UNIVERSITY OF Southampton

Corporate Finance

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Session 1 – 02.12.2014

Module

Introduction to Corporate Finance
The Objective Function in Corporate Finance
Present Value and Related Metrics
Risk and Return – Theory and Practice
Capital Budgeting
Working Capital
Capital Structure
Market Efficiency: Lessons for Corporate Finance
Dividend Policy
Valuation: Basics and Case Studies
Acquisitions and Takeovers
International Finance
Applications of Option Pricing in Corporate Finance

Assessment

Assignment (4 students): 30%
Examination: 70%

References

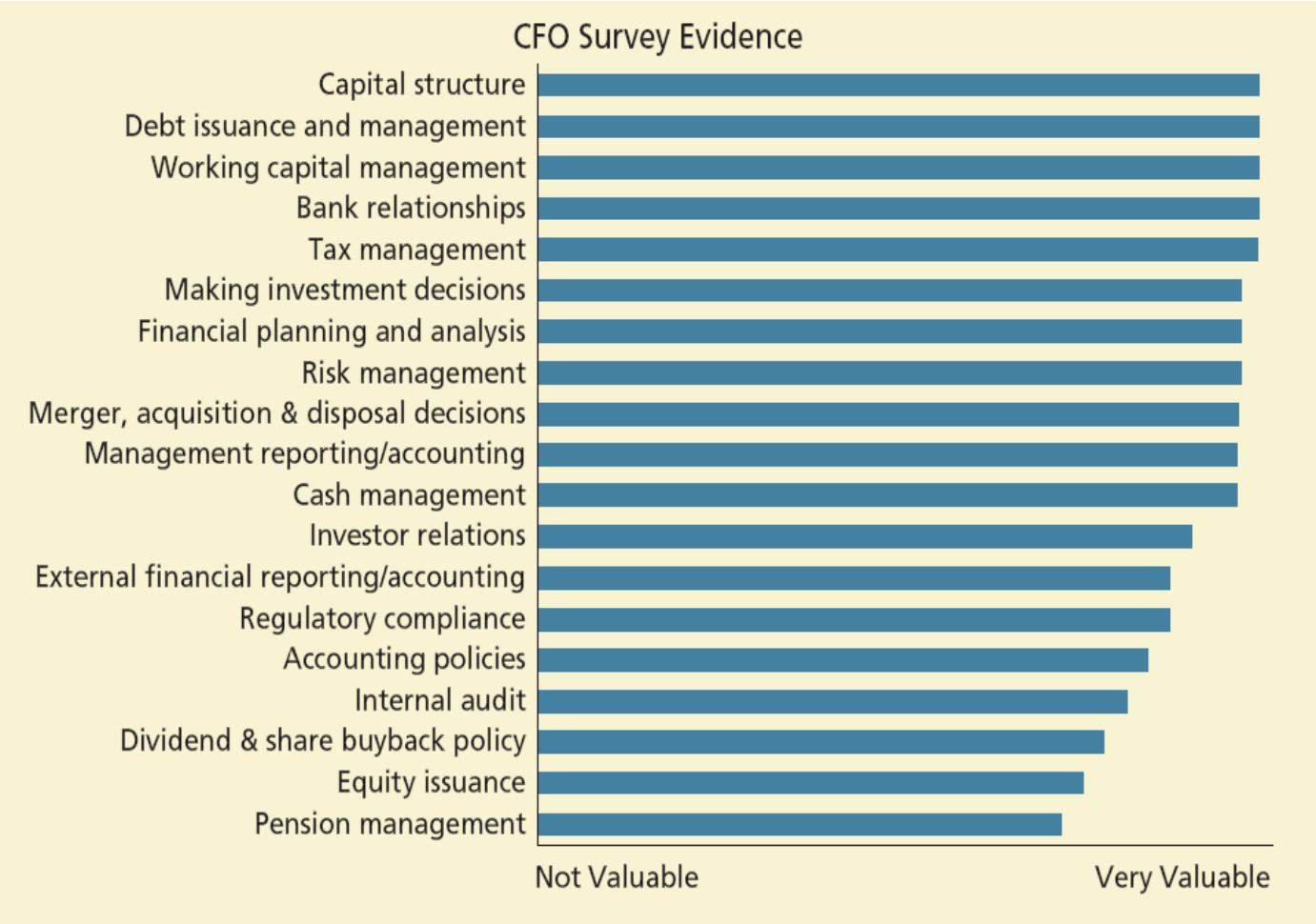
Brealey R., Myers S. and Allen F (2013), Principles of Corporate Finance, McGraw-Hill

Using CFO Surveys as a Motivational Tool to Teach Corporate Finance

One of the most common questions business school professors hear from students is “Will I use this on the job?”

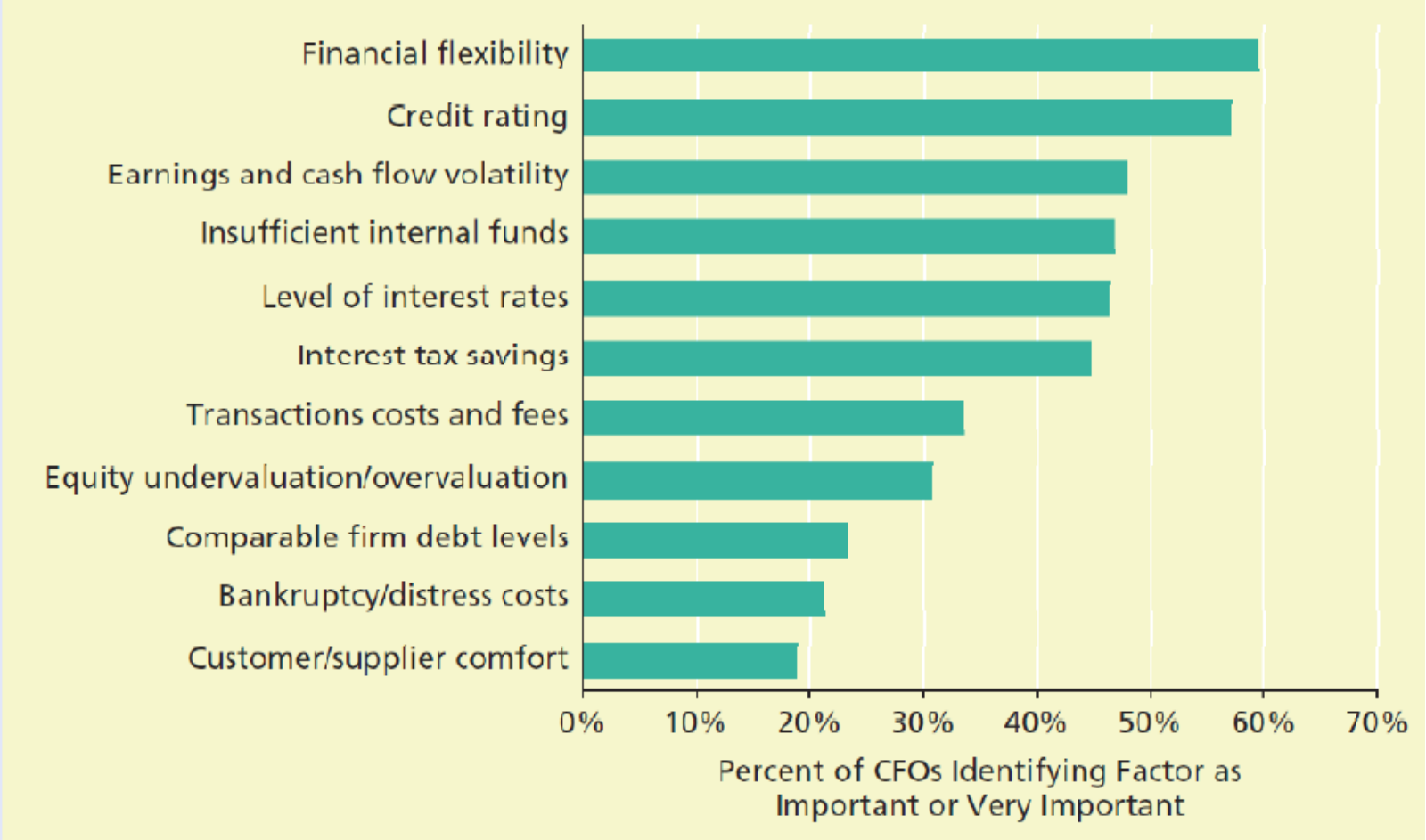
Overlap between the fundamental skills and concepts that a finance practitioner uses on the job and the concepts taught in finance classrooms.

Which Finance Functions add the most value



Servaes and Tufano
"CFO views on the importance and Execution of the Finance Function" (Deutsche Bank, 2006)

What factors Do U.S. Companies Consider When Choosing Debt Policy?



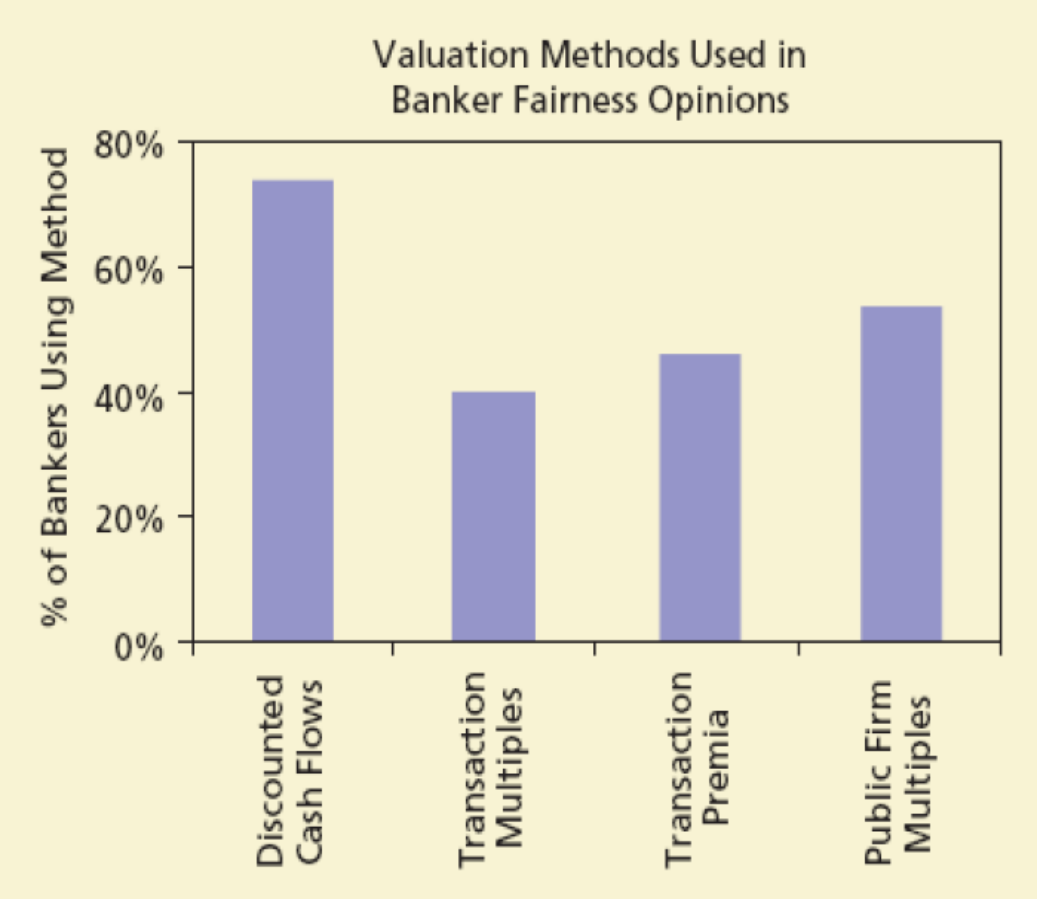
Popularity of Capital Budgeting Techniques

TECHNIQUE	PERCENT OF CFOs ROUTINELY USING TECHNIQUE[a]
Internal rate of return	76%
Net present value	75%
Payback	57%
Discounted payback	29%
Accounting rate of return	20%
Profitability index	12%

