investment?

43

- Input in "CFLO" register:

$$CF_0 = 0$$

$$CF_1 = 10000 \quad \text{Frequency} = 8$$

$$CF_2 = 20000 \quad \text{Frequency} = 12$$

$$CF_3 = 30000 \quad \text{Frequency} = 15$$

- Enter I = 9, then press NPV button to get NPV = \$170,371
- TI-83:
npv(10,0,{10000,20000,30000},{8,12,15})
Enter

44

Uneven cashflows

- Suppose you are offered an investment that pays \$10,000 per year the first 8 years, \$20,000 per year the next 12 years, and \$30,000 per year the following 15 years. If you invest all of the cashflows at an annual interest rate of 9%, what will be the future value of the cashflows at the end of the 35 years?

45

Future value of uneven cashflows

- We first calculate the PV of the uneven CFs, and then calculate the FV.
- From previous problem we have:
 - PV = 170,371

INPUTS		35	9	-170371		
	N	I/YR	PV	PMT	FV	
OUTPUT						3,477,948.13

46

Chapter 5 - Sample Problems

1. If you wish to accumulate \$140,000 in 13 years, how much must you deposit today in an account that pays an annual interest rate of 14%?
2. What will \$247,000 grow to be in 9 years if it is invested today in an account with an annual interest rate of 11%?
3. How many years will it take for \$136,000 to grow to be \$468,000 if it is invested in an account with an annual interest rate of 8%?
4. At what annual interest rate must \$137,000 be invested so that it will grow to be \$475,000 in 14 years?
5. If you wish to accumulate \$197,000 in 5 years, how much must you deposit today in an account that pays a quoted annual interest rate of 13% with semi-annual compounding of interest?
6. What will \$153,000 grow to be in 13 years if it is invested today in an account with a quoted annual interest rate of 10% with monthly compounding of interest?
7. How many years will it take for \$197,000 to grow to be \$554,000 if it is invested in an account with a quoted annual interest rate of 8% with monthly compounding of interest?
8. At what quoted annual interest rate must \$134,000 be invested so that it will grow to be \$459,000 in 15 years if interest is compounded weekly?
9. You are offered an investment with a quoted annual interest rate of 13% with quarterly compounding of interest. What is your effective annual interest rate?
10. You are offered an annuity that will pay \$24,000 per year for 11 years (the first payment will occur one year from today). If you feel that the appropriate discount rate is 13%, what is the annuity worth to you today?
11. If you deposit \$16,000 per year for 12 years (each deposit is made at the end of each year) in an account that pays an annual interest rate of 14%, what will your account be worth at the end of 12 years?
12. You plan to borrow \$389,000 now and repay it in 25 equal annual installments (payments will be made at the end of each year). If the annual interest rate is 14%, how much will your annual payments be?
13. You are told that if you invest \$11,000 per year for 23 years (all payments made at the end of each year) you will have accumulated \$366,000 at the end of the period. What annual rate of return is the investment offering?
14. You are offered an annuity that will pay \$17,000 per year for 7 years (the first payment will be made today). If you feel that the appropriate discount rate is 11%, what is the annuity worth to you today?
15. If you deposit \$15,000 per year for 9 years (each deposit is made at the beginning of each year) in an account that pays an annual interest rate of 8%, what will your account be worth at the end of 9 years?
16. You plan to accumulate \$450,000 over a period of 12 years by making equal annual deposits in an account that pays an annual interest rate of 9% (assume all payments will occur at the beginning of each year). What amount must you deposit each year to reach your goal?

17. You are told that if you invest \$11,100 per year for 19 years (all payments made at the beginning of each year) you will have accumulated \$375,000 at the end of the period. What annual rate of return is the investment offering?
18. You plan to buy a car that has a total "drive-out" cost of \$25,700. You will make a down payment of \$3,598. The remainder of the car's cost will be financed over a period of 5 years. You will repay the loan by making equal monthly payments. Your quoted annual interest rate is 8% with monthly compounding of interest. (The first payment will be due one month after the purchase date.) What will your monthly payment be?
19. You are considering leasing a car. You notice an ad that says you can lease the car you want for \$477.00 per month. The lease term is 60 months with the first payment due at inception of the lease. You must also make an additional down payment of \$2,370. The ad also says that the residual value of the vehicle is \$20,430. After much research, you have concluded that you could buy the car for a total "drive-out" price of \$33,800. What is the quoted annual interest rate you will pay with the lease?
20. You are valuing an investment that will pay you \$12,000 the first year, \$14,000 the second year, \$17,000 the third year, \$19,000 the fourth year, \$23,000 the fifth year, and \$29,000 the sixth year (all payments are at the end of each year). What is the value of the investment to you now if the appropriate annual discount rate is 11.00%?
21. You are valuing an investment that will pay you \$27,000 per year for the first ten years, \$35,000 per year for the next ten years, and \$48,000 per year the following ten years (all payments are at the end of each year). If the appropriate annual discount rate is 9.00%, what is the value of the investment to you today?
22. John and Peggy recently bought a house. They financed the house with a \$125,000, 30-year mortgage with a nominal interest rate of 7 percent. Mortgage payments are made at the end of each month. What total dollar amount of their mortgage payments during the first three years will go towards repayment of principal?
23. You are valuing an investment that will pay you \$26,000 per year for the first 9 years, \$34,000 per year for the next 11 years, and \$47,000 per year the following 14 years (all payments are at the end of each year). Another similar risk investment alternative is an account with a quoted annual interest rate of 9.00% with monthly compounding of interest. What is the value in today's dollars of the set of cash flows you have been offered?
24. You have just won the Georgia Lottery with a jackpot of \$40,000,000. Your winnings will be paid to you in 26 equal annual installments with the first payment made immediately. If you feel the appropriate annual discount rate is 8%, what is the present value of the stream of payments you will receive?
25. You have just won the Georgia Lottery with a jackpot of \$11,000,000. Your winnings will be paid to you in 26 equal annual installments with the first payment made immediately. If you had the money now, you could invest it in an account with a quoted annual interest rate of 9% with monthly compounding of interest. What is the present value of the stream of payments you will receive?
26. You are planning for retirement 34 years from now. You plan to invest \$4,200 per year for the first 7 years, \$6,900 per year for the next 11 years, and \$14,500 per year for the following 16 years (assume all cash flows occur at the end of each year). If you believe you will earn an effective annual rate of return of 9.7%, what will your retirement investment be worth 34 years from now?

27. You plan to retire 33 years from now. You expect that you will live 27 years after retiring. You want to have enough money upon reaching retirement age to withdraw \$180,000 from the account at the beginning of each year you expect to live, and yet still have \$2,500,000 left in the account at the time of your expected death (60 years from now). You plan to accumulate the retirement fund by making equal annual deposits at the end of each year for the next 33 years. You expect that you will be able to earn 12% per year on your deposits. However, you only expect to earn 6% per year on your investment after you retire since you will choose to place the money in less risky investments. What equal annual deposits must you make each year to reach your retirement goal?

Solutions to Sample Problems

(These solutions assume you have periods per year set equal to one.)

1. $n = 13$

$i = 14$

$FV = 140000$

solve for PV (answer = \$25,489.71)

2. $n = 9$

$i = 11$

$PV = -247000$

solve for FV (answer = \$631,835.12)

3. $i = 8$

$PV = -136000$

$FV = 468000$

solve for n (answer = 16.06 years)

4. $n = 14$

$PV = -137000$

$FV = 475000$

solve for i (answer = 9.29%)

5. $n = 10$ (5 years times 2 comp. periods per year)

$i = 6.5$ (13% annually divided by 2 comp. period per year)

$FV = 197000$

solve for PV (answer = \$104,947.03)

6. $n = 156$ (13 years times 12 comp. periods per year)

$i = 0.833333$ (10% annually divided by 12 comp. periods per year)

$PV = -153,000$

solve for FV (answer = \$558,386.38)

7. $i = 0.666667$ (8% annually divided by 12 comp. periods per year)

$PV = -197000$

$FV = 554000$

solve for n (answer on calculator = 155.61)

Since the interest rate was entered as a monthly rate, the answer for n is in months.

The number of years equals the number of months divided by twelve.

Number of years = $(155.61)/12 = 12.97$ years

8. $n = 780$ (15 years times 52 comp. periods per year)

$PV = -134,000$

$FV = 459,000$

solve for i (answer on calculator = 0.157972)

Since the number of periods was entered as weeks, the answer for i is the weekly rate.

The annual rate equals the weekly rate times 52.

Annual rate = $(0.157972\%)(52) = 8.21\%$

9. $n = 4$ (number of comp. periods in one year)

$i = 3.25$ (13% annually divided by 4 comp. periods in one year)

$PV = -100$

solve for FV (answer = 113.65)

Subtract the 100 (percent) you initial had to get the EAR.

$EAR = 113.65 - 100 = 13.65\%$

10. $n = 11$

$i = 13$

$PMT = -24000$

Make sure you are in end mode.

solve for PV (answer = \$136,486.59)

11. $n = 12$

$i = 14$

$PMT = 16000$

Make sure you are in end mode.

solve for FV (answer = \$436,331.98)

12. $n = 25$

$i = 14$

$PV = -389000$

Make sure you are in end mode.

solve for PMT (answer = \$56,598.88)

13. $n = 23$

$FV = 366000$

$PMT = -11000$

Make sure you are in end mode.

solve for i (answer = 3.21%)

14. $n = 7$

$i = 11$

$PMT = 17000$

Make sure you are in begin mode.

solve for PV (answer = \$88,919.14)

15. $n = 9$

$i = 8$

$PMT = 15000$

Make sure you are in begin mode.

solve for FV (answer = \$202,298.44)

16. $n = 12$
 $i = 9$
 $FV = 450000$
 Make sure you are in begin mode.
 solve for PMT (answer = \$20,497.98)

17. $n = 19$
 $FV = 375000$
 $PMT = -11100$
 Make sure you are in begin mode.
 solve for i (answer = 5.48%)

18. $n = 60$ (5 years times 12 payments per year)
 $i = 0.6667$ (8% annually divided by 12 payments per year)
 $PV = -22102$ (\$25,700 price minus down payment of \$3,598)
 Make sure you are in end mode.
 solve for PMT (answer = \$448.15)

19. $n=60$ (total number of payments)
 $PV = -31430$ (price of \$33,800 minus \$2,370 down payment)
 $FV = 20,430$ (residual value)
 $PMT = 477$
 Make sure you are in begin mode.
 solve for i (answer on calculator = 1.122834%)
 Since the number of periods was entered as months, the answer for i is the monthly rate.
 The annual rate equals the monthly rate times 12.
 Annual rate = $(1.122834\%)(12) = 13.47\%$

20. $CF_0 = 0$
 $C_01 = 12000$
 $C_02 = 14000$
 $C_03 = 17000$
 $C_04 = 19000$
 $C_05 = 23000$
 $C_06 = 29000$
 $i = 11$
 $NPV = \$76,273.63$

TI83: $npv(11,0,\{12000,14000,17000,19000,23000,29000\})$

21. $CF_0 = 0$
 $C_01 = 27000$
 $F_01(N_j) = 10$
 $C_02 = 35000$
 $F_02(N_j) = 10$
 $C_03 = 48000$
 $F_03(N_j) = 10$
 $i = 9$
 $NPV = \$323,123.04$

TI83: $npv(9,0,\{27000,35000,48000\},\{10,10,10\})$

22.

First, determine the monthly payment.

$n = 360$ (30 years times 12 payments per year)

$i = 0.5833$ (7% annually divided by 12 payment per year)

$PV = 125000$

Make sure you are in end mode.

solve for PMT (answer = \$831.6281)

Second, solve for the outstanding principal after three years.

$n = 324$ (360 total payments minus 36 payments made)

$i = 0.5833$ (7% annually divided by 12 payment per year)

$PMT = 831.6281$

Make sure you are in end mode

solve for PV (answer = \$120,908.70)

Principal repaid = starting balance minus current balance

Principal repaid = $\$125,000 - \$120,908.70 = \$4,091.30$

Interest paid = total of payments made – principal repaid

Interest paid = $(36)(\$831.6281) - \$4,091.30 = \$29,938.61 - \$4,091.30 = \$25,847.31$

23.

Since the payments occur annually, but the interest is compounded monthly, we first must calculate the effective annual interest rate.

$n = 12$ (number of comp. periods in one year)

$i = 0.75$ (9% annually divided by 12 comp. periods in one year)

$PV = -100$

solve for FV (answer = 109.3807)

Subtract the 100 (percent) you initial had to get the EAR.

$EAR = 109.3807 - 100 = 9.3807\%$

Now calculate the PV of the cash flows using the EAR as the discount rate.

$CF_0 = 0$

$C_1 = 26000$

$F_1(N_j) = 9$

$C_2 = 34000$

$F_2(N_j) = 11$

$C_3 = 47000$

$F_3(N_j) = 14$

$i = 9.3807$

$NPV = \$314,517.85$

TI83: $npv(9.3807, 0, \{26000, 34000, 47000\}, \{9, 11, 14\})$

24.

$n = 26$

$i = 8$

$PMT = (40,000,000)/(26)$

Make sure you are in begin mode.

solve for PV (answer = \$17,961,194.14)

25. Since the payments occur annually, but the interest is compounded monthly, we first must calculate the effective annual interest rate.

$n = 12$ (number of comp. periods in one year)

$i = 0.75$ (9% annually divided by 12 comp. periods in one year)

$PV = -100$

solve for FV (answer = 109.3807)

Subtract the 100 (percent) you initial had to get the EAR.

$EAR = 109.3807 - 100 = 9.3807\%$

Now calculate the PV of the cash flows using the EAR as the discount rate.

$n = 26$

$i = 9.3807$

$PMT = (11,000,000)/(26)$

Make sure you are in begin mode.

solve for PV (answer = \$4,453,789.97)

26. Since we do not have a NFV key, we have to solve this problem in two steps. First, calculate the PV of the uneven cash flows. Second, calculate the future value as a lump sum problem.

$CF_0 = 0$

$C_01 = 4200$

$F_01(N_j) = 7$

$C_02 = 6900$

$F_02(N_j) = 11$

$C_03 = 14500$

$F_03(N_j) = 16$

$i = 9.7$

$NPV = \$66,239.9844$

TI83: $npv(9.7, 0, \{4200, 6900, 14500\}, \{7, 11, 16\})$

$n = 34$

$i = 9.7$

$PV = -66239.9844$

solve for FV (answer = \$1,542,217.26)

27. You must solve this problem in two steps. First, calculate the PV at the time of retirement of the amount needed to give you the annuity and remaining sum wanted. Second, calculate the payment necessary each year over the period from now until retirement to generate the goal.

$n = 27$

$i = 6$

$FV = 2500000$

$PMT = 180000$

solve for PV (answer: = \$3,038,989.79)

(make sure you are in begin mode)

$n = 33$

$i = 12$

$FV = 3038989.79$

solve for PMT (answer: = \$8,874.79)

(make sure you are in end mode)

Chapter 7: Bonds and Their Valuation

Who Issues Bonds

A bond is a long-term contract under which a borrower agrees to make payments of interest and principal, on specific dates, to the holders of the bond. There are four main types of bonds: Treasury, corporate, municipal, and foreign. Each type differs with respect to expected return and degree of risk.

- Treasury bonds, sometimes referred to as government bonds, are issued by the Federal government and are not exposed to default risk. However, Treasury bond prices decline when interest rates rise, so they are not free of all risk.
- Corporate bonds are issued by corporations and are exposed to default risk. Different corporate bonds have different levels of default risk, depending on the issuing company's characteristics and on the terms of the specific bond.
- Municipal bonds are issued by state and local governments. The interest earned on most municipal bonds is exempt from federal taxes and also from state taxes if the holder is a resident of the issuing state.
- Foreign bonds are issued by foreign governments or foreign corporations. These bonds are not only exposed to default risk, but are also exposed to an additional risk if the bonds are denominated in a currency other than that of the investor's home currency.

Key Characteristics of Bonds

Differences in contractual provisions, and in the underlying strength of the companies backing the bonds, lead to major differences in bonds' risks, prices, and expected returns. It is important to understand both the key characteristics, which are common to all bonds, and how differences in these characteristics affect the values and risks of individual bonds.

- The par value is the stated face value of a bond, usually \$1,000. This is the amount of money that the firm borrows and promises to repay on the maturity date.
- The coupon payment is the dollar amount that is paid each period to a bondholder by the issuer for use of the \$1,000 loan. This payment is a fixed amount, established at the time the bond is issued. The coupon interest rate is obtained by dividing the coupon payment by the par value of the bond.
 - In some cases, a bond's coupon payment may vary over time. These bonds are called floating rate bonds. Zero coupon bonds pay no coupons at all, but are offered at a substantial discount below their par values and hence provide capital appreciation rather than interest income. In general, any bond originally offered at a price significantly below its par value is called an original issue discount bond (OID).
- The maturity date is the date on which the par value must be repaid. Most bonds have original maturities of from 10 to 40 years, but any maturity is legally permissible. Original maturity is the number of years to maturity at the time a bond is issued.
- Most bonds contain a call provision, which gives the issuing corporation the right to call the bonds for redemption under specified terms prior to the normal maturity date. The call provision generally states that if the bonds are called, the company must pay the bondholders an amount greater than the par value, a call premium. The process of using the proceeds of a new low-rate bond issue to retire a high-rate issue and reduce the firm's interest expense is called a refunding operation.

- A sinking fund provision facilitates the orderly retirement of a bond issue. This can be achieved in one of two ways, and the firm will choose the least-cost method. The company can call in for redemption (at par value) a certain percentage of bonds each year. The company may buy the required amount of bonds on the open market.
- Convertible bonds are securities that are exchangeable into shares of common stock, at a fixed price, at the option of the bondholder.
- Bonds issued with warrants are similar to convertibles. Warrants are options that permit the holder to buy stock for a stated price, thereby providing a capital gain if the stock price rises.

Bond Valuation

The value of any financial asset is simply the present value of the cash flows the asset is expected to produce. The cash flows from a specific bond depend on its contractual features.

Suppose Jags, Inc. plans to bonds with a par value of \$1000 that will be paid 10 years from now. The bond will have an annual coupon rate of 10% (this means it will pay $(1000 \times 0.10) = \$100$ in interest each year). If we know that bonds similar in risk to this one earn an annual rate of return of 12%, what is current value of Jags' bonds?

Based on what we learned in the last chapter, we know that the value of any asset is the present value of all cash flows. In this case, the present value is calculated using the 12% rate that similar bonds earn as the discount rate. The process is shown below.

Year	Interest	Par value	PV(Interest)	PV(Par)
1	\$100		89.29	
2	100		79.72	
3	100		71.18	
4	100		63.55	
5	100		56.74	
6	100		50.66	
7	100		45.23	
8	100		40.39	
9	100		36.06	
10	100	\$1000	32.20	321.97
Total PV(CFs) = Value of the bond = \$886.99				

A bond represents an annuity plus a lump sum, and its value is found as the present value of this payment stream:

$$V_B = \sum_{t=1}^N \frac{INT}{(1 + k_d)^t} + \frac{M}{(1 + k_d)^N}$$

$$= INT(PVIFA_{k_d, N}) + M(PVIF_{k_d, N})$$

Here V_B = value of the bond, INT = dollars of interest paid each year, M = par, or maturity, value, which is typically \$1,000, k_d = market interest rate on the bond, and N = number of years until the bond matures.

Using the formula for the above example, we have:

$$\text{BondValue} = 100 \left(\sum_{t=1}^{10} \left(\frac{1}{(1 + .12)^t} \right) \right) + 1000 \left(\frac{1}{(1 + .12)^{10}} \right)$$

Bonds with Semi-Annual Coupons

The bond valuation model must be adjusted when interest is paid semiannually:

$$V_B = \sum_{t=1}^{2N} \frac{INT/2}{(1 + k_d/2)^t} + \frac{M}{(1 + k_d/2)^{2N}}$$

With a financial calculator, it is easy to determine the value of a bond. You simply enter,

N = number of times interest will be paid

I = appropriate interest for the bond for each period interest is paid

FV = par value of the bond

PMT = interest paid each period

and then ask the calculator to calculate the PV of the bond.

For example, for Jags, Inc. bonds above:

N = 10; I = 12; FV = 1000; PMT = 100;

and then calculate PV and your answer should be approximately \$886.99.

Bond prices and interest rates are inversely related; that is, they tend to move in the opposite direction from one another. Interest rates do change over time, but for a fixed-rate bond the coupon rate remains fixed after the bond has been issued.

- A fixed-rate bond will sell at par when its coupon interest rate is equal to the going rate of interest, k_d .
- A discount bond is a bond that sells below its par value, when the going rate of interest rises above the coupon rate.
- A premium bond is a bond that sells above its par value, when the going rate of interest falls below the coupon rate.
- Your percentage rate of return on a bond consists of an interest yield, or current yield, plus a capital gains yield.
- The market value of a bond will always approach its par value as its maturity date approaches, provided the firm does not go bankrupt.

Bond Yields

Unlike the coupon interest rate, which is fixed, a bond's yield varies from day to day depending on current market conditions. The expected interest rate on a bond, also called its "yield," can be calculated in a variety of different ways.

The *yield to maturity (YTM)* on a bond is the rate of return you would earn if you bought the bond and held it until maturity. In other words, it is the discount rate that makes the selling price equal the present value of the interest payments plus the present value of the par value. The YTM for a bond that sells at par consists entirely of an interest yield, but if the bond sells at a price other than its par value, the YTM consists of the interest yield plus a positive or negative capital gains yield. The yield to maturity can also be viewed as the bond's promised rate of return. The yield to maturity equals the expected rate of return only if the probability of default is zero and the bond cannot be called.

Suppose you are considering buying bonds from the BIG PHONE COMPANY which have a face value of \$1000 to be paid in 20 years and an annual coupon rate of 8%. The bond is currently selling for \$1,229.40. What rate of return would you be receiving if you buy the bond and hold it until maturity?

Fill in what you know into the bond valuation formula.

$$1,229.40 = 80 \left(\sum_{t=1}^{20} \left(\frac{1}{(1 + R_d)^t} \right) \right) + 1000 \left(\frac{1}{(1 + R_d)^{20}} \right)$$

The only variable we do not know is k_d . Whatever discount rate makes the present value of receiving \$80 each year for 20 years plus the present value of \$1000 to be received 20 years from now equal \$1,229.40 is the rate we would earn on the bond. In other words, if I deposit \$1,229.40 in the bank today, and want to be able to withdraw \$80 at the end of each year for the next 20 years and also withdraw an additional \$1000 at the end of the twentieth year, what rate of interest would I have to earn for this to be possible?

These calculations are a guessing game without a financial calculator. However, they are very simple with one. In this case, ENTER

$n=20$; $PV=-1,229.40$; $FV=1000$; $PMT=80$;

and ask the calculator to compute what i equals.

Your answer should be close to 6%.

Many bonds have a call provision that allows the issuer to buy back the bonds prior to the maturity date. This is included to allow the firm to refinance its debt if interest rates go down. If current interest rates are well below an outstanding bond's coupon rate, then a callable bond is likely to be called, and investors should estimate the expected rate of return on the bond as the yield to-call (YTC) rather than as the yield to maturity.

If the firm does call the bonds, you would not have the option to hold the bonds to maturity and would therefore not earn the yield to maturity. Instead, you would receive what is referred to as the *yield to call*. To calculate the yield to call on a bond, you follow the same procedure as for the yield to maturity except you (1) replace the N with the number of years until the bond may be called, and (2) replace the par value with the price the company must pay for the bonds if it decides to call them.

Suppose once again you are considering buying the bonds mentioned above for the BIG PHONE COMPANY, but now you are told that the company has the option of calling the bonds in five year. The call price (what they must pay if they call the bonds) is \$1,100. What would your yield to call on the bonds be assuming that the company would call the bonds?

$$1,229.40 = 80 \left(\sum_{t=1}^5 \left(\frac{1}{(1 + k_d)^t} \right) \right) + 1100 \left(\frac{1}{(1 + k_d)^5} \right)$$

With your financial calculator you would enter,
n=5; PV=-1,229.40; FV=1100; PMT=80;
and would ask the calculator to calculate i.

You should find an answer of 4.59%. Thus, if the company did call the bonds, your rate of return on the bonds would be much lower than if you could hold the bonds to maturity. It is this fact that makes call provisions very important.

The current yield is the annual interest payment divided by the bond's current price. The current yield provides information regarding the amount of cash income that a bond will generate in a given year, but since it does not take account of capital gains or losses that will be realized if the bond is held until maturity (or call), it does not provide an accurate measure of the bond's total expected return. Since zero coupon bonds pay no annual income, they always have a current yield of zero.

Assessing the Riskiness of a Bond

Interest rates fluctuate over time, and an increase in interest rates leads to a decline in the value of outstanding bonds. People or firms who invest in bonds are exposed to risk from changing interest rates, or interest rate risk. For bonds with similar coupons, the longer the maturity of the bond, the greater the exposure to interest rate risk. The shorter the maturity of the bond, the greater is the risk of a decrease in interest rates. The risk of a decline in income due to a drop in interest rates is called reinvestment rate risk. Reinvestment rate risk is obviously high on callable bonds.

Interest rate risk relates to the value of the bonds in a portfolio, while reinvestment rate risk relates to the income the portfolio produces. No fixed-rate bond can be considered totally riskless. A bond's risk depends critically on how long the investor plans to hold the bond. This is often referred to as the investment horizon. Even a small change in interest rates can have a large effect on the prices of long-term securities. Consequently, investors with shorter investment horizons view long-term bonds as risky investments. By contrast, short-term bonds tend to be riskier than long-term bonds for investors who have longer investment horizons.

Default Risk

Another important risk associated with bonds is default risk. If the issuer defaults, investors receive less than the promised return on the bond. Default risk is influenced by both the financial strength of the issuer and the terms of the bond contract, especially whether collateral has been pledged to secure the bond. The greater the default risk, the higher the bond's yield to maturity. Default risk can be substantial for corporate and municipal bonds.

Bond issues are normally assigned quality ratings by rating agencies. The three major rating agencies are Moody's Investors Service (Moody's), Standard & Poor's Corporation (S&P), and Fitch's Investor Service. These ratings reflect the probability that a bond will go into default.

- Aaa (Moody's) and AAA (S&P) are the highest ratings. The triple- and double-A bonds are extremely safe. Single-A and triple-B bonds are also strong enough to be called investment

grade bonds and they are the lowest-rated bonds that many banks and other institutional investors are permitted by law to hold. Double-B and lower bonds are speculative, or junk bonds, which have a significant probability of going into default.

- Bond rating assignments are based on both qualitative and quantitative factors including the firm's financial ratios, mortgage, subordination and guarantee provisions, regulation, antitrust and environmental factors, product and pension liabilities, labor concerns, as well as accounting policies.

Because a bond's rating is an indicator of its default risk, the rating has a direct, measurable influence on the bond's interest rate and the firm's cost of debt.

- Most bonds are purchased by institutional investors who are often restricted to investment grade securities (securities with ratings of Baa/BBB or above).
- Changes in a firm's bond rating affect both its ability to borrow long-term capital and the cost of that capital.

Rating agencies review outstanding bonds on a periodic basis, occasionally upgrading or downgrading a bond as the issuer's circumstances change. Also, if a company issues more bonds, this will trigger a review by the rating agencies.

CHAPTER 7

Bonds and Their Valuation

- Key features of bonds
- Bond valuation
- Measuring yield
- Assessing risk

1

Key Features of a Bond

1. Par value: Face amount; paid at maturity. (Usually \$1,000 for corporate bonds.)
2. Maturity: Years until bond must be repaid.
3. Issue date: Date when bond was issued.

2

Key Features of a Bond

4. Coupon interest rate: Stated interest rate (generally fixed). Multiply by par to get \$ of interest.
5. Yield to maturity: rate of return earned on a bond held until maturity (also called the “promised yield” or expected return).

3

Effect of a call provision

- Allows issuer to refund the bond issue if rates decline (helps the issuer, but hurts the investor).
- Borrowers are willing to pay more, and lenders require more, for callable bonds.
- Most bonds have a deferred call and a declining call premium.

4

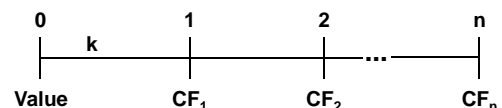
Other types (features) of bonds

- Convertible bond – may be exchanged for common stock of the firm, at the holder’s option.
- Warrant – long-term option to buy a stated number of shares of common stock at a specified price.
- Puttable bond – allows holder to sell the bond back to the company prior to maturity.
- Income bond – pays interest only when interest is earned by the firm.
- Indexed bond – interest rate paid is based upon the rate of inflation.

5

Financial Asset Values

The “price” of any asset should equal the present value (based on an appropriate discount rate) of its expected cash flows.



$$PV = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \dots + \frac{CF_n}{(1+k)^n}$$

6

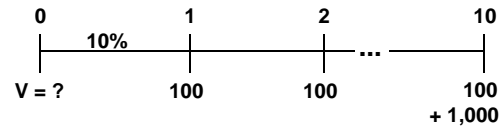
- The discount rate (k_i) is the opportunity cost of capital (i.e., the rate that could be earned on alternative investments of equal risk).

$$k_i = k^* + IP + MRP + DRP + LP$$

- The expected cash flows of a bond are the interest payments and the par value.

7

What is the value of a 10-year, 10% coupon, \$1000 par bond if $k_d = 10\%$?



$$V_B = \frac{\$100}{(1 + k_d)^1} + \dots + \frac{\$100}{(1 + k_d)^{10}} + \frac{\$1,000}{(1 + k_d)^{10}}$$

$$= \$90.91 + \dots + \$38.55 + \$385.54$$

$$= \$1,000.$$

8

Formula

$$V_B = \sum_{t=1}^{m \cdot N} \frac{INT/m}{(1 + k_d/m)^t} + \frac{Par}{(1 + k_d/m)^{m \cdot N}}$$

V_B = value of bond

N = number of years

INT = annual coupon payment (\$)

Par = par value

k_d = annual discount rate

m = number of coupon pmts each year

9

Calculator: The bond consists of a 10-year, 10% annuity of \$100/year plus a \$1,000 lump sum at $t = 10$:

INPUTS: 10 (N), 10 (I/YR), 100 (PMT), 1000 (FV)
OUTPUT: -614.46 (PV)

INPUTS: 10 (N), 10 (I/YR), 1000 (FV)
OUTPUT: -385.54 (PV)

10

PV annuity = \$ 614.46
PV maturity value = 385.54
PV bond = \$1,000.00

The calculator can calculate the present value of the annuity and maturity value in one step (always use end mode).

INPUTS: 10 (N), 10 (I/YR), 100 (PMT), 1000 (FV)
OUTPUT: -1,000 (PV)

11

Bond Valuation using the calculator:

N = total number of coupon payments

I = discount rate (expected return; required return; yield-to-maturity)

PV = price of the bond

FV = Par value of bond

PMT = coupon payment (\$) each payment period

USE THE END MODE

12

What would happen if expected inflation rose by 3%, causing $k = 13\%$?

INPUTS	10	13		100	1000
	N	I/YR	PV	PMT	FV
OUTPUT			-837.21		

When k_d rises, above the coupon rate, the bond's value falls below par, so it sells at a discount.

13

What would happen if inflation fell, and k_d declined to 7%?

INPUTS	10	7		100	1000
	N	I/YR	PV	PMT	FV
OUTPUT			-1,210.71		

Price rises above par, and bond sells at a premium, if coupon $> k_d$.

14

- If coupon rate $< k_d$, discount.
- If coupon rate $= k_d$, par bond.
- If coupon rate $> k_d$, premium.

15

Non-annual Coupon Payments

All calculator entries represent the same items if coupon payments are made during the year.

The only difference is that the N, I, and PMT must be adjusted to account for the non-annual payments.

16

Non-annual Coupon Payments

What's the value of a 10-year, 12% quoted annual coupon bond with semi-annual coupon payments if $k_d = 10\%$?

INPUTS	2x10	10/2		120/2	1000
	N	I/YR	PV	PMT	FV
OUTPUT			1,124.62		

17

Find the value of 10-year, 10% coupon, semiannual bond if $k_d = 13\%$.

INPUTS	2x10	13/2		100/2	1000
	N	I/YR	PV	PMT	FV
OUTPUT			834.72		

18

What is the “yield to maturity” (YTM)?

- YTM is the rate of return earned on a bond held to maturity. Also called the “promised yield.”
- The yield-to-maturity is determined by solving for the discount rate implied by the current selling price of the bond. All items are the same on the calculator, you just solve for I.

19

What’s the YTM on a 10-year, 9% annual coupon, \$1,000 par value bond that sells for \$887?

INPUTS	10	-887	90	1000
	N	I/YR	PV	PMT
OUTPUT		10.91		

20

Find YTM if price were \$1,134.20.

INPUTS	10	-1134.2	90	1000
	N	I/YR	PV	PMT
OUTPUT		7.08		

Sells at a premium. Because coupon = 9% > k_d = 7.08%, bond’s value > par.

21

What’s the quoted annual YTM on a 10-year, 9% coupon, semi-annual payment, \$1,000 par value bond that sells for \$887?

INPUTS	10x2	-887	90/2	1000
	N	I/YR	PV	PMT
OUTPUT		5.441		

Quoted annual YTM = 5.441 X 2 = 10.882%

22

How does adding a “call provision” affect a bond?

- Issuer can refund if rates decline. That helps the issuer but hurts the investor.
- Therefore, borrowers are willing to pay more, and lenders require more, on callable bonds.
- Most bonds have a deferred call and a declining call premium.

23

Yield to call using the calculator:

N = ***total number of coupon payments until bonds are callable

I = YTC (compute)

PV = price of the bond

FV = ***Call price of bond

PMT = coupon payment (\$) each payment period

USE THE END MODE

24

A 10-year, 10% semiannual coupon, \$1,000 par value bond is selling for \$1,135.90. It can be called after 4 years at \$1,050.

What is the bond's nominal yield to maturity (YTM)?

INPUTS	10x2	-1135.9	50	1000
	(N)	(I/YR)	(PMT)	(FV)
OUTPUT	4.00			

$$YTM = 4.00 \times 2 = 8.00\%$$

25

What is the bond's nominal yield to call (YTC)?

