Financial Management

M.Sc. in International Shipping, Finance and Management

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1. Useful information

- **Personal information**
  - **Lecturer:** Leonidas Rompolis
  - **Office:** 12 Derigni street, 6th floor (near the main building of AUEB in Patission).
  - **Office hours**: Monday 11.00-13.00
  - **Email:** rompolis@aueb.gr
- **Course information**
  - **Sessions:** 8 X 3 hours each (every Wednesday 12.00-15.00) + 3 X 3 hours each tutorials
  - **Course assessment:**
    - 3 hours final exam (70%).
    - 2 *compulsory* group projects (30%). The projects count for the final grade given that you have obtained a pass mark (50%) in the final examination.

2. Aims and objectives

- The goal of this course is to analyze corporate decisions from a financial perspective.
- The course focuses on:
  - Investment and financing decisions
  - Valuation of financial assets
  - Risk-return trade-off
- Introduce students to investment and financing decisions made by corporations.
- Explain to them how to reach such decisions using the theory of financial management.

3. Topics covered

1. Introduction to Financial Management
2. The Present Value Rule
3. How to Calculate Present Values
4. Valuing Common Stocks
5. Valuing Bonds
6. Cash Flows for Investment Analysis
7. Investment Decision Rules
8. Financial Statement Analysis
9. Working Capital Management
10. Risk-Return
11. Capital Structure Theory
12. The Optimal Financing Mix
13. Payout policy

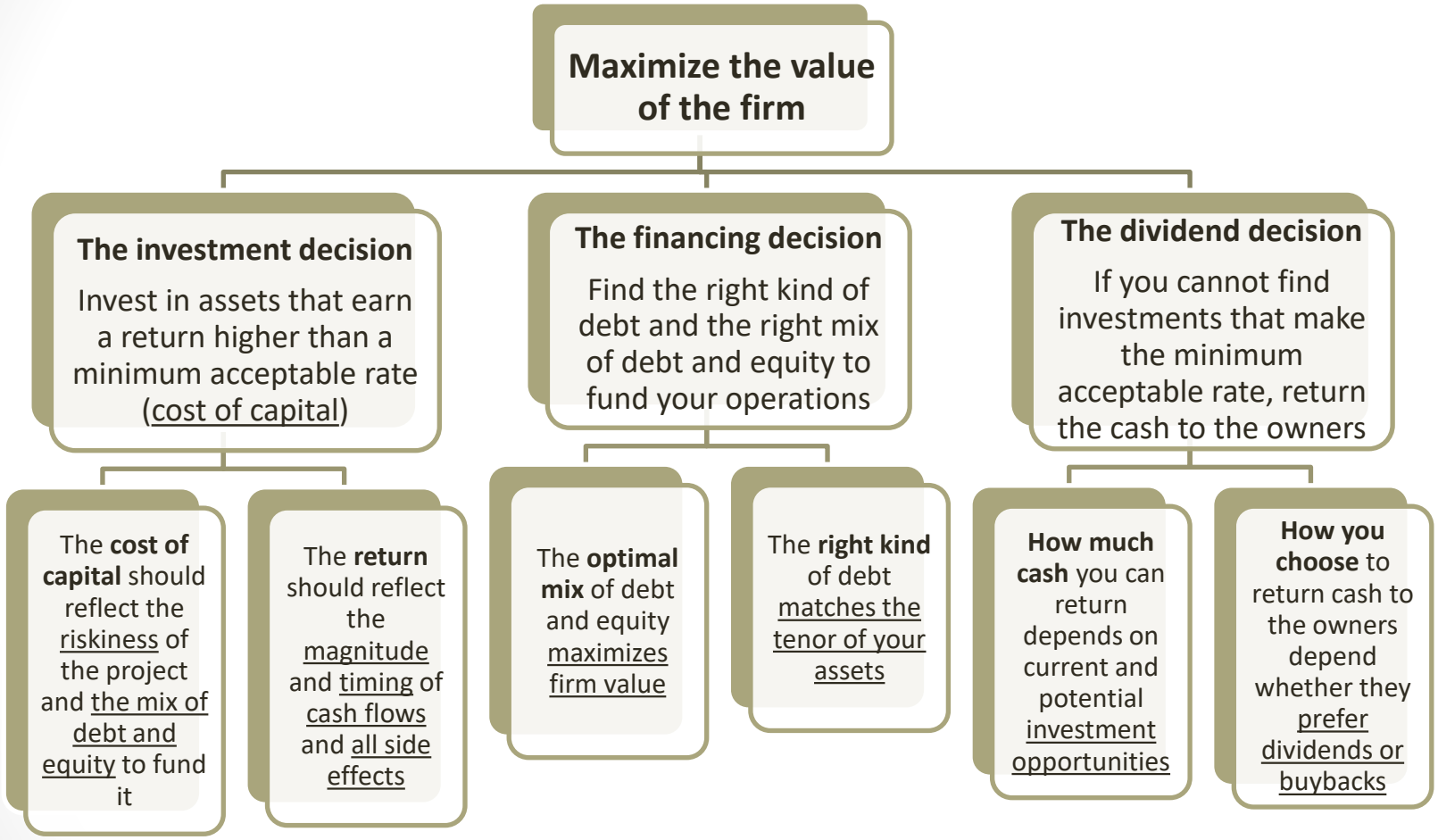
4. Reading materials

- My notes including exercises and their solutions at the end of each chapter uploaded in Eclass.
- Multiple choice questions in class + extra material
- Brealey, Myers and Allen, “Principles of Corporate Finance”, McGraw-Hill 11th ed. 2014.
- Damodaran, “Corporate Finance: Theory and Practice”, Wiley 2nd ed. 2001.

CHAPTER 1

INTRODUCTION TO FINANCIAL MANAGEMENT

1. First principles



2. A snapshot of the firm

2.1. The balance sheet

Assets	Liabilities
Fixed assets (long lived real assets)	Current liabilities (short-term liabilities)
Current assets (short lived assets)	Debt (debt obligations)
Financial investments (investments in securities and assets of other firms)	Other liabilities (other long-term obligations)
Intangible assets (non-physical assets)	Equity (equity investment)

Book value of assets = Book value of liabilities

2. A snapshot of the firm

2.2. The financial view

Assets	Liabilities
Real assets	**Financial assets**
Assets in place (existing investments generate cash flows today)	Debt (fixed claim on cash flows) No role in management *Fixed maturity* *Tax deductible*
Growth assets (expected value that will be created by future investments)	Equity (residual claim on cash flows) Significant role in management *Perpetual lives*

Market value of assets = Market value of equity and debt

Maximize

2. A snapshot of the firm

2.2. The financial view

- **Corporation / Firm**: Management and ownership are separated. The firm is owned by stockholders but it is managed by a board of directors, which represents the interests of stockholders. This separation ensures **limited liability**. Stockholders are not personally responsible for the firm's debts.

- **Real assets**: These are used by the firm to carry out its business.
  1. Tangible: Machineries, buildings, offices etc.
  2. Intangible: Expertise, patents etc.

- **Financial assets (securities)**: In order to purchase real assets the firm sell financial assets. These are *claims on the firm's real assets and on the cash those assets will generate.* Examples are bank loans, common or preferred stocks, bonds etc.
- These assets are sold (and traded) on **financial markets** (**money markets** or **capital markets**).

3. The objectives

- In traditional corporate finance the objective in decision making is to **maximize firm value**.
- A narrower objective is to maximize stockholder wealth. When the stock is traded and markets are viewed to be efficient, the objective is to **maximize the stock price**.
- Why?
  - Stock price is *easily observable* and constantly updated (unlike other measures of performance, which may not be as easily observable, and certainly not updated as frequently).
  - If investors are *rational*, stock prices reflect the wisdom of decisions, short term and long term, instantaneously.
  - The stock price is a real measure of stockholder wealth, since stockholders *can sell their stock and receive the price now*.

3. The objectives

- **Question**: Why do some investment increase value while others decrease it?

- **Answer**: Investments that increase value provide an expected rate of return larger than the expected rate of return that stockholders can earn (on their own) by investing in the financial markets.

- **Explanation**: The firm has some extra cash on hand. The firm:
  1. use this cash to run an investment project with a rate of return equal to 12%.
  2. return this extra cash to stockholders.
- If they can invest this cash in the market with a rate of return of 10%, then it is better for them to keep the cash in the firm and undertake the project. In so doing, the firm's strategy guarantee future profits in excess of what they can generate by themselves, thus increasing the value of their investment.

3. The objectives

- The objective of stock price maximization set aside concerns for other claim holders (lenders, employers, and society).
- It is appropriate under the following conditions:
  - The decision makers (managers) set aside their own objectives and work for the interest of the owners (stockholders) of the firm.
    - They fear stockholders' power to replace them
    - They hold enough stocks themselves
  - Stockholder wealth is not being increased at the expense of the lenders to the firm; *only then is stockholder wealth maximization consistent with firm value maximization*.
    - Stockholders fear the damage in the firm's reputation
    - Lenders protect themselves by writing in restrictions (covenants)
  - Markets are efficient, managers do not try to mislead the financial markets; *only then will stock prices reflect stockholder wealth*.
  - There are no significant social costs (health, environmental); *only then will firms maximizing value be consistent with the welfare of all of society*.

3. The objectives

Stockholders hire managers to run their firms for them…

Because stockholders have absolute power to hire and fire managers…

Managers set aside their interests and maximize stock prices…

Because markets are efficient…

Stockholders wealth is maximized…

Because lenders are fully protected from stockholder actions…

Firm value is maximized…

Because there are no costs created from society…

Societal wealth is maximized

4. What can go wrong?

- The main problem is that the four players:
  1. Stockholders
  2. Managers
  3. Bondholders
  4. Society
- have different interests and incentives.
- These four groups have *conflict of interests,* creating costs for the firm, known as **agency costs**.
- Theses costs may result to stock price maximization to be problematic as an objective.

4. What can go wrong?

- It can fail because:
  - **Managers vs. Stockholders**: Managers, given the limited power that stockholders have on them, may not make decisions to maximize stockholders wealth but may instead choose to further their own interests.
  - **Stockholders vs. Bondholders**: Stockholders, if not restricted, may increase stock price at the expense of bondholders (e.g. increasing dividends significantly, taking riskier projects, borrowing more)
  - **Firm vs. Financial markets**: Firms can increase stock prices by providing misleading or fraudulent information to the markets.
  - **Firm vs. Society**: Firms can create substantial costs to society (environmental, quality of life) trying to increase stockholders wealth.

5. The response

- The stock price maximization principle can be rescued if we can reduce agency costs.
- The strength of the stock price maximization is its internal self correction mechanism. Stake holders learn from their mistakes and try to correct them.
  - Managers taking advantage of stockholders has led to performance-based compensation of managers and to a much more active market for corporate control.
  - Stockholders taking advantage of bondholders has led to bondholders protecting themselves at the time of the issue and the launch of new hybrid form of debt.
  - Firms revealing incorrect or delayed information to markets has led to markets becoming more “skeptical” and “punitive”.
  - Firms creating social costs has led to more regulations, as well as investor and customer backlashes.

Summary

- The objective of traditional corporate finance is to maximize the value of the firm.
- We often adopt the narrower objective of maximizing firm's stock price.
- Stock price maximization may be problematic when the different players in the firm all have different interests.
- These differences, creating agency costs, can lead to managers to put their interests over those of the stockholders, stockholders to try to take advantage of lenders, firms to mislead financial markets, and decisions to be made that create large costs to society.
- The response is to reduce agency problems between the different groups by trying to align the interests of stockholders, managers, and lenders, and punishing firms that lie to financial markets and create large social costs.
- **Reading**: Damodaran (chapters 1 and 2).