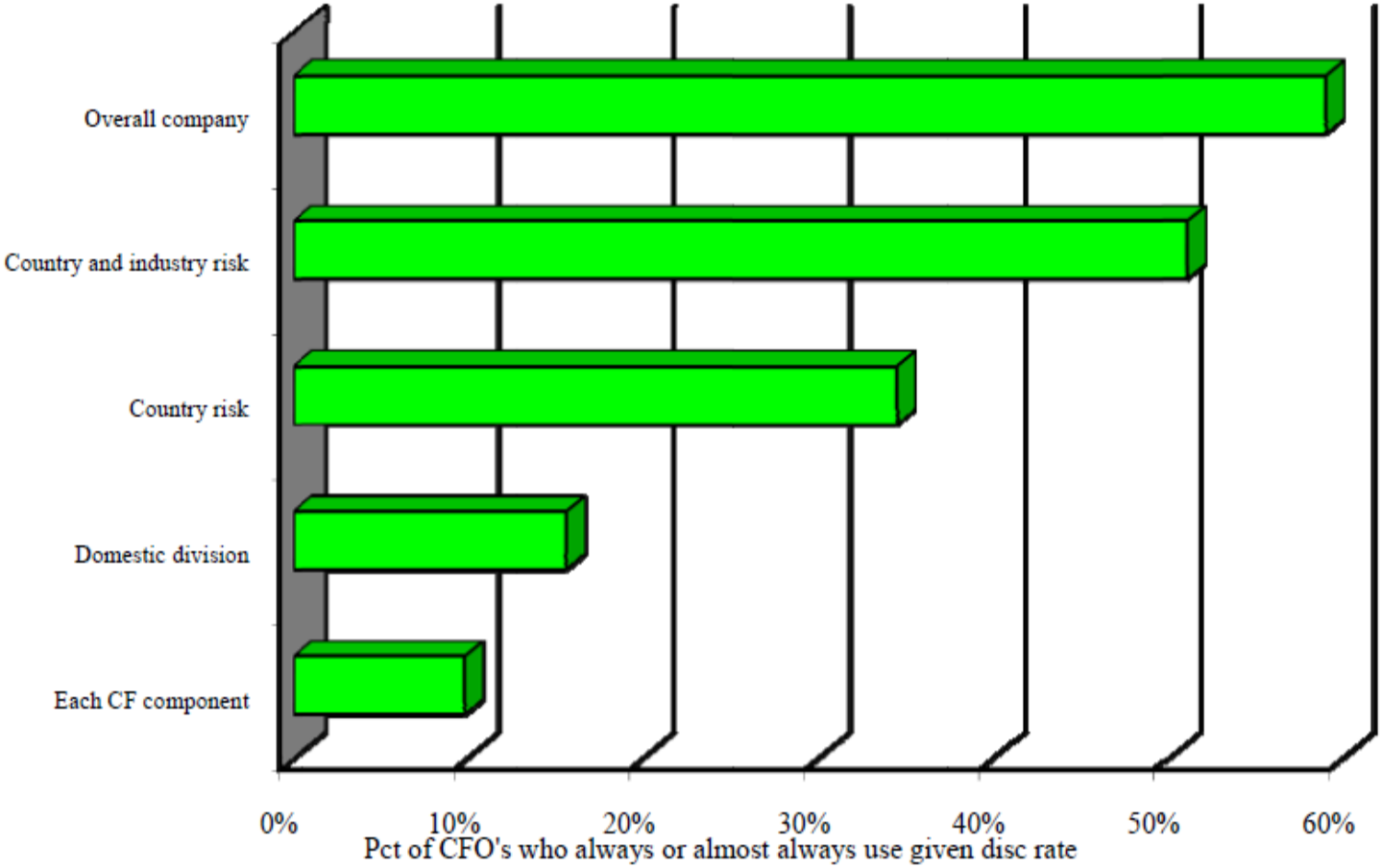
[a]Note that these rounded percentages are drawn from the responses of a large number of CFOs and that many respondents use more than one technique.

Source: Reprinted from *Journal of Financial Economics*, 60, J.R. Graham and C.R. Harvey, "The Theory and Practice of Corporate Finance: Evidence from the Field," pp. 187–243, Copyright 2001, with permission from Elsevier.

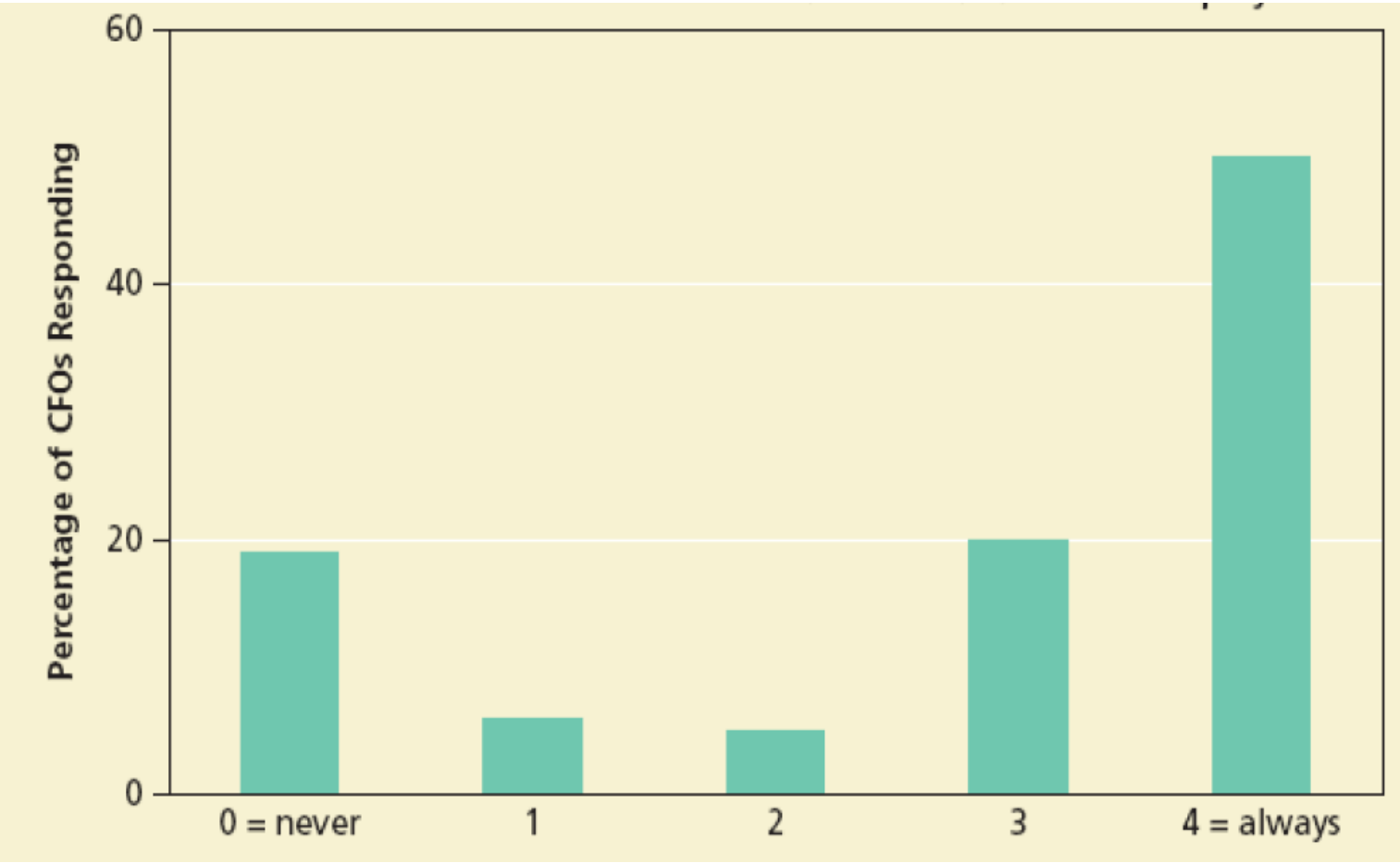
How Investment Bankers Value Companies



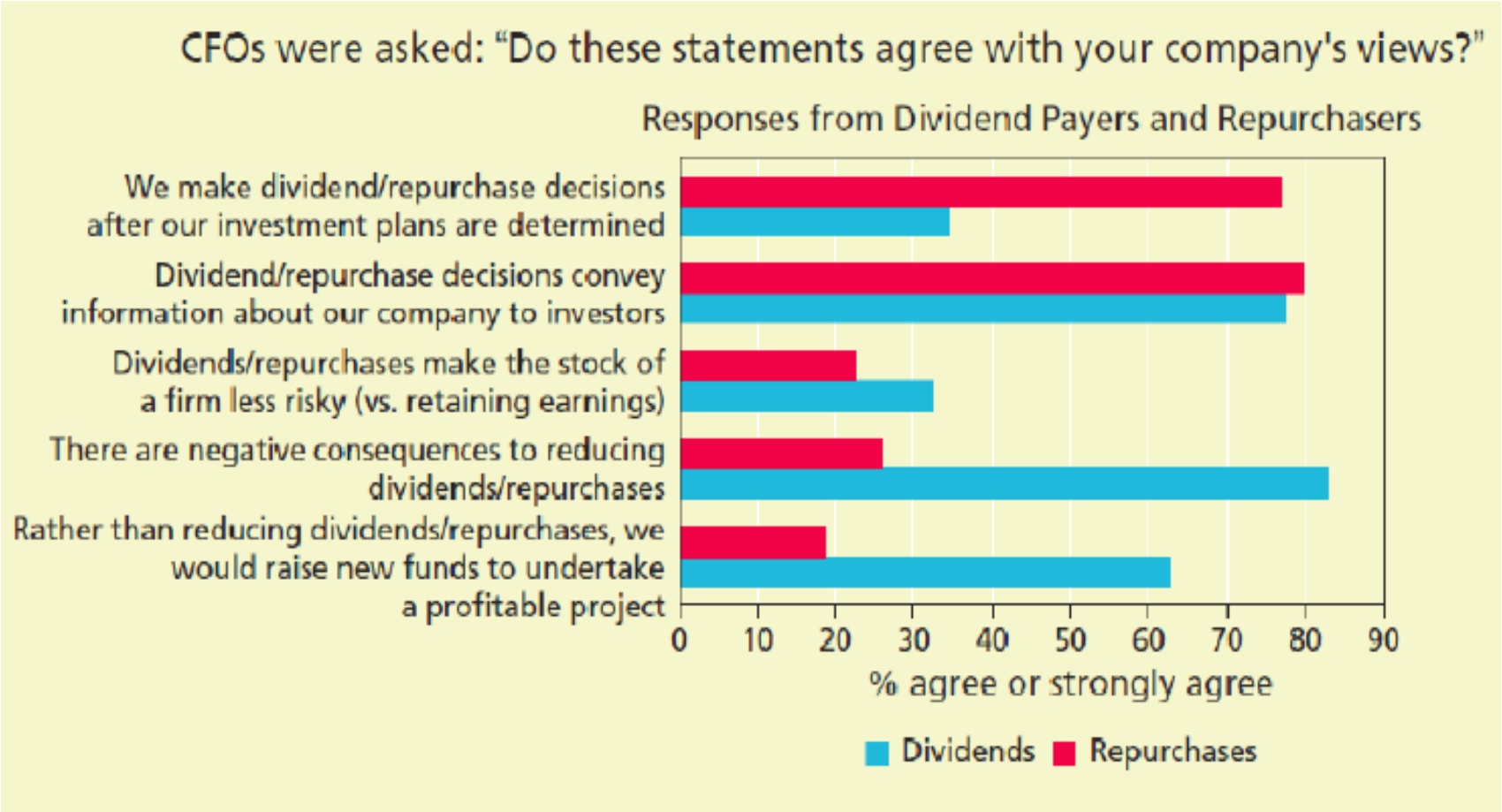
Which discount rate when evaluating a new project



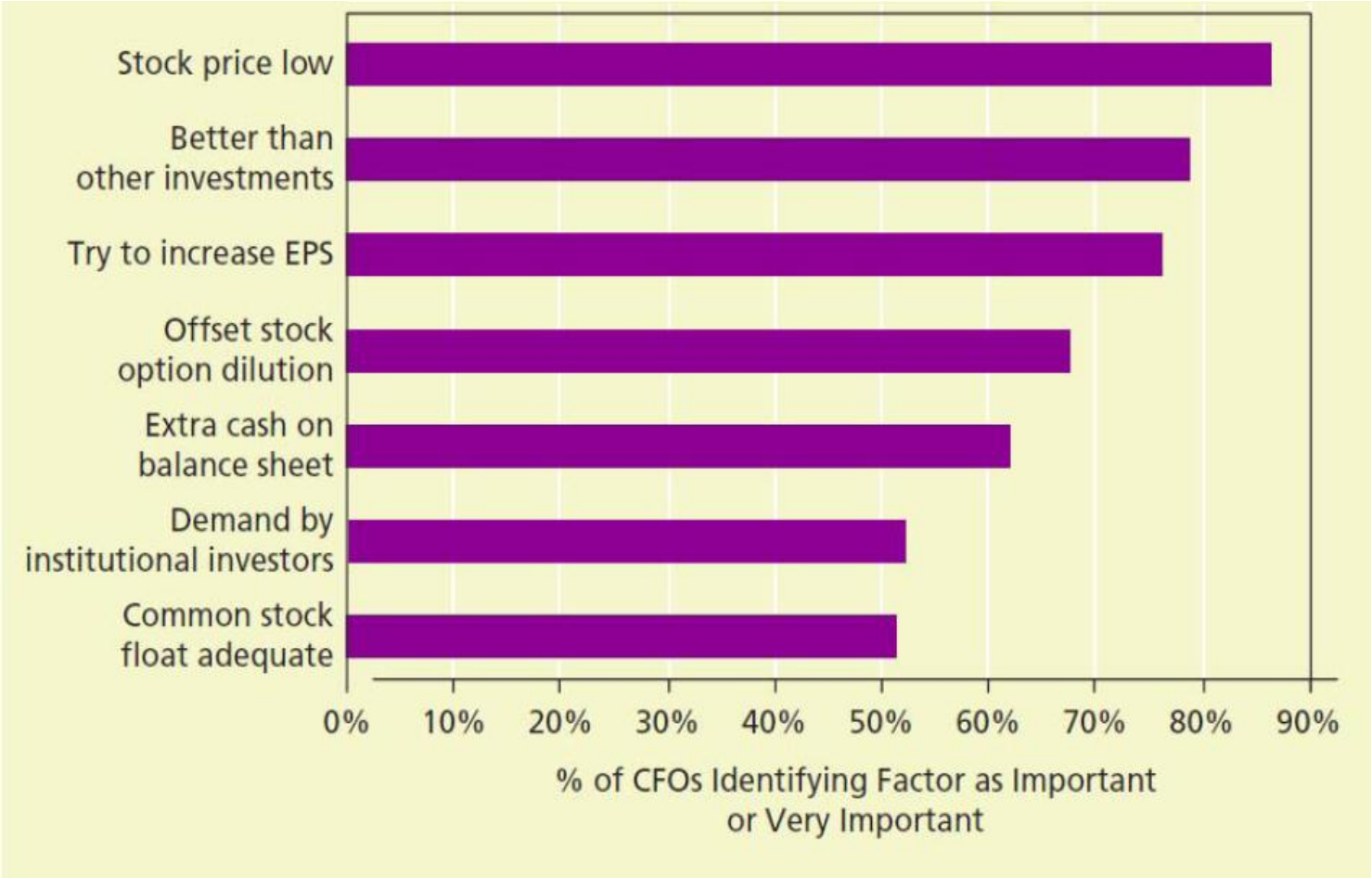
How often to you use the CAPM to calculate the cost of equity?