(To calculate YTC we replace N with the number of coupon payments prior to call and we replace FV with the price that must be paid to call the bonds.)

INPUTS	4x2	-1135.9	50	1050
	(N)	(I/YR)	(PMT)	(FV)
OUTPUT	3.5684			

$$YTC = 3.5684 \times 2 = 7.137\%$$

26

Definitions

$$\text{Current yield} = \frac{\text{Annual coupon pmt}}{\text{Current price}}$$

$$\text{Capital gains yield} = \frac{\text{Change in price}}{\text{Beginning price}}$$

$$\text{Exp total return} = YTM = \text{Exp Curr yld} + \text{Exp cap gains yld}$$

27

Find current yield and capital gains yield for a 9%, 10-year bond when the bond sells for \$887 and YTM = 10.91%.

$$\begin{aligned} \text{Current yield} &= \frac{\$90}{\$887} \\ &= 0.1015 = 10.15\% \end{aligned}$$

$$\begin{aligned} YTM &= \text{Current yield} + \text{Capital gains yield} \\ \text{Cap gains yield} &= YTM - \text{Current yield} \\ &= 10.91\% - 10.15\% \\ &= 0.76\% \end{aligned}$$

28

What's interest rate (or price) risk? Does a 1-year or 10-year 10% bond have more risk?

Interest rate risk: Rising k_d causes bond's price to fall.

k_d	1-year	Change	10-year	Change
5%	\$1,048	+4.8%	\$1,386	+38.6%
10%	1,000	-4.4%	1,000	-25.1%
15%	956		749	

29

What is reinvestment rate risk?

The risk that CFs will have to be reinvested in the future at lower rates, reducing income.

If you invest in a multi-year bond, you get the same interest rate each year until maturity.

If you invest in a one-year bond, you get the stated interest rate the first year. The next year you have to reinvest at the prevailing interest rate.

30

Interest rate and Reinvestment rate risk

- Long-term bonds: High interest rate risk, low reinvestment rate risk.
- Short-term bonds: Low interest rate risk, high reinvestment rate risk.
- Nothing is completely riskless!

31

Do all bonds of the same maturity have the same price and reinvestment rate risk?

No, low coupon bonds have less reinvestment rate risk but more price risk than high coupon bonds.

32

Types of Bonds

- Mortgage bond – a bond backed by fixed assets.
- Debenture – a long-term bond that is not secured by a mortgage on specific property.
- Subordinated debenture – a bond having a claim on assets only after the senior debt has been paid off in the event of liquidation.

33

Bond Default Risk

- If the issuer defaults, investors receive less than the promised return.
- Therefore, the expected return on corporate and municipal bonds may be less than the promised return.
- The difference is dependent on the risk of default.

34

Bond Ratings Provide One Measure of Default Risk

	Investment Grade					Junk Bonds			
Moody's	Aaa	Aa	A	Baa		Ba	B	Caa	C
S&P	AAA	AA	A	BBB		BB	B	CCC	D

35

What factors affect default risk and bond ratings?

- Financial performance
 - Debt ratio; TIE ratio; Current ratio
- Provisions in the bond contract
 - Secured vs. unsecured debt; Senior vs. subordinated debt; Guarantee provisions; Sinking fund provisions; Debt maturity
- Other factors
 - Earnings stability; Regulatory environment; Potential product liability; Accounting policies

36

What is a sinking fund?

- Provision to pay off a loan over its life rather than all at maturity.
- Similar to amortization on a term loan.
- Reduces risk to investor, shortens average maturity.
- But not good for investors if rates decline after issuance.

37

Sample Problems – Chapter 7

1. You are considering buying bonds in ACBB, Inc. The bonds have a par value of \$1,000 and mature in 37 years. The annual coupon rate is 10.0% and the coupon payments are annual. If you believe that the appropriate discount rate for the bonds is 13.0%, what is the value of the bonds to you?

- a. \$1,417.35
- b. \$870.65
- c. \$1,291.18
- d. \$771.74
- e. \$826.14

2. XZYY, Inc. currently has an issue of bonds outstanding that will mature in 31 years. The bonds have a face value of \$1,000 and a stated annual coupon rate of 20.0% with annual coupon payments. The bond is currently selling for \$890. The bonds may be called in 4 years for 120.0% of the par value. What is your expected quoted annual rate of return if you buy the bonds and hold them until maturity?

- a. 22.48%
- b. 28.24%
- c. 20.48%
- d. 33.33%
- e. 36.15%

3. Again, Inc. bonds have a par value of \$1,000, a 33 year maturity, and an annual coupon rate of 12.0% with annual coupon payments. The bonds are currently selling for \$923. The bonds may be called in 4 years for 112.0% of par. What quoted annual rate of return do you expect to earn if you buy the bonds and company calls them when possible?

- a. 17.14%
- b. 13.02%
- c. 18.84%
- d. 14.23%
- e. 11.66%

4. Within Year, Inc. has bonds outstanding with a \$1,000 par value and a maturity of 17 years. The bonds have an annual coupon rate of 17.0% with semi-annual coupon payments. You would expect a quoted annual return of 14.0% if you purchased these bonds. What are the bonds worth to you?

- a. \$1,192.81
- b. \$1,269.29
- c. \$834.55
- d. \$1,146.45
- e. \$2,285.40

5. Yes They May, Inc. has a bond issue outstanding with a \$1,000 par value and a maturity of 40 years. The bonds have an annual coupon rate of 15.0% with quarterly coupon payments. The current market price for the bonds is \$1,035. The bonds may be called in 4 years for 115.0% of par. What is the quoted annual yield-to-maturity for the bonds?

- a. 3.62%
- b. 14.49%
- c. 15.04%
- d. 16.51%
- e. 23.20%

6. Yes They Can, Inc. has a bond issue outstanding with a \$1,000 par value and a maturity of 20 years. The annual coupon rate is 9.0% with semi-annual coupon payments. The bonds are currently selling for \$859. The bonds may be called in 3 years for 109.0% of par. What is the quoted annual yield-to-call for these bonds?

- a. 10.73%
- b. 24.80%
- c. 11.30%
- d. 5.36%
- e. 17.66%

7. You are considering buying bonds in AZYX, Inc. The bonds have a par value of \$1,000 and mature in 13 years. The annual coupon rate is 11.0% and the coupon payments are annual. The bonds are currently selling for \$1,442.63 based on a yield-to-maturity of 6.0%. What is the bond's current yield?

- a. 15.87%
- b. 11.00%
- c. 6.00%
- d. 4.16%
- e. 7.62%

8. You are considering buying bonds in AZYX, Inc. The bonds have a par value of \$1,000 and mature in 13 years. The annual coupon rate is 11.0% and the coupon payments are annual. The bonds are currently selling for \$1,442.63 based on a yield-to-maturity of 6.0%. What is the bond's expected capital gain/loss if the bonds are held until maturity?

- a. 0.00%
- b. -5.00%
- c. -1.62%
- d. 1.84%
- e. -9.87%

Answers:

- 1. d
- 2. a
- 3. a
- 4. a
- 5. b
- 6. e
- 7. e
- 8. c

Solutions

1.

N	I	**PV**	FV	PMT
37	13	771.74	1000	(0.10)(1000)

2.

N	**I**	PV	FV	PMT
31	22.48	-890	1000	(0.20)(1000)

3.

N	**I**	PV	FV	PMT
4	17.14	-923	(1.12)(1000)	120

4.

N	I	**PV**	FV	PMT
17 X 2	(14)/(2)	1192.81	1000	[0.17(1000)]/(2)

5.

N	**I**	PV	FV	PMT
40 X 4	3.622775	-1035	1000	[0.15(1000)]/(4)

Quoted annual rate = $3.622775 \times 4 = 14.49\%$

6.

N	**I**	PV	FV	PMT
3 X 2	8.828586	-859	1090	[0.09(1000)]/(2)

Quoted annual rate = $8.828586 \times 2 = 17.66\%$

7.

current yield = (annual coupon payment)/(price) = $[(0.11)(1000)]/(1442.63) = 0.0762 = 7.62\%$

8.

current yield = $[(0.11)(1000)]/(1442.63) = 0.0762$

YTM = current yield + capital gain/loss

$0.06 = 0.0762 + \text{capital gain/loss}$

capital gain/loss = $-0.0162 = -1.62\%$

Chapter 8: Risk and Rates and Return

Risk

Risk is the possibility that more than one outcome may occur. Risk pertains to the possibility that actual returns will be different from the expected return. The greater the chance (and range) of returns being different from the expected return, the riskier the investment.

Risk also refers to the chance that some unfavorable event will occur. Investment risk is related to the probability of actually earning a low or negative return; thus, the greater the chance of low or negative returns, the riskier the investment.

Risk aversion is a dislike for risk. Risk averse individuals consider a trade-off between risk and return in making decisions. Risk averse investors require higher expected rates of return to compensate them for assuming higher levels of risk.

Investors will expect to receive the risk-free rate of return for any investment, since it can be obtained without any risk. They also will require additional expected return to compensate them for the risk of the asset. It is important to note that investors make their decision based on expected returns and risk. Actual returns may differ from expected returns, so actual returns are not always higher for higher risk investments in the short-run. In the long-run, higher returns do generally occur for higher risk assets.

An asset's risk can be analyzed in two ways:

- (1) stand-alone risk, where the asset is considered in isolation, and
- (2) portfolio risk, where the asset is held as one of a number of assets in a portfolio.

No investment will be undertaken unless the expected rate of return is high enough to compensate the investor for the perceived risk of the investment. The probability distribution for an event is the listing of all the possible outcomes for the event, with mathematical probabilities assigned to each. The sum of the probabilities for a particular event must equal 1.0.

The expected rate of return, k , is the sum of the products of each possible outcome, k_i , times its associated probability, P_i . It is a weighted average of the various possible outcomes, with the weights being their probabilities of occurrence.

$$\text{Expected rate of return} = \hat{k} = \sum_{i=1}^n P_i k_i$$

Where the number of possible outcomes is virtually unlimited, continuous probability distributions are used in determining the expected rate of return of the event.

The tighter or more peaked a distribution is, the more likely it is that the actual outcome will be close to the expected value, and, consequently, the less likely it is that the actual return will end up far below the expected return. Thus, the tighter the probability distribution, the lower the risk assigned to an asset.

One measure for determining the tightness of a distribution is the standard deviation. The standard deviation is a probability-weighted average deviation from the expected value, and it provides an idea of how far above or below the expected value the actual value is likely to be.

$$\text{Standard deviation} = \sigma = \sqrt{\sum_{i=1}^n (k_i - \hat{k})^2 P_i}$$

Another useful measure of risk is the coefficient of variation (CV), which is the standard deviation divided by the expected return. It shows the risk per unit of return and provides a more meaningful basis for comparison when the expected returns on two alternatives are not the same:

$$\text{Coefficient of variation} = CV = \frac{\sigma}{\hat{k}}$$

Because the coefficient of variation captures the effects of both risk and return, it is a better measure than the standard deviation for evaluating risk in situations in which investments have substantially different expected returns.

Risk in a Portfolio Context

An asset held as part of a portfolio is less risky than the same asset held in isolation. This is important because most financial assets are not held in isolation; rather, they are held as parts of portfolios. From the investor's standpoint, what is important is the return and risk on his or her portfolio, not the movements of a particular stock up or down. Thus, the risk and return of an individual security should be analyzed in terms of how it affects the risk and return of the portfolio in which it is held.

The expected return on a portfolio is the weighted average of the expected returns on the individual assets in the portfolio, with the weights being the fraction of the total portfolio invested in each asset:

$$\text{Expected return on a portfolio} = \hat{k}_p = \sum_{i=1}^n w_i \hat{k}_i$$

- The realized rate of return is the return that was actually earned during some past period, and usually is different from the expected return.

The riskiness of a portfolio is generally not a weighted average of the standard deviations of the individual assets in the portfolio; the portfolio's risk will be smaller than the weighted average of the assets' standard deviations. The riskiness of a portfolio depends not only on the standard deviations of the individual stocks, but also on the correlation between the stocks.

- The correlation coefficient, r, measures the tendency of two variables to move together. With stocks, these variables are the individual stock returns.
- Diversification does nothing to reduce risk if the portfolio consists of perfectly positively correlated stocks.
- As a rule, the riskiness of a portfolio will decline as the number of stocks in the portfolio increases.

- However, in the typical case, where the correlation among the individual stocks is positive, but less than +1.0, some, but not all, risk can be eliminated.
- In the real world, it is impossible to form completely riskless stock portfolios. Diversification can reduce risk, but cannot eliminate it.

A portfolio consisting of all stocks is called the market portfolio. While very large portfolios end up with a substantial amount of risk, it is not as much risk as if all the money were invested in only one stock. Almost half of the riskiness inherent in an average individual stock can be eliminated if the stock is held in a reasonably well diversified portfolio, which is one containing 40 or more stocks. Some risk always remains, however, so it is virtually impossible to diversify away the effects of broad stock market movements that affect almost all stocks.

- Diversifiable risk (company specific risk) is that part of the risk of a stock that can be eliminated by proper diversification. It is caused by random events that are unique to a particular firm.
- Market risk is that part of the risk that cannot be eliminated, and it stems from factors that systematically affect most firms, such as war, inflation, recessions, and high interest rates. It can be measured by the degree to which a given stock tends to move up or down with the market. Thus, market risk is the relevant risk, which reflects a security's contribution to the portfolio's risk.

The Capital Asset Pricing Model is an important tool for analyzing the relationship between risk and rates of return. The model is based on the proposition that a stock's required rate of return is equal to the risk-free rate of return plus a risk premium, where risk reflects diversification. Its primary conclusion is that the relevant risk of an individual stock is its contribution to the riskiness of a well-diversified portfolio.

The tendency of a stock to move with the market is reflected in its beta coefficient, b , which is a measure of the stock's volatility relative to that of an average stock.

- An average-risk stock is defined as one that tends to move up and down in step with the general market. By definition it has a beta of 1.0.
- A stock that is twice as volatile as the market will have a beta of 2.0, while a stock that is half as volatile as the market will have a beta coefficient of 0.5.

The beta coefficient of a portfolio of securities, b_p , is the weighted average of the individual securities' betas.

$$b_p = \sum_{i=1}^n w_i b_i$$

The Relationship Between Risk and Rates of Return

Since a stock's beta coefficient determines how the stock affects the riskiness of a diversified portfolio, beta is the most relevant measure of any stock's risk. The Capital Asset Pricing Model (CAPM) employs the concept of beta, which measures risk as the relationship between a particular stock's movements and the movements of the overall stock market. The CAPM uses a stock's beta, in conjunction with the average investor's degree of risk aversion, to calculate the return that investors require, k_s , on that particular stock.

The Security Market Line (SML) shows the relationship between risk as measured by beta and the required rate of return for individual securities. The SML equation can be used to find the required rate of return on Stock i.

$$\left(\begin{array}{c} \text{Required return} \\ \text{on stock i} \end{array} \right) = \left(\begin{array}{c} \text{Risk - free} \\ \text{rate} \end{array} \right) + \left(\begin{array}{c} \text{Market risk} \\ \text{premium} \end{array} \right) \left(\begin{array}{c} \text{Stock i's} \\ \text{beta} \end{array} \right)$$

$$k_i = k_{RF} + (k_M - k_{RF})b_i$$

- Here k_{RF} is the interest rate on risk-free securities, b_i is the i^{th} stock's beta, and k_M is the return on the market or, alternatively, on an average stock.
- The term $k_M - k_{RF}$ is the market risk premium, RP_M . This is a measure of the additional return over the risk-free rate needed to compensate investors for assuming an average amount of risk.
 - The size of this premium depends on the perceived risk of the stock market and investors' degree of risk aversion.

In the CAPM, the market risk premium, $k_M - k_{RF}$, is multiplied by the stock's beta coefficient to determine the additional premium over the risk-free rate that is required to compensate investors for the risk inherent in a particular stock.

- This premium may be larger or smaller than the premium required on an average stock, depending on the riskiness of that stock in relation to the overall market as measured by the stock's beta.
- The risk premium calculated by $(k_M - k_{RF})b_i$ is added to the risk-free rate, k_{RF} (the rate on Treasury securities), to determine the total rate of return required by investors on a particular stock, k_s .

Many factors can affect a company's beta. When such changes occur, the required rate of return also changes.

- A firm can influence its market risk, hence its beta, through changes in the composition of its assets and also through its use of debt.
- A company's beta can also change as a result of external factors such as increased competition in its industry, the expiration of basic patents, and the like.

Some Concerns About Beta and the CAPM

A number of recent studies have raised concerns about the validity of the CAPM.

- A recent study by Fama and French found no historical relationship between stocks' returns and their market betas.
- They found two variables that are consistently related to stock returns: (1) a firm's size and (2) its market/book ratio.
- After adjusting for other factors, they found that smaller firms have provided relatively high returns, and that returns are higher on stocks with low market/book ratios. By contrast, they found no relationship between a stock's beta and its return.

As an alternative to the traditional CAPM, researchers and practitioners have begun to look to more general multi-beta models that encompass the CAPM and address its shortcomings.

- In the multi-beta model, market risk is measured relative to a set of risk factors that determine the behavior of asset returns, whereas the CAPM gauges risk only relative to the market return.
- The risk factors in the multi-beta model are all nondiversifiable sources of risk.

Empirical research has discovered several systematic empirical risk factors, including the bond default premium, the bond term structure premium, and inflation.

CHAPTER 8

Risk and Rates of Return

- Stand-alone risk
- Portfolio risk
- Risk & return: CAPM

The basic goal of the firm is to:
maximize shareholder wealth!

1

Investment returns

The rate of return on an investment can be calculated as follows:

$$\text{Return} = \frac{(\text{Amount received} - \text{Amount invested})}{\text{Amount invested}}$$

For example, if \$1,000 is invested and \$1,100 is returned after one year, the rate of return for this investment is:

$$(\$1,100 - \$1,000) / \$1,000 = 10\%.$$

2

What is risk?

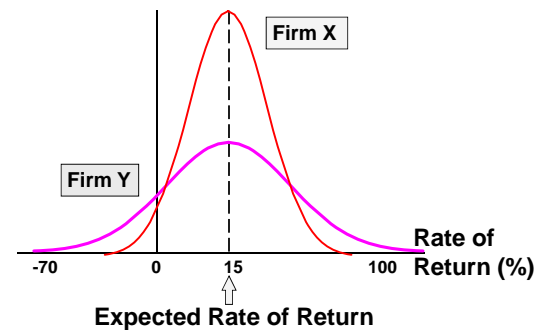
Risk is the possibility that more than one outcome may occur.

Risk pertains to the possibility that actual returns will be different from the expected return

The greater the chance (and range) of returns being different from the expected return, the riskier the investment.

3

Probability distribution



4

If an asset has no risk, it is called risk-free. The closest approximation we have are government securities.

T-bills return their promised return regardless of the economy.

This is why we use T-bills as a proxy for the risk-free rate.

5

Do T-bills promise a completely risk-free return?

NO

T-bills are still exposed to the risk of inflation. However, not much unexpected inflation is likely to occur over a relatively short period.

6

Risk Tolerance of Individuals

- Risk aversion is a dislike for risk.
- Risk averse individuals consider a trade-off between risk and return in making decisions.
- Risk averse investors require higher expected rates of return to compensate them for assuming higher levels of risk.

7

Required return

- Investors will expect to receive the risk-free rate of return for any investment, since it can be obtained without any risk.
- They also will require additional expected return to compensate them for the risk of the asset.

8

The return on any asset can be described by the following equation.

$$\text{Asset's required return} = \text{Risk-free rate of return} + \text{Asset's risk premium}$$

9

NOTE

- It is important to note that investors make their decision based on expected returns and risk.
- Actual returns may differ from expected returns, so actual returns are not always higher for higher risk investments in the short-run.
- In the long-run, higher returns do generally occur for higher risk assets.

10

Risk depends on what could happen versus what is expected to happen.

So, we need to be able to determine what return is expected for a particular asset.

11

Expected rate of return on an individual asset

\hat{k} = expected rate of return.

$$\hat{k} = \sum_{i=1}^n k_i P_i$$

P_i = probability the i^{th} outcome will occur

k_i = return for i^{th} possible outcome

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Expected Rate of Return

Outcomes	Return		Probability		
Better	22%	X	0.3	=	6.6%
Same	12%	X	0.5	=	6.0%
Worse	-8%	X	0.2	=	-1.6%
			Exp. Return	=	11.0%

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Risk and Return

- Risk can be measured in many different ways. There are two main ways of looking at risk.
- Stand-alone risk
- Portfolio risk

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Risk Measures

- Stand-alone risk measures:
 - standard deviation
 - coefficient of variation
- Market risk measure:
 - beta

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What is stand-alone risk?

Stand-alone risk considers all risk.

It is measured by the dispersion of returns about the mean and is relevant only for assets held in isolation.

16

How do we calculate standard deviation?

Standard deviation measures “total risk.”

$$\sigma = \sqrt{\text{Variance}} = \sqrt{\sum_{i=1}^n (k_i - \hat{k})^2 P_i}$$

- measure of “stand-alone” risk
- the larger the σ the lower the probability that actual returns will be close to expected returns.

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Coefficient of Variation (CV)

Standardized measure of dispersion about the expected value:

$$CV = \frac{\text{Std dev}}{\text{Mean}} = \frac{\sigma}{\hat{k}}$$

Shows risk per unit of return.
(still a stand-alone risk measure)

18

Diversification

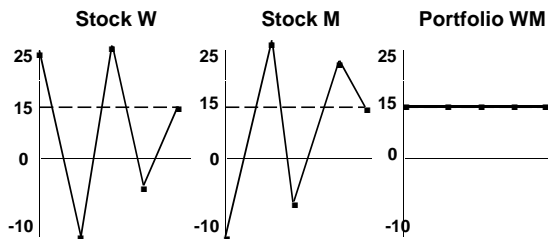
- Generally, we do not hold assets in isolation. We own many assets at any one time.
- This is what is meant by the term diversification (simply, holding more than one asset).
- Diversification has several benefits for investors.

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- Diversification's main benefit is easily seen.
- Since not all investments go up or down at the same time, combining several assets together means that it will be likely that when some are doing "poorly" others will be doing "well."
- This results in returns being closer to the average or expected return over time, which means that there is less risk.

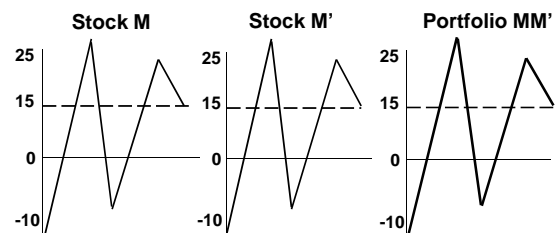
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Returns Distributions for Two Perfectly Negatively Correlated Stocks ($r = -1.0$) and for Portfolio WM



21

Returns Distributions for Two Perfectly Positively Correlated Stocks ($r = +1.0$) and for Portfolio MM'

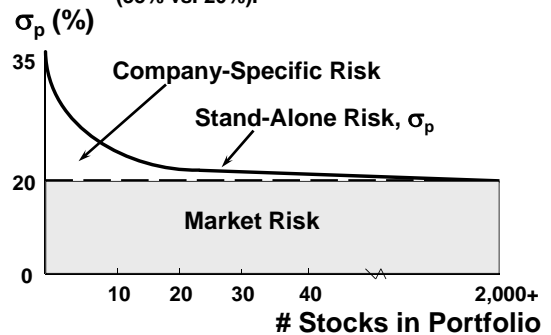


22

- Risk that only affects an individual asset (company specific risk) is "removed" when many assets are held together.
- If you could own a portfolio of all assets, all company specific risk could be eliminated. Only the risk that affects all assets would remain.

23

By forming portfolios, we can eliminate about half the riskiness of individual stocks (35% vs. 20%).



24

$$\text{Stand-alone risk} = \text{Market risk} + \text{Firm-specific risk}$$

Market risk is that part of a security's stand-alone risk that *cannot* be eliminated by diversification, and it is measured by beta.

Firm-specific risk is that part of a security's stand-alone risk that can be eliminated by proper diversification.

25

What is company specific risk?

- Caused by company specific events (e.g., lawsuits, strikes, winning or losing major contracts, etc.)
- Effects of such events on a portfolio can be eliminated by diversification.

26

What is market risk?

- Stems from such external events as war, inflation, recession, and interest rates.
- Because all firms are affected simultaneously by these factors, market risk cannot be eliminated by diversification.
- Market risk is also known as systematic risk since it shows the degree to which a stock moves systematically with other stocks.

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If you chose to hold a one-stock portfolio and thus are exposed to more risk than diversified investors, would you be compensated for all the risk you bear?

28

- NO!
- Stand-alone risk as measured by a stock's σ or CV is not important to a well-diversified investor.
- Rational, risk-averse investors are concerned with σ_p , which is based on market risk.

29

- There can only be one price, hence market return, for a given security. Therefore, no compensation can be earned for the additional risk of a one-stock portfolio.

30

Portfolio Return and Standard Deviation

- The expected return for a portfolio will be the weighted average return for all assets in the portfolio.
- Portfolio standard deviation is generally less than the weighted average of the standard deviations of the individual assets in the portfolio.

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Portfolio return

$$\hat{k}_p = \sum_{i=1}^n w_i k_i$$

w_i = fraction of funds invested in asset i

k_i = exp. return for i^{th} asset

32

Expected Return for a Portfolio

Asset	Invested	Return
AAA	\$2,000	25%
BBB	\$4,000	20%
CCC	\$6,000	16%
DDD	\$8,000	10%

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Expected Return for a Portfolio

Determine the fraction of total funds in each asset, multiply times the return, and sum the resulting values.

Asset	Invested		Return		
AAA	\$2,000	/20000	X	25%	= 2.50%
BBB	\$4,000	/20000	X	20%	= 4.00%
CCC	\$6,000	/20000	X	16%	= 4.80%
DDD	\$8,000	/20000	X	10%	= 4.00%
total	\$20,000			Exp return	15.30%

34

What is the CAPM?

- An equilibrium model specifying the relationship between risk and required return on assets held in *diversified* portfolios.

It says that the return on any asset is equal to the risk-free return plus a risk-premium. The risk-premium equals the asset's beta times the risk-premium for the market portfolio.

35

What is the market risk premium?

- Additional return over the risk-free rate needed to compensate investors for assuming an average amount of risk.
- Its size depends on the perceived risk of the stock market and investors' degree of risk aversion.
- Varies from year to year, but most estimates suggest that it ranges between 4% and 8% per year.

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- Since by forming well-diversified portfolios we can eliminate company specific risk, we need a risk measure that only considers market risk.
- Beta is that risk measure. Beta measures the risk of an asset relative to the "market."
- Beta shows how risky a stock is if the stock is held in a well-diversified portfolio.

37

How are betas calculated?

- Run a regression of past returns on Stock i versus returns on the market.
- The slope of the regression line is defined as the beta coefficient.

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- If beta = 1.0, average stock.
- If beta > 1.0, stock riskier than average.
- If beta < 1.0, stock less risky than average.
- Most stocks have betas in the range of 0.5 to 1.5.

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Security Market Line (SML)

$$k_i = k_{RF} + (k_M - k_{RF})b_i$$

- k_{RF} = risk-free return
- k_M = return on market portfolio
- b_i = beta for asset i
- k_i = return on asset i

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Expected Return for an Asset

- Suppose an asset has a beta of 1.5. the market return is 10% and the risk-free return is 4%. What is the expected return for the asset?
- $k_i = k_{RF} + (k_M - k_{RF})b_i$
- $k_i = 4\% + 1.5(10\% - 4\%) = 13\%$

41

Market Risk Premium

- Note that sometimes the market risk premium is given instead of the market return. The market risk-premium is the return on the market minus the risk-free return.
- Example: Suppose an asset has a beta of 1.5. the market risk premium is 6% and the risk-free return is 4%. What is the expected return for the asset?
- $k_i = k_{RF} + (k_M - k_{RF})b_i$
- $k_i = 4\% + 1.5(6\%) = 13\%$

42

Portfolio beta

The beta for a portfolio is the weighted average of the betas for all stocks in the portfolio.

$$\hat{b}_p = \sum_{i=1}^n w_i b_i$$

= portfolio beta

w_i = fraction of funds invested in asset i

b_i = beta for ith asset

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Beta for a Portfolio

Risk-free rate	5%				
Market return	13%				
Asset	Invested			Beta	
AAA	\$2,000 /20000	X	3.0	=	0.30
BBB	\$4,000 /20000	X	2.5	=	0.50
CCC	\$6,000 /20000	X	1.6	=	0.48
DDD	\$8,000 /20000	X	1.2	=	0.48
total	\$20,000			Beta (port)	1.76

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Expected Return for a Portfolio

- Now use the calculated Beta for the portfolio to calculate the expected return for the portfolio.
- $k_i = 5\% + 1.76(13\% - 5\%) = 19.08\%$

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More thoughts on the CAPM

- CAPM concepts are based upon expectations
- Betas are usually calculated using historical data
- A company's historical data may not reflect investors' expectations about future riskiness

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Chapter 8 - Sample Problems

1. What is the expected return for the following stock? (State your answer in percent with one decimal place.)

Outcomes	Possible returns	Probability
better	32%	0.50
same	17%	0.20
worse	-10%	0.30

2. What is the expected return for the following portfolio? (State your answer in percent with two decimal places.)

Stock	Expected returns	Investment
AAA	31.2%	\$190,000
BBB	24.0%	\$350,000
CCC	18.6%	\$200,000
DDD	11.9%	\$500,000

3. If the risk-free rate is 4.3%, the expected return on the market is 15.7%, and the expected return on Security J is 21.5%, what is the beta for Security J? (Calculate your answer to two decimal places.)

4. You are considering buying a stock with a beta of 0.73. If the risk-free rate of return is 6.9 percent, and the expected return for the market is 12.2 percent, what should the expected rate of return be for this stock? (State your answer as a percentage.)

5. If the risk-free rate is 6.9%, the market risk premium is 7.0%, and the expected return on Security J is 29.4%, what is the beta for Security J? (Calculate your answer to two decimal places.)

6. You are considering buying a stock with a beta of 2.05. If the risk-free rate of return is 6.9 percent, and the market risk premium is 10.8 percent, what should the expected rate of return be for this stock? (State your answer as a percentage.)

7. You are holding a stock that has a beta of 2.4 and is currently in equilibrium. The required return on the stock is 20.4% and the return on a risk-free asset is 8%. What would be the return on the stock if the stock's beta increased to 3.3 while the risk-free rate and market return remained unchanged? (Calculate your answer to two decimal places and state it as a percentage.)

8. The risk-free return is 4.1% and the market return is 14.0%. What is the expected return for the following portfolio? (State your answer in percent with two decimal places.)

Stock	Beta	Investment
AAA	3.4	\$125,000
BBB	2.9	\$330,000
CCC	1.3	\$230,000
DDD	0.9	\$500,000

Solutions to Sample Problems

1. expected return = $(32\%)(0.50) + (17\%)(0.20) + (-10\%)(0.30) = 16.4\%$

2.

First, covert the dollar investments into proportions of total investment by adding the investments in all stocks and then dividing each stock investment by the total.

Stock	Expected returns	Investment
AAA	31.2%	$\$190,000/1,240,000 = 0.1532$
BBB	24.0%	$\$350,000/1,240,000 = 0.2823$
CCC	18.6%	$\$200,000/1,240,000 = 0.1613$
DDD	11.9%	$\$500,000/1,240,000 = 0.4032$
TOTAL		\$1,240,000

Now multiply the expected return for each asset times the proportion of investment allocated to that asset and sum the resulting amounts.

$$\text{Exp ret} = (31.2\%)(0.1532) + (24\%)(0.2823) + (18.6\%)(0.1613) + (11.9\%)(0.4032)$$

$$\text{Exp ret} = 19.35\%$$

3.

k_i = return on asset i

k_{RF} = risk-free rate

k_M = market return

b_i = beta for asset i

$k_M - k_{RF}$ = market risk premium

$$k_i = k_{RF} + (k_M - k_{RF})b_i$$

$$21.5\% = 4.3\% + (15.7\% - 4.3\%) b_i$$

$$17.2\% = (11.4\%) b_i$$

$$b_i = 1.51$$

4.

$$k_i = k_{RF} + (k_M - k_{RF})b_i$$

$$k_i = 6.9\% + (12.2\% - 6.9\%)(0.73)$$

$$k_i = 10.77\%$$

5.

$$k_i = k_{RF} + (k_M - k_{RF})b_i$$

$$29.4\% = 6.9\% + (7\%)(b_i)$$

$$(7\%)b_i = 22.5\%$$

$$b_i = 3.21$$

6.

$$k_i = k_{RF} + (k_M - k_{RF})b_i$$

$$k_i = 6.9\% + (10.8\%)(2.05)$$

$$k_i = 29.04\%$$

7.

$$k_i = k_{RF} + (k_M - k_{RF})b_i$$

Currently,

$$20.4\% = 8\% + (k_M - 8\%)(2.4)$$

$$12.4\% = (2.4)k_M - 19.2\%$$

$$31.6\% = (2.4)k_M$$

$$k_M = 13.17\%$$

If beta changes to 3.3, but the market return and risk-free rate remain unchanged,

$$k_i = 8\% + (13.17\% - 8\%)(3.3)$$

$$k_i = 25.06\%$$

8. First, convert the dollar investments into proportions of total investment by adding the investments in all stocks and then dividing each stock investment by the total.

Stock	Beta	Investment
AAA	3.4	$\$125,000 / \$1,185,000 = 0.105485$
BBB	2.9	$\$330,000 / \$1,185,000 = 0.278481$
CCC	1.3	$\$230,000 / \$1,185,000 = 0.194093$
DDD	0.9	$\$500,000 / \$1,185,000 = 0.421941$
TOTAL		$\$1,185,000$

Now, multiply the beta for each asset times the proportion of investment allocated to that asset and sum the resulting amounts to get the portfolio beta.

$$\text{Port beta} = (3.4)(0.105485) + (2.9)(0.278481) + (1.3)(0.194093) + (0.9)(0.421941)$$

$$\text{Port beta} = 1.79831$$

Now, plug the information into the CAPM formula.

$$k_i = k_{RF} + (k_M - k_{RF})b_i$$

$$k_i = 4.1\% + (14.0\% - 4.1\%)(1.79831) = 21.90\%$$

Chapter 9: Stocks and Their Valuation

Introduction

Common stock constitutes the ownership position in a firm. As owners, common stockholders have certain rights and privileges, including the right to control the firm through election of directors and the right to the firm's residual earnings.