CHAPTER 2

THE PRESENT VALUE RULE

1. Compounding

- Consider that you invest \$100 at an investment providing an annual interest rate of 5%.
- At the end of the first year, you earn interest equal to $0.05 \times 100 = \$5$.
- The value of the investment will grow to $100 + 5 = \$105$, which is the **future value** of your current investment.
- We can mathematically write that:

$$FV_1 = C(1 + r)$$

- In our example we get that $FV_1 = 100(1 + 0.05) = 105$.
- During the second year you earn interest $0.05 \times 105 = 5.25$.
- The value of the investment will grow to $100 + 5 + 5.25 = \$110.25$. This is the future value of the investment two years from now.
- Notice that in the second year you earn interest on both your initial investment (\$100) and the previous year's interest (\$5). Thus, your wealth grows at a *compound rate* and the interest that you earn is called **compound interest.**

1. Compounding

- We can decompose the future value as follows:

$$110.25 = \underbrace{100}_{initial\ investment} + \underbrace{\underbrace{10}_{2\ simple\ interest} + \underbrace{0.25}_{interest\ of\ interest}}_{compound\ interest}$$

- Mathematically, we can write as:

$$FV_2 = C(1+r)^2$$

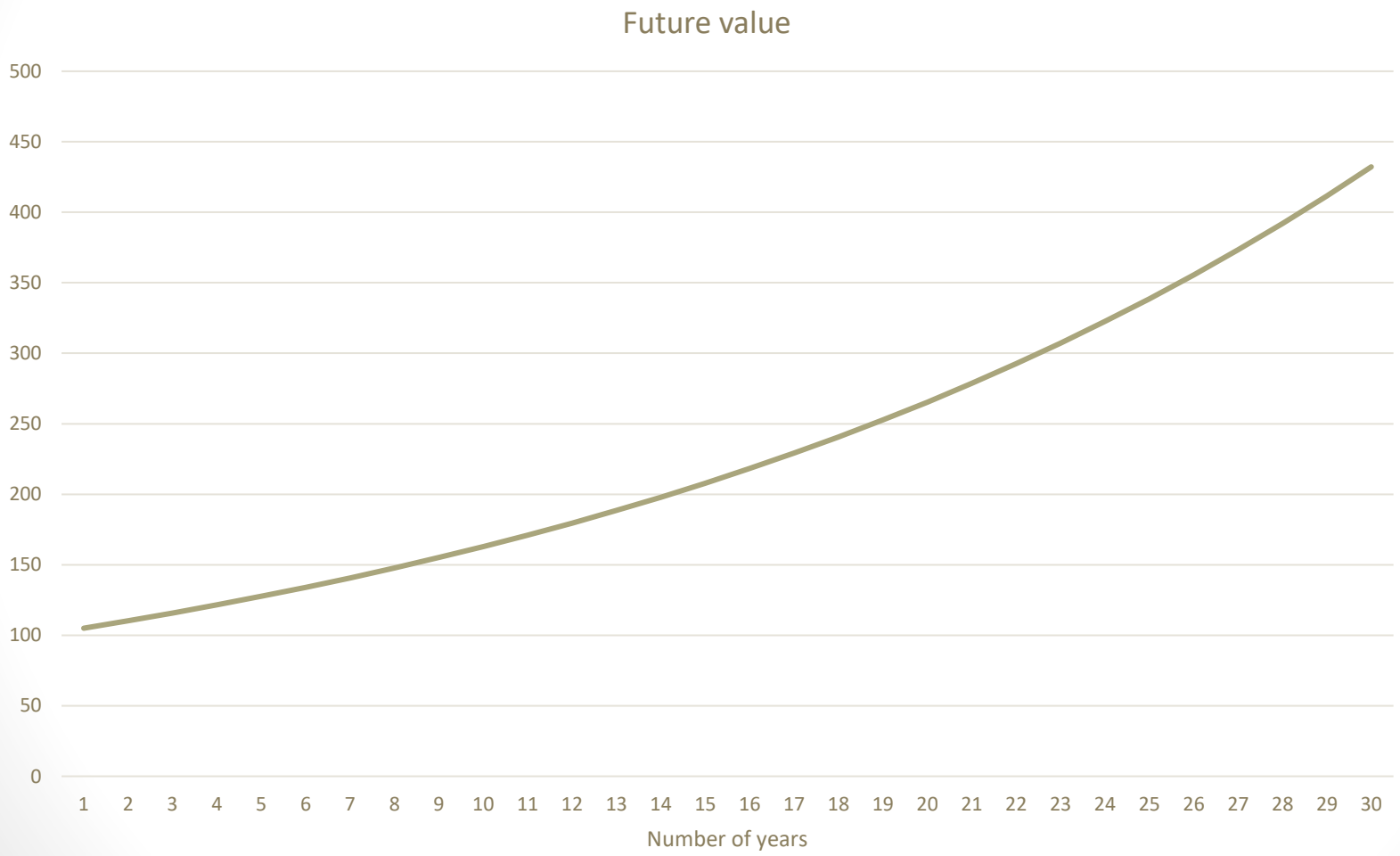
- In our case, $FV_2 = 100(1+0.05)^2 = \$110.25$.
- We can generalize the previous discussion to calculate the future value t years in the future as:

$$FV_t = C(1+r)^t$$

- For example, after 20 years the future value of \$100 invested at 5% per year is equal to:

$$FV_{20} = 100(1+0.05)^{20} = \$265.33$$

1. Compounding



2. Introduction to present value

- **Question**: Given an investment project how you can decide whether to undertake it or not?

- **Answer**: We need to determine the *current* value of this project.

- **Example**: The cost to construct a building is $370,000. A year from now it will generate a cash flow of $420,000 **with certainty**. Also assume an interest rate of 5%.

➢ Calculate the current value of the $420,000 future cash flow. This is equal to the amount needed today in order to generate this $420,000 a year from now:

$$\frac{420{,}000}{1+5\%} = 400{,}000$$

This $400,000 is the **Present Value (PV)** of the $420,000 future cash flow.

➢ The PV of the future cash flow is $400,000 and the cost of the investment is $370,000. The current value of the project, denoted as the **Net Present Value (NPV)**, is 400,000 – 370,000 = 30,000.

➢ Since the NPV is positive we should undertake the project.

➢ *This is the contribution of the project to the increase in the wealth of stockholders.*

2. Introduction to present value

- **Arithmetic**:
  - C_0 is the cost of undertaking the project (negative).
  - C_1 is the future cash flow of the project.
  - r is the interest rate.

$$PV = \frac{C_1}{1+r}$$

$$NPV = C_0 + \frac{C_1}{1+r}$$

- What is exactly r?
  - A rate of return of an investment in the financial markets with the same risk exposure to that of the project.
  - Given that $420,000 is a certain cash flow, this 5% can be the return of short-term government bonds.
  - Several names for r: Discount rate, opportunity cost of capital, or cost of capital.

2. Introduction to present value

- The present value of the investment is $400,000. The future value of the same investment is $420,000, that is more than its present value. Therefore, $400,000 today worth more that $400,000 a year from now. They actually worth $420,000.

- **First Financial Principle**: A $1 today worth more than $1 tomorrow, because the $1 today can be invested to start earning interest immediately. This is known as the **time value of money**.

3. Risk and present value

- **Question**: How to value a project with uncertain cash flows?

- **Answer**: Use again the PV and the NPV. The calculations are similar. Adjust only the future cash flow and the discount rate.
  - C_1 is now the **expected** cash flow of the project.
  - r is the **expected rate of return** of an investment in the financial markets with an equivalent risk exposure to that of the project.

- **Example**: Assume now that \$420,000 is the expected cash flow (the realized one that you can only observe a year from now could be larger of smaller than this assessment). In that case the PV cannot be equal to \$400,000. Investors can generate \$420,000 with certainty using these \$400,000, so the PV of this uncertain cash flow should be now lower than \$400,000.
- To find it we need an estimate of r. Suppose that the project is as risky as an investment in the stock market which provides an expected rate of return of 12%. In that case the PV is equal to

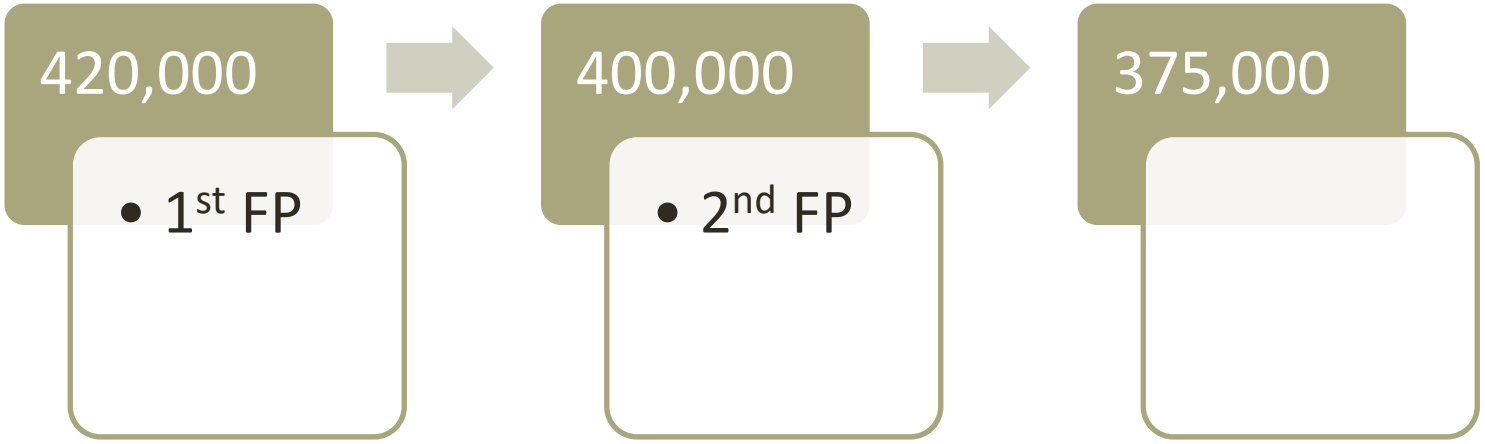
$$\frac{420{,}000}{1+12\%} = 375{,}000$$

The NPV is equal to 375,000 – 370,000 = 5,000.

3. Risk and present value

- You observe that $420,000 with certainty worth more than an expected cash flow of the same amount.

- **Second Financial Principle**: A safe dollar is worth more than a risky one.



4. PVs and rate of return

- Lets calculate the rate of return of the project:

$$Return = \frac{Profit}{cost} = \frac{420{,}000 - 370{,}000}{370{,}000} = 13.5\%$$

- If the cost of capital is 12% you observe that the return of the project exceeds the return that stockholders can earn in the financial markets with the same risk exposure. Thus, we should accept the project.

- Two equivalent decisions rules:
  1. **NPV rule**: Accept investments with positive NPV.
  2. **Rate of return rule**: Accept investments with Return > cost of capital.

5. The NPV rule and the stockholder's preferences

- **Proposition**: The decision taken using the NPV rule is equivalent to the maximization of the wealth of stockholders independently of their consumption preferences.
- **Condition**: Stockholders have access to well-functioning financial markets.

- Remember that managers can only help stockholders to increase their current wealth. The previous proposition states that this can be achieve by managers if the follow investment strategies with positive NPV.

CHAPTER 3

HOW TO CALCULATE PRESENT VALUES

1. Valuing long-term projects

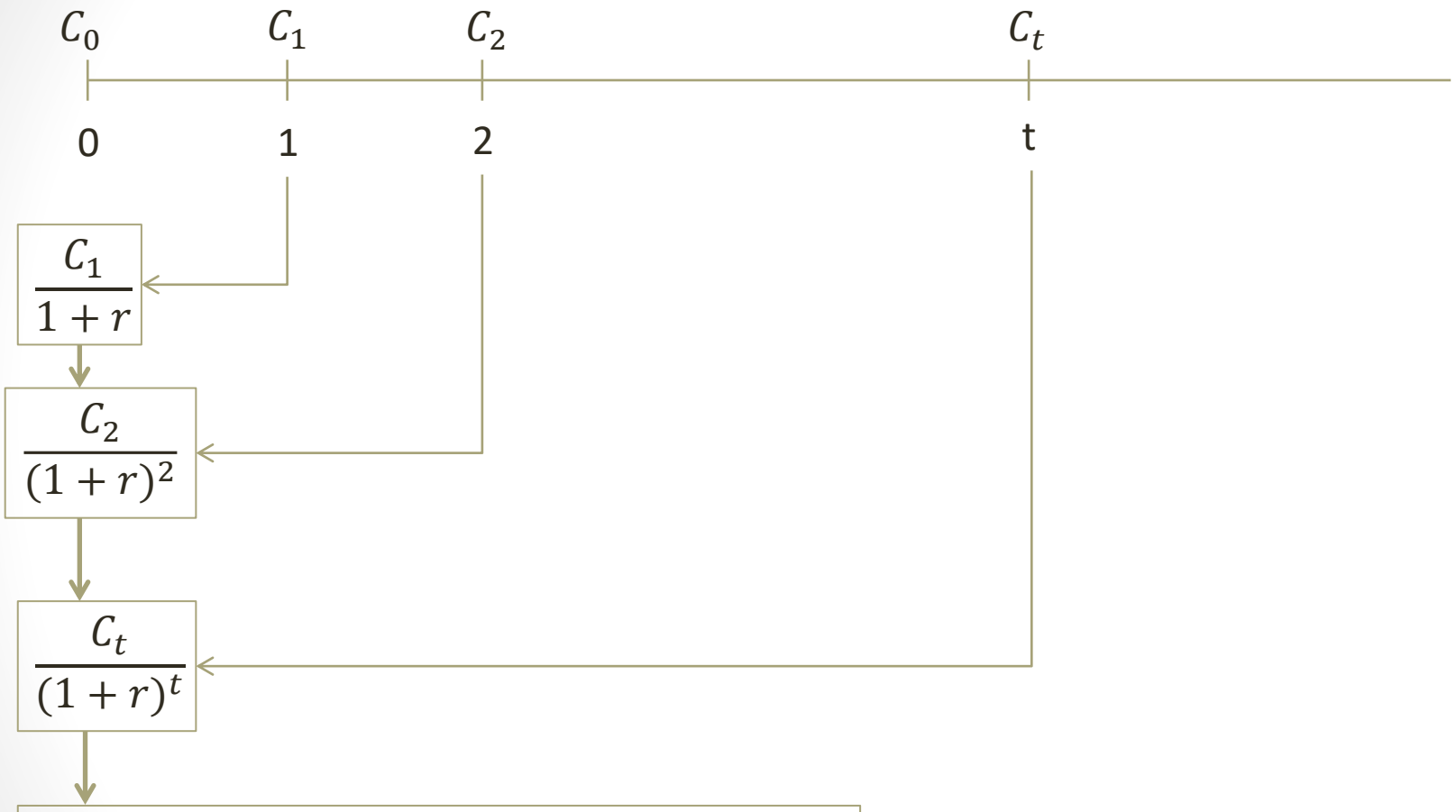
- **Question**: How to calculate the PV and the NPV of a project that generates a stream of future cash flows?