CFOs' views on Dividends and Repurchases



Important Factors in the decision to repurchase Shares



Motivation to teach Corporate Finance

1. Our firm is thinking of issuing a bond and using the proceeds to buy back shares. What issues should we consider in evaluating this move?
2. What impact would you expect on a firm's earnings if it increases its debt-to-equity ratio?
3. Our cost of debt is 8% and cost of equity 15%. Should we borrow more debt because it is cheaper?
4. If you had an hour and a computer, what would you do to value a company?
5. How does depreciation factor into NPV calculations? Is it a noncash expense, so does it matter?
6. How would you explain NPV calculations to a nonfinancial manager?
7. Would you recommend that our company establish a payout policy by initiating a dividend or buy starting a share repurchase program?

Motivation to teach Corporate Finance

8. You own a low volatility stock. If you buy shares of a high-volatility stock, will your portfolio volatility go up? Upon what does your answer depend?

9. Under what circumstances might you advise a client to add a stock to his or her portfolio even though you expect the stock to earn a low return?

What is Finance?

Finance is the study of how individuals, businesses and institutions acquire, spend and manage financial resources

- Major areas of Finance
  - Investment analysis and management
  - Corporate Finance
  - Capital markets and Financial Institutions
  - International Finance
  - Personal finance
  - Real Estate Finance

Overview of Business Finance

The study of Finance is related to the corporate objective of maximizing shareholder wealth

- Our focus is on financial decision making…
  - Individuals/Investors
  - Financial Security Valuation: Earnings and Dividend models
  - Portfolios and Risk Diversification: Portfolio Analysis
  - Determination of Security Prices and Rates of Return: Capital Asset Pricing Model and Arbitrage Pricing Model
  - Using Financial Derivatives: Futures, Forwards and Options

  - Financial Managers
  - Investment Decisions: Capital Budgeting Analysis
  - Financing Decisions: Capital Structure and Dividend Policies

  ….and the interaction among these decisions

Investment Analysis is mainly concerned with where and how to invest

- Valuation of stocks, bonds and derivatives
- Portfolio Diversification
- Asset Pricing and Market efficiency
- These topics are covered in the first half of this course

Corporate Finance is mainly concerned with the decisions of managers

- Capital Budgeting – What investments to make
- Capital Structure – How to finance these investments
- Dividend Policy – What to payout to Shareholders

Why Study Finance

- To make informed economic decisions
- To better manage existing financial resources and accumulate wealth over time
- To be successful in the business world you need to have an understanding of finance.

Corporate Finance

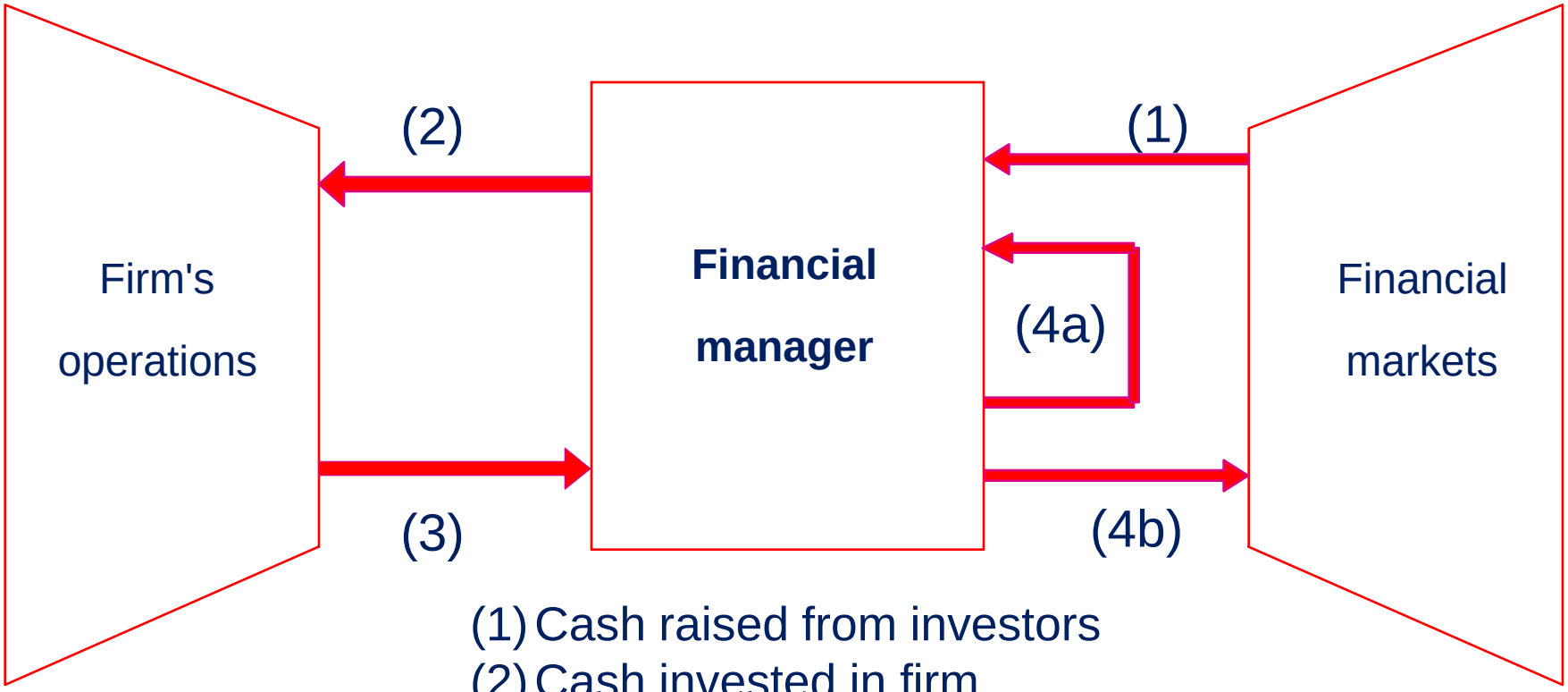
Study of the financing decisions made by firms.

The activities involved in managing money in a business environment

Corporate Finance Functions

- Capital-Raising (Financing)
- Capital Budgeting
- Financial Management
- Risk Management
- Corporate Governance

Role of The Financial Manager



(1) Cash raised from investors
(2) Cash invested in firm
(3) Cash generated by operations
(4a) Cash reinvested
(4b) Cash returned to investors

The Dimensions of the Capital Raising Function

- Primary vs. Secondary Market transactions or Offerings
- Funding via Capital Market *vs* via Financial Intermediary
- Money vs. Capital Markets
- Public vs. Private Capital Markets
- Going Public

Raising Capital: Key Facts

- Most Financing from Internal Rather Than External Sources
- Most External Financing is Debt
- Banks Declining as a Source of Capital for Large Firms
- Securities Markets Growing in Importance

Capital Budgeting

- The process firms use to choose the set of investments that generate the most wealth for shareholders.

- Selecting the best projects in which to invest the resources of the firm, based on each project's perceived risk and expected return.

The Financial Management Function

Managing firms' internal cash flows and their mix of debt and equity financing, both to maximize the value of the debt and equity claims on firms and to ensure that companies can pay off their obligations when they come due.

Managing Daily Cash Inflows and Outflows

Forecasting Cash Balances

Building a Long-Term Financial Plan

Choosing the Right Mix of Debt and Equity

The Risk Management Function

Managing firms' exposures to all types of risk, both insurable and uninsurable, in order to maintain optimum risk-return trade-offs and thereby maximize shareholder value

Managing the Firm's Exposure to Significant Risks

Interest Rate Risk

Exchange Rate Risk

Commodity Price Risk

Corporate Governance Function

Developing ownership and corporate governance structures for companies that ensure that managers behave ethically and make decisions that benefit shareholders.

Corporate goals and wealth maximisation

Maximization of shareholders' wealth is the dominant goal of management in the Anglo-American world.

In the rest of the world, this perspective still holds true (although to a lesser extent in some countries).

In Anglo-American markets, this goal is realistic; in many other countries it is not.

Shareholder Wealth Maximization

In a Shareholder Wealth Maximization model (SWM), a firm should strive to *maximize the return to shareholders*, as measured by the *sum of capital gains and dividends*, for a given level of risk.

Alternatively, the firm should minimize the level of risk to shareholders for a given rate of return.

In a given time period the shareholders are interested in the returns in that time period. The returns are composed of any change in the share price plus the level of dividends

$$\text{Shareholder Value} = \text{Value of Shares} + \text{Value of Dividends}$$

$$\text{Shareholder Return} = \text{Capital Gains} + \text{Dividends}$$

$$R_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$$

In general most companies do not have a large dividends to their share price or indeed their annual capital gain

Thus,

- Shareholders are interested that managers operate in such a way as to rise the price of their shares,

- The price of shares are influenced by a number of different factors;
    - Internal policies of the management
    - Economic environment and,
    - General movements in share prices in the market

It is important for companies to carefully set up their internal management systems to ensure the behavior of managers is congruent with the interests of shareholders

Agency Costs

Agency Costs are costs that arise when there are conflicts of interest between the firm's stakeholders

Different claimants have different incentives, which can lead firms to undertake actions that hurt one group to benefit another.

- Overinvestment and asset Substitution
- Underinvestment and Debt Overhang

Agency costs are another cost of increasing leverage, just like bankruptcy costs

The Time Value of Money

Would you prefer to have $1 million now or $1 million 10 years from now?

Of course, we would all prefer the money now!

This illustrates that there is an inherent monetary value attached to time.

What is The Time Value of Money?

A dollar received today is worth more than a dollar received tomorrow

- This is because a dollar received today can be invested to earn interest
- The amount of interest earned depends on the rate of return that can be earned on the investment

Time value of money quantifies the value of a dollar through time

Uses of Time Value of Money

Time Value of Money, or TVM, is a concept that is used in all aspects of finance including:

- Bond valuation
- Stock valuation
- Accept/reject decisions for project management
- Financial analysis of firms
- And many others!

Introduction to Financial Mathematics

Simple Interest

The value of a cash flow is calculated without including any accrued interest to the principal

Example: If you invest $1,000 at 8% p.a. earning simple interest for 5 years what amount will you have in your account at the end of that time period?

Interest earned in each of the five years	= 1000 × 0.08 = $80
Interest earned in over five years	= 1000 × (5 × 0.08) = $400
Future value at the end of year 5	= 1000 + 400 = $1,400
Future value at the end of year 5	= 1000 × (1 + 5 × 0.08) = $1,400

Future value (Simple interest): $S_n = P_0 \times (1 + n \times i)$

Present value (Simple interest): $P_0 = \frac{S_n}{(1+n\times i)}$

Simple Versus Compounded Interest

Compound Interest

Interest accrued is added to the principal

The value of a cash flow is calculated based on the principal and interest accrued

Example: If you invest $1,000 at 8% p.a. earning compounded interest for 5 years what amount will you have in your account at the end of that time period?

Future value at the end of year 1	$= 1000 \times (1.08) = \$1{,}080.00$
Future value at the end of year 2	$= 1080 \times (1.08) = \$1{,}166.40$
Future value at the end of year 5	$= 1000 \times (1.08)^5 = \$1{,}469.33$

The difference of $69.33 (= 1469.33 - 1400.00) is due to the compounding of interest

Simple Versus Compounded Interest

Amount Invested $1,000 Interest Rate 8%

End of year	Simple Interest	Compounded Interest	Difference
1	$1,080.00	$1,080.00	$0.00
2	$1,160.00	$1,166.40	$6.40
3	$1,240.00	$1,259.71	$19.71
4	$1,320.00	$1,360.49	$40.49
5	$1,400.00	$1,469.33	$69.33
20	$2,600.00	$4,660.96	$2,060.96
50	$5,000.00	$46,901.61	$41,901.61
100	$9,000.00	$2,199,761.26	$2,190,761.26

Future Value of a Single Cash Flow

The future value (or sum) at i% p.a. of $\$P_0$ today is the dollar value to which it grows at the end of time period n

$$S_n = P_0 \times (1 + i)^n$$

Cash flows occur at the end of the period

Future Value of a Single Cash Flow

The future value at r% p.a. of $\$P_0$ today is the dollar value to which it grows at the end of time n

$FVIF_{r,n} = \$1(1 + r)^n$

FVIF is short for Future Value Interest Factor

Cash flows occur at the end of the period

Future Value of a Single Cash Flow

Example: You decide to invest $1,000 for different time periods. What is the future value of this $1,000 in 5, 20 and 100 years at an interest rate of (a) 4% and (b) 6%?

At i = 4% p.a.