Firms generally begin their corporate life as closely held companies, with all the common stock held by the founding managers. Then, as the company grows, it is often necessary to sell stock to the general public (that is, to go public) to raise more funds. Eventually, the firm may choose to list its stock on one of the physical location exchanges.

A common stock is valued as the present value of its expected future dividend stream. The total company model is a valuation model used as an alternative to the dividend growth model to determine the value of a firm, especially one that does not pay dividends or is privately held. The total rate of return on a stock is comprised of a dividend yield plus a capital gains yield. If a stock is in equilibrium, its total expected return must equal the average investor's required rate of return.

Preferred stock is a hybrid. It is similar to bonds in some respects and to common stock in others. The value of a share of preferred stock that is expected to pay a constant dividend forever is found as the dividend divided by the required rate of return.

Legal Rights and Privileges of Common Stockholders

The corporation's common stockholders are the owners of the corporation, and as such, they have certain rights and privileges.

- Common stockholders have control of the firm through their election of the firm's directors, who in turn elect officers who manage the business.
- In a large, publicly owned firm, the managers typically have some stock, but their personal holdings are generally insufficient to give them voting control.
- Managements of most publicly owned firms can be removed by the stockholders if the management team is not effective.
- Stockholders who are unable to attend annual meetings may still vote for directors by means of a proxy. Proxies can be solicited by any party seeking to control the firm.
- If earnings are poor and stockholders are dissatisfied, an outside group may solicit the proxies in an effort to overthrow management and take control of the business. This is known as a proxy fight.
- A takeover is an action whereby a person or group succeeds in ousting a firm's management and taking control of the company.
- A poison pill makes a possible acquisition unattractive and wards off hostile takeover attempts.

The Market for Common Stock

Stock market transactions may be separated into three distinct categories.

- The secondary market deals with trading in previously issued, or outstanding, shares of established, publicly owned companies. The company receives no new money when sales are made in the secondary market.
- The primary market handles additional shares sold by established, publicly owned companies. Companies can raise additional capital by selling in this market.
- The primary market also handles new public offerings of shares in firms that were formerly closely held. Capital for the firm can be raised by going public, and this market is often termed the initial public offering (IPO) market.
 - Initial offerings are generally oversubscribed, which means that the demand for shares at the offering price exceeds the number of shares issued. Small investors can buy the stock in the after-market, but evidence suggests that if you do not get in on the ground floor, the average IPO underperforms the overall market over the longer run.
 - It is important to recognize that firms can go public without raising any additional capital.

Common Stock Valuation

Common stocks are valued by finding the present value of the expected future cash flow stream. People typically buy common stock expecting to earn dividends plus a capital gain when they sell their shares at the end of some holding period. The capital gain may or may not be realized, but most people expect a gain or else they would not buy stocks.

The expected dividend yield on a stock during the coming year is equal to the expected dividend, D_1 , divided by the current stock price, P_0 . P_0 is the expected capital gains yield. The expected dividend yield plus the expected capital gains yield equals the expected total return.

The value of the stock today is calculated as the present value of an infinite stream of dividends. For any investor, cash flows consist of dividends plus the expected future sales price of the stock. This sales price, however, depends on dividends expected by future investors:

$$\begin{aligned}\text{Value of stock} &= \hat{P}_0 = \text{PV of expected future dividends} \\ &= \hat{P}_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + k_s)^t}\end{aligned}$$

Here k_s is the discount rate used to find the present value of the dividends.

Dividends can be rising, falling, fluctuating randomly, or can even be zero for several years. The generalized equation above can be used to value the stock. With a computer spreadsheet this equation can easily be used to find a stock's intrinsic value for any dividend pattern. The hard part is getting an accurate forecast of the future dividends.

For many companies, earnings and dividends are expected to grow at some normal, or constant, rate. Dividends in any future Year t may be forecasted as $D_t = D_0(1 + g)^t$, where D_0 is the last dividend paid and g is the expected growth rate. Using this method of estimating future dividends, the current price, P_0 , is determined as follows:

$$\hat{P}_0 = \frac{D_0(1 + g)}{k_s - g} = \frac{D_1}{k_s - g}$$

This equation for valuing a constant growth stock is often called the constant growth model, or the Gordon Model, after Myron J. Gordon, who developed it.

- A necessary condition of this equation is that $k_s > g$.
- Growth in dividends occurs primarily as a result of growth in earnings per share.
 - Earnings growth results from a number of factors, including inflation, the amount of earnings the company retains and reinvests, and the rate of return the company earns on its equity (ROE).
- The constant growth model is often appropriate for mature companies with a stable history of growth.
 - Expected growth rates vary somewhat among companies, but dividend growth for most mature firms is generally expected to continue in the future at about the same rate as nominal gross domestic product (real GDP plus inflation).

The constant growth model is sufficiently general to handle the case of a zero growth stock, where the dividend is expected to remain constant over time. If $g = 0$, then the stock can be valued as $P_0 = D/k_s$. This is the same equation as that used for a perpetuity.

EXAMPLE 1: APE, Inc.'s stock paid a dividend of \$4.00 last year. The dividends are expected to grow by 5% each year indefinitely. Investors generally expect a 20% return to invest in this stock. What should the price of the stock be?

$$P_0 = \frac{D_0(1+g)}{k_s - g} = \frac{4(1+.05)}{.20 - .05} = \$28$$

EXAMPLE 2: EPA, Inc.'s stock is expected to pay a dividend of \$4.00 next year. The dividends are expected to grow by 5% each year indefinitely. Investors generally expect a 20% return to invest in this stock. What should the price of the stock be?

$$P_0 = \frac{D_1}{k_s - g} = \frac{4}{.20 - .05} = \$26.67$$

NOTE: The difference in Examples 1 and 2 is that in the first example the “last” dividend was given. We had to convert it to the “next” dividend by applying the growth rate. In example 2, the “next” dividend was given.

Valuing Stocks that have a Nonconstant Growth Rate

Firms typically go through periods of nonconstant growth, after which time the growth rate settles to a rate close to that of the economy as a whole. The value of such a firm is equal to the present value of its expected future dividends. To find the value of such a stock, we proceed in three steps:

- Find the present value of the dividends during the period of nonconstant growth.

- Find the price of the stock at the end of the nonconstant growth period, at which point it has become a constant growth stock, and discount this price back to the present.
- Add these two components to find the intrinsic value of the stock.

$$P_0 = \sum_{t=1}^N \frac{D_t}{(1+k_s)^t} + \frac{\left(\frac{D_N(1+g)}{k_s - g} \right)}{(1+k_s)^N}$$

Supernormal (nonconstant) growth firms are firms that are in that part of their life cycle in which they grow at a nonconstant rate which may be lower or higher than the growth in the economy as a whole.

The formula as shown only allows for one nonconstant growth rate, but can easily be altered to allow for several growth rates before reaching the constant growth rate period.

Again, the easiest way to solve a problem of this type is to recognize that there are actually three steps included in the formula. First, we calculate the dividends during the supernormal growth period. Second, we calculate the value of the stock at the point where the dividends begin to grow at a constant rate (by using the constant growth model). Third, we take the present value of the CFs in steps one and two and add them all together.

EXAMPLE: RRRR, Inc. paid a common stock dividend of \$3.00 last year. The dividends are expected to grow at a rate of 20% per year for the next three years, and then 5% per year thereafter. Investors would expect a 16% rate of return to invest in this stock. What should the stock sell for?

STEP 1: Calculate the dividends during the supernormal growth period. (Here this lasts three years, so we need to calculate three dividends.

$$D_1 = D_0(1+g_s) = 3.00(1+.20) = 3.60$$

$$D_2 = D_1(1+g_s) = 3.60(1+.20) = 4.32$$

$$D_3 = D_2(1+g_s) = 4.32(1+.20) = 5.184$$

STEP 2: Calculate the value of the stock at the time the dividends start to grow at a constant rate (using the constant growth model). In this case, the dividends start growing at a constant growth rate as of the end of the third year. So we need to calculate P_3 . The constant growth model can be used for any time period, just remember that the dividend used needs to be the next one to occur after the time for which you are calculating the price. Here we want P_3 , so we need to use D_4 in the formula. We don't know D_4 , but we can calculate it since we know D_3 and

$$P_3 = \frac{D_4}{k_s - g_c} = \frac{D_3(1+g_c)}{k_s - g_c} = \frac{5.184(1+.05)}{.16 - .05} = \$49.48$$

know the growth rate from that point forward is 5% per year.

STEP 3: Take the present value of the dividends and stock price you calculated in steps 1 and 2. Note that what we really have is an uneven CFs problem where we use the investors' required return as the discount rate. Be careful to realize that the last dividend calculated in step 1 and the price calculated in step 2 are for the same

time period. Therefore, they must be added together before putting them in as CFs in the calculator.

$$CF_0=0$$

$$CF_1=D_1=3.60$$

$$CF_2=D_2=4.32$$

$$CF_3=D_3+P_3=5.184+49.48=54.664$$

$$i=16$$

Use the NPV to get the Present value of the CFs: Answer \$41.33

Valuing the Entire Corporation

The total company, or corporate value, model is a valuation model used as an alternative to the dividend growth model to determine the value of a firm, especially one that does not pay dividends or is privately held. This model discounts a firm's free cash flows at the WACC to determine its value.

The value of a firm's stock is directly linked to a firm's total value. The steps to the corporate value model approach are as follows:

- Find the firm's total value, which is the present value of its future free cash flows (FCFs).
- Subtract the market value of debt and preferred stock from the firm's total value.
- Divide the total value of the common equity by the number of shares outstanding to obtain an estimate of the value per share.

The market value of any company can be expressed as follows:

$$\begin{aligned}\text{Market value of company} &= V_{\text{Company}} = \text{PV of expected free cash flows} \\ &= \sum_{t=1}^{\infty} \frac{FCF_t}{(1 + \text{WACC})^t}\end{aligned}$$

Free cash flow represents the cash generated in a given year minus the cash needed to finance the capital expenditures and operating working capital needed to support future growth.

$$FCF = \text{NOPAT} - \text{Net new investment in operating capital}$$

Free cash flow is the cash generated before making any payments to common or preferred stockholders, or to bondholders, so it is the cash flow that is available to all investors.

Therefore, the FCF should be discounted at the company's weighted average cost of debt, preferred stock, and common stock, or the WACC. (We will discuss the concept of WACC more fully in Chapter 10.)

To find the firm's total value, proceed as follows:

- Assume the firm will experience nonconstant growth for N years, after which it will grow at some constant rate.
- Calculate the expected FCF for each of the N nonconstant growth years, and find the PV of these cash flows.

- After Year N growth will be constant. Thus, use the constant growth formula to find the firm's value at Year N.
- Sum the PVs, those of the annual free cash flows during the nonconstant period plus the PV of the terminal value, to find the firm's value.

Stock Market Equilibrium

The relationship between a stock's required and expected rates of return determines the equilibrium price level where buying and selling pressures will just offset each other. The marginal investor is a representative investor whose actions reflect the beliefs of those people who are currently trading a stock. It is the marginal investor who determines a stock's price. If the expected rate of return is less than the required rate, investors will desire to sell the stock; there will also be a tendency for the price to decline. When the expected rate of return is greater than the required rate, investors will try to purchase shares of the stock; this will drive the price upward. Only at the equilibrium price, where the expected and required rates are equal, will the stock price be stable.

Equilibrium will generally exist for a given stock because security prices, especially those of large companies, adjust rapidly to disequilibrium situations. Stock prices certainly change, but this simply reflects changing conditions and expectations. Changes in the equilibrium price can be brought about (1) by a change in risk aversion, (2) by a change in the risk-free rate, (3) by a change in the stock's beta coefficient, or (4) by a change in the stock's expected growth rate.

The Efficient Markets Hypothesis (EMH) holds that stocks are always in equilibrium and that it is impossible for an investor to consistently "beat the market."

- The weak form of the EMH states that all information contained in past price movements is fully reflected in current market prices.
- The semistrong form of the EMH states that current market prices reflect all publicly available information. If this is true, no abnormal returns can be gained by analyzing stocks. Another implication of semistrong-form efficiency is that whenever information is released to the public, stock prices will respond only if the information is different from what had been expected.
- The strong form of the EMH states that current market prices reflect all pertinent information, whether publicly available or privately held (inside information). If this form holds, even insiders would find it impossible to earn abnormal returns in the stock market.

Empirical tests have shown that EMH is, in its weak and semistrong forms, valid. However, the strong-form EMH does not hold, so abnormal profits can be made if inside information is possessed. In general, stocks are neither overvalued nor undervalued. They are fairly priced and in equilibrium. Therefore, it is generally safe to assume that stocks plot on the SML.

Actual Stock Prices and Returns

Anyone who has ever invested in the stock market knows that there can be, and generally are, large differences between expected and realized prices and returns. Investors always expect positive returns from stock investments or else they would not buy them. However, in some years negative returns are actually earned. Even in bad years, some individual stocks do well, and the "name of the game" in security analysis is to pick the winners. Financial managers are

trying to take those actions that will help put their companies in the winners' column, but they don't always succeed.

When investing overseas, you are making two bets: (1) that foreign stocks will increase in their local markets and (2) that the currencies in which you will be paid will rise relative to the dollar. Although U.S. stocks have outperformed foreign stocks in recent years, this by no means suggests that investors should ignore foreign stocks. Foreign investments still improve diversification, and it is inevitable that there will be years when foreign stocks outperform domestic stocks.

Preferred Stock

Preferred stock is a hybrid. It is similar to bonds in some respects and to common stock in others.

Preferred dividends are similar to interest payments on bonds in that they are fixed in amount and generally must be paid before common stock dividends can be paid.

If the preferred dividend is not earned, the directors can omit (or "pass") it without throwing the company into bankruptcy. So, although preferred stock has a fixed payment like bonds, a failure to make this payment will not lead to bankruptcy.

Most preferred stocks entitle their owners to regular fixed dividend payments. If the payments last forever, the issue is a perpetuity whose value, V_p , is found as follows:

$$V_p = \frac{D_p}{k_p}$$

Here D_p is the dividend to be received each year, and k_p is the required rate of return on the preferred stock.

CHAPTER 9

Stocks and Their Valuation

- Preferred stock
- Features of common stock
- Determining common stock values
- Efficient markets

1

Preferred Stock

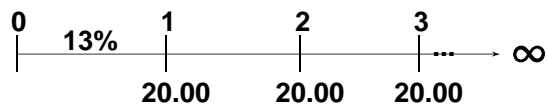
- Hybrid security.
- Similar to bonds in that preferred stockholders receive a fixed dividend that must be paid before dividends can be paid on common stock.
- However, unlike interest payments on bonds, companies can omit dividend payments on preferred stock without fear of pushing the firm into bankruptcy.

2

Stock Value = PV of Dividends

$$V_p = \frac{D}{(1+k_s)^1} + \frac{D}{(1+k_s)^2} + \frac{D}{(1+k_s)^3} + \dots + \frac{D}{(1+k_s)^\infty}$$

The dividend stream is a perpetuity (an annuity with no maturity).



3

Since the dividend remains the same, the present value of each dividend decreases as time until receipt increases.

N	I	PV	FV
1	13	17.70	20.00
5	13	10.86	20.00
50	13	0.04	20.00
100	13	0.0001	20.00

4

Eventually the “far away” future payments have a present value of virtually zero.

This allows us to develop a simple formula to calculate the value of preferred stock.

$$V_p = \frac{D}{k_p}$$

V_p = value of preferred
 D = dividend
 k_p = discount rate

5

If the appropriate discount rate is 13%, what is the value of a preferred stock with a par value of \$200 that promises to pay a dividend equal to 10% of par?

$$V_p = \frac{D}{k_p} = \frac{20.00}{0.13} = 153.85$$

6

Preferred Stock

The value of a preferred stock can be found using the calculator. Treat the stock as an annuity (end mode) with a large number of payments (e.g., $n=1000$).

INPUTS	1000	13		20	
	N	I/YR	PV	PMT	FV
OUTPUT			-153.85		

7

Facts about Common Stock

- Represents ownership.
- Ownership implies control.
- Stockholders elect directors.
- Directors elect management.
- Management's goal: Maximize the stock price.

8

Different Approaches for Valuing Common Stock

- Dividend growth model
- Free cash flow method
- Using the multiples of comparable firms

9

Stock Value = PV of Dividends

$$\hat{P}_0 = \frac{D_1}{(1+k_s)^1} + \frac{D_2}{(1+k_s)^2} + \frac{D_3}{(1+k_s)^3} + \dots + \frac{D_\infty}{(1+k_s)^\infty}$$

What is a constant growth stock?

One whose dividends are expected to grow forever at a constant rate, g .

10

If a stock has constant growth, we can again develop a simple formula to value the stock.

$$P_0 = \frac{D_0(1+g)}{k_s - g} = \frac{D_1}{k_s - g}$$

P_0 = price of stock at time 0

D_0 = "old" dividend

D_1 = "new" (or next) dividend

g = dividend growth rate

k_s = appropriate discount rate ($k_s > g$)

11

What happens if $g > k_s$?

- If $g > k_s$, the constant growth formula leads to a negative stock price, which does not make sense.
- The constant growth model can only be used if:
 - $k_s > g$
 - g is expected to be constant forever

12

Assume beta = 1.2, $k_{RF} = 7\%$, and $k_M = 12\%$. What is the required rate of return on the firm's stock?

Use the CAPM to calculate k_s :

$$\begin{aligned} k_s &= k_{RF} + (k_M - k_{RF})b_{\text{Firm}} \\ &= 7\% + (12\% - 7\%)(1.2) \\ &= 13\% \end{aligned}$$

13

What's the stock's market value?
 $D_1 = 3.50$, $k_s = 13\%$, $g = 6\%$.

Constant growth model:

$$\begin{aligned} P_0 &= \frac{D_1}{k_s - g} = \frac{3.50}{0.13 - 0.06} \\ &= \frac{\$3.50}{0.07} = \$50.00 \end{aligned}$$

14

What's the stock's market value if
 $D_0 = 2.00$, $k_s = 13\%$, $g = 6\%$.

Constant growth model:

$$\begin{aligned} P_0 &= \frac{D_0(1+g)}{k_s - g} = \frac{2(1+0.06)}{0.13 - 0.06} \\ &= \frac{\$2.12}{0.07} = \$30.29 \end{aligned}$$

15

What is the stock's market value
one year from now, \hat{P}_1 ?

- D_1 will have been paid, so expected dividends are D_2 , D_3 , D_4 and so on.

Thus,

$$\begin{aligned} \hat{P}_1 &= \frac{D_2}{k_s - g} = \frac{\$2.247}{0.13 - 0.06} \\ &= \$32.10. \end{aligned}$$

Could also find \hat{P}_1 as follows:

$$\hat{P}_1 = P_0(1.06) = \$32.10.$$

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Rearrange model to rate of return form:

$$\hat{P}_0 = \frac{D_1}{k_s - g} \text{ to } \hat{k}_s = \frac{D_1}{P_0} + g.$$

$$\begin{aligned} \text{Then, } \hat{k}_s &= \$2.12/\$30.29 + 0.06 \\ &= 0.07 + 0.06 = 13\%. \end{aligned}$$

17

Supernormal (multiple) growth model

Often stocks do not have constant growth.

Instead, it is possible that they are currently undergoing a period of high or low growth relative to its average growth.

For these stocks we need a different valuation model.

18

Supernormal growth model

$$P_0 = \sum_{t=1}^N \frac{D_t}{(1+k_s)^t} + \frac{\left(\frac{D_N(1+g)}{k_s - g} \right)}{(1+k_s)^N}$$

The model separates the dividends during the unusual growth period.

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Supernormal growth model

In words the formula has three parts.

1. Calculate the expected dividends during the unusual growth period.
2. Calculate the value of the stock at the end of unusual growth using the constant growth model.
3. Calculate the present value of the amounts found in steps 1 and 2.

20

If we have supernormal growth of 30% for 3 years, the dividend last year was \$2.00, and the long-run constant growth rate is 6%, what should be the price of the stock if the appropriate discount rate is 13%.

21

▪ Step 1: Dividends during unusual growth

- $D_1 = 2.00(1+0.30) = 2.60$
- $D_2 = 2.60(1+0.30) = 3.38$
- $D_3 = 3.38(1+0.30) = 4.394$

Step 2: Calculate value of stock at end of unusual growth period using constant growth model.

$$P_3 = \frac{D_3(1+g_c)}{k_s - g_c} = \frac{4.394(1+.06)}{.13 - .06} = \$66.54$$

22

Step 3: Compute the present value of the amounts in steps 1 and 2. (This is an uneven cash flow problem.)

$$CF_0 = 0$$

$$CF_1 = 2.60$$

$$CF_2 = 3.38$$

$$CF_3 = 4.394 + 66.54$$

$$I = 13$$

$$NPV = 54.11$$

$$TI\ 83: npv(13,0,\{2.60,3.38,70.934\})\ \text{Enter}\ 23$$

Free Cash Flow Method

- The free cash flow method suggests that the value of the entire firm equals the present value of the firm's free cash flows (calculated on an after-tax basis).
- The free cash flow in any given year can be calculated as:

NOPAT – Net capital investment

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Using the Free Cash Flow Method

- Once the value of the firm is estimated, an estimate of the stock price can be found as follows:
 - MV of common stock (market capitalization) = MV of firm – MV of debt and preferred stock.
 - $P_0 = (\text{MV of stock}) \div (\text{\# of shares})$

25

FCF Method Issues (Continued)

- Similar to the dividend growth model, the free cash flow method generally assumes that at some point in time, the growth rate in free cash flow will become constant.
- Terminal value represents the value of the firm at the point in which growth becomes constant.

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FCF Method Issues (Continued)

Determining the value of the firm using the free cash flow method uses the same procedure as the dividend models.

The difference is that the dividend in the models is replaced with the free cash flow and the appropriate discount rate is the firm's cost of capital.

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FCF estimates for the next 3 years are -\$5, \$10, and \$20 million, after which the FCF is expected to grow at 6%. The overall firm cost of capital is 10%.

28

- **Step 1: Free cash flow during unusual growth**

- $FCF_1 = -5.00$
- $FCF_2 = 10.00$
- $FCF_3 = 20.00$

Step 2: Calculate value of stock at end of unusual growth period using constant growth model.

$$P_3 = \frac{FCF_3(1+g_c)}{k_s - g_c} = \frac{20(1+.06)}{.10 - .06} = \$530$$

29

- **Step 3: Compute the present value of the amounts in steps 1 and 2. (This is an uneven cash flow problem.)**

$$CF_0 = 0$$

$$CF_1 = -5$$

$$CF_2 = 10$$

$$CF_3 = 20 + 530$$

$$I = 10$$

$$NPV = 416.94$$

30

If the firm has \$40 million in debt and has 10 million shares of stock, what is the price per share?

Value of equity = Total value – Value of debt
= \$416.94 – \$40
= \$376.94 million.

Price per share = Value of equity/# of shares
= \$376.94/10
= \$37.69

31

What's the Efficient Market Hypothesis?

Securities are normally in equilibrium and are “fairly priced.” One cannot “beat the market” except through good luck or better information.

Weak-form EMH: Cannot profit by looking at past trends. A recent decline is no reason to think stocks will go up (or down) in the future. Evidence supports weak-form EMH, but “technical analysis” is still used.

32

Semistrong-form EMH: All publicly available information is reflected in stock prices, so doesn't pay to pore over annual reports looking for undervalued stocks. Largely true, but superior analysts can still profit by finding and using new information.

Strong-form EMH: All information, even inside information, is embedded in stock prices. Not true—insiders can gain by trading on the basis of insider information, but that's illegal.

33

Is the stock market efficient?

- Empirical studies have been conducted to test the three forms of efficiency. Most of which suggest the stock market was:
 - Highly efficient in the weak form.
 - Reasonably efficient in the semistrong form.
 - Not efficient in the strong form. Insiders could and did make abnormal (and sometimes illegal) profits.

34

Behavioral Finance

- Behavioral finance – incorporates elements of cognitive psychology to better understand how individuals and markets respond to different situations.

35

Sample Problems – Chapter 9

Title: Preferred stock (solve for value)

1. Timeless Corporation issued preferred stock with a par value of \$700. The stock promised to pay an annual dividend equal to 19.0% of the par value. If the appropriate discount rate for this stock is 10.0%, what is the value of the stock?

- a. \$1,330.00
- b. \$368.42
- c. \$772.28
- d. \$1,532.16
- e. \$1,506.89

Title: Preferred stock (solve for req. return)

2. Forever, Inc.'s preferred stock has a par value of \$1,000 and a dividend equal to 13.0% of the par value. The stock is currently selling for \$907.00. What discount rate is being used to value the stock?

- a. 15.08%
- b. 14.33%
- c. 15.75%
- d. 13.34%
- e. 12.10%

Title: Preferred stock (solve for dividend)

3. Here and After Corporation plans a new issue of preferred stock. Similar risk stock currently offers an annual return to investors of 17.0%. The company wants the stock to sell for \$569.00 per share. What annual dividend must the company offer?

- a. \$139.48
- b. \$3,347.06
- c. \$107.37
- d. \$96.73
- e. \$3,089.34

Title: Constant Growth Model (old div)

4. You are considering buying common stock in Grow On, Inc. The firm yesterday paid a dividend of \$5.20. You have projected that dividends will grow at a rate of 8.0% per year indefinitely. If you want an annual return of 20.0%, what is the most you should pay for the stock now?

- a. \$28.08
- b. \$43.33
- c. \$26.00
- d. \$46.80
- e. \$51.13

Title: Constant Growth Model (new div)

5. You are considering buying common stock in Grow On, Inc. You have projected that the next dividend the company will pay will equal \$4.00 and that dividends will grow at a rate of 5.0% per year thereafter. If you would want an annual return of 13.0% to invest in this stock, what is the most you should pay for the stock now?

- a. \$30.77
- b. \$52.50
- c. \$50.00
- d. \$32.31
- e. \$54.63

Title: Supernormal growth (two years $g(s)$)

6. Growing, Inc. is a firm that is experiencing rapid growth. The firm yesterday paid a dividend of \$7.50. You believe that dividends will grow at a rate of 24.0% per year for two years, and then at a rate of 5.0% per year thereafter. You expect the stock will sell for \$46.57 in two years. You expect an annual rate of return of 18.0% on this investment. If you plan to hold the stock indefinitely, what is the most you would pay for the stock now?

- a. \$89.91
- b. \$72.85
- c. \$49.61
- d. \$61.52
- e. \$83.06

Title: Supernormal growth (three years $g(s)$)

7. Growing, Inc. is a firm that is experiencing rapid growth. The firm yesterday paid a dividend of \$5.60. You believe that dividends will grow at a rate of 24.0% per year for three years, and then at a rate of 10.0% per year thereafter. You expect that the stock will sell for \$177.59 in three years. You expect an annual rate of return of 18.0% on this investment. If you plan to hold the stock indefinitely, what is the most you would pay for the stock now?

- a. \$107.92
- b. \$94.29
- c. \$126.66
- d. \$79.63
- e. \$116.83

Title: Supernormal growth (three growth rates - four years)

8. Growing, Inc. is a firm that is experiencing rapid growth. The firm yesterday paid a dividend of \$8.00. You believe that dividends will grow at a rate of 22.0% per year for years one and two, 15.0% per year for years three and four, and then at a rate of 9.0% per year thereafter. If you expect an annual rate of return of 21.0% on this investment, what is the most you would pay for the stock now?

- a. \$130.52
- b. \$106.07
- c. \$113.03
- d. \$98.00
- e. \$89.41

Title: Constant Growth Model (old div - CAPM)

9. You are considering buying common stock in Grow On, Inc. The firm yesterday paid a dividend of \$4.70. You have projected that dividends will grow at a rate of 6.0% per year indefinitely. The firm's beta is 2.39, the risk-free rate is 4.0%, and the market return is 10.9%. What is the most you should pay for the stock now?

- a. \$22.94
- b. \$32.44
- c. \$34.38
- d. \$24.31
- e. \$37.56

Title: Constant Growth Model (new div - CAPM)

10. You are considering buying common stock in Grow On, Inc. You have projected that the next dividend the company will pay will equal \$7.60 and that dividends will grow at a rate of 6.0% per year thereafter. The firm's beta is 0.93, the risk-free rate is 6.1%, and the market return is 13.6%. What is the most you should pay for the stock now?

- a. \$107.34
- b. \$113.79
- c. \$58.10
- d. \$61.59
- e. \$117.28

Title: Free cash flow (constant growth)

11. You are considering buying common stock in Grow On, Inc. You have calculated that the firm's free cash flow was \$8.10 million last year. You project that free cash flow will grow at a rate of 6.0% per year indefinitely. The firm currently has outstanding debt and preferred stock with a total market value of \$9.22 million. The firm has 1.20 million shares of common stock outstanding. If the firm's cost of capital is 25.0%, what is the most you should pay per share for the stock now?

- a. \$35.97
- b. \$37.66
- c. \$45.19
- d. \$29.98
- e. \$49.37

Title: FCF(supernormal growth)

12. You are considering buying common stock in Super Growth, Inc. You have calculated that the firm's free cash flow was \$6.20 million last year. You project that free cash flow will grow at a rate of 20.0% per year for the next three years, and then 6.0% per year indefinitely thereafter. The firm currently has outstanding debt and preferred stock with a total market value of \$26.60 million. The firm has 1.68 million shares of common stock outstanding. If the firm's cost of capital is 19.0%, what is the most you should pay per share for the stock now?

- a. \$76.59
- b. \$42.12
- c. \$15.83
- d. \$70.75
- e. \$26.28

1.

N	I	***PV***	FV	PMT
1000	10	1330		(700)(0.19)

2.

N	***I***	PV	FV	PMT
1000	14.33	-907		(1000)(0.13)

3.

N	I	PV	FV	***PMT***
1000	17	-569		96.73

4.

$$P_0 = \frac{D_0(1+g)}{k_s - g} = \frac{5.20(1+0.08)}{0.20 - 0.08} = 46.80$$

5.

$$P_0 = \frac{D_1}{k_s - g} = \frac{4.00}{0.13 - 0.05} = 50.00$$

6.

$$D_1 = 7.50(1+0.24) = 9.30$$

$$D_2 = 9.30(1+0.24) = 11.532$$

$$P_2 = [11.532(1+0.05)]/(0.18-0.05) = 93.14$$

$$CF_0 = 0$$

$$CF_1 = 9.30$$

$$CF_2 = 11.532 + 93.14$$

$$I = 18$$

$$NPV = 83.06$$

$$TI83: npv(18,0,\{9.30,104.672\})$$

7.

$$D_1 = 5.60(1+0.24) = 6.944$$

$$D_2 = 6.944(1+0.24) = 8.611$$

$$D_3 = 8.611(1+0.24) = 10.677$$

$$P_3 = [10.677(1+0.10)]/(0.18-0.10) = 146.81$$

$$CF_0 = 0$$

$$CF_1 = 6.944$$

$$CF_2 = 8.611$$

$$CF_3 = 10.677 + 146.81$$

$$I = 18$$

$$NPV = 107.92$$

$$TI83: npv(18,0,\{6.944,8.611,157.487\})$$

8.

$$D_1 = 8.00(1+0.22) = 9.76$$

$$D_2 = 9.76(1+0.22) = 11.907$$

$$D_3 = 11.907(1+0.15) = 13.6933$$

$$D_4 = 13.6933(1+0.15) = 15.7473$$

$$P_4 = [15.7473(1+0.09)]/(0.21-0.09) = 143.04$$

$$CF_0 = 0$$

$$CF_1 = 9.76$$

$$CF_2 = 11.907$$

$$CF_3 = 13.6933$$

$$CF_4 = 15.7473 + 143.04 = 158.785$$

$$I = 21$$

$$NPV = 98.00$$

$$TI83: npv(21,0,\{9.76,11.907,13.6933,158.785\})$$

9.

$$k_i = k_{RF} + b_i(k_M - k_{RF})$$

$$k_i = 4.0\% + 2.39(10.9\% - 4.0\%) = 20.491\%$$

$$P_0 = \frac{D_0(1+g)}{k_s - g} = \frac{4.70(1+0.06)}{0.20491 - 0.06} = 34.38$$

10.

$$k_i = k_{RF} + b_i(k_M - k_{RF})$$

$$k_i = 6.1\% + 0.93(13.6\% - 6.1\%) = 13.08\%$$

$$P_0 = \frac{D_1}{k_s - g} = \frac{7.60}{0.1308 - 0.06} = 107.34$$

11.

Let V_0 represent the total value of the firm based on the free cash flow model.

$$V_0 = \frac{FCF_0(1+g)}{k_s - g} = \frac{8.10(1+0.06)}{0.25 - 0.06} = 45.19$$

Value of firm = value of debt and preferred + value of equity

$$45.19 = 9.22 + \text{value of equity}$$

$$\text{value of equity} = 35.97$$

value per share = (total value)/(number of shares)

$$\text{value per share} = (35.97)/(1.2) = 29.98$$

12.

$$FCF_1 = 6.2(1+0.20) = 7.44$$

$$FCF_2 = 7.44(1+0.20) = 8.928$$

$$FCF_3 = 8.928(1+0.20) = 10.7136$$

$$P_3 = [10.7136(1+0.06)]/(0.19-0.06) = 87.36$$

$$CF_0 = 0$$

$$CF_1 = 7.44$$

$$CF_2 = 8.928$$

$$CF_3 = 10.7136 + 87.36$$

$$I = 19$$

$$NPV = 70.755$$

$$TI83: \text{npv}(19,0,\{7.44,8.928,98.0736\})$$

Value of firm = value of debt and preferred + value of equity

$$70.755 = 26.60 + \text{value of equity}$$

$$\text{value of equity} = 44.155$$

value per share = (total value)/(number of shares)

$$\text{value per share} = (44.155)/(1.68) = 26.28$$

Chapter 10: The Cost of Capital

Putting Things in Perspective

When companies issue stocks or bonds, they are raising capital that can be invested in various projects. Capital is a necessary factor of production, and like any other factor, it has a cost. This cost is equal to the marginal investor's required return on the security in question. Recall that the firm's primary financial objective is to maximize shareholder value. Companies can increase shareholder value by investing in projects that earn more than the cost of capital. For this reason, the cost of capital is sometimes referred to as a hurdle rate: For a project to be accepted, it must earn more than its hurdle rate.