- **Answer**: Generalize the PV formula of the previous chapter.
  - C_0 is the cost of undertaking the project (negative).
  - C_t is the future cash flow of the project at year t.
  - r is the discount rate.

$$PV = \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_t}{(1+r)^t} + \cdots$$

$$NPV = C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_t}{(1+r)^t} + \cdots$$

1. Valuing long-term projects



DCF formula

1. Valuing long-term projects

Example: Your company is considering the purchase of a new bulk carrier for $6 million. The forecasted revenues are $5 million a year and operating costs are $3 million. A major refit costing of $3 million will be required after the third year. After 5 years, the ship is expected to be sold for scrap at $1.5 million. If the discount rate is 8%, what is the ship's NPV? Would you suggest the company to purchase the ship?

1. Valuing long-term projects

Period	0	1	2	3	4	5
Investment	-6					
Revenues		5	5	5	5	5
Costs		-3	-3	-3	-3	-3
Operating cash flows		2	2	2	2	2
Repair				-3		
Scrap						1.5
Total cash flows	**$C_0 = -6$**	**$C_1 = 2$**	**$C_2 = 2$**	**$C_3 = -1$**	**$C_4 = 2$**	**$C_5 = 3.5$**

$NPV = C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \frac{C_4}{(1+r)^4} + \frac{C_5}{(1+r)^5} = -6 + \frac{2}{1+8\%} + \frac{2}{(1+8\%)^2} - \frac{1}{(1+8\%)^3} + \frac{2}{(1+8\%)^4} + \frac{3.5}{(1+8\%)^5} = 0.625$ or \$625,000. Since, the NPV is positive the company will purchase the ship.

2. Perpetuities and annuities

- **Perpetuity**: Projects that offer a fixed cash flow to infinity. The PV of them is equal to:

$$PV = \sum_{t=1}^{\infty} \frac{C}{(1+r)^t} = \frac{C}{r}$$

- **Example**: The current value of a house is $100,000. Assume that this house will generate a constant annual rent of $1,000 forever.
- The rate of return of this investment is:

$$r = \frac{C}{PV} = \frac{1{,}000}{100{,}000} = 1\%$$

- **Growing perpetuity:** Projects that offer an increasing stream of cash flows with a constant growth rate to infinity.
  - C is the 1st year cash flow.
  - g is the growth rate.
  - Then, $C_2 = C(1+g)$, $C_3 = C_2(1+g) = C(1+g)^2$, etc. In general, $C_t = C(1+g)^{t-1}$.
  - The PV is equal to:

$$PV = \sum_{t=1}^{\infty} \frac{C(1+g)^{t-1}}{(1+r)^t} = \frac{C}{r-g}$$

2. Perpetuities and annuities

- **Annuities**: Projects that offer a fixed cash flow for a specific number of years N. The PV is equal to

$$PV = \sum_{t=1}^{N} \frac{C}{(1+r)^t} = C \underbrace{\left(\frac{1}{r} - \frac{1}{r(1+r)^N} \right)}_{annuity\ factor}$$

2. Perpetuities and annuities

Example (Loan payment): Suppose that you take out a 4-year loan of $1,000 from a bank, with an interest rate at 10% and annual payments. The yearly payments must be set so that they have a present value of $1,000. Thus,

$$1{,}000 = C\left(\frac{1}{0.1} - \frac{1}{0.1(1+0.1)^4}\right) \Rightarrow C = 315.47$$

This loan is an example of an **amortizing loan**. The amount C repaid each year to the bank is used to pay interest on the loan and part is used to reduce the amount of the loan. The next table illustrates the way this loan is paid.

2. Perpetuities and annuities

Year	Year payment (1)	Year interest (2)	Amortization of loan (1) – (2)	End-of-year balance
0				1,000
1	315.47	100	215.47	784.53
2	315.47	78.45	237.02	547.51
3	315.47	54.75	260.72	286.79
4	315.47	28.68	286.79	0

CHAPTER 4

VALUING COMMON STOCKS

1. Stock market listings

Name	Symbol	Close	Change	Volume	52 week high	52 week low	Div	Yield	P/E
Herbalife Nuturiton	HLF	35.00	0.98	1,906,665	61.77	33.62	....	....	17.33
Hershey	**HSY**	**161.40**	**1.47**	**968,356**	**161.58**	**99.15**	**3.09**	**1.91**	**27.92**
Hess Corp	HES	65.04	1.76	2,429,938	74.81	35.59	1	1.54	....
Hewlett Packard	HPE	13.75	0.26	6,754,580	17.27	12.09	0.45	3.27	....
Home Depot	HD	224.15	1.44	3,110,451	229.27	158.09	5.44	2.43	22.36
Honda	HMC	24.33	0.28	704,716	31.04	22.87	1.03	4.23	4.20
Honeywell	HON	167.14	3.61	3,915,565	178.47	123.48	3.28	1.96	17.68

Data collected from Wall Street Journal

- Hershey's stock is traded at $161.4, increased by $1.47 from the last trading date.
- 968,356 stocks traded during that date.
- The 52-week high was $161.58, while the 52-week low was $99.15.
- The annual dividend provided by the firm the previous period is $3.09.
- This corresponds to a *dividend yield* of 3.09/161.4 = 1.91%.
- The **price-earnings (P/E) ratio** is 27.92. This means in order to buy the stock you need to pay $27.92 per dollar of annual earnings.

2. Expected and realized returns

- If you own a stock you expect two kinds of income:
  1. Cash dividends
  2. Capital gain or losses (due to the change of the market price)

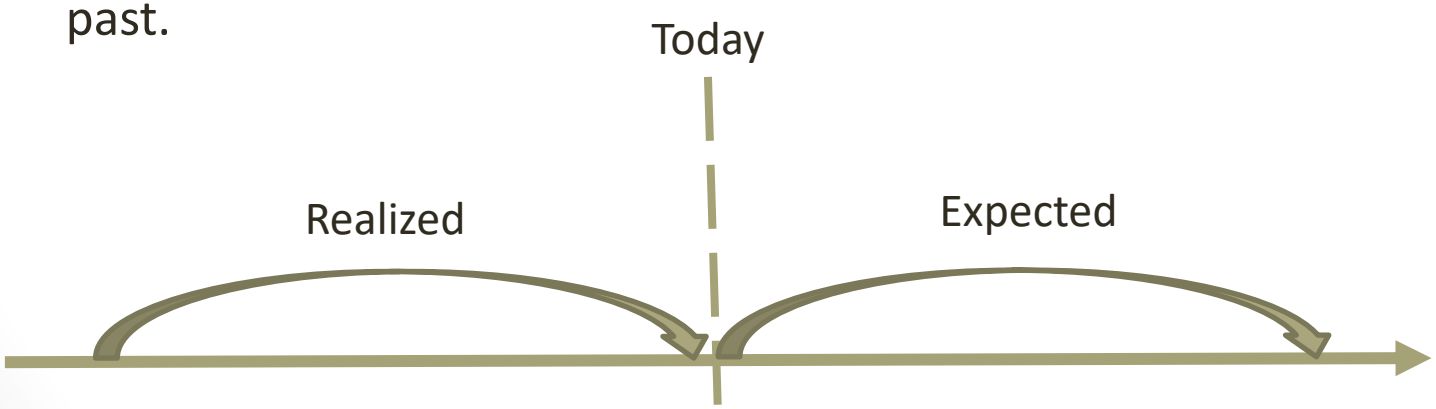
- **Notations**:
  1. P_0 the current price of the stock (at time 0)
  2. P_1 the **expected** price of the stock next period (at time 1)
  3. D_1 the **expected** cash dividend received next period (at time 1)
  4. r the **expected** rate of return of the stock given as:

$$r = \frac{D_1 + P_1 - P_0}{P_0}$$

- Several names for r: market capitalization rate, or cost of equity.

2. Expected and realized returns

- Two kinds of stock returns:
  - Expected returns
  - Realized returns
- They are both defined by the previous formula BUT:
  - for expected returns the interval (0, 1) defines a future time period.
  - for realized returns the interval (0, 1) defines a time period in the past.



2. Expected and realized returns

- Realized returns are **calculated** using historical data.

NETFLIX prices and returns		
Date	Price	Return
01/10/2020	475.74	
01/11/2020	490.7	3.14%
01/12/2020	540.73	10.20%
01/01/2021	532.39	-1.54%
01/02/2021	538.85	1.21%
01/03/2021	521.66	-3.19%
01/04/2021	513.47	-1.57%
01/05/2021	502.81	-2.08%
01/06/2021	528.21	5.05%
01/07/2021	517.57	-2.01%
01/08/2021	569.19	9.97%
01/09/2021	610.34	7.23%

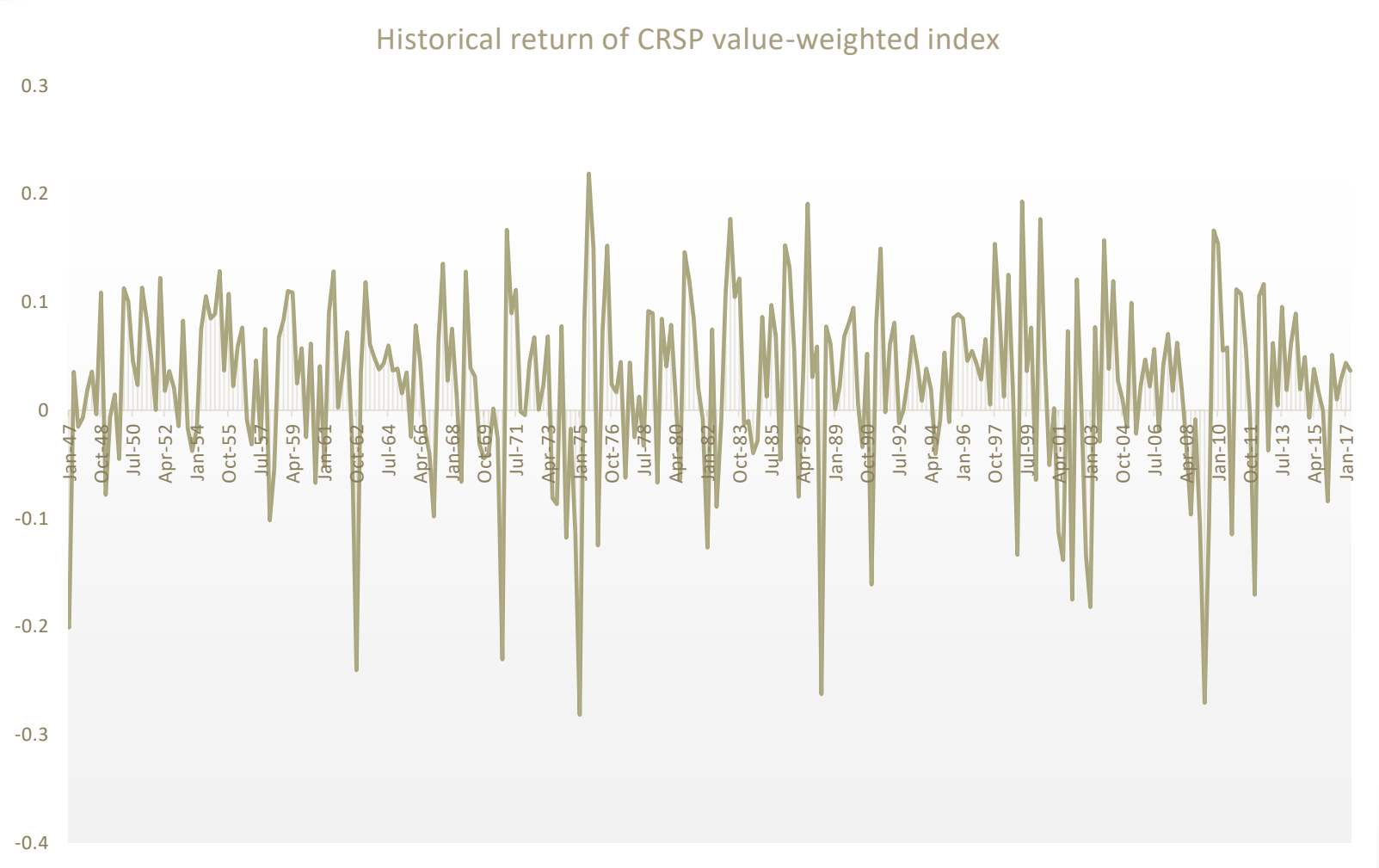
2. Expected and realized returns

- Expected returns are **estimated** using statistics and/or econometrics.
- The most common approach is to assume that the expected return is equal to the sample average value of realized returns calculated over a very long time period.
- If $r_i, i = 1,2, \dots, T$ are realized returns then the expected return is estimated as:

$$E(r) = \frac{1}{T}\sum_{i=1}^{T} r_i$$

- For example, the average value of the CRSP value-weighted index quarterly returns over the sample period Jan/1947 – Apr/2017 is 2.5%.
- We estimate the annualized expected return as $4 \times 2.5\% = 10\%$.