$S_5 = 1000 \times (1.04)^5 = \$1,217$

$S_{20} = 1000 \times (1.04)^{20} = \$2,191$

$S_{100} = 1000 \times (1.04)^{100} = \$50,505$

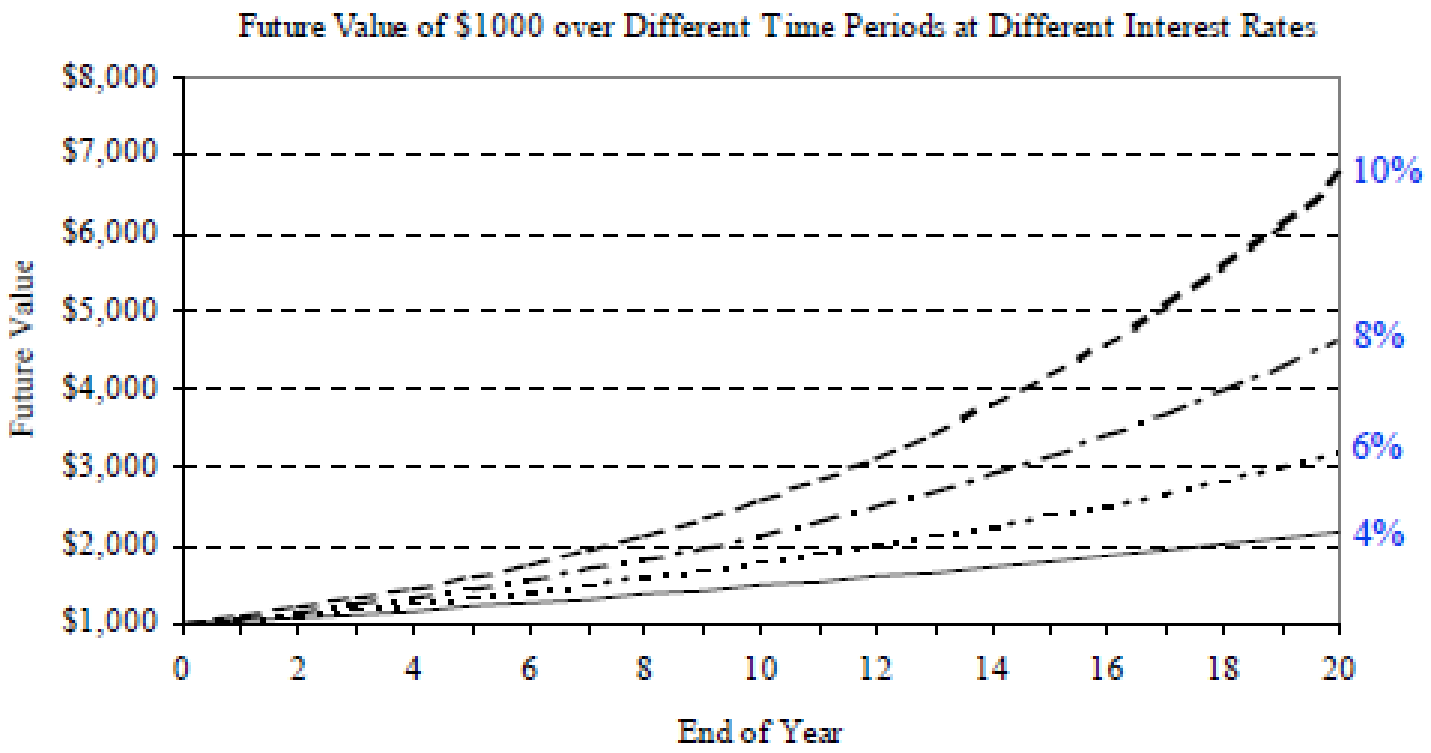
At i = 6% p.a.

$S_5 = 1000 \times (1.06)^5 = \$1,338$

$S_{20} = 1000 \times (1.06)^{20} = \$3,207$

$S_{100} = 1000 \times (1.06)^{100} = \$339,302$

Future Value of a Single Cash Flow



Future Value of a Single Cash Flow

The future value of a cash flow depends on the following factors:

- The time period, *n*
  - Future value increases as *n increases*
- The interest rate, *i*
  - Future value increases as *i increases*
- The method of calculating interest
  - Future value increases as the compounding interval increases (more on this later).

Present Value of a Single Cash Flow

The present value (P_0) at i% p.a. of $\$S_n$ at the end of time n is the amount which invested today would grow to $\$S_n$ in time n

$$P_0 = S_n / (1 + i)^n = S_n \times (1 + i)^{-n}$$

Cash flows occur at the end of the period

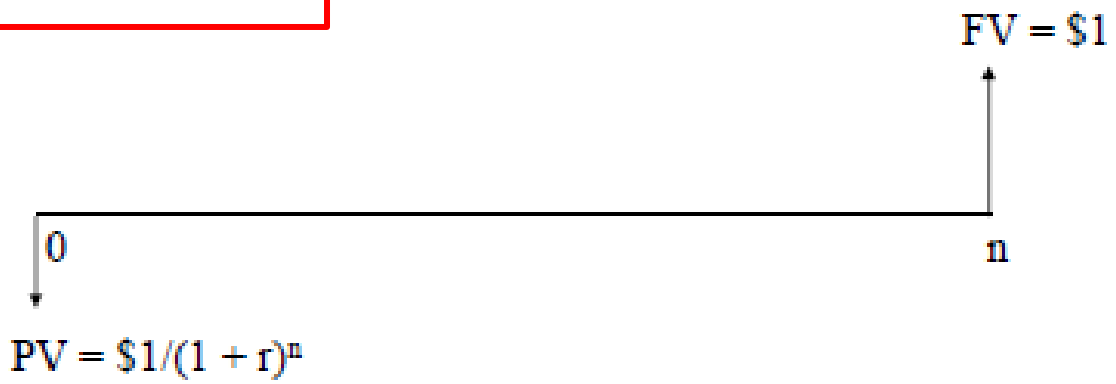
Present Value of a Single Cash Flow

The present value (PV) at r% p.a. of $1 at the end of time n is the amount which invested now would grow to $1 in time n

$PVIF_{r,n} = \$1/(1 + r)^n = \$1(1 + r)^{-n}$

PVIF is the short for Present Value Interest Factor

Note: $PVIF_{r,n} = 1/FVIF_{r,n}$



Cash flows occur at the end of the period

Present Value of a Single Cash Flow

Example: If you needed $10,000 in (a) five years, (b) ten and (c) twenty years how much would you need to save and invest today if the interest rates were (a) 4% and (b) 6%?

The present value of $10,000 in five years

At 4% p.a., $P_0 = 10000/(1.04)^5 = \$8,219.27$

At 6% p.a., $P_0 = 10000/(1.06)^5 = \$7,472.58$

The present value of $10,000 in ten years

At 4% p.a., $P_0 = 10000/(1.04)^{10} = \$6,755.64$

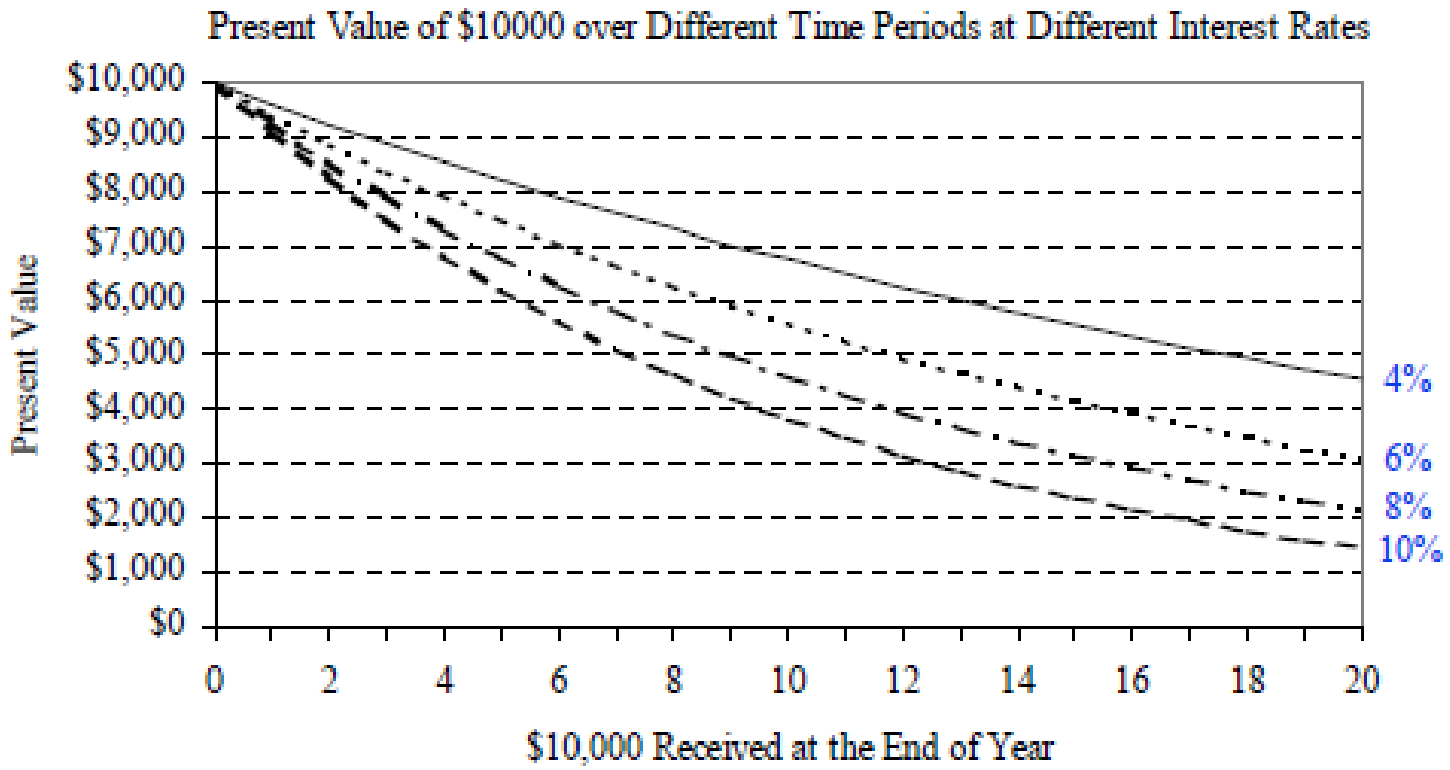
At 6% p.a., $P_0 = 10000/(1.06)^{10} = \$5,583.95$

The present value of $10,000 in twenty years

At 4% p.a., $P_0 = 10000/(1.04)^{20} = \$4,563.87$

At 6% p.a., $P_0 = 10000/(1.06)^{20} = \$3,118.05$

Present Value of a Single Cash Flow



Factors Influencing Present and Future Values

The present and future values of a cash flow depend on the following factors

The time period, *n*

- Future value increases as n increases
- Present value decreases as n increases

The interest rate, *i*

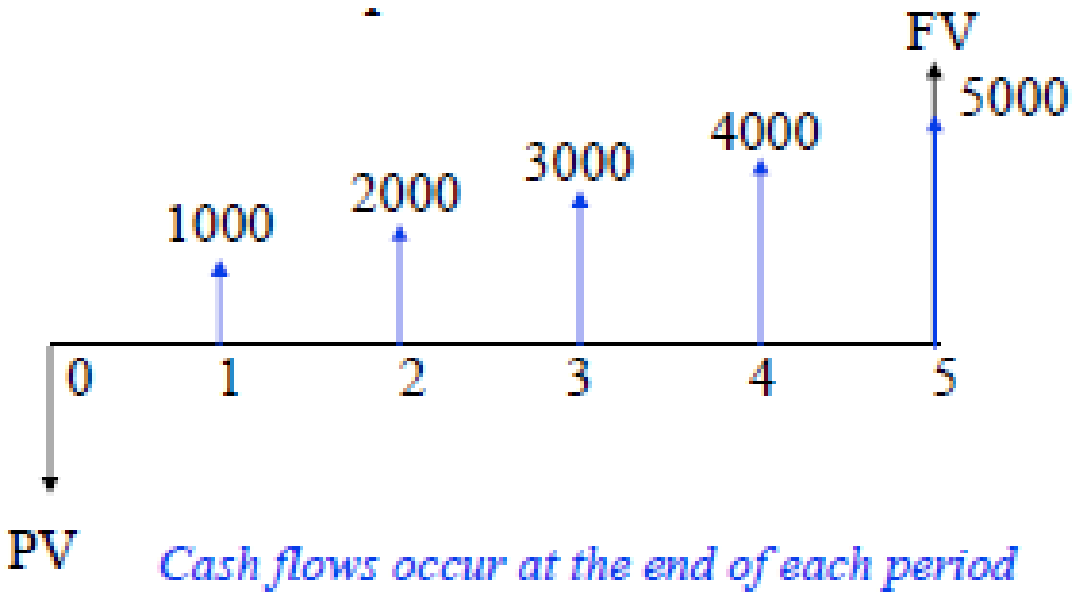
- Future value increases as i increases
- Present value decreases as i increases

The method of calculating interest

- Future value increases as the compounding interval increases
- Present value decreases as the compounding interval increases

Valuing Unequal Cash Flows

Class Exercise 1: You decide to invest $1,000 at the end of year 1 and then an additional $1,000 at the end of every year for five years. What is the future value of these cash flows at the end of five years? What equivalent lump-sum amount could you invest today to get this future amount? Assume an interest rate of 10% p.a.