Although its most important use is in capital budgeting, the cost of capital is also used for at least three other purposes: (1) It is a key input required for determining a firm's or division's economic value added (EVA); (2) managers estimate and use the cost of capital when deciding if they should lease or purchase assets; and, (3) the cost of capital has also been important over time in the regulation of electric, gas, and telephone companies. The same factors that affect required rates of return on securities by investors also determine a firm's cost of capital, so investors and corporate treasurers often use exactly the same models.

The Logic of the Weighted Average Cost of Capital

It is possible to finance a firm entirely with common equity, but most firms raise a substantial portion of their capital as debt, and many also use preferred stock. For these firms, the cost of capital must reflect the average cost of the various sources of funds. An average cost of funds is used since a firm usually has a target capital structure, or mix of funds, it prefers to use. Later chapters will discuss how to arrive at the best financing mix. If the firm uses one type of funds to finance current projects, it must use the other types of funds for future financing to return to its preferred capital structure. Thus, focus should not be placed on where the funds will come from for specific projects. The firm should be viewed as an ongoing concern and the cost of capital used in capital budgeting should be calculated as a weighted average, or composite, of the costs of the various types of funds it generally uses.

Basic Definitions

Determining the firm's cost of capital, or the proper discount rate for use in calculating the present value of the cash inflows for the firm's projects, is an important element of the capital budgeting process. The cost of capital used in capital budgeting should be calculated as a weighted average, or composite, of the types of funds a firm generally uses, regardless of the specific financing used to fund a particular project.

Capital components are items on the right-hand side of the balance sheet such as debt, preferred stock, and common equity. Any increase in total assets must be financed by an increase in one or more of these capital components.

Each element of capital has a component cost that can be identified as follows:

- k_d = interest rate on the firm's new debt, before tax.
- $k_d(1 - T)$ = after-tax cost of new debt where T is the firm's marginal tax rate.
- k_p = component cost of preferred stock.

- k_s = cost of retained earnings; it is equal to the required rate of return investors require on a firm's common stock.
- WACC = the weighted average cost of capital.

Cost of Debt, $k_d(1 - T)$

The largest component of many firm's debt is made up of funds obtained from bond issuance. However, to issue new debt requires incurring *flotation costs*. *Flotation costs* are the costs associated with issuing new securities (debt, preferred stock, common stock). These costs include such items as printing and legal expenses, accounting fees, and other fees paid to the underwriter (investment banker).

To determine the cost of debt we must first address the effect of flotation costs. The easiest way to view these costs is to realize that they will reduce the amount of funds raised by each bond sold. The firm will NOT receive the market price when it sells the bonds, but will instead receive the market price minus flotation costs (i.e. the net proceeds; $V_B - FC$). (Note: For large firms the flotation costs associated with debt are relative small and are often ignored.)

Once we account for these flotation costs, solving for the before-tax cost of debt, k_d , involves the same procedure as solving for a yield to maturity. We'll use the same formula we used to value bonds except we'll replace the market values of the bond with the net proceeds from the bond ($V_B - FC$).

Suppose you are told that Gaseous, Inc. is planning a new issue of bonds. The bonds would have an annual coupon rate of 8% based on a par value of \$1000. The bonds would mature 20 years from now. Management believes that the market value of these bonds would be \$1000 but the company would incur flotation costs of \$91 per bond issued (another way this is sometimes stated is to say that flotation costs would be 9.1% of the market value of the bonds). What would the before-tax cost of the bonds be?

The only variable we do not know is the before-tax cost of debt. Using your financial calculator you enter: $n=20$; $PV=-909$; $FV=1000$; $PMT=80$. Compute the i (discount rate). You should find an answer near 9%.

There is one key element left in determining the cost of debt. This is the fact that interest payments are "tax-deductible". Thus, for every additional dollar paid as interest, the firm lowers its tax expense by a percentage equal to the firm's marginal tax rate. Thus, to get the "after-tax" cost of debt we have to multiply the before-tax cost of debt times one minus the firm's marginal tax rate. If Gaseous, Inc.'s marginal tax rate is 40%, then their after-tax or "true" cost of the new

$$k_d(1 - T) = 9\%(1 - 0.40) = 5.40\%$$

bonds would be:

Cost of Preferred Stock, k_p

As with bonds, issuing preferred stock also involves paying various flotation costs. Thus, to determine the cost of preferred stock we again use the same formula we used to value the stock, but we replace the market value of the preferred stock with the net proceeds received from the

$$(V_p - FC) = \frac{D}{k_p}$$

stock ($V_p - FC$).

Since preferred stock dividends are NOT tax deductible, there is NO tax adjustment.

Suppose Gaseous, Inc. is now considering issuing preferred stock. The preferred stock would have a par value of \$100 and a 10% promised dividend. If the market value of the stock would be \$125, but the firm would have to incur flotation costs equal to 20% of the market value, what would the firm's cost of preferred stock be?

$$125 - (125)(0.20) = \frac{(100)(0.10)}{k_p}$$
$$k_p = \frac{10}{100} = 10\%$$

Cost of Retained Earnings, k_s

New common equity is raised in two ways: (1) By retaining some of the firm's current earnings and (2) by issuing new common stock. A corporation's management might be tempted to think that retained earnings are "free" because they represent funds that are "left over" after paying dividends, but this capital still has a cost. The reason we must assign a cost of capital to retained earnings involves the opportunity cost principle. The firm's after-tax earnings belong to its stockholders. Stockholders could have received the earnings as dividends and invested this money in other stocks, in bonds, in real estate, or in anything else.

Stockholders will be content to allow the retention of profits by the company only if the firm earns on its retained earnings at least as much as the stockholders themselves could earn on alternative investments of comparable risk. Thus, the cost of retained earnings, k_s , is the rate of return stockholders require on the company's common stock. The cost of common equity raised by issuing new stock (external equity), k_e , is somewhat higher due to the flotation costs involved with new stock issues.

There are three approaches used to estimate k_s :

(NOTE: It is recommended that all three approaches be used in estimating the required rate of return on common stock. When the methods produce widely different results, judgment must be used in selecting the best estimate.)

A. The Capital Asset Pricing Model (CAPM) works as follows:

- Estimate the risk-free rate, k_{RF} , usually based on U.S. Treasury securities.
- Estimate the stock's beta coefficient, b_i , as an index of risk.
- Estimate the expected rate of return on the market, or on an "average" stock, k_M .
- Substitute the preceding values into the CAPM equation, $k_s = k_{RF} + (k_M - k_{RF})b_i$, to estimate the required rate of return on the stock in question.
- Thus, if $k_{RF} = 8\%$, $k_M = 13\%$, and b_i is 0.7, then $k_s = 8\% + (13\% - 8\%)0.7 = 11.5\%$.

B. The bond-yield-plus-risk-premium approach is a subjective, ad hoc procedure to estimate a firm's cost of common equity. It estimates k_s by adding a risk premium of around three to five percentage points to the firm's own bond yield. $k_s = \text{Bond yield} + \text{Risk premium}$.

- It is logical to think that firms with risky, low-rated, and consequently high-interest-rate debt will also have risky, high-cost equity. This approach utilizes this logic.

- If the firm uses a risk premium of 4 percentage points, and its bond rate is 12 percent, then $k_s = 12\% + 4\% = 16\%$.
 - Because the risk premium is a judgmental estimate, this method is not likely to produce a precise cost of equity; however, it does get us "into the right ballpark."
- C. The required rate of return, k_s , may also be estimated by the discounted cash flow (DCF) approach. This approach is also called the dividend-yield-plus-growth rate, as it combines the expected dividend yield, D_1/P_0 , with the expected future growth rate, g , of earnings and dividends,

$$k_s = \frac{D_1}{P_0} + g$$

- The DCF approach assumes that stocks are normally in equilibrium and that growth is expected to be at a constant rate. If growth is not constant, then a nonconstant growth model must be used.
- The expected growth rate may be based on projections of past growth rates, if they have been relatively stable, or on expected future growth rates as estimated in some other manner.
- Security analysts regularly make earnings and dividend growth forecasts, looking at such factors as projected sales, profit margins, and competitive factors.
- Another method for estimating g involves first forecasting the firm's average future dividend payout ratio and its complement, the retention rate, and then multiplying the retention rate by the company's expected future rate of return on equity (ROE):
 - $g = (\text{Retention rate})(\text{ROE}) = (1.0 - \text{Payout rate})(\text{ROE})$.
- Intuitively, firms that are more profitable and retain a larger portion of their earnings for reinvestment in the firm will tend to have higher growth rates than firms that are less profitable and pay out a higher percentage of their earnings as dividends.
- If the firm's next expected dividend is \$1.24, its expected growth rate is 8 percent per year, and its stock is selling for \$23 per share, then

$$\begin{aligned} k_s &= \hat{k}_s = \frac{\$1.24}{\$23} + 0.08 \\ &= 0.054 + 0.08 \\ &= 0.134 = 13.4\% \end{aligned}$$

- If the firm cannot earn about 13.4 percent on reinvested equity capital, then it should pay its earnings to stockholders and let them invest directly in other assets that do provide this return. Thus, k_s is an opportunity cost.

Cost of New Common Stock, k_e

Companies generally hire an investment banker to assist them when they issue common stock, preferred stock, or bonds. In return for a fee, the investment banker helps the company structure the terms, sets a price for the issue, and then sells the issue to investors. The banker's fees are often referred to as flotation costs, and the total cost of capital should include not only the required return paid to investors but also the flotation fees paid to the investment banker for

marketing the issue. Flotation costs should be included in a complete analysis of the cost of capital. Two approaches can be used to account for flotation costs.

- The first approach simply adds the estimated dollar amount of flotation costs for each project to the project's up-front cost. Because of the now-higher investment cost, the project's expected rate of return and NPV are decreased.
- The second approach involves adjusting the cost of capital rather than increasing the project's cost. If the firm plans to continue to use the capital in the future, as is generally true for equity, then this second approach is better. When calculating the cost of common equity, the DCF approach can be adapted to account for flotation costs. For a constant growth stock, cost of new common stock, k_e , can be expressed as follows:

$$k_e = \frac{D_1}{P_0(1 - F)} + g$$

- o Here F is the percentage flotation cost required to sell new stock, so $P_0(1 - F)$ is the net price per share received by the company.
- o If the firm has a flotation cost of 10 percent, its cost of new outside equity is computed as follows:

$$k_e = \frac{\$1.24}{\$23(1 - 0.10)} + 0.08 = 0.14 = 14\%$$

- o If the firm can earn 14 percent on investments financed by new common stock, then earnings, dividends, and the growth rate will be maintained, and the price per share will not fall. If it earns more than 14 percent, the price will rise; while if it earns less, the price will fall.

Since no flotation costs are involved, retained earnings have a lower cost than new stock. Therefore, firms should utilize retained earnings to the extent possible to avoid the cost of issuing new common stock.

Because of flotation costs, dollars raised by selling new stock must "work harder" than dollars raised by retained earnings. The retained earnings breakpoint represents the total amount of financing that can be raised before the firm is forced to sell new common stock, and is calculated

$$\text{Retained earnings breakpoint} = \frac{\text{Addition to retained earnings}}{\text{Equity fraction}}$$

as:

- o It is important to recognize that this breakpoint is only suggestive. It is not written in stone. Rather than issuing new common stock, the company could use more debt (hence, less equity), or it could increase its additional retained earnings by reducing its dividend payout ratio. Both actions would increase the retained earnings breakpoint.

Composite, or Weighted Average Cost of Capital, WACC

Each firm has an optimal capital structure, defined as that mix of debt, preferred, and common equity that causes its stock price to be maximized. A value-maximizing firm will establish a target (optimal) capital structure and then raise new capital in a manner designed to keep the actual capital structure on target over time. The target proportions of debt, preferred stock, and common equity, along with the component costs of capital, are used to calculate the firm's weighted average cost of capital (WACC).

The weighted average cost of capital calculation is shown below for a firm that finances 45 percent with debt, 2 percent with preferred stock, and 53 percent with common equity and that has the following after-tax component costs:

<u>Component</u>	<u>Weight</u>	x	<u>After-tax Cost</u>	=	<u>Weighted Cost</u>
Debt	0.45	x	6.0%	=	2.700%
Preferred	0.02	x	10.3	=	0.206
Common	0.53	x	13.4	=	7.102
WACC				=	10.008% ≅ 10.0%

In more general terms, and in equation format,

$$\text{WACC} = w_d k_d (1 - T) + w_p k_p + w_c k_s.$$

Theoretically, the weights used should be based on the market values of the different securities, but if a firm's book value weights are reasonably close to its market value weights, book value weights can be used as a proxy for market value weights. Note that total debt includes both long-term debt and bank debt (notes payable). Investor-supplied capital does not include other current liabilities such as accounts payable and accruals. Therefore, these other items are not included as part of the firm's capital structure.

The WACC represents the marginal cost of capital (MCC), because it indicates the cost of raising an additional dollar.

Factors that Affect the Composite Cost of Capital

The cost of capital is affected by a variety of factors. The two most important factors that are beyond the firm's direct control are the level of interest rates and tax rates.

If interest rates in the economy rise, the cost of debt capital increases because firms will have to pay bondholders a higher interest rate. Higher interest rates also increase the cost of common and preferred equity capital.

Tax rates are used in the calculation of the cost of debt, which is one of the component costs used to develop the WACC. There are other less apparent ways in which tax policy can affect the cost of capital. For example, lowering the capital gains tax rate relative to the rate on ordinary income would make stocks more attractive, which would reduce the cost of equity relative to that of debt. This would lead to a change in a firm's optimal capital structure.

A firm can affect its cost of capital through its capital structure policy, its dividend policy, and its investment (capital budgeting) policy.

The firm can change its capital structure, and such a change can affect its cost of capital. If a firm decides to use more debt and less common equity, this change in the weights in the WACC equation will tend to lower the WACC. However, an increase in the use of debt will increase the riskiness of both debt and equity, and these changes will tend to increase the WACC, and thus, offset the effects of the change in weights.

Because of flotation costs, new common stock is more expensive than retained earnings. For this reason, firms generally issue new common stock only after they have exhausted all of their retained earnings. Since retained earnings is income that has not been paid out as dividends, it follows that dividend policy can affect the cost of capital because it affects the level of retained earnings.

When we estimate the cost of capital, we use as the starting point the required rate of return on the firm's outstanding stock and bonds. These cost rates reflect the riskiness of the firm's existing assets. Therefore, we implicitly have been assuming that new capital will be invested in assets of the same type and with the same degree of risk as is embedded in the existing assets. This assumption will be incorrect if the firm dramatically changes its investment policy.

Adjusting the Cost of Capital for Risk

The cost of capital is a key element in the capital budgeting process. A project should be accepted only if its estimated return exceeds its cost of capital. For this reason, the cost of capital is sometimes referred to as the "hurdle rate." Project returns must jump the "hurdle" to be accepted.

Investors require higher returns for riskier investments. Consequently, a company that is raising capital to take on risky projects will have a higher cost of capital than a company that is investing in safer projects.

Ideally, the hurdle rate for each project should reflect the risk of the project itself, not necessarily the risks associated with the firm's average project as reflected in the firm's composite WACC.

Applying a specific hurdle rate to each project insures that every project is evaluated properly.

- In general, failing to adjust for differences in risk would lead a firm to accept too many risky projects and reject too many safe ones. Over time, the firm will become more risky, its WACC will increase, and its shareholder value will suffer.

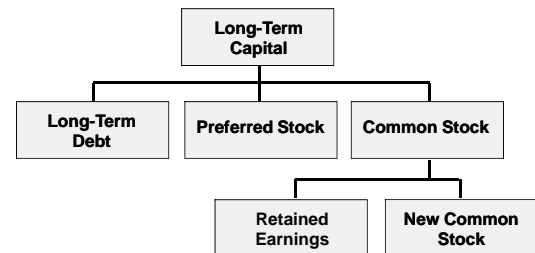
CHAPTER 10

The Cost of Capital

- Sources of capital
- Component costs
- WACC
- Adjusting for flotation costs
- Adjusting for risk

1

What sources of long-term capital do firms use?



2

Major determinant of the cost of capital

Regardless the type of capital, the main determinant of cost is the required return for investors.

The required return must be met to entice market participants to place funds in the firm whether the security is debt, preferred stock, or common stock.

3

Should we focus on before-or after-tax capital costs?

- Tax effects associated with financing can be incorporated either in capital budgeting cash flows or the cost of capital.
- Most firms incorporate tax effects in the cost of capital. Therefore, we focus on after-tax costs.

4

Only the cost of debt needs to be adjusted.

- Interest payments (the amounts paid to debtholders) are tax deductible.
- Dividend payments (the amounts paid to preferred and common stockholders) are not deductible.

5

Historical vs. Marginal Cost?

- The cost of capital is used primarily to make decisions which involve raising and investing new capital.
- So, we focus on marginal costs.
- It is the cost of the next dollar of capital raised which is the relevant concern.

6

Flotation costs

- Total costs of issuing a security reduce the net proceeds from the sale.
- This reduction in fund flowing to the firm is an additional cost that should be considered (although for larger firms the flotation costs may be small for some types of capital).

7

Component Cost of Debt

- The yield to maturity on outstanding long-term debt is used as a measure of the before-tax cost of debt (k_d).
- If flotation costs are substantial, we replace the bond's price with the price minus flotation costs (net proceeds).
- Interest is tax deductible, so the cost of debt must be adjusted to reflect the tax savings.

$$k_{dAT} = k_{dBT}(1 - T)$$

8

Calculate before-tax cost of debt

N	*I*	PV	FV	Pmt
Number of coupon pmts	Cost of debt before taxes	Price minus flotation costs	Par value	Coupon payment each period

9

After-tax cost of debt

$$\left(\begin{array}{c} \text{after - tax} \\ \text{cost of debt} \end{array} \right) = \left(\begin{array}{c} \text{before - tax} \\ \text{cost of debt} \end{array} \right) (1 - \text{tax rate})$$

10

Example Problem

BBB's bonds have a par value of \$1,000, a maturity of 25 years, and an annual coupon rate of 12%. Investors will expect an 11% rate of return for these bonds. The flotation costs will equal 4% of the market value of the bonds. The firm's marginal tax rate is 40%. What is the true cost of the bonds?

11

Calculate Price

SOLVE				
N	I	*PV*	FV	Pmt
25	11	-1084.22	1000	120

To calculate the cost of debt, we first need to determine the price of the bond.

12

To calculate the before-tax cost of debt, we insert the price minus flotation costs as the PV. Net proceeds = $1084.22(1 - 0.04) = 1040.85$

SOLVE				
N	*I*	PV	FV	Pmt
25	11.5	-1040.85	1000	120

The after-tax cost is calculated as the before-tax cost times one minus the marginal tax rate.

After-tax cost of debt = $11.5\% (1 - 0.40) = 6.9\%$

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Component Cost of Preferred Stock

- k_p is the marginal cost of preferred stock which is the rate of return investors require on the firm's preferred stock adjusted for flotation costs.
- Preferred dividends are not tax deductible, so no tax adjustment.

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Cost of preferred stock

Use this formula:

$$(V_p - F) = \frac{D}{k_p}$$

$$k_p = \frac{D}{V_p - F}$$

15

What's the cost of preferred stock? The current price is \$111.10 with a par of \$100 and a 10% dividend. Flotation costs are 5% of the price.

$$k_p = \frac{D}{V_p - F}$$

$$k_p = \frac{0.10(100)}{111.10 - (0.05)(111.10)}$$

$$k_p = 0.09475 = 9.475\%$$

16

Using the calculator:

- You may solve for the cost of preferred using the calculator.
- Let: n = some large number (1000); I/yr = cost of preferred (variable solved for; PV = negative of net proceeds; PMT = preferred dividend

17

$$PV = (111.10) - (0.05)(111.10) = 105.545$$

$$PMT = (0.10)(100) = 10$$

SOLVE				
N	*I*	PV	FV	Pmt
1000	9.475	-105.545		10

18

Component Cost of Equity

- Retained earnings: New equity can be generated by reinvesting profits. Since profits belong to the common shareholder, reinvested profits increase the shareholders' investment in the firm.
- New stock issues: New equity can also be raised through new issues.

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Component Cost of Equity

- k_s is the marginal cost of common equity using retained earnings (no flotation costs).
- The rate of return investors require on the firm's common equity using new equity is k_e (flotation costs are positive).

20

Why is there a cost for retained earnings?

- Earnings can be reinvested or paid out as dividends.
- Investors could buy other securities, earn a return.
- Thus, there is an opportunity cost if earnings are retained.

21

- Opportunity cost: The return stockholders could earn on alternative investments of equal risk.
- They could buy similar stocks and earn k_s , or company could repurchase its own stock and earn k_s . So, k_s is the cost of retained earnings.

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Three ways to determine cost of common equity, k_s :

1. CAPM: $k_s = k_{RF} + (k_M - k_{RF})b$

2. DCF: $k_s = D_1/P_0 + g$

3. Own-Bond-Yield-Plus-Risk Premium: $k_s = k_d + RP$

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What's the cost of common equity based on the CAPM?

$k_{RF} = 7\%$, $RP_M = 6\%$, $b = 1.2$.

$$\begin{aligned} k_s &= k_{RF} + (k_M - k_{RF})b \\ &= 7.0\% + (6.0\%)1.2 = 14.2\% \end{aligned}$$

24

What's the DCF cost of common equity, k_s ? Given: $D_0 = \$4.19$; $P_0 = \$50$; $g = 5\%$.

$$k_s = \frac{D_1}{P_0} + g = \frac{D_0(1+g)}{P_0} + g$$

$$= \frac{\$4.19(1.05)}{\$50} + 0.05$$

$$= 0.088 + 0.05$$

$$= 13.8\%$$

25

Find k_s using the own-bond-yield-plus-risk-premium method. ($k_d = 10\%$, $RP = 4\%$.)

$$k_s = k_d + RP$$

$$= 10.0\% + 4.0\% = 14.0\%$$

- This $RP \neq$ CAPM RP .
- Produces ballpark estimate of k_s . Useful check.

26

What's a good final estimate of k_s ?

- First, look for reasonableness of estimates. (Do they models generally agree and give you widely varying results?)
- If close, maybe use average.
- If very different, you have to look for justification for one model over another.

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What's a reasonable final estimate of k_s ?

<u>Method</u>	<u>Estimate</u>
CAPM	14.2%
DCF	13.8%
$k_d + RP$	<u>14.0%</u>
Average	<u>14.0%</u>

28

Why is the cost of retained earnings cheaper than the cost of issuing new common stock?

1. When a company issues new common stock they also have to pay flotation costs to the underwriter.
2. Issuing new common stock may send a negative signal to the capital markets, which may depress stock price.

29

Two approaches that can be used to account for flotation costs:

- Include the flotation costs as part of the project's up-front cost. This reduces the project's estimated return.
- Adjust the cost of capital to include flotation costs. This is most commonly done by incorporating flotation costs in the DCF model.

30

Suppose new common stock had a flotation cost of 15%. What is k_e ?

$$\begin{aligned}
 k_e &= \frac{D_0(1+g)}{P_0(1-F)} + g \\
 &= \frac{\$4.19(1.05)}{\$50(1-0.15)} + 5.0\% \\
 &= \frac{\$4.40}{\$42.50} + 5.0\% = 15.4\%.
 \end{aligned}$$

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Comments about Flotation Costs

- Flotation costs depend on the risk of the firm and the type of capital being raised.
- The flotation costs are highest for common equity. However, since most firms issue equity infrequently, the per-project cost is fairly small.
- Companies frequently ignore flotation costs when calculating cost of capital.

32

Weighted Average Cost of Capital

- Most operate with a target in mind regarding the relative amount of debt versus equity they intend to use.
- This target capital structure is the basis upon which the firm's cost of capital is based.

33

- For all purposes, the cost of capital for the firm should be estimated based on the target percentage of funds expected to come from all sources.
- This is true even if a particular project is financed with only one type of funds.

34

- Using more of one type of funds than the target weights merit implies that in the future you will have to use more of the other types of funds to reach your target.
- Thus, the firm's cost of capital is the weighted average of the component costs.

35

Concept of WACC

- Firms obtain capital in lumps but use many different types at the same time.
- The different types of financing are interrelated. (e.g. adding debt may increase the cost of other types of financing as well.)

36

How do you calculate the weighted average cost of capital?

$$WACC = w_d k_d (1 - T) + w_p k_p + w_s k_s$$

- The w's refer to the capital structure weights.
- The k's refer to the cost of each component.

37

How do you determine the weights?

$$WACC = w_d k_d (1 - T) + w_p k_p + w_s k_s$$

- Use accounting numbers or market value (book vs. market weights).
- Use actual numbers or target capital structure.

38

Suppose you have the following inputs:

- before-tax cost of debt = 9%
- marginal tax rate = 40%
- cost of preferred = 8%
- cost of equity = 13.1%
- Target structure: Debt = 30%; Pref = 10%; Equity = 60%

39

What is the WACC using retained earnings for the equity component?

$$\begin{aligned} WACC &= w_d k_d (1 - t) + w_p k_p + w_s k_s \\ &= .3 (5.4\%) + .1(8\%) + .6(13.1\%) \\ &= 10.3\% \end{aligned}$$

40

Would the weighted average cost of capital remain constant?

NO.

- As more and more new capital is required in any year, the company's component costs of capital would change.
- This would cause the WACC to rise.

41

Would the weighted average cost of capital remain constant?

There can be multiple WACCs due to changes in any of the component costs.

Each WACC is often called a marginal cost of capital (MCC) to indicate more than one is possible.

For this reason, we need to be able to determine "where" the cost of capital changes.

42

MCC Breakpoint

We need to calculate the breakpoints (BP) in the marginal cost of capital (this is where the WACC changes).

$$BP = \frac{\text{\$ amount of type of funds available}}{\text{fraction that type of funds is of total capital}}$$

43

Suppose you have the following inputs:

- before-tax cost of debt = 9%
- marginal tax rate = 40%
- cost of preferred = 8%
- cost of equity:
 - Ret. earnings = 13.1% (\$120 mil avail.)
 - New stock = 13.85%
- Target structure:
 - Debt = 30%; Pref = 10%; Equity = 60%

44

What is the WACC using retained earnings for the equity component?

$$\begin{aligned} WACC_1 &= W_d k_d (1-t) + W_p k_p + W_s k_s \\ &= .3 (5.4\%) + .1(8\%) + .6(13.1\%) \\ &= 10.3\% \\ &= \text{Cost of new capital until} \\ &\quad \text{retained earnings is} \\ &\quad \text{depleted} \end{aligned}$$

45

WACC with new common equity?

$$\begin{aligned} WACC_2 &= W_d k_d (1-t) + W_p k_p + W_e k_e \\ &= .3(5.4\%) + .1(8\%) + .6(13.85\%) \\ &= 10.7\% \end{aligned}$$

46

Summary to this point:

k_s or k_e	WACC
13.10%	10.3%
13.85%	10.7%

WACC rises because new stock costs more.

47

Find retained earnings breakpoint (where the WACC changes).

Optimal proportion of equity = 60%
Amount of retained earnings available = \$120 million

$$BP_{RE} = \frac{\text{Dollars of RE}}{\text{Fraction of equity}}$$

$$= (\$120 \text{ mil}) / (0.60) = \$200 \text{ mil}$$

48

How would the company raise the \$200,000,000 of new capital?

.3(200mil) = \$ 60 mil Debt
 .1(200mil) = \$ 20 mil Preferred
 .6(200mil) = \$120 mil Ret. Earnings
 \$200 mil Total

49

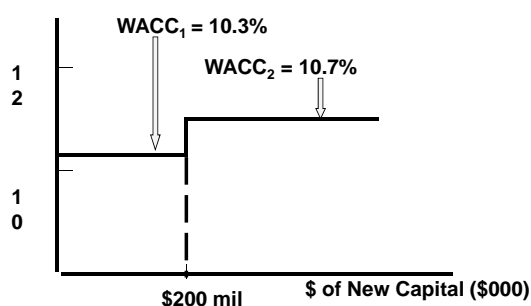
What is the MCC schedule?

A plot of the firms WACC versus new dollars of capital raised.

Shows the cost of each additional, or marginal, dollar raised.

50

WACC %



51

You can have multiple breakpoints.
 Suppose:

- after-tax cost of debt:
 - 6% (up to \$90 million borrowed)
 - 8% (over \$90 million borrowed)
- marginal tax rate = 40%
- cost of preferred = 9%
- cost of equity:
 - Ret earnings = 12% (\$120 mil avail)
 - New stock = 14%
- Target structure: Debt = 30%; Pref = 10%; Equity = 60%

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Solving a problem with multiple breakpoints

First, note that there is a breakpoint each time the cost of a type of capital changes.

Second, note that there will be one more WACC than there are breakpoints.

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Steps:

1. Calculate all breakpoints.
2. Rank the breakpoints from lowest to highest.
3. Calculate the WACC below the lowest breakpoint using the lowest cost of each type of capital, and then calculate each succeeding WACC by changing the cost of the type of capital associated with each breakpoint.

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**Our example: Step 1
Calculate Breakpoints**

Breakpoint (debt):

$$BP(\text{debt}) = (\$90 \text{ million}) / (0.30) = \$300 \text{ million}$$

Breakpoint(equity):

$$BP(\text{eq}) = (\$120 \text{ million}) / (0.60) = \$200 \text{ million}$$

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**Our example: Step 2
Rank Breakpoints**

$$BP(\text{debt}) = \$300 \text{ million}$$

$$BP(\text{eq}) = \$200 \text{ million}$$

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**Our example: Step 3
Calculate WACCs**

$$WACC_3 = (.30)(8\%) + (0.10)(9\%) + (0.60)(14\%) = 11.7\%$$

-----**BP(debt) = \$300 million**-----

$$WACC_2 = (.30)(6\%) + (0.10)(9\%) + (0.60)(14\%) = 11.1\%$$

-----**BP(eq) = \$200 million**-----

$$WACC_1 = (.30)(6\%) + (0.10)(9\%) + (0.60)(12\%) = 9.9\%$$

57

**Would what the company planned
to do with the money it raised have
any effect on the WACC?**

- It might. We have implicitly assumed that the company would invest in assets with equal risk as existing assets.
- If the company planned to invest in riskier assets, this would raise the cost of capital.

58

**What factors influence a
company's composite WACC?**

- Market conditions.
- The firm's capital structure and dividend policy.
- The firm's investment policy. Firms with riskier projects generally have a higher WACC.

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**Should the company use the
composite WACC as the hurdle
rate for each of its projects?**

- **NO!** The composite WACC reflects the risk of an average project undertaken by the firm. Therefore, the WACC only represents the "hurdle rate" for a typical project with average risk.
- Different projects have different risks. The project's WACC should be adjusted to reflect the project's risk.

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Sample Problems – Chapter 10

Title: Cost of Debt

1. Costly Corporation plans a new issue of bonds with a par value of \$1,000, a maturity of 28 years, and an annual coupon rate of 16.0%. Flotation costs associated with a new debt issue would equal 9.0% of the market value of the bonds. Currently, the appropriate discount rate for bonds of firms similar to Costly is 17.0%. The firm's marginal tax rate is 30%. What will the firm's true cost of debt be for this new bond issue?

- a. 20.99%
- b. 18.69%
- c. 17.61%
- d. 12.32%
- e. 13.08%

Title: Cost of preferred stock

2. Costly Corporation is also considering using a new preferred stock issue. The preferred would have a par value of \$400 with an annual dividend equal to 18.0% of par. The company believes that the market value of the stock would be \$968.00 per share with flotation costs of \$68.00 per share. The firm's marginal tax rate is 40%. What would the firm's cost of preferred be for this new preferred stock issue?

- a. 8.00%
- b. 7.44%
- c. 8.79%
- d. 6.92%
- e. 6.28%

Title: Cost of internal equity (new dividend)

3. Costly Corporation is considering using equity financing. Currently, the firm's stock is selling for \$47.00 per share. The firm's dividend for next year is expected to be \$3.40 with an annual growth rate of 5.0% thereafter indefinitely. If the firm issues new stock, the flotation costs would equal 14.0% of the stock's market value. The firm's marginal tax rate is 40%. What is the firm's cost of internal equity?

- a. 11.53%
- b. 13.41%
- c. 12.60%
- d. 13.83%
- e. 12.23%

Title: Cost of external equity (new dividend)

4. Costly Corporation is considering using equity financing. Currently, the firm's stock is selling for \$31.00 per share. The firm's dividend for next year is expected to be \$5.50 with an annual growth rate of 5.0% thereafter indefinitely. If the firm issues new stock, the flotation costs would equal 15.0% of the stock's market value. The firm's marginal tax rate is 40%. What is the firm's cost of external equity?

- a. 23.63%
- b. 22.74%
- c. 25.87%
- d. 26.92%
- e. 24.39%

Title: WACC using RE (before-tax debt)

5. Marginal Incorporated (MI) has determined that its before-tax cost of debt is 9.0%. Its cost of preferred stock is 15.0%. Its cost of internal equity is 17.0%, and its cost of external equity is 19.0%. Currently, the firm's capital structure has \$378 million of debt, \$63 million of preferred stock, and \$459 million of common equity. The firm's marginal tax rate is 45%. The firm is currently making projections for next period. Its managers have determined that the firm should have \$92 million available from retained earnings for investment purposes next period. What is the firm's marginal cost of capital at a total investment level of \$155 million?

- a. 14.52%
- b. 12.82%
- c. 12.31%
- d. 11.80%
- e. 13.50%

Title: WACC using New stock (before-tax debt)

6. Marginal Incorporated (MI) has determined that its before-tax cost of debt is 9.0%. Its cost of preferred stock is 15.0%. Its cost of internal equity is 17.0%, and its cost of external equity is 19.0%. Currently, the firm's capital structure has \$378 million of debt, \$63 million of preferred stock, and \$459 million of common equity. The firm's marginal tax rate is 45%. The firm is currently making projections for next period. Its managers have determined that the firm should have \$92 million available from retained earnings for investment purposes next period. What is the firm's marginal cost of capital at a total investment level of \$247 million?