2. Expected and realized returns



3. One-year dividend discount model

- If you solve the previous formula with respect to P_0 then you have:

$$P_0 = \frac{D_1 + P_1}{1 + r}$$

- The right-hand-side is a *present value* formula.
  - The nominator is the total expected cash inflow at time 1.
  - The denominator is a discount factor, where the discount rate is the expected rate of return of the stock.
- **Conclusion**: P_0 depends on two things:
  1. What are investors expectations about the future cash inflow of the stock.
  2. What is the required rate of return to invest on it.
- If one of these two changes so does the stock price.

3. One-year dividend discount model

- **Third Financial Principle**: In well-functioning capital markets all securities with the same exposure to risk offer the same expected rate of return.

- **Explanation**: Suppose that you have two stocks with the same exposure to risk but stock #1 offers an expected rate of return of 10%, while #2 of 8%. Every investor will try to sell the 8% stock and buy the 10% one. By so doing, the price of the 8% will drop, while that of the 10% will increase. When prices drop returns increase and the vice versa. Thus, the return of the #2 stock will increase while that of the #1 stock will decrease both converging to 9% for example.

4. Multi-year dividend discount model

- Write the previous PV formula one period ahead, then:

$$P_1 = \frac{D_2 + P_2}{1 + r}$$

- Substituting in the first PV formula we have:

$$P_0 = \frac{D_1}{1 + r} + \frac{D_2 + P_2}{(1 + r)^2}$$

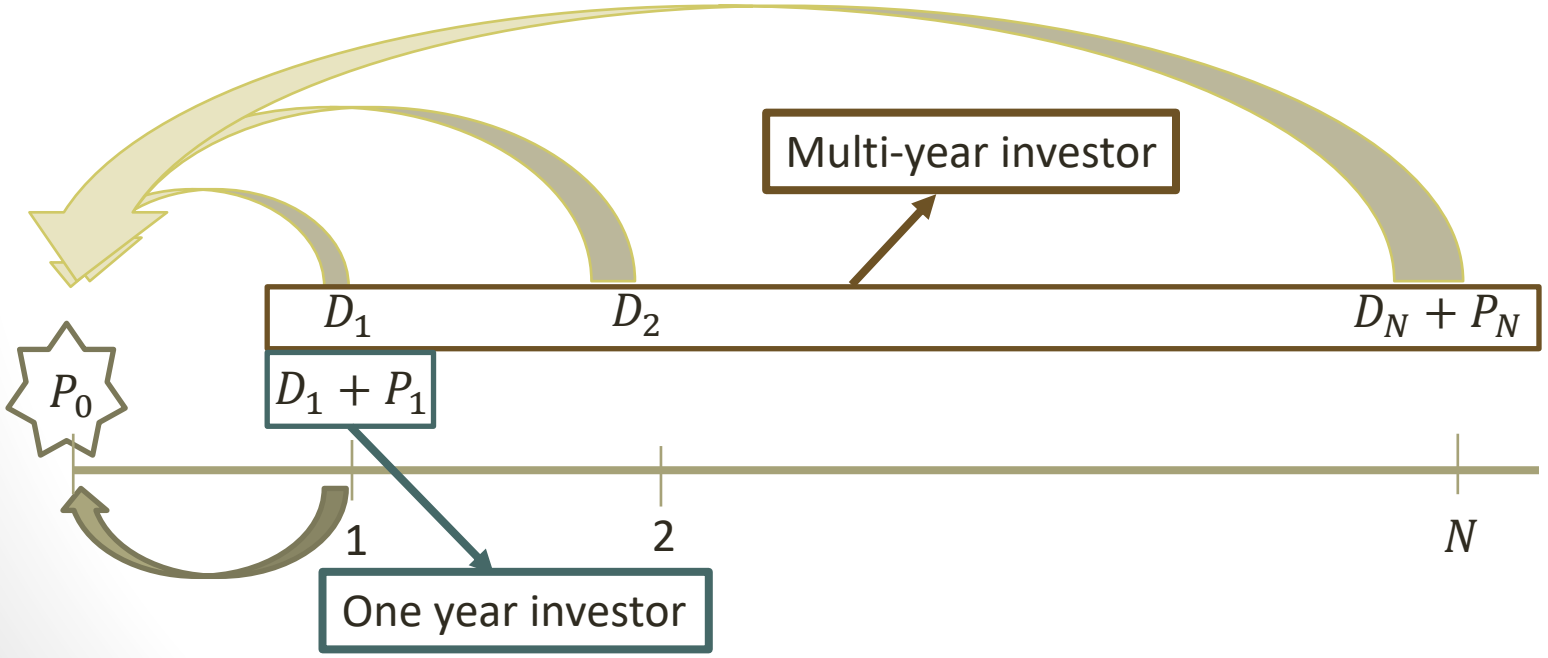
  - This a 2-period PV to price the stock.
  - Both PV formulas are equivalent. The only difference is that in the first P_1 appears explicitly on it, while in the second it is "hidden" inside the expected cash inflow of period 2.

- We can generalize the previous 2-period PV formula by sequentially updating it, thus obtaining a N-period PV formula:

$$P_0 = \frac{D_1}{1 + r} + \frac{D_2}{(1 + r)^2} + \cdots \frac{D_N + P_N}{(1 + r)^N} = \sum_{i=1}^{N} \frac{D_i}{(1 + r)^i} + \frac{P_N}{(1 + r)^N}$$

4. Multi-year dividend discount model

- One-year and multi-year dividend discount models are equivalent.
- *They both provide the current stock price* P_0.



4. Multi-year dividend discount model

- If we assume the stock is a perpetual investment, $N \to \infty$, then the last formula can be written as:

$$P_0 = \sum_{i=1}^{\infty} \frac{D_i}{(1+r)^i}$$

- This PV formula is just the same as it is for the PV of any other asset or investment. We discount the cash flows (the cash dividends stream) by the return that can be earned in the market on securities of equivalent risk (#3 FP).
- This PV formula is very difficult to apply it in practice as it is. We need to make some assumptions.
- **Assumption #1**: All expected cash dividends are constant, $D_i = D$, then

$$P_0 = \frac{D}{r}$$

or

$$\frac{D}{P_0} = r$$

The dividend-price ratio (dividend yield) equals the expected rate of return of the stock.

4. Multi-year dividend discount model

- **Assumption #2**: Expected cash dividends grow with a constant rate, $D_1 = D_0(1+g)$, $D_2 = D_1(1+g) = D_0(1+g)^2$, …, then

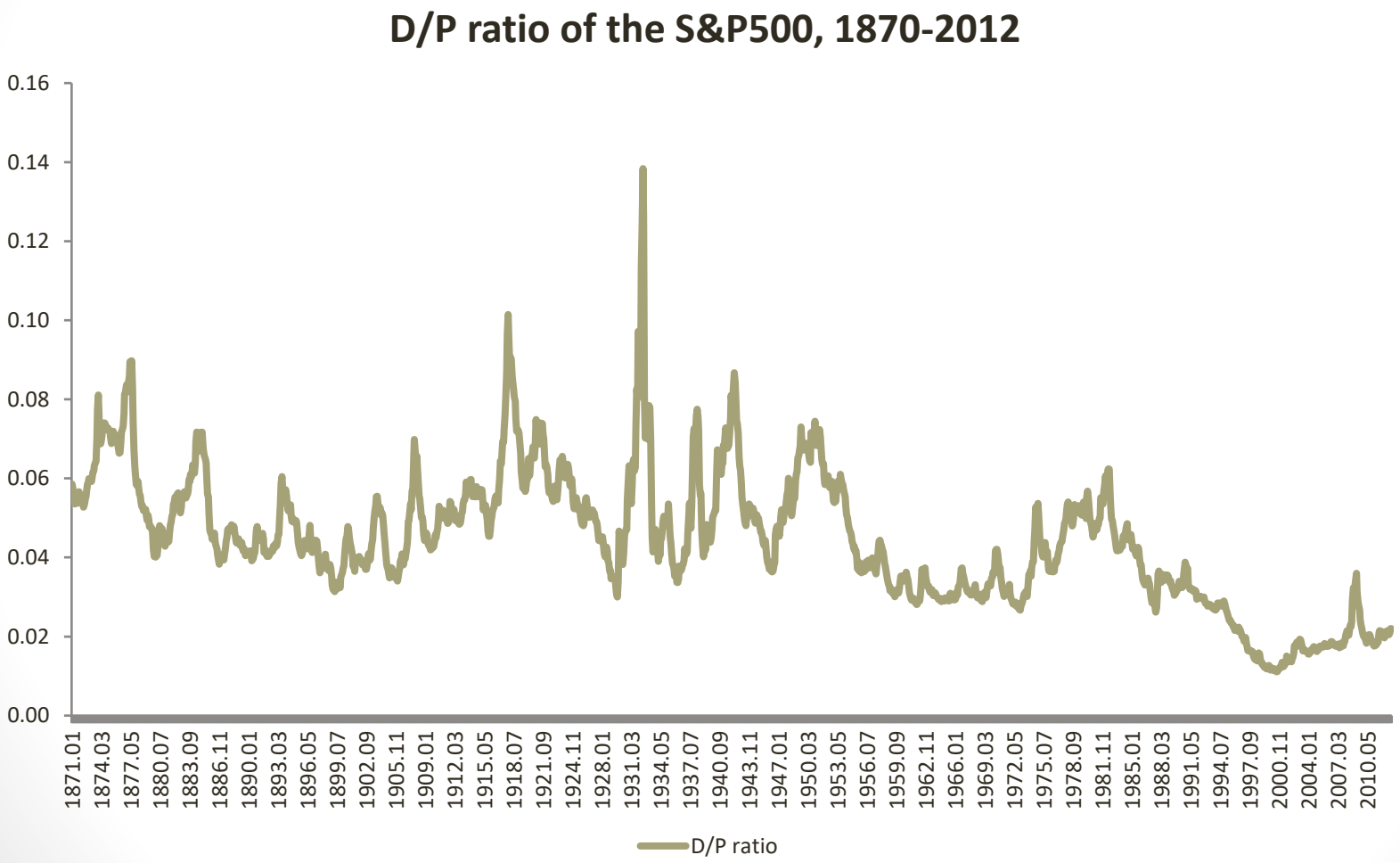
$$P_0 = \frac{D_1}{r-g}$$

- This is known as the **Gordon growth model**. This model implies that:

$$\frac{D_1}{P_0} = r - g$$

- So the D/P ratio increases when the expected return increases or the expected dividend growth rate decreases.
- The D/P ratio moves (and sometimes it moves a lot!). This means that r and g also moves according to the dividend discount model.

4. Multi-year dividend discount model



5. Dividend discount model in practice

- **Example (constant growth rates)**: Assume a stock that its current price is $41.67, its next period dividend is expected to be $1.49 (it is not very difficult to predict dividends), so the D/P ratio is equal to

$$\frac{D_1}{P_0} = \frac{1.49}{41.67} = 0.036$$

- The hard part is to estimate the expected growth rate g.
  - **Earnings per share (EPS)**: the fraction of the total earnings that correspond to its share.
  - **Payout ratio**: the fraction of dividends to EPS.
  - **Plowback ratio**: 1 – Payout ratio. The fraction of EPS that is reinvested by the firm.
  - **Book equity per share**: Represents the equity that a common stockholders has in the net assets of the firm. It is equal to the book equity value divided by the number of shares.
  - **Return on equity (ROE)**: $ROE = \frac{EPS}{book\ equity\ per\ share}$.

5. Dividend discount model in practice

- Assume that the ROE = 10% and the plowback ratio = 38% *which will remain constant throughout the life of the stock.* EPS and dividends will increase by 0.1×0.38 = 0.038, or 3.8%, so g is estimated to be equal to 3.8%. Thus,

$$r = \frac{D_1}{P_0} + g = 0.036 + 0.038 = 0.074$$

- Thus the expected rate of return of the stock is estimated to be equal to 7.4%.
- **Comment**: Even if the analysis seems sound, you fill rather uncomfortable from a practical point of view. Is it possible that a firm would have a constant ROE across time? Is it in general possible that a firm will expand with the same rate across its lifetime? (what about business cycles…)

5. Dividend discount model in practice

- **Example (varying growth rates)**: Consider a stock with current price $50 and next period expected cash dividend of $0.5. Also assume that next period ROE is expected to be equal to 25% and the plowback ratio is 80%. This ROE will persist for 2 periods. Thereafter, the profitability will fall (assuming a ROE = 16%) and the firm will respond by investing less, so the plowback ratio will be 50%.

5. Dividend discount model in practice

Table 1: Forecasted earnings and dividends				
	Year			
	1	**2**	**3**	**4**
Book equity	10	12	14.4	15.55
EPS	2.5	3	2.3	2.49
ROE	0.25	0.25	0.16	0.16
Plowback ratio	0.8	0.8	0.5	0.5
Dividends	0.5	0.6	1.15	1.24
Growth rate of dividends	0.2	0.2	0.92	0.08

5. Dividend discount model in practice

- The dividends grow with 20% for first two periods.
- At year 3 the profitability of the firm decreases while the payout ratio increases, causing dividends to grow with 92%.
- From that period onwards, dividends grow with only 8%. This growth rate will persist in perpetuity.