Answer to Class Exercise 1

To get the total future (present) value of different cash flows occurring at different time periods compute their individual future (present) values and then add across

- Future value of cash flows at the end of five years
  - $FV_5 = 1000\times(1.10)^4 + 2000\times(1.10)^3 + 3000\times(1.10)^2 + 4000\times(1.10) + 5000$
  - $FV_5 = \$17,156.10$

- Equivalent single amount that could be invested today to get this future amount
  - $PV_0 = 1000/(1.10) + 2000/(1.10)^2 + 3000/(1.10)^3 + 4000/(1.10)^4 + 5000/(1.10)^5 = \$10,652.59$

--or equivalently—

  - $PV_0 = FV_5 / (1.10)^5 = 17156.10/(1.10)^5 = \$10,652.59$

Contents

Asset classes and subcategories

Equities	Fixed Income	Cash	Alternative Assets
UK Equities - Large capitalisation - Mid capitalisation - Small capitalisation - Micro capitalisation - Growth - Value - Blend (Value and Growth) - Preference shares - Options and futures **Other Developed Markets** - North America - Europe - Japan - Options and futures **Emerging Markets** - Africa - Asia ex Japan - Emerging Europe - Latin America - Middle East - Options and futures	**UK Fixed Income** - UK Treasury bonds - Municipal - Corporate - Mortgage-backed - Asset-backed - Options and futures **High Yield** **Convertible Securities** **Other Developed Markets** - North America - Europe - Japan - Options and futures - Interest rate swaps **Emerging Markets** - Africa - Asia ex Japan - Emerging Europe - Latin America - Middle East - Options and futures	**Cash** - Physical holdings - Bank balance - UK Treasury bills - Municipal notes - Commercial papers - Certificates of deposit - Repurchase agreement - Banker acceptances - Non UK instruments	**Commodities** - Commodity trading advisors (CTAs) - Physicals: Agricultural, metal and oil - Options and futures **Hedge Funds** - Event driven - Relative value - Market neutral - Long - short - Global macro **Private Equity** - Leveraged Buyouts - Venture Capital - Non UK **Real Estate** - Residential - Commercial - REITs (Real Estate Investment Trusts) **Art**

Fixed Income

Rationale for Investment	Risks and Concerns
Senior claim	Lower returns than equity
Low risk	Interest rate risk
Higher return than cash	Inflation risk
Portfolio diversifier (Low correlation)	Credit risk
	Reinvestment risk
	Prepayment risk (Callable)

High yield fixed income

Rationale for Investment	Risks and Concerns
High return	Issued to finance leveraged buyouts or ex-investment grade bond consequently downgraded
Lower risk than equity	Credit risk
Irrational (Inefficient) pricing: Possibility to beat the market	Liquidity risk
Claim senior to equity	

Features of Debt Securities

Fixed income security: financial obligation of an entity that promises to pay a specified sum of money at specified future dates.

Issuer of the security: Entity that promises to make the payment (e.g. US government, French government, the city of Rio de Janeiro in Brazil, Corporation such Coca-Cola, Sport Institutions such Porto Football Club or supranational governments such as the World Bank.

Fixed Income securities (two general categories): debt obligations and preferred stock

Debt Obligations: bonds, mortgage-backed securities, asset backed securities and bank loans.

Bond indenture (also trust indenture or deed of trust): legal document issued to lenders and describes key terms such as the interest rate, Maturity date, convertibility, pledge, promises, representations, covenants, and other terms of the bond offering.

Bond Covenant: designed to protect the interests of both parties. Negative or restrictive covenants forbid the issuer from undertaking certain activities; positive or affirmative covenants require the issuer to meet specific requirements

Maturity:

Term to maturity: number of years the debt is outstanding or the number of years remaining prior to final principal payment

Maturity date: date that the debt will cease to exist

Type	Maturity
Short-term	1 to 5 years
Intermediate-term	5 – 12 years
Long-term	More than 12 years

Par Value: Amount that the issuer agrees to repay the bondholder at or by the maturity date (principal value, face value, redemption value or maturity value).

Because bonds have different par values, the practice is to quote bonds as a percentage of its par value.

Quoted Price	Price per $1of par value (rounded)	Par value	Dollar Price
90 1/2	0.9050	$1,000	905.00
102 3/4	1.0275	$5,000	5,137.50
70 5/8	0.7063	$10,000	7,062.50
113 11/32	1.1334	$100,000	113,343.75

Coupon Rate (nominal rate): is the interest rate that the issuer agrees to pay each year.

Coupon: Annual amount of the interest payments made to bondholders during the term of the bond. Calculated as:

$$coupon = coupon\ rate\ \times par\ value$$

Example:
6% coupon rate and a par value of $1,000
Coupon (interest payment) = $60

United States (semi-annual instalments), Mortgage and Asset Backed Securities typically pay interest monthly.

Zero-coupon Bonds: the holder realizes interest by buying the bond substantially below its par value

Provisions for Paying off Bonds

Bullet maturity: No principal repayments prior to maturity date.

Amortizing Securities: Schedule of partial payments until maturity (e.g. fixed income securities backed by pool of loans, mortgage backed securities and asset-backed securities).

Sinking Fund: Repayment of the bond may be arranged to repay only a part of the total by the maturity date.

Call provision: guarantee the issuer an option to retire all or part of the issue to the stated maturity date (callable bond).

Convertible bond: grants the bondholder the right to convert the bond for a specified number of shares of common stock.

Put Provision: grants the bondholder the right to sell issue back to the issuer at a specified price on designed dates.

Currency denomination: in the USA, dollar-dominated, nondollar denominated issues and dual-currency issues.

Risks Associated with Investing in Bonds

Interest-rate risk or market risk

As interest rates rise, the price of a bond fall (vice-versa)

If an investor has to sell a bond prior to the maturity date, an increase in interest rates will mean the realization of a loss (i.e. selling the bond below the purchase price).

Example:

Consider a 6% 20-year bond with a face value of $100. if the yield investors require to buy this bond is 6%, the price of this bond would be $100 (selling at par).

If required yield increase to 6.5%, the price of this bond would decline to $94.4479. Thus, for a 50 basis point increase in yield, the bond's price declines by 5.5%. If, instead, the yield declines from 6% to 5.5%, the bond's price will rise by 6.02% to $106.0195.

Coupon rate = yield required by market → price = par value

Coupon rate < yield required by market → price < par value (discount)

Coupon rate > yield required by market → price > par value (premium)

If interest rates increase → price of a bond decreases

If interest rates decrease → price of a bond increases

Bond Features that affect Interest Rate Risk

Maturity: all other factors constant, the longer the bond's maturity, the greater the bond's price sensitivity to changes in interest rates

Coupon Rate: all other factors constant, the lower the coupon rate, the greater the bond's price sensitivity to changes in interest rates

Embedded Options:

Call option: As interest rates decline, the price of a callable bond may not increase as much as an otherwise option-free bond

Price of callable bond = price of option-free bond – price of embedded call option

Yield level: Bond's that trade at a lower yield are more volatile in both percentage price change and absolute price change (as long as the other bond characteristics are the same).

Yield curve risk: bond portfolios have different exposures to how the yield curve shifts.

Call Risk or Prepayment Risk

Issuer can retire or "call" all or part of the issue before the maturity date (Issuer usually retains this right in order to have flexibility to refinance the bond in the future if the market interest rate drops below the coupon rate).

Disadvantages from the investor's perspective:

1) The cash flow pattern of a callable bond is not known with certainty because it is not known when the bond is called.
2) Because the issuer is likely to call the bonds when interest rates have declined below the bond's coupon rate, the investor is exposed to reinvestment risk (will have to reinvest the proceeds at a lower interest rate than the bond's coupon rate)
3) The price appreciation potential of the bond will be reduced relative to an otherwise comparable option-free bond (price compression)

Reinvestment Risk

Risk that the proceeds received from the payment of interest and principal that are available for reinvestment must be reinvested at a lower interest rate than the security that generated the proceeds.

Credit Risk

Three types of credit risk: default risk, credit spread risk and downgrade risk.

Default Risk: Risk that issuer will fail to satisfy the term of the obligations with respect to the timely payment of interest and principal (default rate, recovery rate and expected loss).

Credit Spread Risk: The part of the risk premium or yield spread attributable to default risk. The price performance and the return over some time period will depend on how the credit spread changes.

Downgrade Risk: Risk that the bond issue or issuer credit rating will change.

Three rating agencies in the United States: Moody's Investors Service Inc, Standard &Poor's Corporation and Fitch Ratings

Moody's	S&P	Fitch	Summary Description
Investment Grade – High Credit Worthiness			
Aaa	AAA	AAA	Gilt edge, prime, maximum safety
Aa1	AA+	AA+	High-grade, high credit quality
Aa2	AA	AA	
Aa3	AA-	AA-	
A1	A+	A+	Uper-medium grade
A2	A	A	
A3	A-	A-	
Baa1	BBB+	BBB+	Lower-medium Grade
Baa2	BBB	BBB	
Baa3	BBB-	BBB-	

Moody's	S&P	Fitch	Summary Description
Speculative – Lower Credit Worthiness			
Ba1	BB+		Low grade, speculative
Ba2	BB		
Ba3	BB-		
B1	B	B+	Highly speculative
B2		B	
B3		B-	
Predominantly Speculative, Substantial Risk, or in Default			
Caa	CCC+ CCC	CCC+ CCC	Substantial Risk, in poor standing
Ca	CC	CC	May be in default, very speculative
C	C	C	Extremely speculative
	CI		Income bonds – no interest being paid
	D	DDD DD D	Default

Liquidity Risk

The risk that the investor will have to sell a bond below its indicated value, where the indication is revealed by a recent transaction.

The primary measure of liquidity is the size of the spread between the bid price (the price at which the dealer is willing to buy a security) and the ask price (the price at which a dealer is willing to sell a security).

The wider the bid-ask spread, the greater the liquidity risk.

Exchange Rate or Currency Risk

Risk of receiving less of the domestic currency when investing in a bond issue that makes payments in a currency other than the manager's domestic currency.

Inflation Risk

Risk of decline in the value of a security's cash flows due to inflation.

Volatility Risk: Risk that the "expected yield volatility" will change.

The greater the expected yield volatility, the greater the value (price) of an option.

Price of callable bond = price of option-free bond – price of embedded call option

Price of Putable bond = price of option-free bond + price of embedded put option

Type of embedded option	Volatility risk due to
Callable Bonds	An increase in expected yield volatility
Putable Bonds	An decrease in expected yield volatility

Event Risk

1) Natural disaster (earthquake or hurricane) or an industrial accident.
2) Takeover or corporate restructuring
3) Regulatory change

Sovereign Risk: 1) Unwillingness of a foreign government to pay, or 2) inability to pay due to unfavourable economic conditions in the country

Yield Measures, Spot Rates and Forward Rates

Sources of Return

1) The coupon interest payments made by the issuer
2) Any capital gain (or capital loss – negative return) when the security matures, is called or is sold.
3) Income from reinvestment of interim cash flows (interest and/or principal payments prior to stated maturity).

Current yield

Annual dollar coupon interest to a bond's market price

$$Current\ Yield = \frac{Annual\ dollar\ coupon\ interest}{price}$$

Yield to Maturity

Interest rate that will make the present value of the bond's cash flows equal to its market price plus accrued interest (is the interest that has accumulated since the previous interest payment

Yield to Call

The yield to call assumes the issuer will call a bond on some assumed call date and that the call price is the price specified in the call schedule.

Yield to Put

Interest rate that will make the present value of the cash flows to the first put date equal to the price plus accrued interest.

Yield to Worst

Is the lowest of possible yields (YTM, Yield to call and yield to put).

Spot Rates

A default-free theoretical spot rate curve can be constructed from the observed Treasury yield curve.

The approach for creating a theoretical spot rate curve is called bootstrapping.

Example:

2-year = 1.71%, 5-year = 3.25%, 10-year = 4.35% and 30-year = 5.21%

$$\frac{yield\ at\ higher\ maturity - yield\ at\ lower\ maturity}{number\ of\ years\ between\ two\ observed\ maturity\ points} = \frac{4.35\% - 3.25\%}{5} = 0.22\%$$

Then,

Interpolated 6-year yield = 3.25% + 0.22% = 3.47%

7, 8 and 9-years yield, 3.69%, 3.91% and 4.13%, respectively

Forward Rates

Examples of forward rates:

6-month forward rate six months from now
6-month forward rate three years from now
1-year forward rate one year from now
3-year forward rate two years from now
5-year forward rates three years from now, etc, etc….

Deriving 6-month forward rates

Arbitrage principle (if two investments have the same cash flows and have the same risk, they should have the same value).

Investor with two alternatives:

- Buy a 1-year Treasury bill or,
- Buy a 6-month Treasury bill and when it matures in six months, buy another 6-month Treasury bill.