- a. 12.31%
- b. 11.80%
- c. 12.82%
- d. 14.52%
- e. 13.50%

Title: WACC using RE (after-tax debt)

7. Marginal Incorporated (MI) has determined that its after-tax cost of debt is 9.0%. Its cost of preferred stock is 15.0%. Its cost of internal equity is 17.0%, and its cost of external equity is 19.0%. Currently, the firm's capital structure has \$378 million of debt, \$63 million of preferred stock, and \$459 million of common equity. The firm's marginal tax rate is 45%. The firm is currently making projections for next period. Its managers have determined that the firm should have \$92 million available from retained earnings for investment purposes next period. What is the firm's marginal cost of capital at a total investment level of \$157 million?

- a. 13.50%
- b. 14.52%
- c. 14.01%
- d. 12.82%
- e. 11.80%

Title: WACC using New stock (after-tax debt)

8. Marginal Incorporated (MI) has determined that its after-tax cost of debt is 9.0%. Its cost of preferred stock is 15.0%. Its cost of internal equity is 17.0%, and its cost of external equity is 19.0%. Currently, the firm's capital structure has \$378 million of debt, \$63 million of preferred stock, and \$459 million of common equity. The firm's marginal tax rate is 45%. The firm is currently making projections for next period. Its managers have determined that the firm should have \$92 million available from retained earnings for investment purposes next period. What is the firm's marginal cost of capital at a total investment level of \$247 million?

- a. 14.52%
- b. 13.50%
- c. 14.01%
- d. 12.82%
- e. 11.80%

Title: WACC (before-tax cost of debt)

9. Marginal Incorporated (MI) has determined that its before-tax cost of debt is 7% for the first \$112 million in bonds it issues, and 8% for any bonds issued above \$112 million. Its cost of preferred stock is 10%. Its cost of internal equity is 14%, and its cost of external equity is 17%. Currently, the firm's capital structure has \$400 million of debt, \$100 million of preferred stock, and \$500 million of common equity. The firm's marginal tax rate is 30%. The firm is currently making projections for next period. Its managers have determined that the firm should have \$59 million available from retained earnings for investment purposes next period. What is the firm's marginal cost of capital at each of the following total investment levels?

- (A) Total investment level of \$380 million?
- (B) Total investment level of \$199 million?
- (C) Total investment level of \$69 million?

Title: WACC (after-tax cost of debt)

10. Marginal Incorporated (MI) has determined that its after-tax cost of debt is 6% for the first \$100 million in bonds it issues, and 8% for any bonds issued above \$100 million. Its cost of preferred stock is 9%. Its cost of internal equity is 12%, and its cost of external equity is 14%. Currently, the firm's capital structure has \$600 million of debt, \$100 million of preferred stock, and \$300 million of common equity. The firm's marginal tax rate is 30%. The firm is currently making projections for next period. Its managers have determined that the firm should have \$75 million available from retained earnings for investment purposes next period. What is the firm's marginal cost of capital at each of the following total investment levels?

- (A) Total investment level of \$280 million?
- (B) Total investment level of \$200 million?
- (C) Total investment level of \$77 million?

Answers:

- 1. e
- 2. a
- 3. e
- 4. c
- 5. d
- 6. c
- 7. a
- 8. a

1.

N	I	***PV***	FV	PMT
28	17	941.90	1000	(0.16)(1000)

N	***I***	PV	FV	PMT
28	18.693	-[941.90 – (0.09)(941.90)]	1000	(0.16)(1000)

After-tax cost of debt = (Before-tax cost of debt)(1 – marginal tax rate)

After-tax cost of debt = (18.693%)(1 – 0.30) = 13.08%

2.

N	***I***	PV	FV	PMT
1000	8	-(968 – 68)		(400)(0.18)

3.

$$k_s = \frac{D_1}{P_0} + g = \frac{3.40}{47} + 0.05 = 0.1223 = 12.23\%$$

4.

$$k_e = \frac{D_1}{P_0 - F} + g = \frac{5.50}{(31 - (0.15)(31))} + 0.05 = 0.2587 = 25.87\%$$

For questions 5, 6, 7, and 8 start by calculating the capital structure weights and then calculate the retained earnings breakpoint.

Capital Structure Weights

Debt	378	/	900	=	0.42
Pref	63	/	900	=	0.07
Eq	459	/	900	=	0.51
TOTAL	900				

Retained earnings breakpoint = (RE available)/(equity fraction) = (92 million)/(0.51) = 180.39 million

5. Use the cost of retained earnings for equity since the total investment level of \$155 million is less than the breakpoint for equity. Adjust for the tax effect for debt since the before-tax cost of debt is given.

$$WACC = (0.42)(9\%)(1 - 0.45) + (0.07)(15\%) + (0.51)(17\%) = 11.8\%$$

6. Use the cost of new stock for equity since the total investment level of \$247 million is greater than the breakpoint for equity. Adjust for the tax effect for debt since the before-tax cost of debt is given.

$$WACC = (0.42)(9\%)(1 - 0.45) + (0.07)(15\%) + (0.51)(19\%) = 12.82\%$$

7. Use the cost of retained earnings for equity since the total investment level of \$157 million is less than the breakpoint for equity. Do not adjust for the tax effect for debt since the after-tax cost of debt is given.

$$WACC = (0.42)(9\%) + (0.07)(15\%) + (0.51)(17\%) = 13.50\%$$

8. Use the cost of new stock for equity since the total investment level of \$247 million is greater than the breakpoint for equity. Do not adjust for the tax effect for debt since the after-tax cost of debt is given.

$$WACC = (0.42)(9\%) + (0.07)(15\%) + (0.51)(19\%) = 14.52\%$$

9.

First, calculate the capital structure weights.

Capital Structure Weights

Debt	400	/	1000	=	0.4
Pref	100	/	1000	=	0.1
Eq	500	/	1000	=	0.5
TOTAL	1000				

Next, calculate the breakpoints. (There are two breakpoints in this problem since the cost of debt can be either 7% or 8% and the cost of equity can be 14% or 17%.)

$$\text{Breakpoint(debt)} = 112/0.4 = 280 \text{ million}$$

$$\text{Breakpoint(equity)} = 59/0.5 = 118 \text{ million}$$

Now calculate the WACC for each total investment level. You must adjust the cost of debt for taxes since you are given the before-tax cost of debt.

A)

\$380 million total investment level

The total investment level exceeds the breakpoint for debt ($380 > 280$), so you use the higher cost of debt.

The total investment level exceeds the breakpoint for equity ($380 > 118$), so you use the higher cost of equity.

$$\text{WACC} = (0.4)(8\%)(1 - 0.30) + (0.1)(10\%) + (0.5)(17\%) = 11.74\%$$

B)

\$199 million total investment level

The total investment level is less than the breakpoint for debt ($199 < 280$), so you use the lower cost of debt.

The total investment level exceeds the breakpoint for equity ($199 > 118$), so you use the higher cost of equity.

$$\text{WACC} = (0.4)(7\%)(1 - 0.30) + (0.1)(10\%) + (0.5)(17\%) = 11.46\%$$

C)

\$69 million total investment level

The total investment level is less than the breakpoint for debt ($69 < 280$), so you use the lower cost of debt.

The total investment level is less than the breakpoint for equity ($69 < 118$), so you use the lower cost of equity.

$$\text{WACC} = (0.4)(7\%)(1 - 0.30) + (0.1)(10\%) + (0.5)(14\%) = 9.96\%$$

10.

First, calculate the capital structure weights.

Capital Structure Weights

Debt	600	/	1000	=	0.6
Pref	100	/	1000	=	0.1
Eq	300	/	1000	=	0.3
TOTAL	1000				

Next, calculate the breakpoints. (There are two breakpoints in this problem since the cost of debt can be either 6% or 8% and the cost of equity can be 12% or 14%.)

$$\text{Breakpoint(debt)} = 100/0.6 = 167 \text{ million}$$

$$\text{Breakpoint(equity)} = 75/0.3 = 250 \text{ million}$$

Now calculate the WACC for each total investment level. You do not adjust the cost of debt for taxes since you are given the after-tax cost of debt.

A)

\$280 million total investment level

The total investment level exceeds the breakpoint for debt ($280 > 167$), so you use the higher cost of debt.

The total investment level exceeds the breakpoint for equity ($280 > 250$), so you use the higher cost of equity.

$$\text{WACC} = (0.6)(8\%) + (0.1)(9\%) + (0.3)(14\%) = 9.90\%$$

B)

\$200 million total investment level

The total investment level exceeds the breakpoint for debt ($200 > 167$), so you use the higher cost of debt.

The total investment level is less than the breakpoint for equity ($200 < 250$), so you use the lower cost of equity.

$$\text{WACC} = (0.6)(8\%) + (0.1)(9\%) + (0.3)(12\%) = 9.30\%$$

C)

\$77 million total investment level

The total investment level is less than the breakpoint for debt ($77 < 167$), so you use the lower cost of debt.

The total investment level is less than the breakpoint for equity ($77 < 250$), so you use the lower cost of equity.

$$\text{WACC} = (0.6)(6\%) + (0.1)(9\%) + (0.3)(12\%) = 8.10\%$$

Chapter 11: The Basics of Capital Budgeting

Putting Things in Perspective

Capital budgeting is similar in principle to security valuation in that future cash flows are estimated, risks are appraised and reflected in a cost of capital discount rate, and all cash flows are evaluated on a present value basis. Five primary methods can be used to determine which projects should be included in a firm's capital budget: (1) payback, (2) discounted payback, (3) Net Present Value (NPV), (4) Internal Rate of Return (IRR), and (5) Modified IRR (MIRR). Both payback methods have deficiencies, and thus should not be used as the sole criterion for making capital budgeting decisions. The NPV, IRR, and MIRR methods all lead to the same accept/reject decisions on independent projects. However, the methods may conflict when ranking mutually exclusive projects that differ in scale or timing. Under these circumstances, the NPV method should be used to make the final decision.

Importance of Capital Budgeting, Generating Ideas for Capital Projects, and Project Classifications

Capital budgeting is the process of planning expenditures on assets whose cash flows are expected to extend beyond one year.

- A number of factors combine to make capital budgeting perhaps the most important function financial managers and their staffs must perform. Since the results of capital budgeting decisions continue for many years, the firm loses some of its flexibility. A firm's capital budgeting decisions define its strategic direction. Timing is also important since capital assets must be available when they are needed.
- The same general concepts that are used in security valuation are also involved in capital budgeting; however, whereas a set of stocks and bonds exists in the securities market from which investors select, capital budgeting projects are created by the firm. A firm's growth, and even its ability to remain competitive and to survive, depends on a constant flow of ideas for new products, for ways to make existing products better, and for ways to operate at a lower cost.
- Analyzing capital expenditure proposals has a cost, so firms classify projects into different categories to help differentiate the level of analysis required. Replacement: maintenance of business. Replacement: cost reduction. Expansion of existing products or markets. Expansion into new products or markets. Safety and/or environmental projects. Other miscellaneous projects.
- Normally, a more detailed analysis is required for cost-reduction replacements, expansion, and new product decisions than for simple replacement and maintenance decisions. Also, projects requiring larger investments will be analyzed more carefully than smaller projects. Decisions to invest in intangible assets are analyzed in the same way as decisions related to tangible assets.

Similarities Between Capital Budgeting and Security Valuation

Once a potential capital budgeting project has been identified, its evaluation involves the same steps that are used in security analysis.

- The cost of the project must be determined.
- Cash flows from the project are estimated.
- The riskiness of these projected cash flows is determined.

- Given the riskiness of the projected cash flows, the appropriate cost of capital at which cash flows are to be discounted is determined.
- Cash inflows are discounted to their present value to obtain an estimate of the asset's value to the firm.
- The present value of the expected cash inflows is compared with the required outlay, or cost. If the PV of the cash flows exceeds the cost, the project should be accepted; otherwise, it should be rejected.

There is a direct link between capital budgeting and stock values: The more effective the firm's capital budgeting procedures, the higher its stock price.

Capital Budgeting Decision Rules

Five key methods are used to rank projects and to decide whether or not they should be accepted for inclusion in the capital budget: (1) payback, (2) discounted payback, (3) Net Present Value (NPV), (4) Internal Rate of Return (IRR), and (5) Modified Internal Rate of Return (MIRR). The MIRR is discussed in a later section.

Payback Period is the expected number of years required to recover the original investment in a project. The payback period criterion says select the project which returns the initial outlay the quickest (i.e. the lower the payback period the better). For the payback period you simply add up the expected cash flows until you have recovered the original investment (you have broken even).

Suppose Projects A and B have the following expected cashflows.

YEAR	PROJECT A	TOTAL CFs	PROJECT B	TOTAL CFs
0	-10,000	-10,000	-10,000	-10,000
1	2,000	- 8,000	2,000	- 8,000
2	5,000	- 3,000	5,000	- 3,000
3	3,000	0	2,000	- 1,000
4	4,000	+ 4,000	4,000	+ 3,000
5	6,000	+10,000	6,000	+ 9,000

For Project A, the initial outlay has been recovered after 3 years. Thus, the payback period is 3 years.

For Project B, the initial outlay is recovered sometime in the fourth year. If the cashflows were assumed to occur evenly during the year, then the exact payback period would be:

$$\text{Project B's Payback Period} = \text{year before full recovery} + \frac{\text{unrecovered cost at start of year}}{\text{cashflow during year}} = 3 + \frac{1000}{4000} = 3.25 \text{ years}$$

Payback period is simple but has serious drawbacks. First, it doesn't explicitly consider the time value of money since it doesn't discount the cashflows expected to be received in the future. Second, it doesn't consider any cash flows that occur after payback of the initial outlay.

Consider the following projects with similar risk.

YEAR	PROJECT X	PROJECT Y
0	-5,000	-5,000
1	1,000	1,000
2	3,000	3,000
3	1,000	1,000
4	10,000,000	5,000

Although common sense tells us to select project X over project Y, if we only look at the payback period to choose projects, we would be indifferent between the two projects since they both have a payback period of 3 years.

The **Discounted Payback Period** is a refinement of the Payback Period which does consider the time value of money. The first step in this method is to determine the present value of each project's cashflows. The discount rate used in the present value calculations is the firm's *cost of capital*. The firm's *cost of capital* is its "average cost of obtaining funds to operate the firm. After converting the expected cash flows to present values, you then determine the discounted payback period the same as before by simply adding the discounted cash flows until the initial outlay has been recovered. HOWEVER, this method still does NOT consider any cash flows that occur after the recovery of the initial outlay. *Payback and discounted payback are break-even analyses which show the time to recovery of the initial investment.*

Net Present Value (NPV) - the sum of the present values of ALL project cashflows, including both inflows and outflows.

$$NPV = CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \dots + \frac{CF_n}{(1+k)^n}$$

$$= \sum_{t=0}^n \frac{CF_t}{(1+k)^t}$$

where: CF_t = the cash flow received in year t
 n = the year of the project's terminal cash flow
 k = the firm's cost of capital

Another way of thinking of the NPV is that you are converting all the future cash flows (positive and negative) into present values, adding them together, and then subtracting the initial

$$NPV = PV(\text{future cash flows}) - \text{Initial outlay}$$

$$= \sum_{t=1}^n \frac{CF_t}{(1+k)^t} - IO$$

investment.

The NPV accept/reject criterion if the projects are independent and there is no capital budget constraint is:

If $NPV \geq 0$ accept the project,
 else if $NPV < 0$ reject the project.

Keep in mind that common shareholders receive all residual CFs from the firm. Since NPV already considers the required returns of debt holders, preferred stockholders, and common stockholders, it can be viewed as telling us *the change in common shareholder wealth* if the project is accepted.

NPV is not a break-even analysis. An NPV of zero *does not* mean the firm is breaking-even on the project. It means that the project is returning enough to exactly meet the required returns of the firm's investors (and also meet flotation costs). A positive NPV means that you are receiving more benefit (in today's dollars) from the project than it costs. In effect you are getting a "bargain." A negative NPV means you are paying more for the project than it is worth.

Solving a NPV problem on the calculator works virtually the same as an uneven CF problem from Chapter 7. The only difference is that we now have a CF₀. The initial outlay for the project is a current CF, so it is our CF₀. Also, it is a cost to the firm, so it should be entered as a negative number. The discount rate for a NPV problem is the firm's cost of capital.

EXAMPLE 1:

Your firm is considering a project which is expected to generate CFs of \$100,000 per year for the first ten years and \$200,000 per year for the following fifteen years (years 11-25). The initial cost of the project is \$975,000. If the firm's cost of capital is 12%, what is the NPV of the project?

HP10B

ENTRIES

2 nd function	Clear All	(clears out cashflows)	
975000	+/- CF _j	(Initial outlay entered as negative number)	
100000	CF _j	(CF1)	
10	2 nd function CF _j	(N _j tells the calculator that the CF occurs ten times in a row)	
200000	CF _j	(CF2) (the calculator wants to know the next different CF)	
15	2 nd function CF _j	(N _j tells the calculator that the CF occurs fifteen times in a row)	
12	i	(interest rate)	
2 nd function	NPV	(answer)	\$28,605.52
	(2 nd function key is the solid yellow key)		

BAII+

ENTRIES

CF	2 nd CLR/Work
975000	+/- ENTER ↓

DISPLAY

CF0=
C01=

100000	ENTER ↓	F01=
10	ENTER ↓	C02=
200000	ENTER ↓	F02=
15	ENTER ↓	C03=
NPV		I=
12	ENTER ↓	NPV=
CPT	(answer)	\$28,605.52

Internal Rate of Return - the discount rate that equates the present value of all project's cash flows with zero; OR put another way, the discount rate that equates the present value of the project's FUTURE cash flows with the initial outlay.

$$CF_0 + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \dots + \frac{CF_n}{(1+IRR)^n} = 0$$

$$\sum_{t=0}^n \frac{CF_t}{(1+IRR)^t} = 0$$

OR

$$IO = \sum_{t=1}^n \frac{CF_t}{(1+IRR)^t}$$

The IRR accept/reject criterion if projects are independent and there is no capital constraint is:

If $IRR \geq k$ accept the project,
 else if $IRR < k$ reject the project.

Solving an IRR problem on the calculator is very similar to solving a NPV problem. This difference is that we do not need to know the firm's cost of capital to get the answer. We only need to know the CFs. To work the problem we enter the CFs in the same manner we did for NPV, but we then solve for the IRR instead of the NPV.

EXAMPLE 1:

Your firm is considering a project which is expected to generate CFs of \$100,000 per year for the first ten years and \$200,000 per year for the following fifteen years (years 11-25). The initial cost of the project is \$975,000. What is the IRR of the project?

HP10B

ENTRIES

2 nd function	Clear All	(clears out cashflows)
975000 +/-	CF _j	(Initial outlay entered as negative number)
100000	CF _j	(CF1)
10	2 nd function CF _j	(N _j tells the calculator that the CF occurs ten times
in a row)		
200000	CF _j	(CF2) (the calculator wants to know the next
different CF)		

15 2nd function CF_j (N_j tells the calculator that the CF occurs fifteen times in a row)

2nd function IRR (answer) 12.34% (2nd function is the solid yellow key)

BAII+

ENTRIES		DISPLAY	
CF	2 nd CLR/Work	CF0=	
975000 +/-	ENTER ↓	C01=	
100000	ENTER ↓	F01=	
10	ENTER ↓	C02=	
200000	ENTER ↓	F02=	
15	ENTER ↓	C03=	
IRR		IRR=	
CPT	(answer)		12.34%

Comparison of the NPV and IRR Methods

The same basic equation is used for both the NPV and the IRR methods, but in the NPV method, the discount rate, k , is specified and the NPV is found, whereas in the IRR method the NPV is specified to equal zero, and the value of IRR that forces this equality is determined.

- The NPV and IRR methods will always lead to the same accept/reject decisions for independent projects. This occurs because if NPV is positive, IRR must exceed k .
- NPV and IRR can give conflicting rankings for mutually exclusive projects.
- Multiple IRRs can result when the IRR criterion is used with a project that has nonnormal cash flows.

The **Modified Internal Rate of Return** (MIRR) solves the problem of multiple IRRs. It is similar to the IRR, but separately considers cash inflows and outflows which guarantees one solution. Also, the MIRR assumes that the future CFs will be reinvested at the firm's cost of capital. The MIRR is the discount rate that equates the present value of the cash outflows with

$$\sum_{t=0}^n \frac{COF_t}{(1+k)^t} = \frac{\sum_{t=0}^n CIF_t (1+k)^{n-t}}{(1+MIRR)^n}$$

$$PV \text{ costs} = \frac{TV}{(1+MIRR)^n}$$

the terminal value of the cash inflows.

Here: COF_t = negative cash flow in year t (cash outflows)
 CIF_t = positive cash flow in year t (cash inflows)

The steps involve:

1. PV(costs): Determine the present value of all negative cash flows, including the initial outlay if negative, using the firm's cost of capital as the discount rate, and then add all the present values together.
2. Terminal value of inflows: Determine the future value of the positive cash flows at the time of the final cash flow (termination of the project) using the firm's cost of capital as the interest rate that could be earned.
3. MIRR: Determine the discount rate (MIRR) that equates the present value of the negative cash flows (cash outflows) with the terminal value of the positive cash flows (cash inflows).

The MIRR accept/reject criterion for independent projects with no capital budget constraint is:

If $MIRR \geq k$ accept the project,
else if $MIRR < k$ reject the project.

The calculators we are using do not have an "MIRR" button. To solve these problems we have to go solve each step described above separately. In most cases, step 2 actually involves two parts since we also do not have a way of directly calculating the FV of a set of uneven CFs. The steps on the calculator are described below and an example is given.

STEPS on Calculator:

Step 1: PV(Cash outflows/negative CFs)

To get the PV of the negative CFs we replace all positive CFs from the project with zeroes and use the NPV methodology to get a PV. The firm's cost of capital serves as the discount rate.

Step 2:

To get the FV of the positive CFs we must go through two parts since there is not a NFV key on the calculators (if you have a HP 17B, there is a NFV key).

A) Replace all the negative CFs with zeroes and use the NPV methodology to get a PV of these. The firm's cost of capital serves as the discount rate.

B) Calculate the FV at the end of the project of the positive CFs by using the simple single sum time value keys. The PV from part A is your starting value, the number of periods until the end of the project is your N, and your firm's cost of capital is your interest rate.

Step 3:

Solve for the interest rate that makes the PV(negative CFs) grow to equal the FV(positive CFs) over the life of the project. Use the simple single sum time value keys for this step. Here the answer you calculated in step 1 is your PV, the answer from step 2 (B) is your FV, and your n is the number of periods the project last. You calculate the interest rate.

EXAMPLE: Suppose your firm is considering a project with the following CFs. If the firm's cost of capital is 10%, what is the project's MIRR?

Separate negative and positive CFs

<u>Year</u>	<u>CFs</u>	<u>Step1</u>	<u>Step2</u>
0	-100,000	-100,000	0
1	20,000	0	20,000
2	40,000	0	40,000
3	-35,000	-35,000	0
4	80,000	0	80,000
5	70,000	0	70,000
6	-10,000	-10,000	0

STEP 1: Calculate the PV of the negative CFs.**HP10B****ENTRIES**

2 nd function	Clear All	
100000	+/-	CF _j
0		CF _j
2		2 nd function CF _j
35000	+/-	CF _j
0		CF _j
2		2 nd function CF _j
10000	+/-	CF _j
10		
2 nd function	NPV	(answer) -131,940.76

(2nd function key is the solid yellow key)

BAIL+**ENTRIES****DISPLAY**

CF	2 nd CLR/Work	CF0=
100000	+/- ENTER ↓	C01=
0	ENTER ↓	F01=
2	ENTER ↓	C02=
35000	+/- ENTER ↓	F02=
1	ENTER ↓	C03=
0	ENTER ↓	F03=
2	ENTER ↓	C04=
10000	+/- ENTER ↓	F04=
1	ENTER ↓	C05=
NPV		I=
10	ENTER ↓	NPV=
CPT	(answer)	-131,940.76

STEP 2: Calculate the FV of the positive Cfs. This is done in two parts. (A) Calculate the PV of the positive CFs and then (B) calculate the FV as of the end of the project's life.

(A)

HP10B**ENTRIES**

2 nd function	Clear All	
0	CF _j	
20000	CF _j	
40000	CF _j	
0	CF _j	
80000	CF _j	
70000	CF _j	
10	i	
2 nd function	NPV	(answer) 149,345.24

(2nd function key is the solid yellow key)

BAIL+

ENTRIES			DISPLAY
CF	2 nd CLR/Work		CF0=
0	ENTER	↓	C01=
20000	ENTER	↓	F01=
1	ENTER	↓	C02=
40000	ENTER	↓	F02=
1	ENTER	↓	C03=
0	ENTER	↓	F03=
1	ENTER	↓	C04=
80000	ENTER	↓	F04=
1	ENTER	↓	C05=
70000	ENTER	↓	F05=
1	ENTER	↓	C06=
NPV			I=
10	ENTER	↓	NPV=
CPT		(answer)	149,345.24
(B)			
	<u>N</u>	<u>I/YR</u>	<u>PV</u>
	6	10	149345.24
			<u>FV</u> (this is what we compute)
			answer: 264,574.20

STEP 3: Calculate the interest rate which makes PV(-) grow to be the FV(+).

(MIRR)			
<u>N</u>	<u>I/YR (compute)</u>	<u>PV</u>	<u>FV</u>
6	answer: 12.295	-131940.76	264574.20

- NPV and MIRR will lead to the same project selection decision if the two projects are of equal size and have the same life.
 - If the projects are of equal size but differ in lives, the MIRR will always lead to the same decision as the NPV, if the MIRRs are both calculated using as the terminal year the life of the longer project.
 - Fill in zeros for the shorter project's missing cash flows.
 - However, conflicts can still occur when projects differ in scale, and in this case, NPV should be used.
- MIRR is superior to the regular IRR as an indicator of a project's "true" rate of return, or "expected long-term rate of return." MIRR can also overcome the multiple IRR problem because there is only one MIRR for any set of cash flows.

CHAPTER 11

Capital Budgeting Decision Methods

- Payback
- Net present value (NPV)
- Internal rate of return (IRR)
- Modified internal rate of return (MIRR)

1

What is capital budgeting?

- Analysis of potential additions to fixed assets.
- Long-term decisions; involve large expenditures.
- Very important to firm's future.

2

Capital Budgeting Steps:

1. Generate ideas.
2. Estimate the CFs (inflows and outflows).
3. Assess the riskiness of the CFs.
4. Determine the project cost of capital.
5. Find NPV, IRR, and/or MIRR.
6. Accept if $NPV \geq 0$, $IRR \geq WACC$, $MIRR \geq WACC$.

3

What is the difference between independent and mutually exclusive projects?

- Projects are independent if the cash flows of one are not affected by the acceptance of the other
- Projects are mutually exclusive if acceptance of one "precludes" acceptance of the other

4

What is the difference between normal and non-normal projects?

- Projects are normal if they have outflows or costs in the first year(s) followed by a series of inflows
- Projects are non-normal if one or more outflows occur after the inflows have begun

5

Cash flow data we will use for examples:

Year	CF
0	-\$150,000
1	15,000
2	90,000
3	120,000

Interest Rate = 10%

6

What is the payback period?

- The expected number of years required to recover a project's cost, i.e. how long will it take to get our money back?

What is the rationale for the payback period?

It is a type of "breakeven" analysis. It tells us when the project will breakeven in a cash flow sense.

7

Payback for Project

	0	1	2	3
CF _t	-150	15	90	120
Cumulative CF =	-150	-135	-45	75

$$\text{Payback} = 2 + 45/120 = 2.375 \text{ years}$$

8

Strengths of Payback:

1. Indication of a project's risk and liquidity.
2. Easy to calculate and understand.

Weaknesses:

1. Ignores time value of money.
2. Ignores CF's occurring after payback.

9

Should we look at payback?

- Some firms do calculate payback and give it some weight in capital budgeting decisions.
- It's not the primary criterion; rather it is used as one measure of a project's liquidity and riskiness.

10

Net Present Value (NPV)

$$\text{NPV} = \sum_{t=0}^n \frac{\text{CF}_t}{(1+k)^t}$$

OR:

$$\text{NPV} = \sum_{t=1}^n \frac{\text{CF}_t}{(1+k)^t} - \text{CF}_0$$

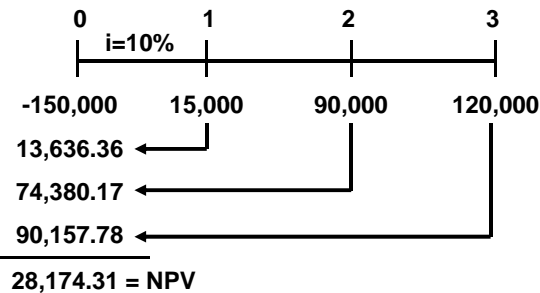
11

NPV in words:

- NPV = PV of future CFs discounted at the firm's cost of capital MINUS the initial outlay
- NPV = the change in shareholder wealth if the project is accepted

12

Net Present Value Calculation



13

Rationale for NPV method?

- NPV = PV inflows - PV costs
= Net gain in wealth
- Accept project if $NPV \geq 0$
- Choose between mutually exclusive projects on the basis of higher positive NPV. Adds most to value.

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NPV: TI-83

Uneven cash flow problem:
Use npv function (#7: finance functions)

`npv(INT,CF0,{C01,C02, ... , C0n}) ENTER`

`npv(10,-150000,{15000,90000,120000})`

NPV = 28,174.31

15

NPV: BAIL+

Uneven cash flow problem:

CF 2nd CE/C	120000 ENTER ↓
150000 +/- ENTER ↓	1 ENTER ↓
15000 ENTER ↓	NPV
1 ENTER ↓	10 ENTER ↓
90000 ENTER ↓	CPT
1 ENTER ↓	NPV = 28,174.31

16

NPV: HP10B

Uneven cash flow problem:

2nd C	10 i/yr
150000 +/- CF_i	2nd NPV
15000 CF_i	
90000 CF_i	
120000 CF_i	
	NPV = 28,174.31

17

Same CF Multiple Times

- Suppose you want to find the net present value of a project that costs \$500,000. It is expected to yield cash flows of \$15,000 per year the first 3 years, then \$90,000 per year the next 8 years, and then \$120,000 per year the next 6 years. The appropriate discount rate is 10%.

18

NPV: TI-83

Uneven cash flow problem:
Use npv function (#7: finance functions)

npv(INT,CF0,{C01,C02, ... , C0n},
{F01,F02, ... , F0n}) ENTER

npv(10,-500000,{15000,90000,120000},
{3,8,6})

NPV = 81,220.67

19

NPV: BAII+

Uneven cash flow problem:

CF	2 nd	CE/C	120000	ENTER	↓
500000	+/-	ENTER	6	ENTER	↓
15000	ENTER	↓		NPV	
3	ENTER	↓	10	ENTER	↓
90000	ENTER	↓		CPT	
8	ENTER	↓		NPV = 81,220.67	

20

NPV: HP10B

Uneven cash flow problem:

2 nd	C	120000	CF _j
500000	+/-	6	2 nd CF _j
15000	CF _j	10	i/yr
3	2 nd CF _j	2 nd	NPV
90000	CF _j		NPV = 81,220.67
8	2 nd CF _j		

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Internal Rate of Return (IRR)

IRR is the discount rate which forces the NPV to equal zero:

$$\sum_{t=0}^n \frac{CF_t}{(1+IRR)^t} = 0$$

IRR can also be described as the discount rate which forces the present value of future CFs to equal the initial outlay:

$$\sum_{t=1}^n \frac{CF_t}{(1+IRR)^t} = \text{Initial Outlay}$$

22

Internal rate of return rationale:

If IRR = k,
the project cash flows meet the investors' required return.

If IRR > k
return is beyond what shareholders expected.

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IRR acceptance criteria:

- If projects are independent,
 - accept all projects with IRR ≥ k
 - reject all projects with IRR < k

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IRR: TI-83

Use irr function (#8: finance functions)

`irr(CF0,{C01,C02, ... , C0n})` ENTER

`irr(-150000,{15000,90000,120000})`

IRR = 18.13%

25

IRR: BAI+

Uneven cash flow problem:

CF 2nd CE/C

150000 +/- ENTER ↓

15000 ENTER ↓

1 ENTER ↓

90000 ENTER ↓

1 ENTER ↓

120000 ENTER ↓

1 ENTER ↓

IRR

CPT

IRR = 18.13%

26

IRR: HP10B

Uneven cash flow problem:

2nd C

150000 +/- CF_j

15000 CF_j

90000 CF_j

120000 CF_j

2nd IRR/YR

IRR = 18.13%

27

Same CF Multiple Times

- Suppose you want to find the internal rate of return of a project that costs \$500,000. It is expected to yield cash flows of \$15,000 per year the first 3 years, then \$90,000 per year the next 8 years, and then \$120,000 per year the next 6 years. The appropriate discount rate is 10%.

28

IRR: TI-83

Use irr function (#8: finance functions)

`irr(CF0,{C01,C02, ... , C0n},
{F01,F02, ... , F0n})` ENTER

`irr(-500000,{15000,90000,120000},
{3,8,6})`

IRR = 11.90%

29

IRR: BAI+

Uneven cash flow problem:

CF 2nd CE/C

500000 +/- ENTER ↓

15000 ENTER ↓

3 ENTER ↓

90000 ENTER ↓

8 ENTER ↓

120000 ENTER ↓

6 ENTER ↓

IRR

CPT

IRR = 11.90%

30

IRR: HP10B

Uneven cash flow problem:

2 nd	C	120000	CF _j
500000	+/-	6	2 nd CF _j
15000		2 nd	
3	2 nd		IRR/YR
90000			
8	2 nd		

IRR = 11.90%

31

NPV and IRR lead to the same accept/reject decision for any independent project.

IRR > k and NPV > 0	IRR < k and NPV < 0
------------------------	------------------------

ACCEPT	REJECT
--------	--------

NPV and IRR can rank "acceptable" projects differently which can lead to conflicting choices for mutually exclusive projects.