- **How to write the PV formula now in order to estimate r?**
  - The price at year 3 can be estimated by the Gordon growth model:

$$P_3 = \frac{D_4}{r-g} = \frac{1.24}{r-0.08}$$

  - The current price of the stock is given as:

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

$$50 = \frac{0.5}{1+r} + \frac{0.6}{(1+r)^2} + \frac{1.15}{(1+r)^3} + \frac{1.24/r - 0.08}{(1+r)^3}$$

  - Numerically solving the equation we calculate $r = 9.9\%$.

6. Stock price and EPS

- **No-growing firm**: It does not reinvest any of the earnings, thus generating a perpetual constant stream of dividends equal to the earnings per share (EPS). Thus,

$$r = \frac{D}{P_0} = \frac{EPS}{P_0}$$

Expected return = D/P ratio = E/P ratio

- **Growing firm**:
  - Project's rate of return = r

    Assume that $P_0 = 100$ and $EPS = 10$. Then $r = 10\%$. The firm has the opportunity to invest next year \$10 a share to a new project. This will generate a perpetual income of \$1 per share.
    - No dividends at year 1.
    - Dividends will be equal to \$11 for year 2 to infinity.
    - **What is the NPV of the new project?**

$$NPV = -10 + \frac{1}{0.1} = 0$$

    - **What is the stock price if the new project is undertaken?** THE SAME \$100, which means that again r = E/P ratio.

6. Stock price and EPS

- Project's rate of return > r
  - Assume that the firm can now invest \$10 a share at year 1 in the new project but the project would generate a perpetual stream of income of \$1.5.
  - No dividends at year 1.
  - Dividends would be equal to \$11.5 from year 2 to infinity.
  - **What is the NPV of the new project?**

$$NPV = -10 + \frac{1.5}{0.1} = 5 > 0$$

  - **What is the stock price if the new project is undertaken?**

$$P_0 = \frac{D_2/r}{1+r} = \frac{11.5/0.1}{1+0.1} = 104.55$$

6. Stock price and EPS

- So the E/P ratio is now equal to $\frac{10}{104.55} = 0.096$ which is lower than the expected rate of return.
- The increase of \$4.55 in the stock price is the PV of the NPV of the new project, $\frac{5}{1+0.1} = 4.55$. **So, the stock price has increased by the amount of the PV of the NPV of the new project undertaken.**

- **Conclusion**: When the firm grows undertaking projects with positive NPV, the E/P ratio underestimate the expected return of the firm's stock.

6. Stock price and EPS

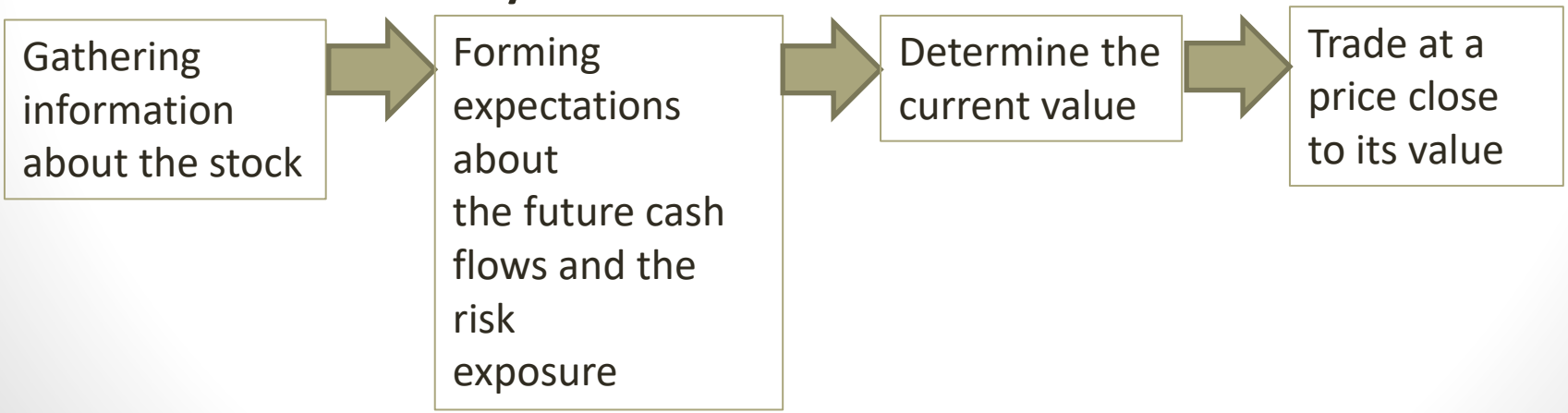
- In general, we can think of the current price of the stock as the capitalized value of earnings under no-growth policy plus the **net present value of growth opportunities (PVGO)**. These are the PVs of the NPVs of the future projects undertaken by the firm,

$$P_0 = \frac{EPS}{r} + PVGO$$

- **Income vs growth stocks**:
  - When the PVGO accounts for a significant fraction of P_0 this is known as a **growth stock**.
  - Investors buy these firms due to their expectations of superior profitability for projects not yet made.
  - **Examples**: High-tech / rapidly expanding firms.
  - When the PV of earnings under no-growth policy accounts for the larger part of P_0 then we have an **income stock**.
  - Investors buy these firms for the profitability of its existing projects.
  - **Examples**: Industrial / mature firms.

7. Market efficiency

- Market price = present value of future cash flows (this is what the dividend discount model implies).
- What is the process underlying this equality?
- How investors form prices in the market?
  - Prices are determined according to the following process.
  - If the process does not break then, *market prices reflect all available information regarding the stock*. This is the definition of **market efficiency**.



7. Market efficiency

- Prices can deviate from the true value of fundamentals for three reasons:
  - Information are insufficient or incorrect.
  - Investors are fully informed but their expectations are not correct (irrational).
  - Investors are fully informed and form expectations properly but are willing to trade at prices which does not reflect these expectations. For example, the value of the stock is $50 but you are ready to buy it as $60 because you believe that another investor will buy it later on at $75. BUBBLE!

7. Market efficiency

- An announcement regarding the future profitability of the firm is made public.
  - The stock prices increases immediately. *The market "react" to the new information*.
  - The stock does not change. *The news was already reflected in the stock price.*
- Three ways to measure market efficiency:
  - How much and how long prices deviate from true values. Deviations can exist as long as they are random.
  - How quickly and how well markets react to new information. Market prices should adjust immediately and correctly to these.
  - Investors cannot consistently earn higher (abnormal) returns than others who are exposed to the same amount of risk.

7. Market efficiency

- **Evidences**:
  - Stocks with higher expected cash flows and/or growth rates are priced higher than other stocks with lower cash flows and/or growth rates. This is especially true for stocks for which investors have easy access to information.
  - Stocks in general react to new announcements. There is mixed evidence as to whether the initial assessment is correct.
  - Investors (even professional ones) cannot “beat” the market after taking into account transaction costs and problem in execution of complicated strategies.

8. Market efficiency and corporate financing

- Market efficiency gives us 5 lessons for the financial manager:
  - **Markets have no memory**: There are not predictable upward/downward cycles in the market.
  - **Trust market prices**: Market prices gives an estimate of the true value of the firm.
  - **Prices reflect the future**: A high-yield bond is not an investment opportunity. It rather conveys information about the low ability of the firm to repay its debt in the future.
  - **There are no financial illusions**: Manipulating the firm's numbers (creative accounting) does not affect market prices (especially in the long-term).
  - **Do-it-yourself**: Investors will not pay others for what they can do equally well themselves.

CHAPTER 5

VALUING BONDS

1. Bond characteristics

- A bond is a security that represents a long-term debt.
- The borrower issues a bond to the seller by a receiving an amount of cash.
- The issuer (borrower) should:
  - Make periodic payments to the bondholder, known as **coupon payments**.
  - Return to the bondholder the **face value (principal)** of the bond at the maturity date.
- Variables:
  - Coupon rate: The rate that determine the coupon payment.
  - Maturity date: The date at which principal is paid.
  - Face value: The final amount that repays the debt.
  - Coupon payment = coupon rate × face value

1. Bond characteristics

Maturity	Coupon	Bid	Asked	Change	Asked yield to maturity
31-Dec-20	1.750	100.040	100.044	0.008	1.641
15-Dec-21	2.625	102.216	102.222	0.032	1.418
15-May-24	2.500	105.054	105.060	0.750	1.356
15-May-30	**6.250**	**147.023**	**147.032**	**0.781**	**1.474**
15-Feb-39	3.500	128.202	128.212	0.126	1.754
15-May-49	2.875	121.006	121.016	0.794	1.939

Data collected from Wall Street Journal

- The bond matures on May 15, 2030. It pays an annual coupon rate of 6.25%.
- If the nominal (face) value is $1,000 investor will receive $62.5 each year until 2030.
- The bid price (the price you receive when you sell the bond) is 147.023% of par, while the asked price (the price you pay to buy the bond is 147.032% of par.
- The *yield to maturity* based on the asked price is 1.474%. It can be interpreted as the annualized rate of return to an investor that buys the bond.

2. Valuing bonds

- Like stocks, bonds can be priced using a PV formula.
- **Example**: A bond is issued on 2006 with the following characteristics:
  - Face value = $1,000
  - Coupon rate = 5%
  - Annual coupon payments
  - Maturity date = 2010

Cash flows			
2007	2008	2009	2010
$50	$50	$50	$1,050

2. Valuing bonds

- The current price is the PV of these future cash flows.
- Assume that other bonds with equivalent risk exposure offer a return of 3%. Then,

$$P_0 = \frac{50}{1+0.03} + \frac{50}{(1+0.03)^2} + \frac{50}{(1+0.03)^3} + \frac{1{,}050}{(1+0.03)^4} = 1{,}074.3$$

- Often we express their prices as a % of face value. So, this bond worth 107.4%.
- Coupon payments constitute an annuity. We can use the annuity formula from Ch.3 to do the calculations:

$$P_0 = 50\left(\frac{1}{0.03} - \frac{1}{0.03(1+0.03)^4}\right) + \frac{1{,}000}{(1+0.03)^4} = 1{,}074.3$$

2. Valuing bonds

- The general formula to determine the price of the bond as the PV of its future cash flows is:

$$P_0 = C\left(\frac{1}{r} - \frac{1}{r(1+r)^T}\right) + \frac{P_T}{(1+r)^T}$$

- C is the coupon payment.
- T is the time-to-maturity.
- P_T is the face value.
- r is an appropriate discount rate reflecting the risk exposure of the bond.

3. Bond yields

- Rather than asking the price of the bond given a discount rate, we can ask the opposite. Given the market price of the bond, what is its expected return?
- In that case we need to solve the PV formula with respect to r given P_0,

$$1{,}074.3 = 50\left(\frac{1}{r} - \frac{1}{r(1+r)^4}\right) + \frac{1{,}000}{(1+r)^4}$$

- Here we know that the solution is 3%.
- In general this is a non-linear equation that we can solve numerically (see for example the YLD function in Excel).
- This rate of return is known as the **yield to maturity** (or simply the **yield**).

3. Bond yields

- We can also define the **current yield** of the bond as the fraction of the coupon payment to its market price. In in this example this is equal to $50/1{,}074.3 = 4.65\%$**.**
- Observe that yield < coupon rate. This is because $P_0 > P_T$.
  - You pay $1,074.3 today to receive $1,000 after 4 years, so you lose $74.3.
  - On the same time you receive 4 coupon payments which represents the 4.65% of your initial investment.
  - The yield is an "average" between the current yield and the decline in value over its remaining life.
- When $P_0 = P_T$ then coupon rate = yield. The bond is **traded at par**.
- In the previous case the bond is **traded above par (premium bond)**.
- In the opposite case the bond is **traded below par (discount bond).**

3. Bond yields

- **Question**: How can we exactly interpret the yield to maturity?
- **Answer**: This yield is the expected rate of return realized over the life of the bond under the conditions:
  - Future interest rates are constant and equal to the yield.
  - Default risk is not priced.
- **Example**: Assume a bond with coupon rate = 5%, face value = \$1,000, T = 2 and $P_0 = 964.73$.
  - The yield to maturity solves the following equation:

$$964.73 = \frac{50}{1+r} + \frac{1{,}050}{(1+r)^2}$$

  - It is found equal to 6.94%.
  - Assume that the yield is expected to remain constant.
  - Then the price of the bond 1 year from now is expected to be

$$P_1 = \frac{1{,}050}{1+0.0694} = 981.85$$

3. Bond yields

- The 1-year expected return of the bond is equal to:

$$\frac{981.85 + 50 - 964.73}{964.73} = 6.94\%$$

- This is exactly the yield.
- Now assume that the yield does not remain constant but increases at 8.24% after 1 year. In that case $P_1 = 970$ and the expected return is 5.72%, lower than the yield.