Spot rate on the 6-month Treasury bill = 3.0% (Z_1)
Spot rate on the 1-year Treasury bill = 3.3% (Z_2)

6-month forward rate on in six months from now = ?

$$(1+Z_1)\times\left(1+f_{1,1}\right)=(1+Z_2)^2$$

$$f_{1,1}=\frac{(1+Z_2)^2}{(1+Z_1)}-1=\frac{(1+0.0165)^2}{(1+0.015)}-1=1.80\%$$

The Valuation Principle

The price of a security today is the present value of all future expected cash flows discounted at the "appropriate" required rate of return (or discount rate)

The valuation variables are

1. Current price
2. Future expected cash flows - Face value and/or coupons
3. Yield or required rate of return

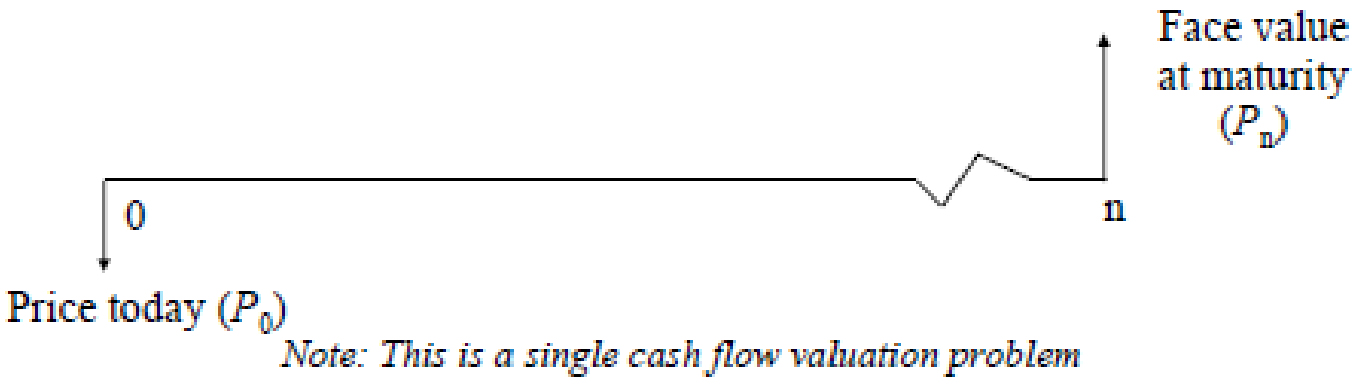
The valuation problem is to

1. Estimate the price; given the future cash flows and required rate of return, or
2. Estimate the required rate of return; given the future cash flows and price

Zero Coupon Securities

Zero coupon bonds are long-term securities paying the face value at maturity

- No coupon or interest payment made
- Issued at deep discount to face value
- Return earned is based on the appreciation in bond's value (price) over time



Pricing Zero Coupon Securities

Example:

Consider a zero coupon bond which matures in 5 years with a face value of $1,000

a) If the bond has a yield to maturity of 8% what price should it be selling for today?

b) Suppose interest rates change suddenly and the price of these bonds rises to $700. What has happened to the yield to maturity of the bonds and why?

Given: P_n = $1,000, n = 5 years, and k_d = YTM = 8%

a) $P_0 = \frac{1{,}000}{(1.08)^5} = \$680.58$

b) The price has risen so you'd expect the YTM to be lower

$$New\ price, P_0 = 700 = \frac{1{,}000}{(1+k_{d*})^5} \qquad k_{d*} = \left(\frac{1{,}000}{700}\right)^{1/5} = 7.39\%$$

Coupon Paying Securities

Fixed coupon payment, typically every six months

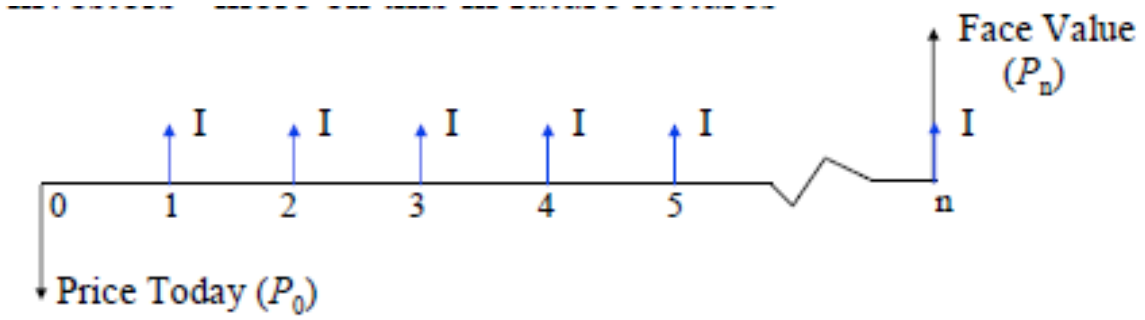
- Non coupon paying bonds called zero coupon bonds

Repayment of face value at maturity

Typically issued at face value

- Examples: Treasury bonds, corporate bonds

Market price depends on the rate of return required by investors



Note: This is a single cash flow plus annuity valuation problem

Pricing a Bond

Equal to the present value of the expected cash flows from the financial instrument. Determining the price requires:

An estimate of the expected cash flows

An estimate of the appropriate required yield

The price of the bond is the present value of the cash flows, it is determined by adding these two present values:

i) The present value of the semi-annual coupon payments

ii) The present value of the par or maturity value at the maturity date

$$P = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \ldots + \frac{C}{(1+r)^n} + \frac{M}{(1+r)^n}$$

$$P = \sum_{t=1}^{n} \frac{C}{(1+r)^t} + \frac{M}{(1+r)^n}$$

P = Price

n = number of periods (nr of years times 2, if semi-annual)

C = semi-annual coupon payment

r = periodic interest rate (required annual yield divided by 2, if semi-annual)

t = time period when payment is to be received

Because the semi-annual coupon payments are equivalent to an ordinary annuity, applying the equation for the present value of an ordinary annuity gives the present value of the coupon payments:

$$C \times \left[\frac{1 - \frac{1}{(1+r)^n}}{r} \right]$$

Consider a 20 year 10% coupon bond with a par value of $1,000. The required yield on this bound is 11%.

$$50 \times \left[\frac{1 - \frac{1}{(1+0.055)^{40}}}{0.055} \right] = \$802.31$$

The PV of the par or maturity value of $1,000 received 40 six-month periods from now, discounted at 5.5%, is $117.46, as follows:

$$\frac{\$1{,}000}{(1.055)^{40}} = \frac{\$1{,}000}{8.51332} = \$117.46$$

Price = PV coupon payments + PV of par (maturity value)

$802.31 + $117.46 = $919.77

Holding Period Yield

Example

Consider a 30-year zero coupon bond with a face value of $100. If the bond is priced at a yield-to-maturity of 10%, it will cost $5.73 today (the present value of this cash flow). Over the coming 30 years, the price will advance to $100, and the annualized return will be 10%.

Suppose that over the first 10 years of the holding period, interest rates decline, and the yield-to-maturity on the bond falls to 7%.

With 20 years remaining to maturity, the price of the bond will be $25.84.

Even though the yield-to-maturity for the remaining life of the bond is just 7%, and the yield-to-maturity bargained for when the bond was purchased was only 10%, the return earned over the first 10 years is 16.26%. This can be found by evaluating:

$$(1+r)=\left({}^{25.84}/_{5.73}\right)^{1/10} = 1.1626$$

Over the remaining 20 years of the bond, the annual rate earned is not 16.26%, but 7%

This can be found by evaluating:

$$25.84 = {}^{100}/_{(1+\mathrm{r})^{20}}$$

$$(1+i)=({}^{100}/_{25.84})^{0.05}=1.07$$

Over the entire 30 year holding period, the original $5.73 invested matured to $100, so 10% annually was made, irrespective of interest rate changes in between

Theories of Term Structure of Interest Rates

What is the information in the yield curve?

How can it be explained and interpreted changes in the yield curve?

Three main theories:

1) The pure expectation theory (unbiased expectations theory)

2) The liquidity preferences theory (or liquidity premium theory)

3) The market segmentation theory

Pure Expectations Theory

Makes simple link between the yield curve and investors' expectations about future interest rates.

Also, because long-term interest rates are possible linked to investors expectations about future inflation, it also address economic interpretations.

Explains the term structure in terms of expected future short-term interest rates.

The market will sets the yield on a two year-bond so that the return on a two-year bond is approximately equal to the return on a one-year bond plus the expected return on a one-year bond purchased one year from today.

Therefore:
Raising term structure indicates that the market expects short-term rates to raise in the future

Shape of term structure	Implications according to pure expectations theory
Upward sloping (normal)	Rates expected to rise
Downward sloping (inverted)	Rates expected to decline
Flat	Rates not expected to change

Under the hypothesis that interest rates reflect the sum of a relatively stable real rate of interest plus a premium for expected inflation:

If short-term rates are expected to rise, investors expect inflation to rise as well.

Shortcomings: assumes that investors are indifferent to interest rate risk and any other factors associated with investing in bonds with different maturities.

Liquidity Preference Theory

Market participants want to be compensated for the interest rate risk associated with holding longer-term bonds.

Therefore, the term structure of interest rates is determined by:

1) Expectations about future interest rates
2) Yield premium for interest rate risk (more interest rate risk, the less the liquidity)

Since interest rate risk increases with maturity, yield premium increases with maturity

Shape of term structure	Implications according to Liquidity Preference Theory
Upward sloping (normal)	Rates expected to rise, or will be unchanged or even fall (but with yield premium increasing with maturity fast enough to produce an upward sloping of yield curve)
Downward sloping (inverted) or flat	Rates expected to fall, given the theory's prediction that the yield premium for interest rate risk increases with maturity

Market Segmentation Theory

Each maturity "sector" is an independent or segmented market for purposes of determining the interest rate in the maturity "sector".

Two major groups of investors:

1) Those who manage funds versus a broad-based bond market index, and
2) those that manage funds against liabilities.

The 2nd group will restrict their activities to the maturity sector that provides the best match with the maturity of their liabilities (basic principle of asset-liability management).

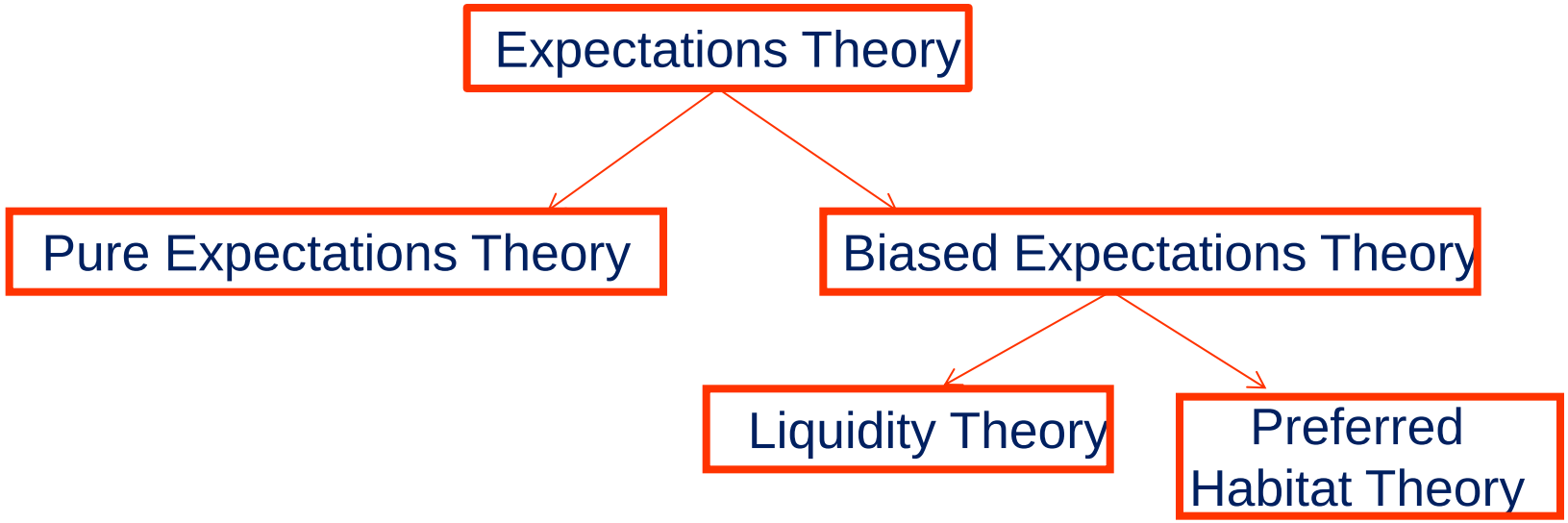
Defined benefit pension fund: investment in long-term maturity sector of the bond market

Commercial banks: will focus in short-term fixed income investments (since their liabilities are mainly short-term).

Preferred habitat theory: variant of the market segmentation theory

Investors might be willing to shift out for their preferred maturity sector if a incentive yield premium exist.

Implication: Under the preferred habitat theory any shape of the yield curve is possible.



The measurement of Interest Rate Risk

Most obvious way: Re-value the bond when interest rates change

Example:

$10 million par value position in a 9% coupon 20-year bond (option free).

Current price: 134.6722 for a YTM of 6%. Market value of the position is $13,467,220

Three scenarios:

1) 50 basis point increase
2) 100 basis point increase
3) 200 basis point increase

Scenario	Yield change (bp)	New yield	New Price	New Market Value ($)	Percentage Change in Market Value (%)
1	50	6.5%	127.7606	12,776,050	-5.13%
2	100	7.0%	121.3551	12,135,510	-9.89%
3	200	8.0%	109.8964	10,989,640	-18.40%

Price Volatility Characteristics of Bonds

Price of bond changes in the opposite direction to a change in the bond's yield.