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Problems with IRR:

- Lack of unique solution: Projects with non-normal CFs can have more than one IRR.
- Reinvestment rate: IRR assumes that future CFs can be reinvested at the same rate of return for the current project.

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NPV

- Always has a unique solution.
- Assumes reinvestment at the opportunity cost (firm's cost of capital).

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Reinvestment rate assumptions

- Reinvestment at the opportunity cost, k, is more realistic, since it only implies that the firm exists. Any higher reinvestment rate implies that the future projects meet that return.
- NPV should be used to choose between mutually exclusive projects.

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**BUT, Managers like rates - they can visualize IRR better than NPV.
Can we give them a better IRR?**

YES. The Modified Internal Rate of Return (MIRR) is the discount rate which causes the PV of a project's terminal value (TV) to equal the PV of its costs.

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Modified Internal Rate of Return (MIRR)

The MIRR is always unique.

Also, the TV is found by compounding inflows at the opportunity cost of capital, so the MIRR assumes cash inflows are reinvested at the firm's cost of capital (as in NPV).

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MIRR Formula

$$\sum_{t=0}^n \frac{\text{COF}_t}{(1+k)^t} = \frac{\sum_{t=0}^n \text{CIF}_t (1+k)^{n-t}}{(1+\text{MIRR})^n}$$

COF = cash outflows

CIF = cash inflows

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MIRR Calculation Steps:

- Step 1: Calculate the present value of all negative CFs (using the cost of capital as the interest rate).
- Step 2: Calculate the future value of all positive CFs as of the end of the project (using the cost of capital as the interest rate). First, get PV and use it to calculate FV.
- Step 3: Find the interest rate (MIRR) that equates the future value from 2 with the present value from 1.

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EXAMPLE: Your firm's cost of capital is 10% and it is considering a project with the following CFs. What is the project's MIRR?

Separate negative and positive CFs

Year	CFs	Step1	Step2
0	-100,000	-100,000	0
1	20,000	0	20,000
2	40,000	0	40,000
3	-35,000	-35,000	0
4	80,000	0	80,000
5	70,000	0	70,000
6	-10,000	-10,000	0

40

Step 1: PV(-)

$$\text{CF}_0 = -100000$$

$$\text{CF}_4 = 0$$

$$\text{CF}_1 = 0$$

$$\text{CF}_5 = 0$$

$$\text{CF}_2 = 0$$

$$\text{CF}_6 = -10000$$

$$\text{CF}_3 = -35000$$

$$I = 10$$

$$\text{NPV} = -131,940.76$$

41

Step 2a: PV(+)

$$\text{CF}_0 = 0$$

$$\text{CF}_4 = 80000$$

$$\text{CF}_1 = 20000$$

$$\text{CF}_5 = 70000$$

$$\text{CF}_2 = 40000$$

$$\text{CF}_6 = 0$$

$$\text{CF}_3 = 0$$

$$I = 10$$

$$\text{NPV} = 149,345.24$$

42

Step 2b: FV(+)

N = number of years in project

I = cost of capital

PV = present value of positive cash flows

SOLVE			
N	I	PV	*FV*
6	10	149345.24	264574.20

43

Step 3: MIRR

N = number of years in project

PV = present value of negative cash flows

FV = future value of positive cash flows

SOLVE			
N	*I*	PV	FV
6	12.295 MIRR	-131940.76	264574.20

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Is MIRR better than NPV?

NO. MIRR does not always lead to the same decision as NPV for mutually exclusive projects. Small projects often have a higher MIRR, but a lower NPV than larger projects.

NPV remains the conceptually best decision rule.

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CHAPTER 11 Capital Budgeting Decision Methods

- Payback
- Net present value (NPV)
- Internal rate of return (IRR)
- Modified internal rate of return (MIRR)

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Chapter 11 – Sample Problems

Title: NPV (6 different future CFs) Sample

1. Determine the net present value for a project that costs \$104,000 and would yield after-tax cash flows of \$16,000 the first year, \$18,000 the second year, \$21,000 the third year, \$23,000 the fourth year, \$27,000 the fifth year, and \$33,000 the sixth year. Your firm's cost of capital is 12.00%.

- a. \$138,000.00
- b. \$90,238.86
- c. -\$13,761.14
- d. \$34,000.00
- e. \$153,621.60

Title: NPV (3 sets of numerous CFs) Sample

2. Determine the net present value for a project that costs \$253,494.00 and is expected to yield after-tax cash flows of \$29,000 per year for the first ten years, \$37,000 per year for the next ten years, and \$50,000 per year for the following ten years. Your firm's cost of capital is 12.00%.

- a. \$260,454.65
- b. \$6,960.65
- c. \$133,707.65
- d. \$906,506.00
- e. \$10,023.33

Title: IRR (6 different future CFs) Sample

3. Determine the internal rate of return for a project that costs \$78,000 and would yield after-tax cash flows of \$12,000 the first year, \$14,000 the second year, \$17,000 the third year, \$19,000 the fourth year, \$23,000 the fifth year, and \$29,000 the sixth year..

- a. 9.75%
- b. 8.72%
- c. 10.33%
- d. 8.38%
- e. 10.88%

Title: IRR (3 sets of numerous CFs) Sample

4. Determine the internal rate of return for a project that costs \$180,532.00 and is expected to yield after-tax cash flows of \$25,000 per year for the first five years, \$33,000 per year for the next five years, and \$46,000 per year for the following five years.

- a. 11.88%
- b. 12.36%
- c. 13.81%
- d. 14.64%
- e. 15.41%

Title: MIRR (8 different future CFs) Sample

5. Your company has an opportunity to invest in a project that is expected to result in after-tax cash flows of \$18,000 the first year, \$20,000 the second year, \$23,000 the third year, -\$8,000 the fourth year, \$30,000 the fifth year, \$36,000 the sixth year, \$39,000 the seventh year, and -\$6,000 the eighth year. The project would cost the firm \$142,000. If the firm's cost of capital is 12%, what is the modified internal rate of return for the project?

- a. 7.03%
- b. 5.64%
- c. 6.30%
- d. 5.42%
- e. 6.68%

Title: MIRR (6 different future CFs) Sample

6. Your company has an opportunity to invest in a project that is expected to result in after-tax cash flows of \$8,000 the first year, \$10,000 the second year, \$13,000 the third year, -\$8,000 the fourth year, \$20,000 the fifth year, and \$26,000 the sixth year. The project would cost the firm \$59,000. If the firm's cost of capital is 13%, what is the modified internal rate of return for the project?

- a. 6.30%
- b. 7.46%
- c. 7.04%
- d. 6.05%
- e. 7.85%

Title: Payback period Sample

7. Determine the payback period (in years) for a project that costs \$120,000 and would yield after-tax cash flows of \$20,000 the first year, \$22,000 the second year, \$25,000 the third year, \$27,000 the fourth year, \$31,000 the fifth year, and \$37,000 the sixth year.

- a. 3.93
- b. 4.08
- c. 4.56
- d. 4.84
- e. 5.09

Answers:

- | | |
|------|------|
| 1. c | 5. e |
| 2. b | 6. b |
| 3. c | 7. d |
| 4. d | |

Solutions:

1. TI83: npv(12,-104000,{16000,18000,21000,23000,27000,33000})

CF0 = -104000

CF1 = 16000

CF2 = 18000

CF3 = 21000

CF4 = 23000

CF5 = 27000

CF6 = 33000

I = 12

Answer:

NPV = -13,761.14

2. TI83: npv(12,-253494,{29000,37000,50000},{10,10,10})

CF0 = -253494

CF1 = 29000

F01 = 10

CF2 = 37000

F02 = 10

CF3 = 50000

F03 = 10

I = 12

Answer:

NPV = 6,960.65

3. TI83: irr(-78000,{12000,14000,17000,19000,23000,29000})

CF0 = -78000

CF1 = 12000

CF2 = 14000

CF3 = 17000

CF4 = 19000

CF5 = 23000

CF6 = 29000

Answer:

IRR = 10.33%

4. TI83: irr(-180532,{25000,33000,46000},{5,5,5})

CF0 = -180532

CF1 = 25000

F01 = 5

CF2 = 33000

F02 = 5

CF3 = 46000

F03 = 5

Answer:

IRR = 14.64%

5. Step 1: PV(-)

CF0 = -142000

CF1 = 0

CF2 = 0

CF3 = 0

CF4 = -8000

CF5 = 0

CF6 = 0

CF7 = 0

CF8 = -6000

I = 12

Compute:

NPV = -149,507.44

TI83: npv(12,-142000,{0,0,0,-8000,0,0,0,-6000})

Step 2: FV(+)

Part a: PV(+)

CF0 = 0

CF1 = 18000

CF2 = 20000

CF3 = 23000

CF4 = 0

CF5 = 30000

CF6 = 36000

CF7 = 39000

CF8 = 0

I = 12

Compute: NPV = 101,289.40

Part b: FV(+)

N = 8

I = 12

PV = 101289.40

Compute:

FV = 250,788.82

TI83: npv(12,0,{18000,20000,23000,0,30000,36000,39000,0})

Step 3: MIRR

$N = 6$

$PV = -149507.44$

$FV = 250788.82$

Compute:

$I = 6.68\%$

6. Step 1: PV(-)

$CF_0 = -59000$

$CF_1 = 0$

$CF_2 = 0$

$CF_3 = 0$

$CF_4 = -8000$

$CF_5 = 0$

$CF_6 = 0$

$I = 13$

Compute:

$NPV = -63,906.55$

TI83: $\text{npv}(13, -59000, \{0, 0, 0, -8000, 0, 0\})$

Step 2: FV(+)

Part a: PV(+)

$CF_0 = 0$

$CF_1 = 8000$

$CF_2 = 10000$

$CF_3 = 13000$

$CF_4 = 0$

$CF_5 = 20000$

$CF_6 = 26000$

$I = 13$

Compute:

$NPV = 47,264.25$

TI83: $\text{npv}(13, 0, \{8000, 10000, 13000, 0, 20000, 26000\})$

Part b: FV(+)

$N = 6$

$I = 13$

$PV = 47264.25$

Compute:

$FV = 98,401.89$

Step 3: MIRR

$N = 6$

$PV = -63906.55$

$FV = 98401.89$

Compute:

$I = 7.46\%$

7.	Year	CF	Cost left to recover
	0	-120,000	120,000
	1	20,000	100,000
	2	22,000	78,000
	3	25,000	53,000
	4	27,000	26,000
	5	31,000	-5,000
	6	37,000	-42,000

The final portion of the initial cost is recovered in the fifth year. Divide the amount remaining to be recovered at the end of the fourth year by the amount received in the fifth year to get the portion of the fifth year necessary to complete recovery of the cost. Payback period = $4 + (26000/31000) = 4.84$ years

Chapter 12: Cash Flow Estimation and Risk Analysis

Introduction

One of the most critical steps in capital budgeting analysis is cash flow estimation. The key to correct cash flow estimation is to consider only incremental cash flows. However, the process is complicated by such factors as sunk costs, opportunity costs, externalities, net operating working capital changes, and salvage values.

Project risk analysis focuses on three issues: (1) the effect of a project on the firm's beta coefficient (market risk), (2) the project's effect on the probability of bankruptcy (corporate risk), and (3) the risk of the project independent of both the firm's other projects and investors' diversification (stand-alone risk). Market risk directly affects the value of the firm's stock. Corporate risk affects the financial strength of the firm, and this, in turn, influences its ability to use debt, and to maintain smooth operations over time. Stand-alone risk is measured by the variability of a project's expected returns.

Capital budgeting analysis is in many respects straightforward. A project is deemed acceptable if it has a positive NPV, where the NPV is calculated by discounting the estimated cash flows at the project's risk-adjusted cost of capital. However, things often get more complicated in the real world. One complication is that many projects include a variety of "embedded options" that dramatically affect their value. For example, companies often have to decide not only if they should proceed with a project, but also when they should proceed with the project. In many instances, this choice radically affects the project's NPV.

Estimating Cash Flows and Identifying the Relevant Cash Flows

The most important, and also the most difficult, step in the analysis of a capital project is estimating its cash flows which are the investment outlays and the annual net cash inflows after a project goes into operation. Two key issues to recognize are: (1) capital decisions must be based on cash flows, not accounting income, and (2) only incremental cash flows are relevant.

- Relevant cash flows are the specific set of cash flows that should be considered in the decision at hand. The relevant cash flow for a project is the additional free cash flow that the company expects if it implements the project. The value of a project depends on its free cash flow, the cash flow available for distribution to investors.
- There are four major ways that project cash flows differ from accounting income:
 - Costs of fixed assets. This is a negative project cash flow; however, accountants do not show the purchase of fixed assets as a deduction from accounting income. Instead, they deduct a depreciation expense each year throughout the asset's life.
 - Noncash charges. In calculating net income, accountants usually subtract some noncash charges from revenues. One example is depreciation. Depreciation is added back when estimating project cash flow.
 - Changes in net operating working capital. The difference between the required increase in current assets and the spontaneous increase in current liabilities is the change in net operating working capital. If this change is positive, then additional financing, over and above the cost of fixed assets, will be needed. The investment in operating working capital will be returned by the end of the project's life.

- Interest expenses are not included in project cash flows. In calculating accounting income, interest expenses are subtracted because accountants attempt to measure the profit available for stockholders. Project cash flow is the cash flow available for all investors, so interest expenses are not subtracted.
- In evaluating a capital project, we focus on those cash flows that result directly from the project. These incremental cash flows represent the change in the firm's total cash flow that occurs as a direct result of accepting the project. There are three special problems in determining incremental cash flows:
 - A sunk cost is an outlay that has already been incurred and that cannot be recovered regardless of whether the project is accepted or rejected. Sunk costs are not incremental, and hence should not be included in the analysis.
 - Opportunity costs, which are cash flows that could be generated from assets the firm already owns provided they are not used for the project in question, must be included in the capital budgeting analysis.
 - Externalities involve the effects of a project on other parts of the firm, and their effects need to be considered in the incremental cash flows.
 - Cannibalization occurs when the introduction of a new product causes sales of existing products to decline. This is an externality that must be considered in the analysis.
- Incremental cash flows from a typical project can be classified into three categories:
 - The initial investment outlay includes the up-front cost of fixed assets associated with the project plus any increases in net operating working capital.
 - The operating cash flows are the incremental cash inflows over the project's economic life. Annual operating cash flows equal after-tax operating income plus depreciation.
 - At the end of a project's life, some extra cash flows called terminal year cash flows are received. These include the after-tax salvage value of the fixed assets plus the return of the net operating working capital.

Evaluating Capital Budgeting Projects

Two types of capital budgeting decisions are (1) expansion projects and (2) replacement projects. Despite some differences, the principles for evaluating expansion and replacement projects are the same.

- A new expansion project is defined as one in which the firm invests in new assets to increase sales. Steps in the capital budgeting analysis for the project include:
 - Summarize the investment outlays required for the project. Changes in net operating working capital should be included as an outflow here; however, they should be considered as an inflow at the end of the project.
 - Estimate the cash flows that will occur once production begins, including effects of depreciation and salvage values.
 - Summarize the data by combining all the net cash flows on a time line and evaluate the project by payback period, IRR, MIRR, and NPV (at the appropriate cost of capital). If the project has a positive NPV, the project should be accepted.

- The cost of capital may need to be increased if the project is deemed riskier than the firm's average project.
- Cash flows need to be adjusted for inflation because the discount rate includes inflation.
- A replacement project is defined as one in which the firm replaces an existing asset with a new asset.
 - The incremental cash flows are the additional inflows and outflows from the new asset, relative to the cash flows from the existing asset.
 - The company is effectively comparing its value with the new asset to its value if it stays with the existing asset.

Incorporating Real Options into the Capital Budgeting Decision

One complication in capital budgeting analysis is that many projects include a variety of embedded real options that dramatically affect their value. In many instances, this choice can radically affect the project's NPV.

- In many respects, evaluating decisions with investment timing options is similar to choosing among mutually exclusive projects.
 - The mutually exclusive choice with timing options is between investing in the project today or waiting some time period before deciding whether or not to make the investment.
 - The company should select the strategy with the highest expected net present value.
- In addition to the investment timing option, many projects also include a variety of other embedded strategic options.
 - Growth/expansion options. Many projects, if undertaken, will enable the company to pursue other profitable projects down the road that would not otherwise be possible.
 - Abandonment/shutdown options. Abandonment can reduce a project's loss potential, and this can both increase expected cash flows and reduce project risk.
 - Flexibility options. It is often worth spending money today if it allows you to maintain flexibility over time.

The Optimal Capital Budget

For planning purposes, managers also need to forecast the total amount of investment that will be made, because it is necessary to know how much capital must be raised.

- Typically, there are four main steps for estimating the optimal capital budget.
 - An estimate of the firm's overall composite WACC is obtained.
 - The corporate WACC is scaled up or down for each of the firm's divisions to reflect the division's capital structure and risk characteristics.
 - Financial managers within each of the firm's divisions estimate the relevant cash flows and risk of each of their potential projects. Within each division, projects are classified into one of three groups-high risk, average risk, and low risk.
 - Each project's NPV is then determined, using its risk-adjusted cost of capital. The optimal capital budget consists of all independent projects with positive NPVs plus those mutually exclusive projects with the highest positive NPVs.

CHAPTER 12

Project Cash Flow Analysis

- Relevant cashflows
- After-tax cashflows
- Initial outlay; operating cashflows; terminal cashflow
- Real options

1

Estimating cash flows:

- The most important, but also most difficult, step in capital budgeting is estimating a project's CFs.
- The underlying principle is to estimate the incremental CFs (the firm's CFs with the project minus the firm's CFs without the project).

2

Project CF versus Accounting Income:

- Cash outlays must be considered at time they occur.
- Non-cash charges must be included in CF estimations.
- Changes in net working capital.
- Interest expenses are NOT included in CF estimations.

3

Incremental CFs:

- Represent the change in the firm's total CF as a result of the project.
- Sunk costs are always ignored.
- Opportunity costs are considered.
- Effects on other parts of the firm are important (externalities).

4

Timing of CFs:

- Technically we should account for CFs exactly as they are expected to occur.
- However, we generally assume CFs occur at the end of each year for estimation and calculation simplicity. (Remember, these are estimates.)

5

Depreciation:

- Depreciation is a non-cash charge and are included in CF estimates.
- We must calculate depreciation and originally remove it from estimated CFs since it lowers taxable income which results in a reduction of a cash expense (taxes).

6

MACRS Depreciation:

- Identifies several classes of assets with set *recovery periods*.
- Based on class of assets, MACRS gives the allowable percentage of depreciation charged each year.
- Depreciable basis: Purchase price plus any shipping and installation costs.

7

CF Estimation:

- Unfortunately, there is no “set” formula for estimating CFs for all projects.
- Logic is required to determine that all relevant CFs are considered.
- General guidelines are listed on the following slides.

8

Initial Outlay:

- Cost of new project: (Total cost including, S&H, and installation.
- Net value of replaced equipment (market value adjusted for tax effects).
- Increase in NWC beyond that covered by spontaneous accounts.

9

Operating CFs:

- Incremental revenues
- Incremental costs
- Incremental depreciation
- Tax effects

10

Terminal year CFs:

- Salvage value of equipment
- Tax effects
- Recovery of NWC

11

Proposed Project

- Cost: \$200,000 + \$10,000 shipping +\$30,000 installation. (Depreciable cost \$240,000.)
- Economic life = 4 years.
- Salvage value = \$25,000.
- MACRS 3-year class.

12

- Incremental gross sales = \$250,000.
- Incremental cash operating costs = \$125,000.
- Tax rate = 40%.
- Cost of capital = WACC = 10%

13

Net Investment Outlay At $t=0$

Equipment	(\$200,000)
Freight + Inst.	<u>(40,000)</u>
Net CF ₀	(\$240,000)

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What is the annual depreciation?

Year	Rate	x	Basis	Depreciation
1	0.33		\$240	\$ 79
2	0.45		240	108
3	0.15		240	36
4	0.07		240	17
	1.00			\$240

Due to half-year convention, a 3-year asset is depreciated over 4 years.

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Operating cash flows:

	1	2	3	4
Sales	\$250	\$250	\$250	\$250
Cash costs	125	125	125	125
Depreciation	79	108	36	17
EBT	\$ 46	\$ 17	\$ 89	\$108
Taxes (40%)	18	7	36	43
Net Income	28	10	53	65
Add: Depreciation	79	108	36	17
Operating Cash flow	\$107	\$118	\$ 89	\$ 82

16

Net Terminal Cash Flow At $t = 4$

Salvage value	\$25,000
Tax on SV	<u>(10,000)</u>
Net Termination CF	\$15,000

17

What if you terminate a project before the asset is fully depreciated?

Cash flow = Sale proceeds - taxes paid

Taxes are based on IRS definition of capital gain = Sale proceeds - basis

Basis = Original basis - Accum. deprec.
= remaining depreciation

18

Example: if sold after 3 years

- Original basis = 240K
- After 3 years = 17K remaining
- Sale Price = 25K
- Tax on sale = $.4(25K - 17K)$
= \$3,200
- Cashflow = 25,000 - 3,200
= \$21,800

19

Should CFs include interest expense? Dividends?

- NO. The costs of capital are already incorporated in the analysis since we use them in discounting.
- If we included them as cash flows, we would be double counting the cost of capital.

20

Suppose \$100,000 had been spent last year to improve the production line site. Should this cost be included in the analysis?

- NO. This is a sunk cost. Focus on incremental investment and cash flows.

21

Suppose the plant space could be leased out for \$25,000 a year. Would this affect the analysis?

- Yes. Accepting the project means we will not receive the \$25,000. This is an opportunity cost and it should be charged to the project.

22

If the new product line would decrease sales of the firm's other products by \$50,000 per year, would this affect the analysis?

- Yes. The effects on the other projects CFs is an "externality".
- Net CF loss per year on other lines would be a cost to this project.
- Externalities will be positive if new projects are complements to existing assets, negative if substitutes.

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Externalities

- Of course, if you would lose the \$50,000 in sales of the other product even if you reject the new project (a competitor steps in), the \$50,000 is NOT charged to the new project. What matters is the difference between expected CFs with and without the new project.

24

If this were a replacement rather than a new project, would the analysis change?

Yes. The old equipment would be sold and the incremental CFs would be the changes from the old to the new situation.

25

- The relevant depreciation would be the change with the new equipment.
- Also, if the firm sold the old machine now, it would not receive the salvage value at the end of the machine's life. (This would represent an opportunity cost.)

26

What is real option analysis?

- Real options exist when managers can influence the size and riskiness of a project's cash flows by taking different actions during the project's life.
- Real option analysis incorporates typical NPV budgeting analysis with an analysis for opportunities resulting from managers' decisions.

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What are some examples of real options?

- Investment timing options
- Abandonment/shutdown options
- Growth/expansion options
- Flexibility options

28

Is it likely that a project might have strategic option value over and above the indicated NPV?

- Strategic option value: Investment in a project may lead to other valuable opportunities
- Because of this, managers might be willing to accept a negative NPV project if it might lead to one or more positive NPV projects in the future.
- In many instances, only a qualitative evaluation is possible.

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What is sensitivity analysis?

- Sensitivity analysis measures the effect of changes in a variable on the project's NPV.
- To perform a sensitivity analysis, all variables are fixed at their expected values, except for the variable in question which is allowed to fluctuate.
- Resulting changes in NPV are noted.

30

What are the advantages and disadvantages of sensitivity analysis?

- Advantage
 - Identifies variables that may have the greatest potential impact on profitability and allows management to focus on these variables.
- Disadvantages
 - Does not reflect the effects of diversification.
 - Does not incorporate any information about the possible magnitudes of the forecast errors.

31

What subjective risk factors should be considered before a decision is made?

- Numerical analysis sometimes fails to capture all sources of risk for a project.
- If the project has the potential for a lawsuit, it is more risky than previously thought.
- If assets can be redeployed or sold easily, the project may be less risky.

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CHAPTER 12
Project Cash Flow Analysis

- Relevant cashflows
- Working capital treatment
- Unequal project lives
- Abandonment value
- Inflation

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Chapter 12 – Sample Problems

Use the following information to answer questions 1-5.

You have been asked by the president of your company to evaluate the proposed acquisition of new equipment. The equipment's basic price is \$177,000, and shipping costs will be \$3,500. It will cost another \$26,600 to modify it for special use by your firm, and an additional \$12,400 to install the equipment. The equipment falls in the MACRS 3-year class, and it will be sold after three years for \$22,000. The equipment is expected to generate revenues of \$173,000 per year with annual operating costs of \$81,000. The firm's tax rate is 30.0%.

MACRS

Ownership year	3-year
1	33%
2	45%
3	15%
4	7%

1. What is the net investment (initial outlay) for the project?

- a. \$192,900
- b. \$177,000
- c. \$219,500
- d. \$203,600
- e. \$197,500

2. What is the operating cash flow for year 1?

- a. \$72,435
- b. \$13,695
- c. \$92,000
- d. \$19,565
- e. \$86,130

3. What is the operating cash flow for year 2?

- a. \$94,033
- b. -\$4,742
- c. \$92,000
- d. -\$6,775
- e. \$98,775

4. What is the operating cash flow for year 3?

- a. \$41,352
- b. \$74,277
- c. \$92,000
- d. \$59,075
- e. \$32,925

5. What is the value of the terminal year non-operating cash flows at the end of Year 3? (What is the after-tax cash flow associated with the sale of the equipment?)

- a. \$6,635
- b. \$15,400
- c. \$20,009
- d. \$4,644
- e. \$13,374

Use the following information to answer questions 6-10.

You have been asked by the president of your company to evaluate the proposed acquisition of new equipment. The equipment's basic price is \$195,000, and shipping costs will be \$3,900. It will cost another \$23,400 to modify it for special use by your firm, and an additional \$9,800 to install the equipment. The equipment falls in the MACRS 3-year class, and it will be sold after three years for \$30,200. The equipment is expected to generate revenues of \$179,000 per year with annual operating costs of \$90,000. The firm's tax rate is 25.0%.

MACRS

Ownership year	3-year
1	33%
2	45%
3	15%
4	7%

6. What is the net investment (initial outlay) for the project?

- a. \$232,100
- b. \$195,000
- c. \$208,700
- d. \$218,400
- e. \$201,900

7. What is the operating cash flow for year 1?

- a. \$9,305
- b. \$85,898
- c. \$89,000
- d. \$12,407
- e. \$76,593

8. What is the operating cash flow for year 2?

- a. \$89,000
- b. -\$11,584
- c. \$92,861
- d. -\$15,445
- e. \$104,445

9. What is the operating cash flow for year 3?

- a. \$75,454
- b. \$40,639
- c. \$89,000
- d. \$54,185
- e. \$34,815

10. What is the value of the terminal year non-operating cash flows at the end of Year 3? (What is the after-tax cash flow associated with the sale of the equipment?)

- a. \$13,953
- b. \$22,650
- c. \$26,712
- d. \$10,465
- e. \$12,759

Answers :

1. c
2. e
3. a
4. b
5. c
6. a
7. b
8. c
9. a
10. c

Solutions

Problems 1-5

Initial Outlay

Base price	\$177,000
Shipping	\$3,500
Installation	\$12,400
add'l changes	\$26,600
TOTAL COST	\$219,500

Depreciation

year	schedule	cost	DEP
1	0.33	\$219,500	\$72,435
2	0.45	\$219,500	\$98,775
3	0.15	\$219,500	\$32,925
4	0.07	\$219,500	\$15,365

Oper. cash flows

	1	2	3
Revenue	\$173,000	\$173,000	\$173,000
- oper costs	\$81,000	\$81,000	\$81,000
- depreciation	\$72,435	\$98,775	\$32,925
TAXABLE	\$19,565	-\$6,775	\$59,075
TAXES	-\$5,870	\$2,033	-\$17,723
NI	\$13,695	-\$4,742	\$41,352
DEP	\$72,435	\$98,775	\$32,925
operating ACFs	\$86,130	\$94,033	\$74,277
			\$20,009
Total ACFs	\$86,130	\$94,033	\$94,286

Terminal CF

salvage value	\$22,000
- book value	\$15,365
Taxable	\$6,635
times tax rate	0.30
TAXES	\$1,991
salvage value	\$22,000
minus taxes	\$1,991
net term CF	\$20,009

Problems 6-10.**Initial Outlay**

Base price	\$195,000
Shipping	\$3,900
Installation	\$9,800
add'l changes	\$23,400
TOTAL COST	\$232,100

Depreciation

year	schedule	cost	DEP
1	0.33	\$232,100	\$76,593
2	0.45	\$232,100	\$104,445
3	0.15	\$232,100	\$34,815
4	0.07	\$232,100	\$16,247

Oper. cash flows	1	2	3
Revenue	\$179,000	\$179,000	\$179,000
- oper costs	\$90,000	\$90,000	\$90,000
- depreciation	\$76,593	\$104,445	\$34,815
TAXABLE	\$12,407	-\$15,445	\$54,185
TAXES	-\$3,102	\$3,861	-\$13,546
NI	\$9,305	-\$11,584	\$40,639
DEP	\$76,593	\$104,445	\$34,815
operating ACFs	\$85,898	\$92,861	\$75,454
			\$26,712
Total ACFs	\$85,898	\$92,861	\$102,166

Terminal CF

salvage value	\$30,200
- book value	\$16,247
Taxable	\$13,953
times tax rate	0.25
TAXES	\$3,488
salvage value	\$30,200
minus taxes	\$3,488
net term CF	\$26,712

Chapter 13: Capital Structure and Leverage

Introduction

Capital structure theory suggests that some optimal capital structure exists that simultaneously maximizes a firm's stock price and minimizes its cost of capital. The use of debt tends to increase earnings per share, which will lead to a higher stock price. At the same time, the use of debt also increases the risk borne by stockholders, which lowers the stock price. The optimal capital structure strikes a balance between these risk and return effects. While it is difficult to determine the optimal capital structure with precision, it is possible to identify the factors that influence it. A firm's target capital structure is generally set equal to the estimated optimal capital structure. The target may change over time as conditions vary, but at any given moment, a well-managed firm's management has a specific structure in mind. Financing decisions are made so as to be consistent with this target capital structure.

The Target Capital Structure

Capital structure policy involves a tradeoff between risk and return: Using more debt raises the riskiness of the firm's earnings stream and the risk borne by stockholders. However, a higher debt ratio generally leads to a higher expected rate of return. The target capital structure is the mix of debt, preferred stock, and common equity with which the firm plans to raise capital. This target may change over time as conditions change. A firm's target capital structure is generally set equal to the estimated optimal capital structure. The optimal capital structure is the one that strikes the optimal balance between risk and return, and thereby maximizes the firm's stock price.

Four primary factors influence target capital structure decisions, but operating conditions can cause the actual capital structure to vary from target. (1) Business risk is the risk inherent in the firm's operations if no debt is used. The greater the firm's business risk, the lower its optimal debt ratio. (2) The firm's tax position is a major reason for using debt. Interest is tax deductible, which lowers the effective cost of debt. Thus, the higher a firm's tax rate, the more advantageous debt is to the firm. (3) Financial flexibility, which is the ability to raise capital on reasonable terms under adverse conditions, is another consideration. The potential future availability of funds and the consequences of a funds shortage influence the target capital structure. The greater the probable future need for capital and the worse the consequences of a capital shortage, the stronger the balance sheet should be. (4) Managerial conservatism or aggressiveness influences the target capital structures firms actually establish.

Business and Financial Risk

Business risk varies from one industry to another and also among firms in a given industry. It can also change over time. Business risk depends on the following factors: (1) demand variability, (2) sales price variability, (3) input cost variability, (4) ability to adjust output prices for changes in input costs, (5) ability to develop new products in a timely, cost-effective manner, (6) foreign risk exposure, and (7) operating leverage (the extent to which costs are fixed). Each of these factors is determined partly by the firm's industry characteristics, but each is also controllable to some extent by management. Many firms use hedging techniques to reduce business risk.

Financial leverage refers to the firm's use of fixed-income securities such as debt and preferred stock in the firm's capital structure, and financial risk is the additional risk placed on the common stockholders as a result of the decision to finance with debt. The degree to which a firm employs financial leverage will affect its expected earnings per share (EPS) and the riskiness of these earnings. Financial leverage will cause EPS to rise; but the degree of risk associated with the firm will also increase as leverage increases.

Determining the Optimal Capital Structure

The optimal capital structure is the one that maximizes the price of the firm's stock, and this generally calls for a debt ratio that is lower than the one that maximizes expected EPS.

- At first, EPS will rise as the use of debt increases. Interest charges rise, but the number of outstanding shares will decrease as equity is replaced by debt. At some point EPS will peak. Beyond this point interest rates will rise so fast that EPS is depressed in spite of the fact that the number of shares outstanding is decreasing.
- Risk, as measured by the coefficient of variation of EPS, rises continuously as the use of debt increases.
- Managers should choose the capital structure that maximizes the firm's stock price. The capital structure that maximizes the stock price is also the one that minimizes the WACC.
- An increase in the debt/assets ratio raises the costs of both debt and equity.
 - Bondholders recognize that if a firm has a higher debt ratio, this increases the risk of financial distress, and more risk leads to higher interest rates.
 - Sophisticated financial managers use their forecasted ratios to predict how bankers and other lenders will judge their firms' risks and determine their cost of debt. They can judge quite accurately the effects of capital structure on the cost of debt.
- An increase in the debt ratio also increases the risk faced by shareholders which has an effect on the cost of equity, k_s .
- Although the component cost of equity is generally higher than that of debt, using only debt would not maximize value because the savings would be more than offset by the increased risk which would raise the costs of both debt and equity.
- The expected stock price will at first increase with financial leverage, will then reach a peak, and finally will decline as financial leverage becomes excessive due to the importance of potential bankruptcy costs.
- The financial structure that maximizes EPS usually has more debt than the one that results in the highest stock price.

Capital Structure Theory

Modern capital structure theory began in 1958, when Professors Franco Modigliani and Merton Miller (MM) published what has been called the most influential finance article ever written.

- MM proved, under a very restrictive set of assumptions, that a firm's value is unaffected by its capital structure. MM's results suggest that it doesn't matter how a firm finances its operations, hence capital structure is irrelevant. Their theory produces what is often referred to as the "irrelevance result."