- **Example**: Consider the same bond with previous example but now the current price is $950.
  - The yield is now 7.79%.
  - Assume that the price also reflect the possibility that the firm will default after 2 years. In that case the bondholder will receive half of the face value. If the probability of this event is 20% then the **expected face value** is equal to

$$50 + (1{,}000 \times 0.8 + 500 \times 0.2) = 950$$

3. Bond yields

- We can now estimate the expected return of the bond as the discount rate that makes the PV of expected cash flows equal to its market value as follows:

$$950 = \frac{50}{1+r} + \frac{950}{(1+r)^2}$$

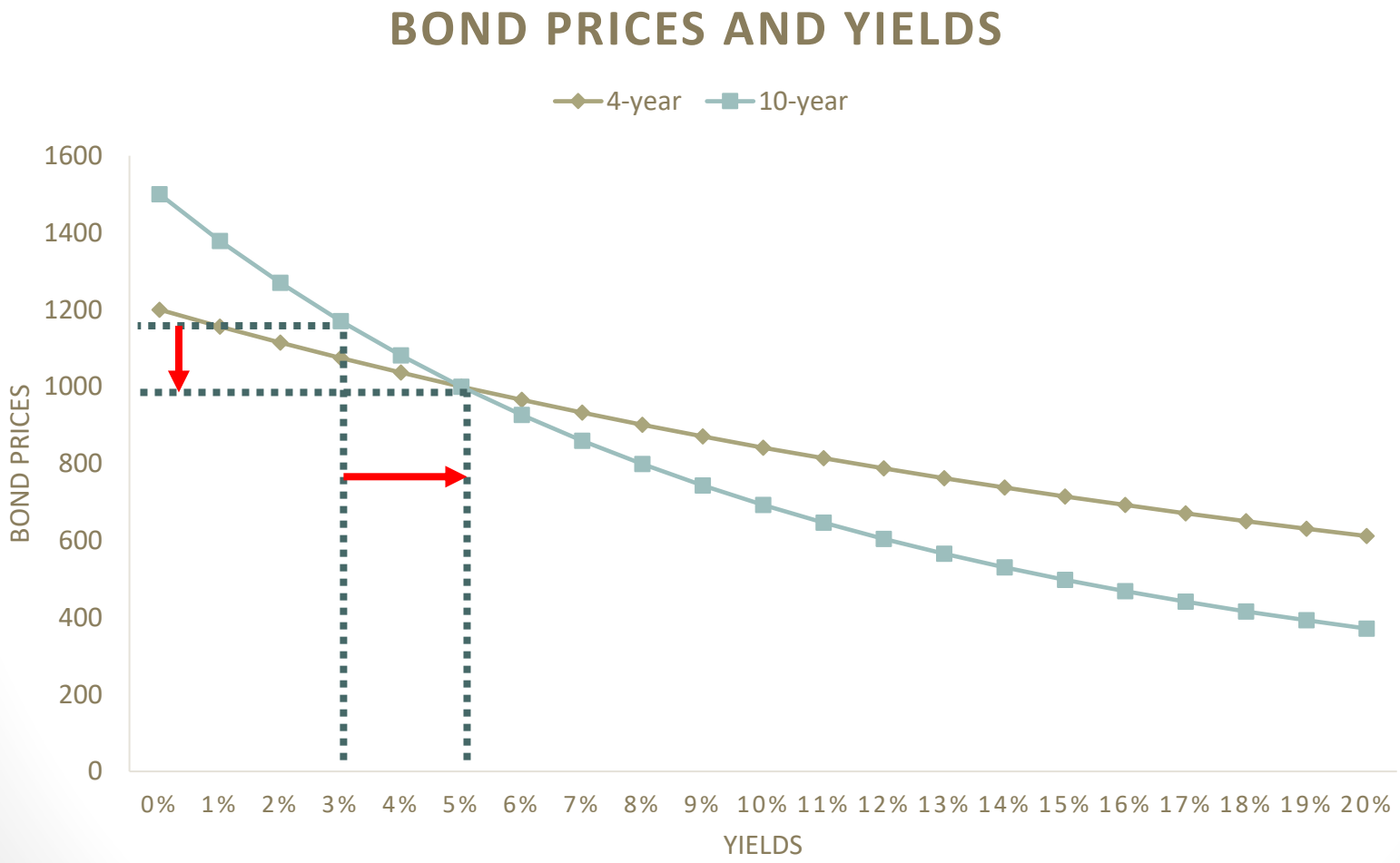
  - This is equal to 2.26%, which is much lower than the yield.
- **Conclusion**: The yield to maturity overestimate the true expected return when default risk is priced.

- **Zero-coupon bonds**: They do not offer intermediate coupon payments and offer only the principal at the maturity date. In the US they are known as **Treasury strips**.

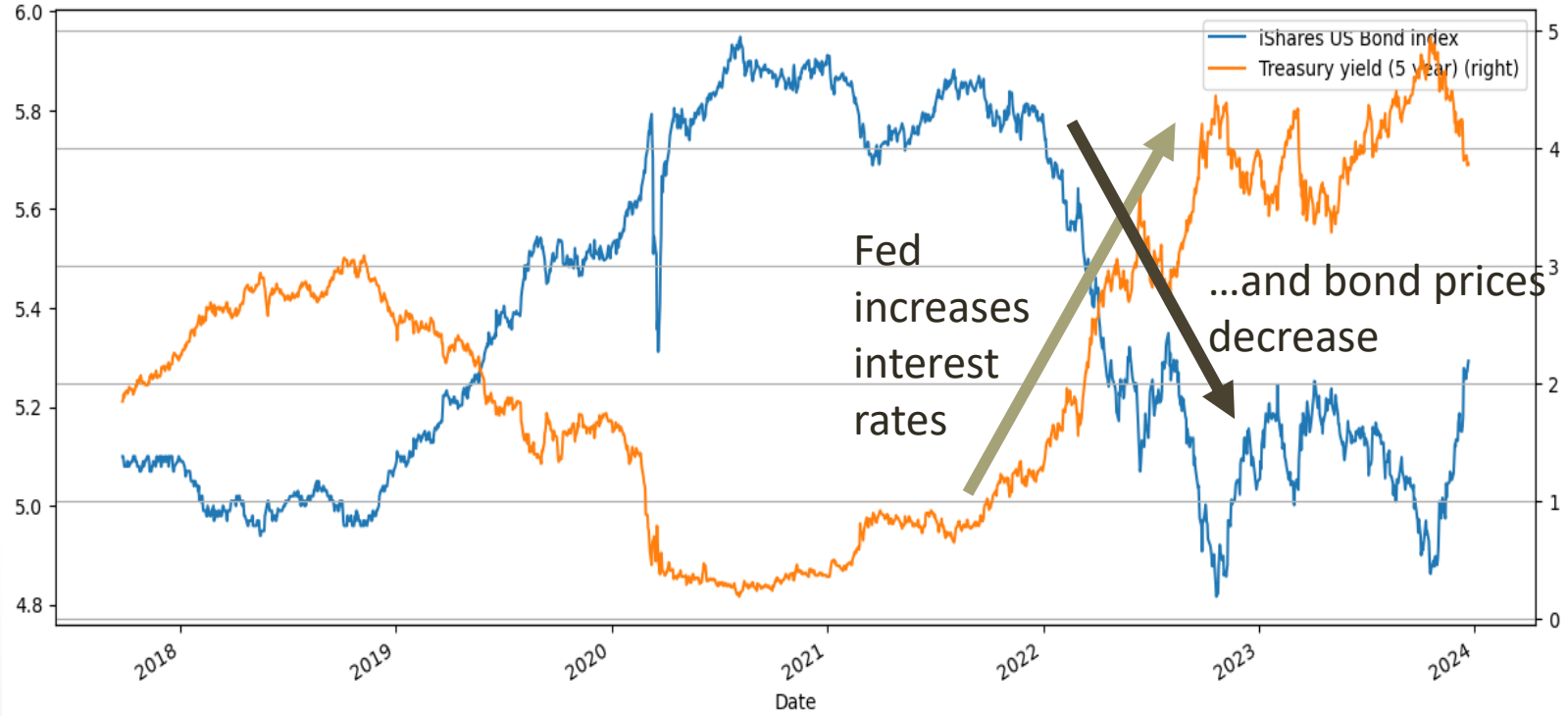
4. How bond prices vary with interest rates

- **Bond prices and yields are inversely related.** When interest rates increase (decrease) bond prices decrease (increase).
- If you buy the bond at par with a coupon rate of 5% and the rates of return of investments with equivalent risk suddenly increase then you suffer a loss because you have tied up your money at the 5% rate when other securities offer higher rates.
- From the next figure we observe:
  - The negative slope indicating the inverse relation.
  - The line is convex.
  - Short-term bonds are less exposed to a change in interest rates than long-term ones.

4. How bond prices vary with interest rates



4. How bond prices vary with interest rates



5. Duration

- To measure the sensitivity of a bond price to a change in yields we use the **duration** which is defined as:

$$D = \sum_{t=1}^{T} t \times w_t$$

where $w_t = \frac{CF_t/(1+y)^t}{P_0}$, where CF_t is the cash flow at time t, y is the yield of the bond, and P_0 is the bond price.

- This is a weighted average of the times until the receipt of each of the bond's payments.

5. Duration

Example: Assume a 5.5% 4-year coupon bond with face value \$1,000 and a yield of 2.75%. The bond price is \$1,102.8.

Year	Payments	PV(payments)	w_t	$t \times w_t$
1	55	53.53	0.049	**0.049**
2	55	52.10	0.047	**0.094**
3	55	50.70	0.046	**0.138**
4	1,055	946.51	0.858	**3.433**
				D = 3.714

- So the duration is 3.714.
- The duration of a 4-year zero-coupon bond is 4. Thus, a 4-year zero-coupon bond is more exposed to a change in yields than a 4-year coupon bond.

5. Duration

- **The duration rule**: Duration can help us to predict the proportional change in the bond price related to a change in its yield according to the formula:

$$\frac{\Delta P}{P} = -D^* \Delta y$$

where $D^* = \frac{D}{1+y}$ is the **modified duration**.

- **Example**: Consider the bond in the previous example. Predict the proportional change in the bond price for 1 basis point increase in its yield.
- 1 basis point = 0.01%.
- The modified duration is $D^* = \frac{3.714}{1+0.0275} = 3.615$
- $\frac{\Delta P}{P} = -3.615 \times 0.01\% = -0.036\%$

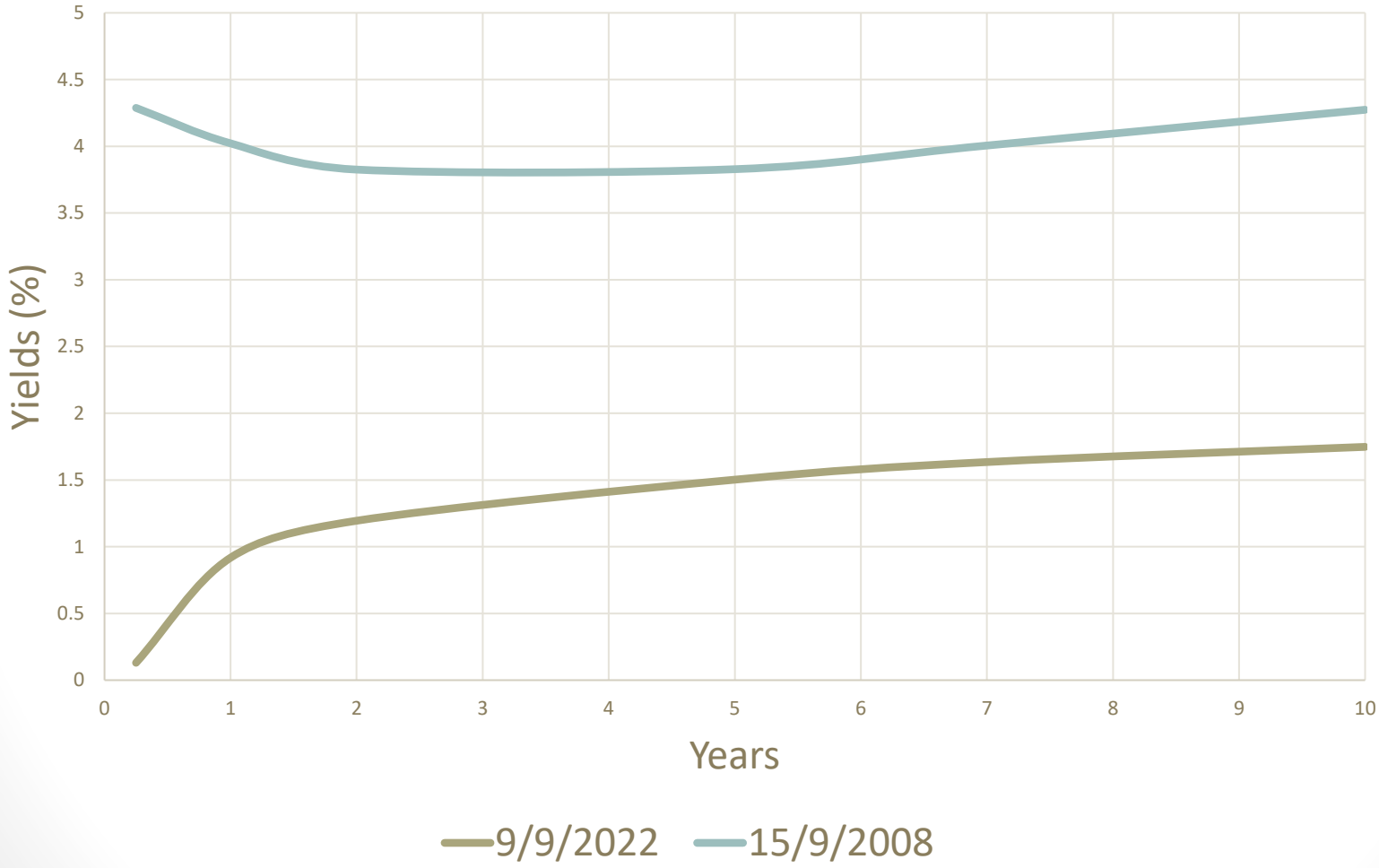
6. The term structure of interest rates

- The relation between short- and long-term interest rates is called the **term structure**.
- To measure the term structure we use the yields of zero-coupon bonds. Given their prices, we solve formula

$$P_0 = \frac{P_t}{(1 + r_t)^t}$$

  with respect to r_t for different maturities t. These yields are called the **spot rates**.
- In reality we can observe three different forms:
  - Upward-sloping (the most observed pattern)
  - Flat
  - Downward-sloping (during period of market stress)
- See http://www.ecb.europa.eu/stats/money/yc/html/index.en.html for the euro-area term structure.