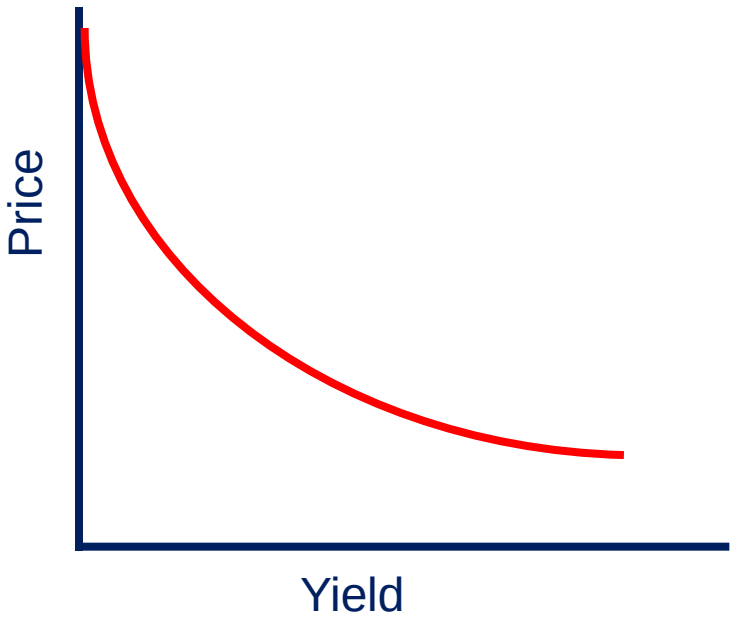
The percentage price change is not the same to all bonds

	Price ($)			
Yield (%)	6%/ 5 year	6%/20 year	9%/5 year	9%/20 year
4.00	108.9826	127.3555	122.4565	168.3887
5.00	104.3760	112.5514	117.5041	150.2056
5.50	102.1600	106.0195	115.1201	142.1367
5.90	100.4276	101.1157	113.2556	136.1193
5.99	100.0427	100.1157	112.8412	134.8159
6.00	100.0000	100.0000	112.7953	134.6722
6.01	99.9574	99.8845	112.7494	134.5287
6.10	99.5746	98.8535	112.3373	133.2472
6.50	97.8944	94.4479	110.5280	127.7605
7.00	95.8417	89.3225	108.3166	121.3551
8.00	91.8891	80.2072	104.0554	109.8964

Instantaneous Percentage Price Change for Four Hypothetical Bonds (Initial yield for all four bonds is 6.%)

	Percentage Price Change			
Yield (%)	6%/ 5 year	6%/20 year	9%/5 year	9%/20 year
4.00	8.98	27.36	8.57	25.04
5.00	4.38	12.55	4.17	11.53
5.50	2.16	6.02	2.06	5.54
5.90	0.43	1.17	0.41	1.07
5.99	0.04	0.12	0.04	0.11
6.01	-0.04	-0.12	-0.04	-0.11
6.10	-0.43	-1.15	-0.41	-1.06
6.50	-2.11	-5.55	-2.01	-5.13
7.00	-4.16	-10.68	-3.97	-9.89
8.00	-8.11	-19.79	-7.75	-18.40

Price/yield relationship for a hypothetical option-free bond



1) Although the price moves in the opposite direction from the change in the yield, percentage change is not the same for all bonds
2) For small changes in the yield, the percentage price changes for a given bond is roughly the same, whether the yield increases or decreases.
3) For large changes in yield, the percentage price change is not the same for an increase in yield as it is for a decrease in yield
4) For a given large change in yield, the percentage price increase is greater than the percentage price decrease.

Duration/Convexity approach

Duration is a measure of the approximate price sensitivity of a bond to interest rate changes. It is the approximate percentage change in price for a 100 basis points change in rate.

Duration: average lifetime of a debt security's stream of payments

Two bonds with the same term to maturity does not mean that they have the same interest-rate risk

Macaulay Duration

Is the weighted average time-to-maturity of the cash flows of a bond. In the Macaulay, and all other duration measures, the weighting of the cash flows is based on their discounted present value, rather then their nominal value.

$$Macaulay\ Duration = \frac{\sum(n)(PV\ of\ Cash\ Flows)}{k \times Bond\ Price}$$

Where:
n is the number of periods until each cash flow is paid
k is the number of times coupon interest is paid per year

Calculating Macaulay Duration on a $1,000 ten-year 10% Coupon Bond when its Interest Rate is 10%

(1)	(2)	(3)	(4)	(5)
Year	Cash Payments (Zero-Coupon Bonds)	Present Value of Cash Payments	Weights (% of total)	Weighted Maturity (1×4)/100
1	**100**	**90.91**	**9.091**	**0.09091**
2	**100**	**82.64**	**8.264**	**0.16528**
3	**100**	**75.13**	**7.513**	**0.22539**
4	**100**	**68.30**	**6.830**	**0.27320**
5	**100**	**62.09**	**6.209**	**0.31045**
6	**100**	**56.44**	**5.644**	**0.33864**
7	**100**	**51.32**	**5.132**	**0.35924**
8	**100**	**46.65**	**4.665**	**0.37320**
9	**100**	**42.41**	**4.241**	**0.38169**
10	**100**	**38.55**	**3.855**	**0.38550**
10	**1000**	**385.54**	**38.554**	**3.85500**
Total		1,000.00	100.00	**6.75850 (years)**

Effective Duration

If the yield increased by a small amount Δr, from r_0 to r_+, the price of the bond will decrease from P_0 to P_-.

A bond's effective duration measures how sensitive the return on the bond (measured as the percentage change in its price) will be to the change in interest rates.

$$DE = \frac{Percentage\ Change\ in\ Price\ of\ Bond}{Change\ in\ Interest\ Rates}$$

$$DE = \frac{\Delta P/P}{\Delta rates} = \frac{(P_- - P_+)/P_0}{2\Delta r}$$

$$DE = \frac{P_- - P_+}{2P_0\Delta r}$$

Example:

A 7% coupon, 5-year bond, yielding 6% is priced at 104.265. If its yield declines by 25 basis points to 5.75%, the bond's price will increase to 105.366. On the other hand, if its yield increases by 25 basis points to 6.25%, the price of the bond will decline to 103.179. Compute the effective duration of the bond under these conditions.

$$DE = \frac{P_- - P_+}{2P_0 \Delta r} = \frac{105.366 - 103.179}{2(104.265)(.0025)} = 4.2$$

If this bond's yield increases by 1% (apparently because interest rates have increased by 100 basis points), the price of the bond will fall by approximately 4.2%.

Dollar Duration

Measures the dollar market value change resulting from a 100 basis point change in yield:

$$\text{Dollar duration} = -D_E \times (\$\ \text{Market Value}) \times \Delta r$$

Example:

A manager has a holding of XYZ bond with a current market value of $25 million and a duration of 5.4. If the bond's yield dropped by 100 basis points, what would be the change in the market value.

$$\text{Dollar duration} = -D_E \times (\$\ \text{Market Value}) \times \Delta r$$
$$= -5.4 \times (\$25{,}000{,}000) \times -0.0100$$
$$= +\$1{,}350{,}000$$

Application of Effective Duration

From the basic formula: percentage change in the price of bond will approximately equal its effective duration times any change that occurs in its yield, but in opposite direction

$$\%\ \text{Change in Price of Bond} = \frac{\Delta P_B}{P_B} = -D_E \times \Delta r$$

Example:

A 7% coupon, 5-year bond, priced at 104.265 with duration of 4.2 has a YTM of 6%. Estimate the percentage change in the price and the new price of the bond if its YTM declines by 50 basis points from 6% to 5.5%.

$$\text{\% Change in Price of Bond} = \frac{\Delta P_B}{P_B} = -D_E \times \Delta r = -4.2(-.005) = 2.1\%$$

$$P_{NEW} = P_0\left(1 + \frac{\Delta P_B}{P_B}\right) = 104.265 \times (1.021) = 106.455$$

Modified Duration

Is an adjusted measure of the Macaulay duration that produces a more accurate estimate of how much the percentage change in the price of a bond will be per 100 basis points change in the interest rate.

$$\text{Modified Duration (D*)} = \frac{\text{Macaulay Duration}}{(1 + \text{yield} / k)}$$

Where

Yield is the yield-to-maturity of the bond

K is the number of periodic payment (compounding) periods per year

The arbitrage-free Approach to Bond Valuation

The traditional valuation approach is deficient because it uses a single discount rate (the appropriate YTM) to find the present value of the future cash flows with no regard given to the timing of those cash flows.
Cash flows received in year 1 on a 20 year bond are discounted at the same rate as the cash flows received in 20 years!

Arbitrage Free Valuation Model

$$P = \frac{CF_1}{(1+r_1)} + \frac{CF_2}{(1+r_2)^2} + \frac{CF_3}{(1+r_3)^3} + \cdots + \frac{CF_n}{(1+r_n)^n}$$

This model treats each separate cash flow paid by a fixed-income security as if it were a stand-alone zero-coupon bond. These discount rates are called spot rates.

Example

Give the following Treasury spot rates, calculate the arbitrage-free value of a 5% coupon, 2 year treasury note.

Maturity	Spot Rate
0.5 years	4.0%
1.0	4.4%
1.5	5.0%
2.0	5.2%

The arbitrage-free price of the note is:

$$P = \frac{CF_1}{(1+r_1)} + \frac{CF_2}{(1+r_2)^2} + \frac{CF_3}{(1+r_3)^3} + \cdots + \frac{CF_n}{(1+r_n)^n}$$

$$\mathrm{P} = \frac{\$2.50}{(1.020)} + \frac{\$2.5}{(1.022)^2} + \frac{\$2.5}{(1.025)^3} + \frac{\$102.5}{(1.026)^4} = \$99.66 \text{ per } \$100 \text{ of par value}$$

Contents

Asset classes and subcategories

Equities	Fixed Income	Cash	Alternative Assets
UK Equities - Large capitalisation - Mid capitalisation - Small capitalisation - Micro capitalisation - Growth - Value - Blend (Value and Growth) - Preference shares - Options and futures **Other Developed Markets** - North America - Europe - Japan - Options and futures **Emerging Markets** - Africa - Asia ex Japan - Emerging Europe - Latin America - Middle East - Options and futures	**UK Fixed Income** - UK Treasury bonds - Municipal - Corporate - Mortgage-backed - Asset-backed - Options and futures **High Yield** **Convertible Securities** **Other Developed Markets** - North America - Europe - Japan - Options and futures - Interest rate swaps **Emerging Markets** - Africa - Asia ex Japan - Emerging Europe - Latin America - Middle East - Options and futures	**Cash** - Physical holdings - Bank balance - UK Treasury bills - Municipal notes - Commercial papers - Certificates of deposit - Repurchase agreement - Banker acceptances - Non UK instruments	**Commodities** - Commodity trading advisors (CTAs) - Physicals: Agricultural, metal and oil - Options and futures **Hedge Funds** - Event driven - Relative value - Market neutral - Long - short - Global macro **Private Equity** - Leveraged Buyouts - Venture Capital - Non UK **Real Estate** - Residential - Commercial - REITs (Real Estate Investment Trusts) **Art**

Valuation

At different levels business decisions involves valuation

Capital Budgeting: involves consideration of how a particular project will affect firm value.

Strategic planning: focuses on how value is influenced by larger sets of actions.

Security analysts: conduct valuation to support their buy/sell decisions, and potential acquirers.

Basics in Valuation Approaches

- perception that markets are inefficient and make mistakes in assessing value

- an assumption about how and when these inefficiencies will get corrected

In an efficient market, the market price is the best estimate of value.

The purpose of any valuation model is then the justification of this value.

Valuation objective is to search for “true” value

Valuations are biased. The question is how much and in which direction.

The direction and magnitude of the bias is *directly proportional* to who pays you and how much you are paid.

Valuation Approaches

Discounted Cash Flow: value of any asset is estimated by computing the PV of the expected cash flows on that asset, discounted back at a rate that reflects the riskiness of the cash flows (measure of the intrinsic value of an asset).

Relative Valuation: The value of any asset can be estimated by looking how similar assets are priced in the market place.

Academic Studies

Mainly focus on the comparison of two model approaches:

- Discounted Dividends
- Discounted Cash Flows

Ratios or multiple based models are discussed in isolation or in addition of the three previous models.

Main valuation models:

Discounted Dividends: This approach expresses the value of firm's equity as the present value of forecasted future dividends.

Discounted Cash Flow (DCF): involves detailed production of multiple year forecasts of cash flows. Cash Flows are then discounted at the firm's estimated cost of capital to arrive at an estimated present value.

*Discounted Abnormal Earnings: Value of firm's equity is expressed as the sum of its book value and the present value of the forecasted abnormal earnings.

*Discounted abnormal earnings growth: Value of the firm's equity as the sum of its capitalized next-period earnings forecast and the present value of forecasted abnormal earnings growth beyond the next period.

*Real Options: Contingent Claim (Option) Valuation

Valuation based on price multiples: Current measure of performance or single forecast of performance is converted into a value by applying an appropriate price multiple derived from the value of comparable firms.

Example: firm value can be estimated by applying a price-to-earnings ratio to a forecast of the firm's earnings for the coming year. Other commonly used multiples include price-to-book ratios and price-to-sales ratios.

Discounted Cashflow Valuation

$$\text{Value} = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t}$$

Where

- CF_t is the cash flow in period t,
- *r* is the discount rate appropriate given the riskiness of the cash flow, and
- t is the life of the asset.

For an asset to have value, the expected cash flows have to be positive some time over the life of the asset.

Assets that generate cash flows early in their life will be worth more than assets that generate cash flows later; the later may however have greater growth and higher cash flows to compensate.