- By indicating the conditions under which capital structure is irrelevant, MM provided us with some clues about what is required for capital structure to be relevant and hence to have an effect on a firm's value. Consequently, MM's work was only the beginning of capital structure research.
 - Subsequent research has focused on relaxing the MM assumptions in order to develop a more realistic theory of capital structure.
- MM published a follow-up paper in 1963 in which they relaxed the assumption that there are no corporate taxes. MM demonstrated that if all of their other assumptions hold, the asymmetry of the tax deductibility of interest versus the non-deductibility of dividend payments leads to a situation that calls for 100 percent debt financing.
- Merton Miller then analyzed the effects of personal taxes. While an increase in the corporate tax rate makes debt look better to corporations, an increase in the personal tax rate encourages additional equity financing.
 - All income from bonds is generally interest that is taxed as ordinary income at rates going up to 39.6 percent.
 - Income from stocks generally comes partly from dividends and partly from capital gains.
 - Long-term capital gains are taxed at a rate of 20 percent.
 - Capital gains tax is deferred until the stock is sold and the gain realized.
 - If stock is held until the owner dies, no capital gains tax must be paid.
 - On balance, returns on common stocks are taxed at lower effective rates than returns on debt.
- The deductibility of interest favors the use of debt financing, but the more favorable tax treatment of income from stocks lowers the required rate of return on stock and favors the use of equity financing.
 - It is difficult to say what the net effect of these two factors is. Most observers believe that interest deductibility has the stronger effect, hence that our tax system still favors the corporate use of debt. However, that effect is certainly reduced by the lower long-term capital gains tax rate.
- Bankruptcy-related problems are more likely to arise when a firm includes more debt in its capital structure. Therefore, bankruptcy costs discourage firms from pushing their use of debt to excessive levels.
 - Bankruptcy-related costs have two components: the probability of their occurrence and the costs they would produce given that financial distress has arisen.
 - Firms whose earnings are more volatile, all else equal, face a greater chance of bankruptcy and should use less debt than more stable firms.
 - Firms with high operating leverage, and thus greater business risk, should limit their use of financial leverage.
 - Likewise, firms that would face high costs in the event of financial distress should rely less heavily on debt.
- The trade-off theory of leverage recognizes that firms trade off the benefits of debt financing (favorable corporate tax treatment) against the costs of debt financing (higher interest rates and bankruptcy costs).
- Many large, successful firms use far less debt than the trade-off theory suggests. This led to the development of signaling theory.

- Signaling theory recognizes the fact that investors and managers do not have the same information regarding a firm's prospects (as was assumed by the trade-off theory). This is called asymmetric information and has an important effect on the optimal capital structure.
 - Symmetric information is the situation in which investors and managers have identical information about firms' prospects.
 - Asymmetric information would lead a firm with very favorable prospects to try to avoid selling stock and to attempt to raise any required new capital by other means, including using debt beyond the normal target capital structure.
 - The announcement of a stock offering by a mature firm that seems to have financing alternatives is taken as a signal that the firm's prospects (as seen by its management) are not bright. This, in turn, suggests that when a firm announces a new stock offering, more often than not, the price of its stock will decline.
 - The implication of the signaling theory for capital structure decisions is that firms should maintain a reserve borrowing capacity that can be used in the event that some especially good investment opportunity comes along. This means that firms should, in normal times, use more equity and less debt than is suggested by the tax benefit/bankruptcy cost trade-off model.
- Agency conflicts are particularly likely when the firm's managers have too much cash at their disposal. Managers with limited free cash flow are less able to make wasteful expenditures. Firms can reduce excess cash flow in a variety of ways:
 - Funnel cash back to shareholders through higher dividends or stock repurchases.
 - Shift the capital structure toward more debt in the hope that higher debt service requirements will force managers to become more disciplined.
 - A leveraged buyout (LBO) is one way to reduce excess cash flow.
- Increasing debt and reducing free cash flow has its downside: It increases the risk of bankruptcy, which can be costly.
 - Adding debt to a firm's capital structure is like putting a dagger into the steering wheel of a car.
 - The dagger motivates you to drive more carefully, but you may get stabbed if someone runs into you, even if you're being careful.
 - Higher debt forces managers to be more careful with shareholders' money, but even well-run firms could face bankruptcy if some event beyond their control occurs.
 - The capital structure decision comes down to deciding how big a dagger stockholders should use to keep managers in line.
- In practice, capital structure decisions must be made using a combination of judgment and numerical analysis.

Chapter 14: Distributions to Shareholders: Dividends and Share Repurchases

Introduction

Dividend policy involves the decision to pay out earnings as dividends or to retain and reinvest them in the firm. Any change in dividend policy has both favorable and unfavorable effects on the firm's stock price. Higher dividends mean higher immediate cash flows to investors, which is good, but lower future growth, which is bad. The optimal dividend policy balances these opposing forces and maximizes stock price. Three of the theories regarding the relationship between dividend payout and stock price include: (1) dividend irrelevance, which states that dividend policy has no effect on the firm's stock price; (2) the "bird-in-the-hand" theory, which states that investors prefer dividends because they are less risky than potential capital gains; and (3) the tax preference theory, which states that investors prefer to have companies retain earnings rather than pay them out as dividends because capital gains are subject to less taxes than dividends. In addition, dividend policy is further complicated due to signaling and clientele effects. It is simply not possible to state that one dividend policy is correct, and hence it is impossible to develop a precise model for use in establishing dividend policy. Financial managers must consider a number of factors when setting their firms' dividend policies.

Dividends Versus Capital Gains: What do Investors Prefer?

Dividend policy involves the decision to pay out earnings or to retain them for reinvestment in the firm.

- The target payout ratio is defined as the percentage of net income to be paid out as cash dividends, and it should be based in large part on investors' preferences for dividends versus capital gains.
- The constant growth stock model, $P_0 = D_1 / (k_s - g)$, shows that paying out more dividends will increase stock price. However, if D_1 is raised, less money will be available for reinvestment which will cause the expected growth rate to decline and tend to lower the stock's price.
- The optimal dividend policy strikes a balance between investors' desire for current cash flows (dividends) and future expected growth so as to maximize the firm's stock price.

A number of theories have been proposed to explain how factors interact to determine a firm's optimal dividend policy. These theories include: (1) the dividend irrelevance theory, (2) the "bird-in-the-hand" theory, and (3) the tax preference theory.

- Modigliani and Miller (MM), the principal proponents of the dividend irrelevance theory, argue that the value of the firm depends only on the income produced by its assets, not on how this income is split between dividends and retained earnings.
 - MM prove their proposition, but only under a set of restrictive assumptions including the absence of taxes and brokerage costs.
 - Obviously, taxes and brokerage costs do exist, so the MM conclusions on dividend irrelevance may not be valid under real-world conditions. The validity of a theory must be judged by empirical tests, not by the realism of its assumptions.
- The principal conclusion of MM's dividend irrelevance theory is that dividend policy does not affect the required rate of return on equity, k_s . Relaxing this assumption provides the basis for the "bird-in-the-hand" theory.

- Myron Gordon and John Lintner argue that k_s decreases as the dividend payout is increased because investors are less certain of receiving income from capital gains than they are of receiving dividend payments.
- MM call the Gordon-Lintner argument the "bird-in-the-hand" fallacy because Gordon and Lintner believe that investors view dividends in the hand as being less risky than capital gains in the bush. In MM's view, however, most investors plan to reinvest their dividends in the stock of the same or similar firms, and the riskiness of the firm's cash flows to investors in the long run is determined by the riskiness of operating cash flows, not by dividend payout policy.
- The tax preference theory states that investors may prefer to have companies retain most of their earnings because of various tax advantages. Investors then would be willing to pay more for low-payout companies than for otherwise similar high-payout companies. There are three tax-related reasons for thinking that investors might prefer a low dividend payout to a high payout.
 - Long-term capital gains are taxed at a rate of 20 percent. Therefore, wealthy investors might prefer to have companies retain and plow earnings back into the business. Earnings growth would presumably lead to stock price increases, and lower-taxed capital gains would be substituted for higher-taxed dividends.
 - Taxes are not paid on the gain until a stock is sold.
 - If a stock is held by someone until he or she dies, no capital gains tax is due at all.

Empirical testing of the dividend theories has not produced definitive results regarding which theory is correct. We cannot find a set of publicly owned firms that differ only in their dividend policies, nor can we obtain precise estimates of the cost of equity.

- Both evidence and logic suggest that investors prefer firms that follow a stable, predictable dividend policy (regardless of the payout level).

Other Dividend Policy Issues

There are two other issues that have a bearing on optimal dividend policy: These include (1) the information content (or signaling) hypothesis and (2) the clientele effect.

- It has been observed that a dividend increase announcement is often accompanied by an increase in the stock price.
 - This might be interpreted by some to mean that investors prefer dividends over capital gains, thus supporting the Gordon-Lintner hypothesis.
 - However, MM argue that a dividend increase is a signal to investors that the firm's management forecasts good future earnings. Thus, MM argue that investors' reactions to dividend announcements do not necessarily show that investors prefer dividends to retained earnings. Rather, the fact that the stock price changes merely indicates that there is an important information content in dividend announcements. This is referred to as the information content (or signaling) hypothesis.
- MM also suggest that a clientele effect might exist.
 - Some stockholders (for example, retirees) prefer current income. They would want the firm to pay out a high percentage of its earnings as dividends.
 - Other stockholders have no need for current income (for example, doctors in their peak earning years) and they would simply reinvest any dividends received, after

first paying income taxes on the dividend income. Therefore, they would want the firm to retain most of its earnings.

- Thus, a firm establishes a dividend policy and then attracts a specific clientele that is drawn to this dividend policy. Those who do not like the dividend policy can simply sell their shares to those that do.
- To the extent that stockholders can switch firms, a firm can change from one dividend payout policy to another and then let stockholders who do not like the new policy sell to other investors who do.
 - However, frequent switching would be inefficient because of brokerage costs, the likelihood that stockholders who are selling will have to pay capital gains taxes, and a possible shortage of investors who like the firm's newly adopted dividend policy.
 - Management should be hesitant to change its dividend policy because a change might cause current shareholders to sell their stock, forcing the stock price down.

Dividend Stability

Dividend stability is important.

- Profits and cash flows vary over time, as do investment opportunities. This suggests that corporations should vary their dividends over time. Dividends would be increased when cash flows are large and the need for funds is low and lowered when cash is in short supply relative to investment opportunities.
 - However, many stockholders rely on dividends to meet expenses, and they would be seriously inconvenienced if the dividend stream were unstable.
 - Reducing dividends to make funds available for capital investment could send incorrect signals to investors who may push down the stock price because they interpret the dividend cut to mean that the company's future earnings prospects have been diminished.
- Maximizing its stock price requires a firm to balance its internal needs for funds against the needs and desires of its stockholders.
- Dividend stability has two components.
 - How dependable is the growth rate?
 - Can we count on at least receiving the current dividend in the future?
- The most stable policy, from an investor's standpoint, is that of a firm whose dividend growth rate is predictable.
 - Such a company's total return (dividend yield plus capital gains yield) would be relatively stable over the long run, and its stock would be a good hedge against inflation.
- The second most stable policy is one in which stockholders can be reasonably sure that the current dividend will not be reduced. The dividend may not grow at a steady rate, but management will probably be able to avoid cutting the dividend.
- The least stable policy is one in which earnings and cash flows are so volatile that investors cannot count on the company to maintain the current dividend over a typical business cycle.
- Investors prefer stocks that pay more predictable dividends to stocks that pay the same average amount of dividends, but in a more erratic manner. The cost of equity will be

minimized, and the stock price maximized, if a firm stabilizes its dividends as much as possible.

Establishing the Dividend Policy in Practice

When deciding how much cash should be distributed to stockholders, two points should be kept in mind. (1) The overriding objective is to maximize shareholder value. (2) The firm's cash flows really belong to its shareholders, so management should refrain from retaining income unless it can be reinvested to produce returns higher than shareholders could themselves earn by investing the cash in investments of equal risk.

- When establishing a dividend policy, one size does not fit all.
- The optimal payout ratio is a function of four factors: (1) investors' preferences for dividends versus capital gains, (2) the firm's investment opportunities, (3) its target capital structure, and (4) the availability and cost of external capital.
 - The last three elements are combined in the residual dividend model.
- The residual dividend model is based on the premise that investors prefer to have a firm retain and reinvest earnings rather than pay them out in dividends if the rate of return the firm can earn on reinvested earnings exceeds the rate of return investors can obtain for themselves on other investments of comparable risk. Further, it is less expensive for the firm to use retained earnings than it is to issue new common stock. A firm using the residual model would follow these four steps:
 - Determine the optimal capital budget.
 - Determine the amount of equity required to finance the optimal capital budget given its target capital structure, recognizing that the funds used will consist of both equity and debt to preserve the optimal capital structure.
 - To the extent possible, use retained earnings to supply the equity required.
 - Pay dividends only if more earnings are available than are needed to support the optimal capital budget.
- If a firm rigidly follows the residual dividend policy, then dividends paid in any given year can be expressed as follows:
 - $\text{Dividends} = \text{Net Income} - [(\text{Target Equity Ratio})(\text{Total Capital Budget})]$.
- Since investment opportunities and earnings will surely vary from year to year, strict adherence to the residual dividend policy would result in unstable dividends. Firms should use the residual policy to help set their long-run target payout ratios, but not as a guide to the payout in any one year.
- Companies use the residual dividend model to help understand the determinants of an optimal dividend policy, but they typically use a computerized financial forecasting model when setting the target payout ratio.
- Most companies use the computer model to find a dividend pattern over the forecast period that will provide sufficient equity to support the capital budget without having to sell new common stock or move the capital structure ratio outside the optimal range.
- Some companies, especially those in cyclical industries, have difficulty maintaining a dividend in bad times that is really too low in good times. Such companies set a very low "regular" dividend and then supplement it with an "extra" dividend when times are good. This is called a low-regular-dividend-plus-extras policy.

- Investors recognize that the extras might not be maintained in the future, so they do not interpret them as a signal that the companies' earnings are increasing permanently, nor do they take the elimination of the extra as a negative signal.
- Dividends clearly depend more on cash flows, which reflect the company's ability to pay dividends, than on current earnings, which are heavily influenced by accounting practices and do not necessarily reflect the ability to pay dividends.

Firms usually pay dividends on a quarterly basis in accordance with the following payment procedures:

- Declaration date. This is the day on which the board of directors declares the dividend. At this time they set the amount of the dividend to be paid, the holder-of-record date, and the payment date.
- Holder-of-record date. This is the date the stock transfer books of the corporation are closed. Those shareholders who are listed on the company's books on this date are the holders of record and they receive the announced dividend.
- Ex-dividend date. This date is two business days prior to the holder-of-record date. Shares purchased after the ex-dividend date are not entitled to the dividend. This practice is a convention of the brokerage business that allows sufficient time for stock transfers to be made on the books of the corporation.
- Payment date. This is the day when dividend checks are actually mailed to the holders of record.

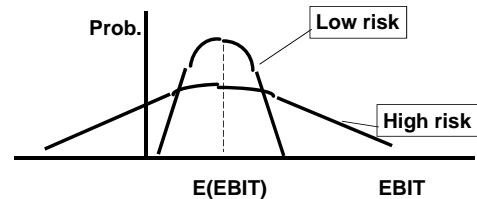
CHAPTERS 13 & 14 Capital Structure Decisions and Dividend Policy

■ Business and financial risk

■ Capital structure theory

What's business risk?

■ Uncertainty about future operating income (EBIT), i.e. how well can we predict operating income?



Some factors that affect business risk:

- Uncertainty about demand (unit sales).
- Uncertainty about output prices.
- Uncertainty about input prices.
- Product, types of other liability.
- Degree of operating leverage (DOL).

What is financial leverage? Financial risk?

- Financial leverage is the use of debt and preferred stock.
- Financial risk is the additional risk placed on common stockholders as a result of financial leverage.

Business Risk vs. Financial Risk

- Business risk depends on business factors such as competition, product liability, and operating leverage.
- Financial risk depends only on the types of securities issued: More debt, more financial risk. Concentrates business risk on the stockholders.

Who are Modigliani and Miller(MM)?

- They published theoretical papers which changed the way people thought about financial leverage.
- They won Nobel prizes in economics because of this work.

What assumptions underlie the Independence Hypothesis?

- No brokerage/transaction costs.
- No taxes.
- No bankruptcy costs.
- Investors have the same information about the firm's future as management.
- Investors borrow at the same rate as corporations.
- EBIT is not affected by the use of debt.

■ Without corporate taxes, the Independence Hypothesis says:

Firm value is not affected by the level of debt in the firm.

THEORY: Main contribution is that it shows the items that can cause debt to affect firm value.

What if interest is tax deductible? (Corporate Taxes)

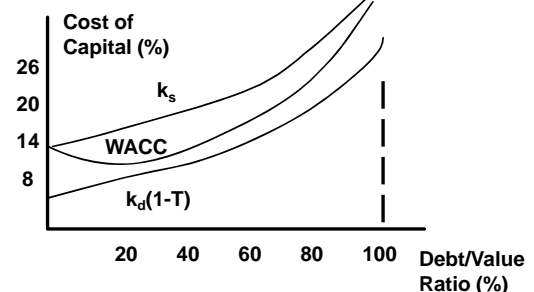
- Even if the costs of debt and equity were the same before taxes, with interest deductibility the cost of debt would be less than the cost of equity after taxes.
- Replacing higher cost equity with lower cost debt would result in a lower WACC and higher firm value.

What if interest is tax deductible and there are bankruptcy costs?

- The tax advantage for debt still has the same effect as before.
- However, the existence of bankruptcy costs causes ALL investors to recognize that increased debt means more risk.
- More risk means more expected return.

- The cost of equity and debt will increase as the level of debt used increases.
- Initially this increase will likely be small so that the benefit of debt exceeds its cost.
- Eventually costs will exceed benefits.
- This is the Trade-off Theory.

Relationship between capital costs and leverage when corporate taxes and bankruptcy risk are considered.

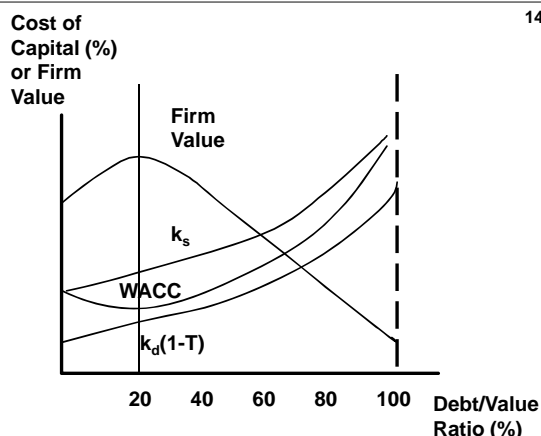


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Implications of Tradeoff Theory

- The firm's value is the discounted value of future CFs.
- The appropriate discount rate is WACC.
- The firm's value will be maximized when the WACC is at its lowest.
- The optimal capital structure will be where the WACC is at its lowest which results in firm value at its highest.

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15

Information asymmetry (Signaling)

- It is difficult to accept that investors know as much about the firm's future prospects as managers.
- If this is not true, we say information asymmetry exists.

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- Managers cannot simply tell investors what they know because investors may not believe them
- With information asymmetry present, the old saying "action speaks louder than words" becomes paramount.
- Investors know watch managers actions for clues.

17

Logically, when would managers use debt instead of equity financing?

- Debt has a set payment amount. If it is not met, the firm can be forced into bankruptcy.
- Equity only promises residual payments (if there are profits, they belong to shareholders).

18

- Generally, this means managers are more likely to use debt when they view the future as favorable. In such a situation they see no reason to "fear" fixed payment amounts.
- They are more likely to choose equity when prospects are more uncertain.

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Signaling Theory

- Financing choices provide a “signal” to investors.
- Debt financing - “good news”
- Equity financing - “bad news”
- This may lead managers to maintain “reserve borrowing capacity.”

20

Agency costs

- In many corporations, the managers of the firm own relative small portions of the company.
- Thus, they may have incentives to operate in a manner which is not most beneficial to shareholders.

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- Some have argued that this incentive is greater if the managers have access to large amounts of unrestricted CFs (free CF).
- Since debt imposes fixed payments that must be met, its use may help alleviate agency costs.

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OVERALL

- Which of the theories are most correct?
- Clearly, the original M&M theorem is not what we face in the “real world.”
- (Of course, the importance of it is that it identifies the factors that may cause capital structure to matter.)

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- More than likely all of the factors come into play, thus real world capital structure policy is actually a composite of all of the theories.
- Further, other factors may also be important. (e.g., managerial attitudes toward risk)

24

Dividend Policy

- Do investors prefer dividends?
- Signaling effects
- Residual dividend model

25

What is “dividend policy”?

- It is the decision about how much of earnings to pay out as dividends versus retaining and reinvesting earnings in the firm.

26

What are the three elements of dividend policy?

- Dollars of dividends to be paid out in the near future.
- Target payout ratio: Long-run policy regarding the average percentage of earnings to be paid out to stockholders.
- Should we announce our dividend policy and then stick with it?

27

Do investors prefer high or low payouts? There are three theories:

- Irrelevant: Investors do not care what payout is set.
- Bird in hand: Investors prefer a high payout.
- Tax preference: Investors prefer a low payout in order to get growth and capital gains.

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Dividend Irrelevance Theory

- Investors are indifferent between dividends and retention-generated capital gains. If they want cash, they can sell stock. If they don't want cash, they can use dividends to buy stock.
- Modigliani-Miller support irrelevance but their theory is based on unrealistic assumptions (no taxes or brokerage costs), and hence may not be true.

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“Bird in the Hand” Theory

- Investors think dividends are less risky than potential future capital gains, hence they like dividends.
- If so, investors would value high payout firms more highly, i.e., a high payout would result in a low k_S , hence a high P_0 .

30

Tax Preference Theory

- Retained earnings lead to capital gains, which are taxed at lower rates than dividends: 28% maximum vs. up to 39.6%. Capital gains taxes are also deferred.
- This could cause investors to prefer firms with low payouts, i.e., low payout results in a high P_0 .

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What are the implications of the three theories for managers?

<u>Theory</u>	<u>Implication</u>
Irrelevance	Any payout okay
Bird in the Hand	Set high payout
Tax preference	Set low payout

But which, if any, is correct?

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Information Content (Signaling) Hypothesis

- Managers hate to cut dividends, so they won't raise dividends unless they think the increase is sustainable.
- Thus investors view dividend increases as signals of management's view of the future.

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- If a company's stock price increases at the time it announces a dividend increase, this could reflect expectations for higher future EPS, not a preference for dividends over retention and capital gains.
- Conversely, a dividend cut would be a signal that managers are worried about future earnings.

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- The signaling impact constrains dividend decisions by imposing a large cost on a dividend cut and by discouraging managers from raising dividends until they are sure about future earnings.
- Managers tend to raise dividends only when they believe future earnings can comfortably support a higher dividend level and they cut dividends only as a last resort.

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What is the "clientele effect" and how does it affect dividend policy?

- Different groups of investors, or clienteles, prefer different policies, e.g. retirees need dividends.
- A firm's past dividend policy determines its current clientele of investors.
- Clientele effects impede changing policy. Taxes and brokerage costs hurt investors who switch companies.

36

What impact might dividend policy have on agency costs?

- Firms with high payouts will have to go to the capital markets more frequently.
- Bankers will supply capital more willingly to better-managed firms.
- So, stockholders can worry less if the payout is high.

37

What is the “residual dividend model?”

- Find the retained earnings needed to support the capital budget.
- Pay out any leftover earnings (the residual) as dividends.
- This policy minimizes new equity issues, and hence flotation and signaling costs.

38

How would a change in investment opportunities affect the dividend under the residual dividend policy?

- Fewer good investments would lead to a smaller capital budget, hence a higher dividend payout.
- More good investments would lead to a lower dividend payout.

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What are the advantages and disadvantages of the residual dividend policy?

- **Advantages:** Minimizes new stock issues, hence flotation costs, and negative signals associated with new stock.
- **Disadvantages:** Variable dividends send conflicting signals, increase risk, and do not appeal to any specific clientele. Results in higher required return.

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Conclusion

- Consider residual policy when setting long-run target payout ratio, but don't follow it rigidly in the short run.
- Pay a stable, dependable dividend.

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CHAPTERS 13 & 14 Capital Structure Decisions and Dividend Policy

- Business and financial risk
- Capital structure theory

Chapter 16: Financial Planning and Forecasting

Use of forecasted information

Managers use pro forma, or projected, statements in several ways. First, by looking at projected statements, managers can assess whether the firm's anticipated performance is in line with the firm's own internal targets and with investors' expectations. Second, managers can use pro forma statements to estimate the impact of proposed operating changes. Third, managers can use pro forma statements to anticipate the firm's future financing needs, and then arrange the necessary financing. Finally, managers can use projected financial statements to estimate cash flows, which determine the company's overall value.

Managers forecast cash flows under different operating plans, forecast their capital requirements, and then choose the plan that maximizes shareholder value. Security analysts make the same types of projections as managers, and influence investors, who determine the future of managers.

Methods of forecasting

There are numerous forecasting methods that can be used. Regression analysis, trend analysis, and percent of sales are but a few of the methods. However, all methods have some similarities. (We will focus on the percent of sales method.)

All of the methods require that you first forecast needed assets and then forecast available liabilities and equity. All methods also recognize that various accounts are affected differently by changes in the level of the firm's operations (by operations we may mean level of sales, production, etc.).

Two main types of accounts exist. Spontaneous accounts are those accounts that generally vary with the level of the firm's sales (include accounts payable and accrued expenses). Discretionary accounts are accounts that vary only when management makes a conscious decision to change them (include long-term debt, preferred stock, common stock)

The Financial Plan and Computerized Financial Planning Models

The financial planning process can be divided into six steps.

- development of projected financial statements and analysis of effects on ratios,
- determination of the funds needed to support the five-year plan,
- forecast of funds availability over the next five years,
- establishment and maintenance of a system of controls governing the allocation and use of funds within the firm,
- development of procedures for adjusting the basic plan, and
- establishment of a performance-based management compensation system.

Although the type of financial forecasting described in this chapter can be done with a hand calculator, virtually all corporate forecasts are made using computerized forecasting models. Most models are based on spreadsheet programs, such as Microsoft Excel.

Sales Forecasts

The sales forecast generally begins with a review of sales during the past five to ten years. The sales forecast is a forecast of a firm's unit and dollar sales for some future period, and it is generally based on recent sales trends plus forecasts of the economic prospects for the nation, region, industry, and so forth. If the sales forecast is off, the consequences can be serious. Thus, an accurate sales forecast is critical to the firm's well being.

Financial Statement Forecasting: The Percent of Sales Method

Once sales have been forecasted, future balance sheets and income statements must be forecast. The most commonly used technique is the percent of sales method, which begins with the sales forecast expressed as an annual growth rate.

- The percent of sales method is a method of forecasting future financial statements that expresses each account as a percentage of sales. These percentages can be constant or they can change over time.
- The forecasted sales over a period of time is called the explicit forecast period, with the last year being the forecast horizon.
- Population growth and inflation determine the long-term growth rate for most companies.
- Companies often have a competitive advantage period, during which they can grow at rates higher than the long-term growth rate.
- Many items on the income statement and balance sheet are often assumed to increase proportionally with sales (spontaneous sources of funds). Items that are not tied directly to sales depend on the company's policies and its managers' decisions and are called discretionary sources of funds.

Major Goal

The major goal of financial forecasting is to determine the additional funds needed by the firm for a future period. The basic procedure requires you to determine the level of operations for the period, forecast the assets needed to support these operations, forecast the funds available, and finally determine the difference between assets needed and funds available.

Step 1: Forecast next period's sales. The sales forecast should consider: (1) past trends (usually 5 to 10 years), and (2) any events which may affect that trend (e.g. new marketing plan; new products; changes in the general economy, etc.)

Step 2: Identify and forecast all accounts that will vary with sales. This includes all spontaneous sources of funds and any asset accounts that will vary with sales. (Note: This formula assumes that the percentage change in the account is the same as the percentage change in sales.)

$$\text{projected account balance} = \left(\frac{\text{old account}}{\text{balance}} \right) * \left(\frac{\text{projected sales}}{\text{old sales}} \right)$$

Step 3: Identify asset accounts and discretionary sources of funding accounts that will NOT vary with sales. For these accounts the projected account balance will equal the old account balance (unless change is given).

$$\text{projected account balance} = \left(\frac{\text{old account}}{\text{balance}} \right) + \text{stated change}$$

Step 4: Determine the amount of funds that will be available from net income to add to retained

$$\begin{aligned} \text{change in} \\ \text{retained earnings} &= \text{net income} - \text{dividends} \\ &= \left(\frac{\text{net profit}}{\text{margin}} \right) \left(\frac{\text{projected}}{\text{sales}} \right) - (\text{dividends}) \end{aligned}$$

earnings.

Step 5: Subtract projected liabilities and equity from projected assets to get additional funds

$$\text{additional funds} = \text{projected} - \left(\frac{\text{projected}}{\text{liabilities}} + \frac{\text{projected}}{\text{equity}} \right)$$

needed.

Example Problem.

Are You Kidding, Inc. projects next year's sales to be \$20 million. Current sales are at \$15 million per year. Current assets equal \$5 million and fixed assets equal \$5 million. The firm's net profit margin is 5 percent. AYK forecasts that current assets will rise in direct proportion to sales but fixed assets will increase by only \$100,000. At present, AYK has \$1.5 million in accounts payable, \$2 million in long-term debt, and common equity totaling \$6.5 million. AYK plans to pay \$500,000 in common stock dividend next year. What are AYK's additional funds needed for next year? Using a chart can make the problem easier. First, identify the starting values of the accounts and how they are expected to change (values in \$ millions). Now calculate the new values of the accounts using the appropriate formulas. (All values have been rounded to millions.)

Account	Old Balance	Change	New Balance
Current assets	5	with sales	$(5)(20/15) = 6.67$
Fixed assets	5	up by 0.1	$5 + 0.1 = 5.1$
Acc. Payable	1.5	with sales	$(1.5)(20/15) = 2.0$
Long-term debt	2	no change	$2 + 0 = 2$
Common Equity	6.5	change in retained earnings	$6.5 + (0.05)(20) = 0.5$
			$= 7.0$

To get the final answer, add the asset accounts together (CA+FA), and then subtract the total of liabilities and equity (Acc Pay + LTD + Eq).

$$\text{AFN} = (6.67 + 5.1) - (2 + 2 + 7) = (11.77) - (11) = \$ 0.77 \text{ million}$$

This means that the company needs an additional \$ 0.77 million to fund its operations for the next year.

For various reasons the company may not want to search for additional funding for the next year. The next question to arise may be what level of operations can we support without using

discretionary funds. (In the percent of sales method, the level of operations means level of sales.) This question can be answered in the same manner as before, except now we set the additional funds needed equal to zero and solve for new sales. We can use the same type of table as before to set up the problem. All old account values are the same and the changes are the same. The difference is that now we are solving for new sales (new sales = x).

Account	Old Balance	Change	New Balance
Current assets	5	with sales	$(5)(x/15) = 6.67$
Fixed assets	5	up by 0.1	$5 + 0.1 = 5.1$
Acc. Payable	1.5	with sales	$(1.5)(x/15) = 2.0$
Long-term debt	2	no change	$2 + 0 = 2$
Common Equity	6.5	change in retained earnings	$6.5 + (0.05)(x) = 0.5$
			$= 7.0$

To get the final answer, we must again add assets together and subtract liabilities and equity. To find the new sales level where additional funds needed equals zero, we set the difference in assets and liabilities and equity equal to zero.

$$0 = (5(x/15) + 5.1) - (1.5(x/15) + 2 + 6.5 + .05x - 0.5)$$

$$0 = (.3333x + 5.1) - (.10x + .05x + 8)$$

$$0 = (.3333x + 5.1) - (.15x + 8)$$

$$0 = .1833x - 2.9$$

$$-.1833x = -2.9$$

$$x = \$ 15.82 \text{ million}$$

This means that the firm can have sales of \$15.82 million next year without needing additional funds beyond what they already expect to have.

Forecasting Financial Requirements when the Balance Sheet Ratios are Subject to Change

Both the AFN formula and the projected financial statement method as used initially in the text assume that the ratios of assets and liabilities to sales remain constant over time. This, in turn, requires the assumption that each "spontaneous" asset and liability item increases at the same rate as sales. The assumption of constant ratios and identical growth rates is appropriate at times, but there are times when it is incorrect.

- Where economies of scale occur in asset use, the ratio of that asset to sales will change as the size of the firm increases.
- Technological considerations sometimes dictate that fixed assets be added in large, discrete units, often referred to as lumpy assets. This automatically creates excess capacity immediately after a plant expansion.
- Forecasting errors can cause the actual asset/sales ratio for a given period to be quite different from the planned ratio, resulting in excess capacity.

Other Techniques for Forecasting Financial Statements

If any of the previously described conditions apply (economies of scale, lumpy assets, or excess capacity), the constant growth forecasting methods as discussed should not be used. Rather, other techniques must be used to forecast asset levels to determine additional financing requirements. Two of these methods include linear regression and excess capacity adjustments.

Chapter 16

Financial Forecasting

Use of forecasted information

- Managers use pro forma, or projected, statements in several ways.
 - First, by looking at projected statements, managers can assess whether the firm's anticipated performance is in line with the firm's own internal targets and with investors' expectations.
 - Second, managers can use pro forma statements to estimate the impact of proposed operating changes.

2

Use of forecasted information

- Third, managers can use pro forma statements to anticipate the firm's future financing needs, and then arrange the necessary financing.
- Finally, managers can use projected financial statements to estimate cash flows, which determine the company's overall value.

3

Use of forecasted information

- Managers forecast cash flows under different operating plans, forecast their capital requirements, and then choose the plan that maximizes shareholder value.
- Security analysts make the same types of projections as managers, and influence investors, who determine the future of managers.

4

Major Goal

- The major goal of financial forecasting is to determine the additional funds needed by the firm for a future period.
- The basic procedure requires you to determine the level of operations for the period, forecast the assets needed to support these operations, forecast the funds available, and finally determine the difference between assets needed and funds available.