6. The term structure of interest rates



6. The term structure of interest rates

- **Explaining the term structure**:
  - Why the term structure is usually upward-sloping?
  - Does this imply that we should invest in long rather in short-term bonds?
  - Why some investors still prefer low-return short-term bonds?
- Three possible answers to these questions:
  - Short-term rates will be higher in the future.
  - Long-term bonds are more exposed to interest rate fluctuations than short-term ones.
  - Long-term bonds are more exposed to higher future inflation.

6. The term structure of interest rates

- Short-term rates are expected to be higher in the future.
  - If the market expects short-term rates to increase in the near future, investors are willing to invest in low-return short-term bonds now and to roll-over this strategy at a higher rate later.
- The exposure to risk.
  - Long-term bonds are more exposed to interest rate fluctuations (interest rate risk) than short-term ones.
  - Investors will be willing to hold long-term bonds only if they offer a higher return.
- The role of inflation.
  - Bonds guarantee a nominal payment after a period of time. However, they do not guarantee the real value of this.
  - Investing in short-term bonds reduce the exposure to inflation risk.
  - On the other hand, for long-term bonds inflation is an important source of risk, thus investors demand a higher return to hold them.

7. Corporate bonds – the risk to default

Most Active Investment Grade Bonds

Issuer Name	Symbol	Coupon	Maturity	Moody's®/ S&P	High	Low	Last	Change	Yield%
CVS HEALTH CORP	CVS4607885	5.050%	03/25/2048	Baa2/BBB	114.865	113.151	113.784	−1.2350	4.206514
BOEING CO	BA4866208	3.250%	02/01/2035	/A	104.678	103.634	104.242	−1.0690	2.899978
KEURIG DR PEPPER INC	KDP4843943	3.551%	05/25/2021	/BBB	102.343	102.224	102.309	−0.0400	2.085152
BOEING CO	BA4866206	2.700%	02/01/2027	/A	102.812	101.717	101.842	−0.7960	2.417044
MITSUBISHI UFJ FINL GROUP INC	MTU4657147	3.761%	07/26/2023	A1/	105.817	105.243	105.243	−0.3170	2.304181
ALTRIA GROUP INC	MO4403915	3.875%	09/16/2046	A3/BBB	91.051	89.224	90.692	0.021933	4.472984
HCA INC	HCA4843309	5.250%	06/15/2049	Baa3/BBB-	109.588	108.408	108.408	−1.6770	4.716027

Source: Bodie, Kane and Marcus, 10th edition.

- The last row of the table reports the yields of several corporate bonds.
- As the Moody's ratings deteriorates, bond's yields increase.
- The difference in yields among bonds can be attributed to the risk to default.
- The higher this risk, the higher yield we observe in the market.

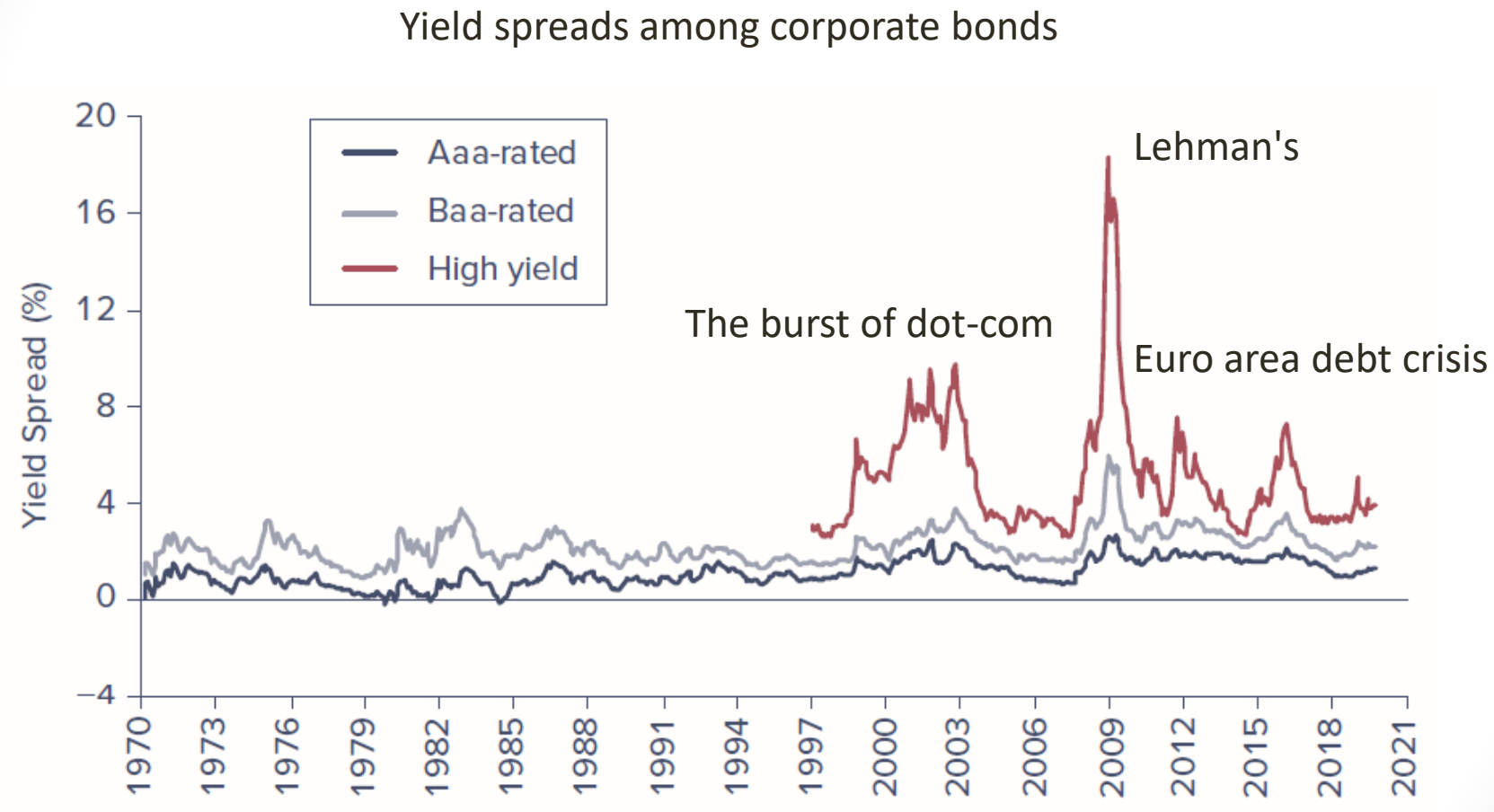
7. Corporate bonds – the risk to default

	Bond ratings	
	Moody's	**S&P's and Fitch**
Investment grade High quality	Aaa	AAA
	Aa	AA
	A	A
	Baa	BBB
High yield Speculative (junk bonds)	Ba	BB
	B	B
	Caa	CCC
	Ca	CC
	C	C
In default →	D	D

7. Corporate bonds – the risk to default

- The difference between the yield of a bond and the yield of a almost safe bond (issued by governments with AAA rating) is known as the **yield spread**.
- For example, if the yield of a corporate bond is 12% and that a AAA government bond is 3%, then the yield spread is 9%.
- Interpret as the insurance premium paid every year in order to be compensated for any loss in the bond value due to default.

7. Corporate bonds – the risk to default



Source: Bodie, Kane and Marcus, 10th edition.

7. Determinants of bond safety

- Credit rating agencies base their quality ratings largely on the level and trend of the some of the issuer's financial ratios.
- The key ratios used to evaluate safety are:
  - Coverage ratios: Times-interest-earned (T-I-E) ratio. A high T-I-E means that the firm's earnings can easily cover its interest obligations.
  - Leverage ratios: Debt-to-equity (D/E) ratio. A high D/E ratio means that the firm has accumulated a large amount of debt relative to equity.
  - Liquidity ratios: Current ratio, quick ratio. A high liquidity ratio means that the firm has enough liquid assets to pay for its bills.
  - Profitability ratios: ROA, ROE. A high ROA (or ROE) means that the firm offers good prospects on the firm's investments.
  - Cash flow-to-debt (CF/D) ratio. A high CF/D ratio means that the firm generates enough cash with respect to its outstanding debt.
- Based on these ratios we create **credit scoring systems** estimating the probability of default.

7. Determinants of bond safety

	Aaa	Aa	A	Baa	Ba	B	C
EBITA/Assets (%)	12.3%	10.2%	10.8%	8.7%	8.5%	6.7%	4.1%
Operating profit margin (%)	25.4%	17.4%	14.9%	12.0%	11.5%	9.0%	4.6%
EBITA to interest coverage (multiple)	11.5	13.9	10.7	6.3	3.7	1.9	0.7
Debt/EBITDA (multiple)	1.9	1.8	2.3	2.9	3.7	5.2	8.1
Debt/(Debt + Equity) (%)	35.1%	31.0%	40.7%	46.4%	55.7%	65.8%	89.3%
Funds from operations/Total debt (%)	41.5%	43.4%	34.1%	27.1%	19.9%	11.7%	4.6%
Retained cash flow/net Debt (%)	31.4%	30.1%	27.3%	25.3%	19.7%	11.5%	5.1%

Note: EBITA is earnings before interest, taxes, and amortization.

Source: Moody's Financial Metrics, *Key Ratios by Rating and Industry for Global Non-Financial Corporations,* December 2013.

Source: Bodie, Kane and Marcus, 10th edition.

CHAPTER 6

CASH FLOWS FOR INVESTMENT ANALYSIS

1. Accounting earnings vs cash flows

- NPV depends on future expected cash flows.
- Cash flows = $ received minus $ paid out *that have to do with the operation of the project.*
- We estimate cash flows based on the income statement of the project.
- **However**, there are 3 main reasons that make cash flows and accounting income to be different. Accounting distinct:
  - Operating from capital expenses.
  - Cash from noncash expenses.
  - Accrual from cash revenues and expenses.

1. Accounting earnings vs cash flows

- Operating and capital expenses:
  - Operating expenses: Expenses that yield benefit only in the intermediate period (labor, raw materials).
  - Capital expenses: Expenses that yield benefit for multiple periods (land, building, long-lived assets).
  - Operating expenses are subtracted from revenues the period that they are made.
  - Capital expenses are spread over multiple times and subtracted as an expense each period. These expenses are called **depreciation** or **amortization**.
  - For investment analysis we need to recognize capital expenses at the time they are made, so depreciation should be added back to accounting earnings in order to calculate the cash flows.

1. Accounting earnings vs cash flows

- Cash and noncash expenses
  - Depreciation is a noncash expense. It reduces accounting income but it does not affect cash flows.
  - In fact, it has a significant positive impact on cash flows.
  - Why? Because it reduces the tax liability of the firm.
  - The tax benefit of depreciation = tax rate × depreciation.
- Accrual and cash revenues and expenses
  - In accounting, revenues are recognized when the sale is made and not when the customer pays its bill.
  - Also, expenses are recognized when the firm uses materials and services provided by third parties. But the firm may have acquired these in previous periods (inventory) or it may pay for them later.

1. Accounting earnings vs cash flows

- **Working capital**: The difference between current assets and current liabilities.
  - Current assets: Inventory of materials and finished goods + accounts receivables (sales that have not yet been paid by customers).
  - Current liabilities: Accounts payables (unpaid bills of the firm) + taxes incurred but not yet paid.
- Most projects require an initial investment in working capital which should be taken into account in the cash flow calculation.
- As the project comes to its end, the firm recover this investment.
- We are not interested in the working capital itself but in the **change in working capital** from one period to the other. This change measure any cash inflow or outflow associated with the project.

1. Accounting earnings vs cash flows

- **Example #1**: Assume that at year 1 the WC = $600. In year 2 it increases to $700 because accounts receivables have increased by $100. This means that the firm has sold products of $100 without being paid for them. This signifies a $100 cash outflow for it.
- **Example #2**: Suppose that at year 3 the WC decreases to $650 because accounts payables increase by $50. This means that the firm has bought goods of $50 without paying for them yet. This signifies a cash inflow for it.