Characteristics of Ordinary Shares

Ordinary shares typically provide investors with an infinite stream of uncertain cash flows or dividends - D_1, D_2, ..., D_n,... The price of ordinary shares today is the present value of all future expected dividends discounted at the "appropriate" required rate of return (or discount rate)

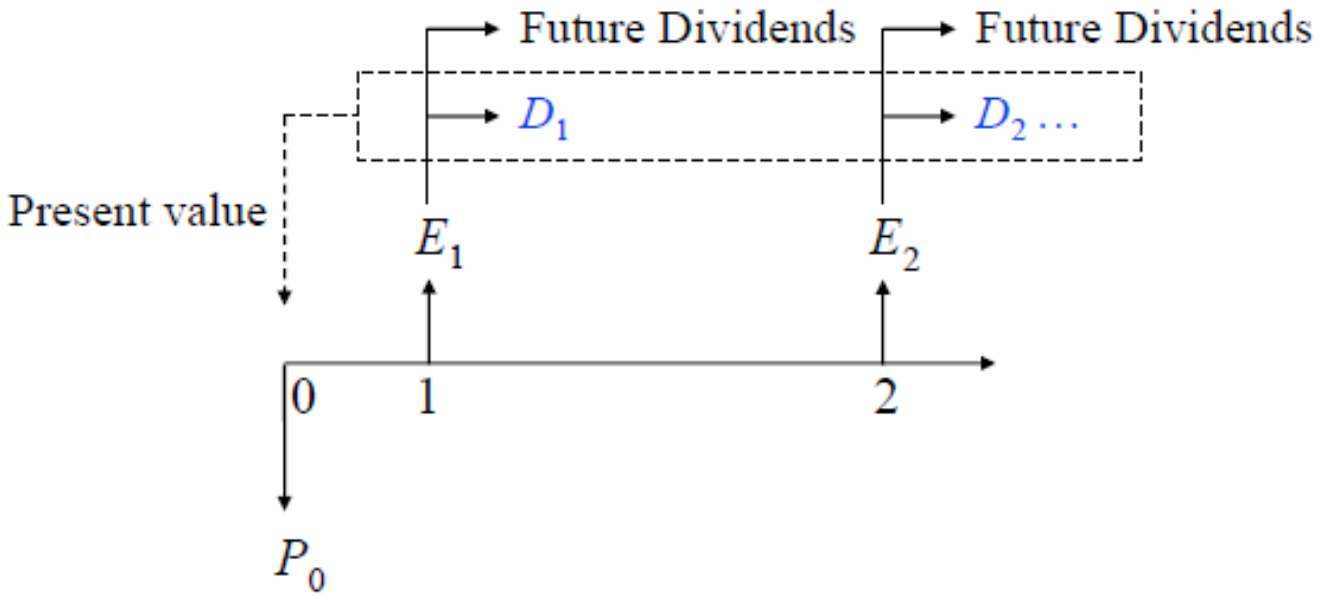
$$P_0 = \sum_{t=1}^{N} \frac{CF_t}{(1+k_e)^t}$$

where k_e is the rate of return required by investors for the time value and risk associated with the security's cash flows (CFt)

What cash flows are relevant?

Characteristics of Ordinary Shares

Need to consider dividends, which are paid from earnings



Pricing Ordinary Shares

In a one period framework, the stock price is equal to the sum of the next period's dividend and the expected price discounted at the required return

$$P_0 = \frac{D_1 + P_1}{1 + k_e} \quad \text{and} \quad P_1 = \frac{D_2 + P_2}{1 + k_e} \quad \text{and} \quad P_t = \frac{D_{t+1} + P_{t+1}}{1 + k_e}$$

Over any period, the expected rate of return (*ke) is*

$$k_e = \frac{D_{t+1} + P_{t+1}}{P_t} - 1 = \frac{D_{t+1}}{P_t} + \frac{P_{t+1} - P_t}{P_t}$$

$$k_e = \text{Dividend yield} + \text{Percent price change}$$

Pricing Ordinary Shares

Example: The price and dividend per share for OzCo Ltd next period are expected to be \$5.00 and \$0.50, respectively. If the expected return on these shares is 10% p.a. what is OzCo's current stock price? If the current price changes to \$4.80 what has happened to the expected return on these shares? Why?

Given: P_{t+1} = \$5.00, D_{t+1} = \$0.50 and k_e = 10%

$$P_t = \frac{0.50 + 5.00}{1 + 0.10} = \$5.00$$

If the current price changes to \$4.80, the expected return rises to

$$k_e = \frac{0.50 + 5.00}{4.80} - 1 = 14.6\%$$

Note that prices and expected returns are inversely related

Pricing Ordinary Shares

The stock price over periods 0, 1 and 2 can be written as

$$P_0 = \frac{D_1 + P_1}{1 + k_e} \quad \text{and} \quad P_1 = \frac{D_2 + P_2}{1 + k_e} \quad \text{and} \quad P_2 = \frac{D_3 + P_3}{1 + k_e}$$

Substituting P_2 and P_1 recursively, we get P_0 as

$$P_0 = \frac{D_1}{1 + k_e} + \frac{D_2}{(1 + k_e)^2} + \frac{D_3 + P_3}{(1 + k_e)^3}$$

- The current dividend (D_0) is not relevant to our estimate of the current price - all prices estimated are ex-dividend prices
- Ex-dividend prices are prices after the current period's dividend has been paid

Pricing Ordinary Shares

Extending the above process to H periods, we get

$$P_0 = \frac{D_1}{1+k_e} + \frac{D_2}{(1+k_e)^2} + \frac{D_3}{(1+k_e)^3} + \ldots + \frac{D_H + P_H}{(1+k_e)^H}$$

$$P_0 = \sum_{t=1}^{H} \frac{D_t}{(1+k_e)^t} + \frac{P_H}{(1+k_e)^H}$$

$$As\ H \to \infty, PV(P_H) \to 0$$

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t}$$

Market analysts often make simplifying assumptions about future expected dividends

Constant Dividend Growth Model

A constant growth rate in dividends implies

$$D_2 = D_1(1+g),\ D_3 = D_1(1+g)^2,\ \ldots,\ D_t = D_1(1+g)^{t-1}$$

Substituting the above dividends in the expression for P_0 we get

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t} = \sum_{t=1}^{\infty} \frac{D_1(1+g)^{t-1}}{(1+k_e)^t}$$

$$As\ t \to \infty,\ \sum_{t=1}^{\infty} \frac{(1+g)^{t-1}}{(1+k_e)^t} \to \frac{1}{k_e - g}$$

The above expression simplifies to

$$P_0 = \frac{D_1}{k_e - g} \quad \text{where } k_e > g \qquad \text{or} \qquad P_t = \frac{D_{t+1}}{k_e - g}$$

Constant Dividend Growth Model

Application 1: Assume that year 0 is the end of 2004. Telstra Ltd is expected to pay annual dividends of $0.26 in 2005 (year 1). Assume that this dividend grows at an annual rate of 5% in the foreseeable future and investors require a return of 10% p.a.

a) Estimate Telstra's stock price today
b) What is Telstra's price expected to be at the end of 2005?
c) Based on Telstra's current price of $4.75, what is the constant dividend growth rate implied?
d) How sensitive is the price estimate to different assumptions regarding the growth in dividends over time?
e) How sensitive is the price estimate to different assumptions regarding the required rate of return?

Constant Dividend Growth Model

Given: $D_1 = 0.26$, $g = 0.05$ and $ke = 0.10$

a) $P_0 = 0.26/(0.10 - 0.05) = \$5.20$
b) $P_1 = D2/(ke - g) = 0.26(1.05)/(0.10 - 0.05) = \$5.46$ (a 5% rise)
c) $ke = D_1 /P_0 + g$ or $g = ke - D_1 /P_0$
$g = 0.10 - 0.26/4.75 = 0.0453$ or 4.5%
d) Sensitivity of Telstra's price to changes in expectations of g

$g = 3\%$: $P_0 = 0.26/(0.10 - 0.03) = \$3.71$ (-28.7%)
$g = 4\%$: $P_0 = 0.26/(0.10 - 0.04) = \$4.33$ (-16.7%)
$g = 5\%$: $P_0 = 0.26/(0.10 - 0.05) = \$5.20$
$g = 6\%$: $P_0 = 0.26/(0.10 - 0.06) = \$6.50$ (+25.0%)
$g = 7\%$: $P_0 = 0.26/(0.10 - 0.07) = \$8.67$ (+66.7%)

Constant Dividend Growth Model

Sensitivity of Telstra's price to changes in ke

ke = 8%: P_0 = 0.26/(0.08 - 0.05) = $8.67 (+66.7%)
ke = 9%: P_0 = 0.26/(0.09 - 0.05) = $6.50 (+25.0%)
ke = 10%: P_0 = 0.26/(0.10 - 0.05) = $5.20
ke = 11%: P_0 = 0.26/(0.11 - 0.05) = $4.33 (-16.7%)
ke = 12%: P0 = 0.26/(0.12 - 0.05) = $3.71 (-28.7%)

- Price estimates are very sensitive to assumptions regarding future dividends, growth in dividends and required rate of return

- It is often more realistic to assume a variable growth rate in dividends with higher initial growth in dividends followed by subsequent lower (or zero) growth in dividends

Variable Dividend Growth Model

Application 2: In the previous application, assume that Telstra's current dividend of $0.25 grows at 10% for 3 years and then stabilizes at 5% thereafter. What price should Telstra shares sell for today if the required rate of return remains at 10%?

Three step procedure to estimate P_0

Step 1: Compute the dividends up to the point where g becomes constant (over years 1 to 4 in this case)

Step 2: Compute the price at the end of the year after which dividends grow at a constant rate (year 3 in this case)

Step 3: Add the present value of dividends from Step 1 to the present value of the price from Step 2 to get P_0

Variable Dividend Growth Model

Given: D_0 = \$0.25, g_1 = 10% over years 1 - 3,
g_2 = 5% from year 4 onwards, ke = 10%

Step 1: Obtain dividends up to where g becomes constant

$D_1 = 0.2500(1.10) = \$0.2750$
$D_2 = 0.2750(1.10) = \$0.3025$
$D_3 = 0.3025(1.10) = \$0.3328$
$D_4 = 0.3328(1.05) = \$0.3494$

Step 2: Obtain P_n (after which dividend growth is constant)

$P_3 = D_4 /(ke - g_2) = 0.3494/(0.10 - 0.05) = \$6.988$

Step 3: Add the present values of dividends and P_n to get P_0

$P_0 = D_1/(1 + ke) + D_2 /(1 + ke)^2 + (D_3 + P_3)/(1 + ke)^3$
$P_0 = 0.2750/1.1 + 0.3025/1.1^2 + (0.3328 + 6.988)/1.1^3 = \$6.00$

Equity versus Firm Valuation

- Value just the equity stake in the business.

- Value the entire business, which includes, besides equity, the other claimholders in the firm

Equity Valuation

The value of equity is obtained by:

Discounting expected *cashflows to equity* (the residual cashflows after meeting all expenses, tax obligations and interest and principal payments) at the cost of equity (required return to shareholders).

$$\text{Value of Equity} = \sum_{t=1}^{n} \frac{\text{CF to Equity}_t}{(1+k_e)^t}$$

$\text{CF to Equity}_t = \text{Expected Cashflow to Equity in period t}$

$k_e = \text{Cost of Equity}$

Note: The dividend discount model is a specialized case of equity valuation

Firm Valuation

The value of the firm is obtained by:

Discounting expected *cashflows to the firm* (the residual cashflows after meeting all operating expenses and taxes, but prior to debt payments) *at the WACC* (cost of the different components of financing used by the firm, weighted by their market value proportions)

$$\text{Value of Firm} = \sum_{t=1}^{n} \frac{\text{CF to Firm}_t}{(1+\text{wacc})^t}$$

Adjusted Present Value approach:

Firm Value = Unlevered Firm Value + PV of tax benefits of debt - Expected Bankruptcy Cost

Generic DCF Valuation Model

Firm is a stable growth
Grows at constant rate
forever

Cash Flows
Firm: Pre-debt cash flows
Equity: After-debt cash flows

Expected Growth
Firm: Growth in Operating Earnings
Equity: Growth NI/EPS

Value
Firm: Value of Firm
Equity: Value of Equity

CF_1 CF_2 CF_3 CF_4 CF_5 CF_n

Terminal Value
Forever

Length of period of High Growth

Discount Rate
Firm: Cost of Capital
Equity: Cost of Equity

Estimating the Intrinsic Value

Most investment valuation involves:

Estimating the amount and timing of the cash flows

Interest, dividends, and capital gains

Estimating the growth rate of returns

common stock / Real estate
(Can grow over time)

Preferred Stock / Bonds
(fixed)

Applying an appropriate discount rate to the cash flows to estimate the investment's intrinsic value

The required return for the risk assumed Amount & timing of cash flow

Comparing the intrinsic value to the market price

If estimated intrinsic value > market price, then BUY!

Discounted Cash Flow Models

Preferred Stock

$$P_{pdf} = \frac{DIV}{r_P}$$

- Fixed/Perpetual Income-never matures
- Market Rate

Common Stock

Projected (not fixed)

$$P_{cs} = \frac{DIV_1}{(1+R_{CE})} + \frac{DIV_2}{(1+R_{CE})^2} + \ldots + \frac{DIVn + P_{CS_n}}{(1+RCE)^n} = \frac{DIV_n + 1}{r-g}$$

Constant (Gordon) Growth DDM

- g ≤ g economy

$$P_{CS} = \frac{DIV_1}{R_{CE} - g_{DIV}}$$

DIV_1: $DIV_0 \times (1+g)$; $EPS_1 \times \text{Payout Rate}$

g_{DIV}: $ROE \times \text{Retention Rate}$