5

Methods of forecasting

- There are numerous forecasting methods that can be used.
- Regression analysis, trend analysis, and percent of sales are but a few of the methods.
- However, all methods have some similarities. (We will focus on the percent of sales method.)

6

Methods of forecasting

- All of the methods require that you first forecast needed assets and then forecast available liabilities and equity.
- All methods also recognize that various accounts are affected differently by changes in the level of the firm's operations (by operations we may mean level of sales, production, etc.).

7

Methods of forecasting

- Two main types of accounts exist.
 - Spontaneous accounts - those accounts that generally vary with the level of the firm's sales (include accounts payable and accrued expenses)
 - Discretionary accounts - accounts that vary only when management makes a conscious decision to change them (include long-term debt, preferred stock, common stock)

8

Percent of Sales Method

- In the percent of sales method, the level of firm operations is the sales level.
- We first determine the level of sales we wish to obtain, and then based on this information we forecast the level of assets, liabilities, and equity we will have. (In all problems, I will give you the level of sales.)

9

Basic Procedure

- Additional funds needed equals projected assets minus projected liabilities and projected equity.

$$\left(\begin{array}{c} \text{additional} \\ \text{funds} \\ \text{needed} \end{array} \right) = \left(\begin{array}{c} \text{projected} \\ \text{assets} \end{array} \right) - \left[\left(\begin{array}{c} \text{projected} \\ \text{liabs} \end{array} \right) + \left(\begin{array}{c} \text{projected} \\ \text{equity} \end{array} \right) \right]$$

10

Percent of Sales Forecasting Method - In the percent of sales method we expected spontaneous accounts to vary by the same percentage as sales. Using this method:

$$\left(\begin{array}{c} \text{projected} \\ \text{account} \\ \text{balance} \end{array} \right) = \left(\begin{array}{c} \text{old account} \\ \text{balance} \end{array} \right) \left(\frac{\text{projected sales}}{\text{old sales}} \right)$$

NOTE: This is true since projected sales divided by old sales equals one plus the percentage change in sales.

11

Discretionary accounts (other than equity) only change if management decides to change them. Thus, you only make a change if you are told to do so.

$$\text{Projected Balance} = \text{Old account Balance} + \text{Stated change}$$

12

Unless new equity is issued, **owner's equity** will change only by the amount of profit that will be retained for reinvestment in the firm.

$$\left(\begin{array}{c} \text{change in} \\ \text{retained earnings} \end{array} \right) = \text{net income} - \text{dividends}$$

$$= \left(\begin{array}{c} \text{net profit} \\ \text{margin} \end{array} \right) \left(\begin{array}{c} \text{projected} \\ \text{sales} \end{array} \right) - \text{dividends}$$

13

Are You Kidding, Inc. projects next year's sales to be \$20 million. Current sales are at \$15 million per year. Current assets equal \$5 million and fixed assets equal \$5 million. The firm's net profit margin is 5 percent. **AYK forecasts that current assets will rise in direct proportion to sales but fixed assets will increase by only \$100,000.** At present, AYK has \$1.5 million in accounts payable that will vary proportionally with sales, \$2 million in long-term debt, and common equity totaling \$6.5 million. **AYK plans to pay \$500,000 in common stock dividend next year.**

What are AYK's additional funds needed for next year?

14

Using a chart can make the problem easier. First, identify the starting values of the accounts and how they are expected to change (values in \$ millions).

Account	OLD	Change	NEW
CA	5	with sales	5(20/15)=6.67
FA	5	+0.1	5.1
Acc Pay	1.5	with sales	1.5(20/15)=2.0
LTD	2	+0	2
Equity	6.5	+ change in RE	6.5+(20)(0.05)-0.5=7.0

Note: Acc Pay is spontaneous and always varies with sales.

15

To get the final answer now add the asset accounts together (CA+FA) and then subtract the total of liabilities and equity (AccPay+LTD+Eq).

$$\begin{aligned} \text{AFN} &= (6.67 + 5.1) - (2 + 2 + 7) \\ &= (11.77) - (11) \\ &= \$ 0.77 \text{ million} \end{aligned}$$

This means that the company needs an additional \$ 0.77 million to fund its operations for the next year.

16

For various reasons the company may not want to search for additional funding for the next year. The next question to arise may be what level of operations can we support without using discretionary funds. (In the percent of sales method, the level of operations means level of sales.)

This question can be answered in the same manner as before, except now we set the additional funds needed equal to zero and solve for new sales.

17

Using a chart can make the problem easier. First, identify the starting values of the accounts and how they are expected to change (values in \$ millions).

Account	OLD	Change	NEW
CA	5	with sales	5(x/15)
FA	5	+0.1	5.1
Acc Pay	1.5	with sales	1.5(x/15)
LTD	2	+0	2
Equity	6.5	+ change in RE	6.5+(x)(0.05)-0.5

Note: Acc Pay is spontaneous and always varies with sales.

18

To get the final answer, we must again add assets together and subtract liabilities and equity.

To find the new sales level where additional funds needed equals zero, we set the difference in assets and liabilities and equity equal to zero.

19

$$0 = (5(x/15) + 5.1) - (1.5(x/15) + 2 + 6.5 + .05x - 0.5)$$

$$0 = (.3333x + 5.1) - (.10x + .05x + 8)$$

$$0 = (.3333x + 5.1) - (.15x + 8)$$

$$0 = .1833x - 2.9$$

$$-.1833x = -2.9$$

$$x = \$ 15.82 \text{ million}$$

This means that the firm can have sales of \$15.82 million next year without needing additional funds beyond what they already expect to have.

20

Chapter 16 – Sample Problems

1. CCC currently has sales of \$24,000,000 and projects sales of \$32,400,000 for next year. The firm's current assets equal \$6,000,000 while its fixed assets are \$5,000,000. The best estimate is that current assets will rise directly with sales while fixed assets will rise by \$300,000. The firm presently has \$3,000,000 in accounts payable, \$1,800,000 in long-term debt, and \$6,200,000 in common equity. All current liabilities are expected to change directly with sales. CCC plans to pay \$800,000 in dividends next year and has a 4.0% net profit margin. What are the company's additional funds needed for the next year? (Round your answer to the nearest dollar.)

- a. \$1,904,000
- b. \$854,000
- c. \$1,350,000
- d. \$54,000
- e. \$2,400,000

2. CCC currently has sales of \$24,000,000 and projects sales of \$32,400,000 for next year. The firm's current assets equal \$6,000,000 while its fixed assets are \$5,000,000. The best estimate is that current assets will rise directly with sales while fixed assets will rise by \$300,000. The firm presently has \$3,000,000 in accounts payable, \$1,800,000 in long-term debt, and \$6,200,000 in common equity. All current liabilities are expected to change directly with sales. CCC plans to pay \$800,000 in dividends next year and has a 4.0% net profit margin. Assuming the increase in fixed assets will occur, what is the most sales could equal next year without using discretionary sources of funds? (Round your answer to the nearest dollar.)

- a. \$22,352,941
- b. \$24,834,118
- c. \$27,527,647
- d. \$19,735,412
- e. \$21,060,494

Answers:

- 1. b
- 2. a

1.

Account	OLD	CHANGE	NEW
CA	6,000,000	with sales	$6,000,000(32,400,000/24,000,000) = 8,100,000$
FA	5,000,000	+300,000	$5,000,000 + 300,000 = 5,300,000$
Acc Pay	3,000,000	with sales	$3,000,000(32,400,000/24,000,000) = 4,050,000$
LTD	1,800,000	+0	1,800,000
CE	6,200,000	+ change in RE	$6,200,000 + (0.04)(32,400,000) - 800,000 = 6,696,000$

AFN = projected assets – [projected liabilities + projected equity]

AFN = [8,100,000 + 5,300,000] – [4,050,000 + 1,800,000 + 6,696,000]

AFN = [13,400,000] – [12,546,000] = \$854,000

2.

Account	OLD	CHANGE	NEW
CA	6,000,000	with sales	$6,000,000(x/24,000,000) = 0.25x$
FA	5,000,000	+300,000	$5,000,000 + 300,000 = 5,300,000$
Acc Pay	3,000,000	with sales	$3,000,000(x/24,000,000) = 0.125x$
LTD	1,800,000	+0	1,800,000
CE	6,200,000	+ change in RE	$6,200,000 + (0.04)(x) - 800,000$

AFN = projected assets – [projected liabilities + projected equity]

Since we do not want to use discretionary (additional) funds, we set the AFN equation equal to zero.

$0 = [0.25x + 5,300,000] - [0.125x + 1,800,000 + 6,200,000 + 0.04x - 800,000]$

$0 = [0.25x + 5,300,000] - [0.165x + 7,200,000]$

$0 = 0.085x - 1,900,000$

$\frac{-0.085x = -1,900,000}{-0.085 \quad -0.085}$

$x = \$22,352,941$

BA II Plus Tutorial

By default the BA II Plus displays only two decimal places. At most you will usually need four decimal places. To change the display, press the second function key and then the “FORMAT” key. Enter the number 4 and then press the “ENTER” key. Press “CE/C” to exit.

The calculator also has periods per year set equal to 12. You can change the periods per year for each problem, but the solutions in the lecture supplement are based on the periods per year being set to one. To change the setting, press the second function key and then press the “P/Y” key. Enter the number 1 and then press the “ENTER” key. Press “CE/C” to exit.

The “CE/C” key is the key that clears the display. To clear the time value function keys press the second function key and then “CLR TVM.” To clear the cash flow register for uneven cash flow problems, press the second function key and then “CLR Work.” You should get into the habit of clearing the time value keys before starting a new problem.

Note that the calculator treats PV as negative numbers (cash outflows). Therefore, it is good to enter all PV’s as negative numbers. To make a number negative, be sure to enter the number first and then press the “+/-” key. Do not use the subtraction key (“-“).

You will use the time value keys at the top of the calculator to solve “lump sum” and annuity future and present value problems. To enter values simply type the number first and then press the associated time value key. For example, if you want $n=8$, press the number 8 and then press the “N” key.

EXAMPLES:

(A) calculate PV

What is the present value of \$2000 received 10 years from now if the interest rate you could have received is 7%?

First enter the information that is given.

$N = 10$

$I\% = 7$

$PV =$

$PMT = 0$

$FV = 2000$

To solve the problem, press the “CPT” key and then the “PV” key.

Answer: \$1016.70 (The answer will appear with a negative sign.)

(B) calculate FV

What is the future value 10 years from now of \$2000 deposited today in an account which has a quoted annual interest rate of 10% with quarterly compounding of interest?

First enter the information that is given.

Note: For the calculated values, be sure to hit the “=” key before pressing the time value key.

$N = 10 \times 4$ (This indicates 10 years times 4 interest payments per year.)

$I\% = 10/4$ (This indicates 2.5% per quarter.)

$PV = -2000$ (The negative sign is a result of the calculator’s default programming.)

$PMT = 0$

$FV =$

To solve the problem, press the “CPT” key and then the “FV” key.

Answer: \$5370.13

(C) calculate i

What annual interest rate must you earn if you plan to deposit \$10,000 in the bank today and you want it to grow to be \$17,623.42 in 5 years?

First enter the information that is given.

$N = 5$

$I\% =$

$PV = -10000$ (The negative sign is due to the calculator’s default programming.)

$PMT = 0$

$FV = 17623.42$

To solve the problem, press the “CPT” key and then the “I/YR” key.

Answer: 12%

(D) calculate n

If you deposit \$5000 in an account which earns 9% per year, how many years will it take for the investment to grow to be worth \$10,000?

First enter the information that is given.

$N =$

$I\% = 9$

$PV = -5000$ (The negative sign is a result of the calculator’s default programming.)

$PMT = 0$

$FV = 10000$

To solve the problem, press the “CPT” key and then the “N” key.

Answer: 8.0432 years

Your calculator allows you to solve for the various items for an **ordinary annuity or an annuity due**. You must make sure the calculator is in the correct "mode" for the type of annuity you are considering. The calculator has two annuities modes: END and BEGIN. The "BEGIN" mode is used for an annuity due (begin means the payments are at the beginning of the period). The "END" mode is used for ordinary annuities (end means the payments are at the end of the period). To set the mode, press the second function key and then the “BGN” key. To change the

mode shown, press the second function key and then the “SET” key. When the correct mode is shown, press the “CE/C” key to exit. If you are in the begin mode, the letters “BGN” will show in the display. To change to the end mode, do the same again.

EXAMPLE:

You are offered an investment that will pay you \$5000 per year for the next 10 years. Each payment will be made at the end of each year. If the appropriate discount rate is 9% per year, what is the present value of the annuity?

Note: Payments are at the end of each year, so be sure you are in the end mode.

Enter the information that is given.

$N = 10$

$I\% = 9$

$PV =$

$PMT = 5000$

$FV = 0$

To solve the problem, press the “CPT” key and then the “PV” key.

Answer: \$32,088.29

EXAMPLE:

You are offered an investment that will pay you \$8000 per year for the next 20 years. Each payment will be made at the beginning of each year. If you expect to earn an annual return of 7% per year, what is the future value of the annuity at the end of the 20 years?

Note: Payments are at the beginning of each year, so make sure you are in the begin mode.

Enter the information that is given.

$N = 20$

$I\% = 7$

$PV = 0$

$PMT = 8000$

$FV =$

To solve the problem, press the “CPT” key and then the “FV” key.

Answer: \$350,921.41

Uneven Cash Flows

The calculator will calculate the present value of an uneven stream of cash flows using the NPV function. You enter the cash flows in the order they occur starting with any cash flow that occurs now (cash flow zero). Always clear the cash flow register when starting a new problem. To enter the cash flows, press the “CF” key first. Now clear the register by pressing the second function key and then the “CLR Work” key. Now enter each cash flow in order. The calculator will prompt you for the cash flows and their associated frequency.

Example:

Suppose that you are offered an investment which will pay \$100 at the end of the first year, \$200 at the end of the second year, \$300 at the end of the third year, \$400 at the end of the fourth year, and \$500 at the end of the fifth year. How much are the cash flows worth in today’s dollars if your annual required rate of return is 12%?

To solve the problem, first enter the cash flows. Remember you must start with cash flow zero. Since nothing happens now in the problem, cash flow zero equals 0.

Press “CF” and then the second function key and the “CLR Work” key.

Press 0 then “ENTER” then the ↓ key

Press 100 then “ENTER” then the ↓ key

Press 1 then “ENTER” then the ↓ key

Press 200 then “ENTER” then the ↓ key

Press 1 then “ENTER” then the ↓ key

Press 300 then “ENTER” then the ↓ key

Press 1 then “ENTER” then the ↓ key

Press 400 then “ENTER” then the ↓ key

Press 1 then “ENTER” then the ↓ key

Press 500 then “ENTER” then the ↓ key

Press 1 then “ENTER” then the ↓ key

When all cash flows are entered, press the “NPV” key

Now enter the interest rate. Press 12 then “ENTER” then the ↓ key

To solve the problem, press the “CPT” key.

Answer: \$1000.18

If cash flows occur multiple times, we input the cash flow frequency following each cash flow instead of the “1’s” we entered above.

Example:

Suppose that you are offered an investment that at the end of each year will pay \$500 for the first 5 years, \$1500 for the next 10 years, and \$2500 for the next 15 years. What is the present value of the cash flows if your annual required rate of return is 13%?

To solve the problem, first enter the cash flows. Remember you must start with cash flow zero. Since nothing happens now in the problem, cash flow zero equals 0.

Press “CF” and then the second function key and the “CLR Work” key.

Press 0 then “ENTER” then the ↓ key

Press 500 then “ENTER” then the ↓ key

Press 5 then “ENTER” then the ↓ key

Press 1500 then “ENTER” then the ↓ key

Press 10 then “ENTER” then the ↓ key

Press 2500 then “ENTER” then the ↓ key

Press 15 then “ENTER” then the ↓ key

When all cash flows are entered, press the “NPV” key

Now enter the interest rate. Press 13 then “ENTER” then the ↓ key

To solve the problem, press the “CPT” key.

Answer: \$8759.52

HP 10BII Tutorial

By default the HP 10B displays only two decimal places. At most you will usually need four decimal places. To change the display, press the second function key (usually orange or gold in color), then “DISP,” and then the number 4.

The HP 10B also has periods per year set equal to 12. You can change the periods per year for each problem, but the solutions in the lecture supplement are based on the periods per year being set to one. To change the setting, press the number 1, then the second function key, and then “P/YR.”

The “C” key is the clear key that clears the display. To clear the time value function keys press the second function key and then “C ALL.” You should get into the habit of clearing the time value function keys before starting a new problem.

Note that the calculator treats PV as negative numbers (cash outflows). Therefore, it is good to enter all PV’s as negative numbers. To make a number negative, be sure to enter the number first and then press the “+/-” key. Do not use the subtraction key (“-“).

You will use the time value keys at the top of the calculator to solve “lump sum” and annuity future and present value problems. To enter values simply type the number first and then press the associated time value key. For example, if you want $n=8$, press the number 8 and then press the “N” key.

EXAMPLES:

(A) calculate PV

What is the present value of \$2000 received 10 years from now if the interest rate you could have received is 7%?

First enter the information that is given.

$N = 10$

$I\% = 7$

$PV =$

$PMT = 0$

$FV = 2000$

To solve the problem, press the “PV” key.

Answer: \$1016.70 (The answer will appear with a negative sign.)

(B) calculate FV

What is the future value 10 years from now of \$2000 deposited today in an account which has a quoted annual interest rate of 10% with quarterly compounding of interest?

First enter the information that is given.

Note: For the calculated values, be sure to hit the “=” key before pressing the time value key.

$N = 10 \times 4$ (This indicates 10 years times 4 interest payments per year.)

$I\% = 10/4$ (This indicates 2.5% per quarter.)

$PV = -2000$ (The negative sign is a result of the calculator’s default programming.)

$PMT = 0$

$FV =$

To solve the problem, press the “FV” key.

Answer: \$5370.13

(C) calculate i

What annual interest rate must you earn if you plan to deposit \$10,000 in the bank today and you want it to grow to be \$17,623.42 in 5 years?

First enter the information that is given.

$N = 5$

$I\% =$

$PV = -10000$ (The negative sign is due to the calculator’s default programming.)

$PMT = 0$

$FV = 17623.42$

To solve the problem, press the “I/YR” key.

Answer: 12%

(D) calculate n

If you deposit \$5000 in an account which earns 9% per year, how many years will it take for the investment to grow to be worth \$10,000?

First enter the information that is given.

$N =$

$I\% = 9$

$PV = -5000$ (The negative sign is a result of the calculator’s default programming.)

$PMT = 0$

$FV = 10000$

To solve the problem, press the “N” key.

Answer: 8.0432 years

Your calculator allows you to solve for the various items for an **ordinary annuity or an annuity due**. You must make sure the calculator is in the correct "mode" for the type of annuity you are considering. The calculator has two annuities modes: END and BEGIN. The "BEGIN" mode is used for an annuity due (begin means the payments are at the beginning of the period). The "END" mode is used for ordinary annuities (end means the payments are at the end of the period). The “BEG/END” key changes the payment mode of the calculator. To change modes

press the second function key and then the “BEG/END” key. If you are in the begin mode, the word “BEGIN” will show in the display. To change to the end mode, do the same again.

EXAMPLE:

You are offered an investment that will pay you \$5000 per year for the next 10 years. Each payment will be made at the end of each year. If the appropriate discount rate is 9% per year, what is the present value of the annuity?

Note: Payments are at the end of each year, so be sure you are in the end mode.

Enter the information that is given.

$N = 10$

$I\% = 9$

$PV =$

$PMT = 5000$

$FV = 0$

To solve the problem, press the “PV” key.

Answer: \$32,088.29

EXAMPLE:

You are offered an investment that will pay you \$8000 per year for the next 20 years. Each payment will be made at the beginning of each year. If you expect to earn an annual return of 7% per year, what is the future value of the annuity at the end of the 20 years?

Note: Payments are at the beginning of each year, so make sure you are in the begin mode.

Enter the information that is given.

$N = 20$

$I\% = 7$

$PV = 0$

$PMT = 8000$

$FV =$

To solve the problem, press the “FV” key.

Answer: \$350,921.41

Uneven Cash Flows

The calculator will calculate the present value of an uneven stream of cash flows using the NPV function. You enter the cash flows in the order they occur starting with any cash flow that occurs now (cash flow zero). To enter the cash flows, press the number first and then press the “CF_j” key. After you enter all cash flows, enter the interest rate by pressing the number and then the “I/YR” key. To solve the problem, press the second function key and then the “NPV” key.

Example:

Suppose that you are offered an investment which will pay \$100 at the end of the first year, \$200 at the end of the second year, \$300 at the end of the third year, \$400 at the end of the fourth year, and \$500 at the end of the fifth year. How much are the cash flows worth in today’s dollars if your annual required rate of return is 12%?

To solve the problem, first enter the cash flows. Remember you must start with cash flow zero. Since nothing happens now in the problem, cash flow zero equals 0.

Press 0 then “CF_j”

Press 100 then “CF_j”

Press 200 then “CF_j”

Press 300 then “CF_j”

Press 400 then “CF_j”

Press 500 then “CF_j”

Now enter the interest rate. Press 12 then “I/YR”

To solve the problem, press the second function key and then “NPV.”

Answer: \$1000.18

If cash flows occur multiple times, we use the cash flow frequency button. The cash flow frequency button is the “N_j”key. Always enter the cash flow first, and then the frequency.

Example:

Suppose that you are offered an investment that at the end of each year will pay \$500 for the first 5 years, \$1500 for the next 10 years, and \$2500 for the next 15 years. What is the present value of the cash flows if your annual required rate of return is 13%?

To solve the problem, first enter the cash flows. Remember you must start with cash flow zero. Since nothing happens now in the problem, cash flow zero equals 0.

Press 0 then “CF_j”

Press 500 then “CF_j”

Press 5 then the second function key and then “N_j”

Press 1500 then “CF_j”

Press 10 then the second function key and then “N_j”

Press 2500 then “CF_j”

Press 15 then the second function key and then “N_j”

Now enter the interest rate. Press 13 then “I/YR”

To solve the problem, press the second function key and then “NPV.”

Answer: \$8759.52

TI 83 and TI 83 Plus Tutorial

By default the TI 83 displays only two decimal places. To change the display, press the Mode key, then the down arrow key to the Float line. Next, use the right arrow key to highlight the number of decimal places desired (4 is a good choice) and press Enter. Finally, press 2nd and Quit to exit the menu.

Before entering data for any type of financial problem, you must go to the finance functions page. For the TI-83, press 2nd then FINANCE. On the TI 83 Plus, press the Apps button, and then choose the Finance menu.

To solve a lump sum or annuity problem you choose 1: TVM Solver from the finance function menu. (Either highlight 1:TVM Solver and then press Enter, or just enter 1.) You will now see in your screen a series of items you are able to enter (N, I%, PV, PMT, FV, P/Y, C/Y). All lump sum and annuity problems require that you enter the data given by using the arrow keys to place the cursor next to the items you know and typing the value. Make sure all items that are not used in the problem are set equal to zero. After entering the data you are given, move the cursor to the item you wish to solve and press Alpha and then Enter.

NOTES:

- (1) The calculators by default treat PV as a negative number (cash outflow). Therefore, it is a good idea to enter all PV's as negative numbers. On these calculators you enter a negative number by first pressing the sign change key “(-)” and entering the number value.)
- (2) Make sure the values for P/Y and C/Y are set equal to 1.

EXAMPLES:

(A) calculate PV

What is the present value of \$2000 received 10 years from now if the interest rate you could have received is 7%?

First enter the information that is given.

N = 10

I% = 7

PV =

PMT = 0

FV = 2000

To solve the problem, place the cursor beside PV and press Alpha and then solve.

Answer: \$1016.70 (The answer will appear with a negative sign.)

(B) calculate FV

What is the future value 10 years from now of \$2000 deposited today in an account which has a quoted annual interest rate of 10% with quarterly compounding of interest?

First enter the information that is given.

(For the calculated values, be sure to press the enter key so the answer is calculated.)

$N = 10 \times 4$ (This indicates 10 years times 4 interest payments per year.)

$I\% = 10/4$ (This indicates 2.5% per quarter.)

$PV = -2000$ (The negative sign is a result of the calculator's default programming.)

$PMT = 0$

$FV =$

To solve the problem, place the cursor beside FV and press Alpha and then solve.

Answer: \$5370.13

(C) calculate i

What annual interest rate must you earn if you plan to deposit \$10,000 in the bank today and you want it to grow to be \$17,623.42 in 5 years?

First enter the information that is given.

$N = 5$

$I\% =$

$PV = -10000$ (The negative sign is a result of the calculator's default programming.)

$PMT = 0$

$FV = 17623.42$

To solve the problem, place the cursor beside $I\%$ and press Alpha and then solve.

Answer: 12%

(D) calculate n

If you deposit \$5000 in an account which earns 9% per year, how many years will it take for the investment to grow to be worth \$10,000?

First enter the information that is given.

$N =$

$I\% = 9$

$PV = -5000$ (The negative sign is a result of the calculator's default programming.)

$PMT = 0$

$FV = 10000$

To solve the problem, place the cursor beside N and press Alpha and then solve.

Answer: 8.0432 years

Your calculator allows you to solve for the various items for an **ordinary annuity or an annuity due**. You must make sure the calculator is in the correct "mode" for the type of annuity you are considering. The calculator has two annuities modes: END and BEGIN. The "BEGIN" mode is used for an annuity due (begin means the payments are at the beginning of the period). The "END" mode is used for ordinary annuities (end means the payments are at the end of the period). The calculator is using the mode that is highlighted. To change modes, use the arrow keys to highlight the correct mode and then press enter.

EXAMPLE:

You are offered an investment that will pay you \$5000 per year for the next 10 years. Each payment will be made at the end of each year. If the appropriate discount rate is 9% per year, what is the present value of the annuity?

First enter the information that is given.

$N = 10$

$I\% = 9$

$PV =$

$PMT = 5000$

$FV = 0$

NOTE: Make sure you are in the END mode.

To solve the problem, place the cursor beside PV and press Alpha and then solve.

Answer: \$32,088.29

EXAMPLE:

You are offered an investment that will pay you \$8000 per year for the next 20 years. Each payment will be made at the beginning of each year. If you expect to earn an annual return of 7% per year, what is the future value of the annuity at the end of the 20 years?

First enter the information that is given.

$N = 20$

$I\% = 7$

$PV = 0$

$PMT = 8000$

$FV =$

NOTE: Make sure you are in the BEGIN mode.

To solve the problem, place the cursor beside FV and press Alpha and then solve. Answer:
\$350,921.41

Uneven Cash Flows

The TI 83 requires a correct input format to calculate the present value of uneven cashflows. To find the present value of an uneven stream of cash flows, we need to use the NPV function. You access the NPV function by going to the finance menu and choosing option number 7. This function is defined as:

$\text{NPV}(\text{Rate}, \text{Initial Outlay}, \{\text{Cash Flows}\}, \{\text{Cash Flow Frequencies}\})$

Rate is the interest rate per period. Initial Outlay indicates what happens now (today). {Cash Flows} are the future cash flow amounts. Enter the cash flows in braces separated by commas. {Cash Flow Frequencies} are the number of times each cash flow occurs. They are also entered in braces separated by commas. Note that the {Cash Flow Frequencies} are needed only if there are cash flows of equal amounts that occur multiple times.

Example:

Suppose that you are offered an investment which will pay \$100 at the end of the first year, \$200 at the end of the second year, \$300 at the end of the third year, \$400 at the end of the fourth year, and \$500 at the end of the fifth year. How much are the cash flows worth in today's dollars if your annual required rate of return is 12%?

To solve the problem, go to the finance function menu and choose option 7:npv(. The screen will show npv(when you choose option 7. You now enter the information given based on the format listed above.

$\text{npv}(12,0,\{100,200,300,400,500\})$ and then press "ENTER." ANSWER: \$1000.18

12 is your interest rate. 0 is the initial outlay (cash flow zero) since nothing happens now. The future cash flows are entered in braces in order of occurrence separated by commas. The cash frequencies are not needed since all cash flows occur only one time.

If there are multiple cash flows we need the cash flow frequencies.

Example:

Suppose that you are offered an investment that at the end of each year will pay \$500 for the first 5 years, \$1500 for the next 10 years, and \$2500 for the next 15 years. What is the present value of the cash flows if your annual required rate of return is 13%?

To solve the problem, go to the finance function menu and choose option 7:npv(. The screen will show npv(when you choose option 7. You now enter the information given based on the format listed above.

$\text{npv}(13,0,\{500,1500,2500\},\{5,10,15\})$ and then press "ENTER." ANSWER: \$8759.52

13 is your interest rate. 0 is the initial outlay (cash flow zero) since nothing happens now. The future cash flow are entered in braces in order of occurrence separated by commas. Note that you only enter each "different" cash flow. The cash flow frequencies are entered in the same order as the corresponding cash flows to indicate how many times you receive each of the "different" cash flows.

FINC 3511 - Corporate Finance - Formulas

$$\text{Net income} = (\text{EBIT} - \text{INT})(1 - \text{tax rate})$$

$$\text{Operating cash flow} = \text{NOPAT} + \text{Dep}$$

$$\text{NOPAT} = \text{EBIT}(1 - \text{tax rate})$$

$$\text{Net cash flow} = \text{Net income} + (\text{Dep} + \text{Amort})$$

$$\text{MVA} = (\text{shares outstanding})(\text{stock price}) - (\text{total common equity})$$

$$\text{EVA} = \text{EBIT}(1 - \text{tax rate}) - (\text{investor supplied capital})(\text{percentage cost of capital})$$

$$\text{Current assets} = \text{cash} + \text{marketable securities} + \text{inventory} + \text{accounts receivable}$$

$$\text{Current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

$$\text{Basic earning power} = \frac{\text{EBIT}}{\text{Total assets}}$$

$$\text{Inventory turnover ratio} = \frac{\text{sales}}{\text{inventory}}$$

$$\text{Times interest earned} = \frac{\text{EBIT}}{\text{Interest charges}}$$

$$\text{Quick ratio} = \frac{\text{current assets} - \text{inventory}}{\text{current liabilities}}$$

$$\text{Fixed asset turnover} = \frac{\text{Sales}}{\text{Net fixed assets}}$$

$$\text{Days sales outstanding} = \frac{\text{receivables}}{(\text{annual sales})/365}$$

$$\text{EBITDA Coverage Ratio} = \frac{\text{EBITDA} + \text{Lease Payments}}{\text{Interest Charges} + \text{Principal pmts} + \text{Lease pmts}}$$

$$\text{Debt ratio} = \frac{\text{total debt}}{\text{total assets}}$$

$$\text{Total asset Turnover} = \frac{\text{Sales}}{\text{total assets}}$$

$$\text{Net profit margin} = \frac{\text{Net income}}{\text{sales}}$$

$$\text{Price earnings ratio} = \frac{\text{Price per share}}{\text{Earnings per share}}$$

$$\text{Market/Book ratio} = \frac{\text{Market price per share}}{\text{Book price per share}}$$

$$\text{Return on total assets} = \frac{\text{Net income}}{\text{Total assets}} = (\text{Net profit margin})(\text{Total asset turnover})$$

$$\text{Return on common equity} = \frac{\text{Net income}}{\text{common equity}} = (\text{net profit margin})(\text{total asset turnover})(1/(1 - \text{debt ratio}))$$

$$\text{projected account balance} = (\text{old account balance})[(\text{new sales})/(\text{old sales})]$$

$$\text{Change in retained earnings} = (\text{net profit margin})(\text{sales}) - \text{dividends}$$

$$\text{Additional funds needed} = \text{projected assets} - (\text{projected liabilities} + \text{projected equity})$$

$$\hat{k}_i = \sum_{i=1}^n k_i p_i \quad \hat{k}_P = \sum_{i=1}^n w_i \hat{k}_i \quad b_P = \sum_{i=1}^n w_i b_i \quad k_i = k_{RF} + b_i (k_M - k_{RF})$$

$$FV_n = PV \left(1 + \frac{i}{m} \right)^{n \cdot m} \quad PV = FV_n \left(\frac{1}{\left(1 + \frac{i}{m} \right)^{n \cdot m}} \right) \quad FVA_n = PMT \sum_{t=1}^n (1+i)^{n-t}$$

$$PVA_n = PMT \sum_{t=1}^n \left(\frac{1}{(1+i)^t} \right) \quad EAR = \left(1 + \frac{i}{m} \right)^m$$

$$V_B = \frac{INT}{m} \sum_{t=1}^{N \cdot m} \left(\frac{1}{\left(1 + \frac{k_b}{m} \right)^t} \right) + M \left(\frac{1}{\left(1 + \frac{k_b}{m} \right)^{N \cdot m}} \right) \quad V_P = \frac{D}{k_P}$$

Current yield = (annual interest payment)/(current price)

Yield-to-maturity = current yield + capital gain/loss

$$\hat{P}_0 = \frac{D_0(1+g)}{k_s - g} = \frac{D_1}{k_s - g} \quad \hat{P}_0 = \sum_{t=1}^{N_s} \frac{D_0(1+g_s)^t}{(1+k_s)^t} + \left[\frac{D_{N_s}(1+g_c)}{k_s - g_c} \right] \frac{1}{(1+k_s)^{N_s}}$$

$$(V_B - FC) = INT \left(\sum_{t=1}^N \frac{1}{(1+k_d^B)^t} \right) + M \left(\frac{1}{(1+k_d^B)^N} \right) \quad (V_{ps} - FC) = \frac{D}{k_{ps}}$$

$$(\hat{P}_0 - FC) = \frac{D_1}{k_s - g} \quad WACC = w_d k_d^B (1-t) + w_p k_{ps} + w_s k_s$$

Breakpoint (equity) = $\frac{\text{total dollar amount of retained earnings available}}{\text{fraction of equity in the capital structure}}$

$$NPV = \sum_{t=1}^n \frac{CF_t}{(1+k)^t} - IO \quad IO = \sum_{t=1}^n \frac{CF_t}{(1+IRR)^t} \quad \sum_{t=0}^n \frac{COF_t}{(1+k)^t} = \frac{\sum_{t=0}^n CIF_t (1+k)^{n-t}}{(1+MIRR)^n}$$