2. Further considerations

- **Incremental cash flows**: Measure only the additional cash flows generated by the project.
- Total and incremental cash flows may be different for 2 reasons:
  - **Sunk costs**: Costs already paid but cannot be recovered if the project is rejected.
  - **Allocated overhead costs**: Several costs are allocated across the firm's units and divisions. But these costs are paid whether or not a new unit is open. So, for the investment analysis of the new unit these costs are not relevant.
- **Opportunity costs**: The cost of using a recourse may be relevant to the investment decision even when no cash changes hand.

2. Further considerations

- **Incidental effects**: The new project may affect the cash flows of other existing projects.
  - The launch of a new product may negatively affect the demands of new products.
  - If the new project reports negative pre-tax earnings this will positively affect the total tax payments of the firm.
- **Salvage value**: When a project finishes, some of the assets can be sold or redeployed. They have a salvage value that should be taken into account in the cash flows calculation.

3. Estimating cash flows

- For investment analysis we can estimate the cash flows (CF):
  - To the firm
  - To stockholders (equity investors)
- **CF to the firm**: Starting from after-tax operating earnings we:
  - Add back depreciation
  - Subtract all capital expenditures
  - Measure the effect of the change in working capital

$$CF\ to\ firm = EBIT(1-\tau) + \mathrm{Dep} - \mathrm{CWC} - \mathrm{CE}$$

  - $EBIT$ = earnings before interest and taxes
  - τ = the corporate tax rate
  - Dep = depreciation
  - CWC = the change in working capital
  - CE = capital expenditures

3. Estimating cash flows

- **CF to equity**: Starting from net income (measures the earnings of equity investors) we do the previous three adjustments plus:
  - we add the net debt = new debt – debt repayments

$$CF\ to\ equity = net\ income + Dep - CWC - CE + net\ debt$$

4. A new project for a retail firm

- A retail firm considers to open a new store. It has made the following assessments about the new store financing and operations:
  - Requires an initial investment of $20 million.
  - It will borrow $5 million at 5.8% using a 10-year loan. The loan will be paid off in equal increments.
  - The store will have a life of 10 years.
  - The store investment will be depreciated using a 10-year straight-line depreciation.
  - The salvage value will be equal to $7.5 million.
  - Revenues are expected to be equal to $40 million in year 1. They will grow at 5% a year for the remaining years of the store.
  - Operating expenses are 10% lower than revenues.
  - Investment in working capital is made at the beginning of each period. The initial investment in working capital is $3.2 million (the 8% of revenues in year 1). Change in working capital for the years that follow are the 8% of changes in revenues in these years. At the end of the period the entire investment in working capital is recovered.
  - The tax rate is 35%.

4. A new project for a retail firm

- **Steps**:
  1. Analyze the loan (interest and amortization).
  2. Calculate the net income.
  3. Calculate the CF to the firm.
  4. Calculate the CF to equity.

- **Loan**: Using the annuity formula we calculate the loan installment:

$$5{,}000{,}000 = C\left(\frac{1}{0.058} - \frac{1}{0.058(1+0.058)^{10}}\right)$$

which gives $C = 672{,}917$.

4. A new project for a retail firm

Table 1: Interest and principal payments on debt				
Year	Total payment	Interest	Principal repaid	Remaining principal
0				5,000,000
1	672,917	290,000	382,917	4,617,083
2	672,917	267,791	405,127	4,211,956
3	672,917	244,293	428,624	3,783,332
4	672,917	219,433	453,484	3,329,848
5	672,917	193,131	479,786	2,850,062
6	672,917	165,304	507,614	2,342,448
7	672,917	135,862	537,055	1,805,393
8	672,917	104,713	568,205	1,237,188
9	672,917	71,757	601,160	636,028
10	672,917	36,890	636,028	0

4. A new project for a retail firm

- **Net income**: This is given as

$$net\ income = taxable\ income\ - taxes$$

  - The taxable income is given as

$$taxable\ income = EBIT - Interest$$

  - The EBIT is given as

$$EBIT = Revenues - operating\ expenses - Dep$$

  - The taxes are $taxes = tax\ rate \times taxable\ income$
  - The depreciation is equal to $\frac{20{,}000{,}000}{10} = 2{,}000{,}000.$

4. A new project for a retail firm

Table 2: Net income								
Year	Revenues	Operating expenses	Depreciation	EBIT	Interest	Taxable income	Taxes	Net income
1	40,000,000	36,000,000	2,000,000	2,000,000	290,000	1,710,000	598,500	1,111,500
2	42,000,000	37,800,000	2,000,000	2,200,000	267,791	1,932,209	676,273	1,255,936
3	44,100,000	39,690,000	2,000,000	2,410,000	244,293	2,165,707	757,997	1,407,709
4	46,305,000	41,674,500	2,000,000	2,630,500	219,433	2,411,067	843,873	1,567,193
5	48,620,250	43,758,225	2,000,000	2,862,025	193,131	2,668,894	934,113	1,734,781
6	51,051,263	45,946,136	2,000,000	3,105,126	165,304	2,939,823	1,028,938	1,910,885
7	53,603,826	48,243,443	2,000,000	3,360,383	135,862	3,224,521	1,128,582	2,095,938
8	56,284,017	50,655,615	2,000,000	3,628,402	104,713	3,523,689	1,233,291	2,290,398
9	59,098,218	53,188,396	2,000,000	3,909,822	71,757	3,838,065	1,343,323	2,494,742
10	62,053,129	55,847,816	2,000,000	4,205,313	36,890	4,168,423	1,458,948	2,709,475

4. A new project for a retail firm

- **CF to the firm:** We already know the EBIT from which we can calculate the after-tax operating earnings. To that we add the depreciation and the change in working capital.
- **How to measure the change in working capital?**
  - At year 0 the working capital investment in $3.2 million.
  - From that year onwards change in working capital is the 8% of change in revenues.
    - The revenues at year 1 are expected to be $40,000,000. Those of year 2 are $42,000,000. So revenues have increased during the 2nd year by 2,000,000. The change in working capital is $2{,}000{,}000 \times 8\% = 160{,}000$. As investment in working capital is made at the beginning of each period we have to account for an investment (cash outflow) of 160,000 at year 1.
    - At the end of the project the entire investment in working capital is recovered. So at year 10 we have a cash inflow which is equal to the sum of all previous working capital investments. This is equal to 4,964,250.

4. A new project for a retail firm

Table 3: Cash flows to firm							
Year	Capital expenditure	EBIT	Operating earnings	Depreciation	Change in working capital	Salvage value (after-tax)	CF to firm
0	-20,000,000				-3,200,000		-23,200,000
1		2,000,000	1,300,000	2,000,000	-160,000		3,140,000
2		2,200,000	1,430,000	2,000,000	-168,000		3,262,000
3		2,410,000	1,566,500	2,000,000	-176,400		3,390,100
4		2,630,500	1,709,825	2,000,000	-185,220		3,524,605
5		2,862,025	1,860,316	2,000,000	-194,481		3,665,835
6		3,105,126	2,018,332	2,000,000	-204,205		3,814,127
7		3,360,383	2,184,249	2,000,000	-214,415		3,969,833
8		3,628,402	2,358,461	2,000,000	-225,136		4,133,325
9		3,909,822	2,541,384	2,000,000	-236,393		4,304,991
10		4,205,313	2,733,453	2,000,000	4,964,250	4,875,000	14,572,704

4. A new project for a retail firm

- **CF to equity**: We already know the net income to which we can add the depreciation, the change in working capital and the net debt to get the CF to equity.
- **How the calculate the net debt?**
  - It is the difference between the new debt issued by the firm and the debt repayments.
  - Firm issues new debt only once at year 0 equal to $5,000,000.
  - From year 1 up to 10 it repays this debt. Debt repayments are equal to the principal payments.

4. A new project for a retail firm

Table 4: Cash flows to equity investors							
Year	Capital expenditure	Net income	Depreciation	Principal repaid	Change in working capital	Salvage value (after-tax)	CF to equity
0	-20,000,000			5,000,000	-3,200,000		-18,200,000
1		1,111,500	2,000,000	-382,917	-160,000		2,568,583
2		1,255,936	2,000,000	-405,127	-168,000		2,682,809
3		1,407,709	2,000,000	-428,624	-176,400		2,802,685
4		1,567,193	2,000,000	-453,484	-185,220		2,928,489
5		1,734,781	2,000,000	-479,786	-194,481		3,060,514
6		1,910,885	2,000,000	-507,614	-204,205		3,199,066
7		2,095,938	2,000,000	-537,055	-214,415		3,344,468
8		2,290,398	2,000,000	-568,205	-225,136		3,497,057
9		2,494,742	2,000,000	-601,160	-236,393		3,657,189
10		2,709,475	2,000,000	-636,028	4,964,250	4,875,000	13,912,698

5. Free cash flow to equity discount models

- In Ch.4 we have written the dividend discount model to calculate the current price of the stock. There are at least two problems with the use of dividends:
  - If the firm is privately held, owners withdraw cash not in the form of dividends. Even in publically traded firms stockholders may be compensated in different forms (stocks buy-back).
  - The model assumes that the firm pays out what it can afford in the form of dividends. When this is not the case then the model will estimate the value of stocks incorrectly.
- To solve the problem we need a broader definition of cash flows that we call **free cash flows to equity (FCFE)**.
- The definition of the FCFE is the same to the CF to equity given previously, but now the variables refer to the entire firm and not to a specific project.
- Once you have estimated the FCFE you can discount them to estimate the value of firm's equity.
- For example if the FCFE will grow at a constant growth rate g we have that

$$V_0 = \frac{FCFE_1}{r - g}$$

CHAPTER 7

INVESTMENT DECISION RULES

1. Investment decision rules

- In this chapter we are going to discuss various **investment decision rules (capital budgeting techniques)**.
- They allow to formalize the process and set the conditions need to be met for a project to be undertaken.
- We already know one such rule, the NPV. If NPV > 0 then the project should be undertaken.
- Analyze four different investment decision rules:
  - Accounting income-based decision rules.
  - Cash flow-based decision rules.
  - Payback period.
  - Internal rate of return.

2. Accounting income-based rules

- **Return on capital (ROC)**: It is the fraction of after-tax operating earnings to the average book value of total investment in the project.

$$ROC = \frac{EBIT(1-\tau)}{\text{Avg. BV}}$$

- *Decision rule*: If the average ROC across time > cost of capital then the project should be undertaken.

2. Accounting income-based rules

- **Example**:

Period	0	1	2	3	4
BV of Inv.	1,500	1,300	1,100	900	700
EBIT(1-τ)		180	240	300	360
ROC		**12.86%**	**20%**	**30%**	**40%**

- For example the 1st period ROC is equal to 180/1,400 = 12.86%, where 1,400 is the average of the BV of investment between period 0 and 1.
- The average ROC is equal to 26.96%.
- A different way to estimate an "average ROC" is to use the average after-tax operating earnings and the average BV of investment over time. This is equal to 270/1,100 = 24.54%.
- If the cost of capital is lower to the average ROC then the project should be undertaken.

2. Accounting income-based rules

- **Return on equity (ROE)**: It is the fraction of net income to the average book value of equity investment in the project.

$$ROE = \frac{net\ income}{Avg.BV\ of\ equity}$$

- *Decision rules*: If the average ROE across time > cost of equity then the project should be undertaken.
- **Drawbacks of these rules**:
  - They are affected by accounting choices.
  - They are not equivalent to firm value maximization, as accounting income are not equal to cash flows and they ignore the time value of money.
  - They work better for projects that have a large up-front payment and generate income over time.

3. Cash flow-based rules

- **Cash return on capital (ROC)**: It is the fraction of cash operating income to the average book value of investment.
- $Cash\ operating\ income = EBIT(1-\tau) + noncash\ expenses$
- $Cash\ ROC = \frac{cash\ operating\ income}{Avg.\ BV}$
- *Decision rule*: Accept the project if the average cash ROC > cost of capital.
- **Cash return on equity (ROE)**: It is the fraction of cash equity income to the average book value of equity investment.
- $Cash\ equity\ income = net\ income + noncash\ expenses$
- $Cash\ ROE = \frac{cash\ equity\ income}{Avg.\ BV\ of\ equity}$
- *Decision rule*: Accept the project if the average cash ROE > cost of equity.

4. Payback period

- **The payback period** measures how quickly the cash flows generated by the project cover the initial investment.
- Intuitively, projects that return their investments sooner can be considered more attractive, since all cash flows earned beyond that point in time can be considered as profit on the project.
- **Example**:

	Cash flows				
Project	C_0	C_1	C_2	C_3	Payback period
A	-2,000	500	500	5,000	3
B	-2,000	500	1,800	0	2
C	-2,000	1,800	500	0	2

4. Payback period

- *Drawbacks*:
  - It does not take into consideration all cash flows.
  - It does not account for the time value of money.
  - Recouping the initial investment is not enough to create value as this amount of money could be invested elsewhere and earned a higher return.
  - It is designed for projects with a large up-from payment which is followed by positive cash flows.

5. Internal rate of return

- The **internal rate of return (IRR)** is the discount rate that makes the NPV equal to 0.
- *Decision rule*: If the IRR > cost of capital then the project should be undertaken.
- **Example**:

Cash flows		
C_0	C_1	C_2
-4,000	2,000	4,000

- The IRR solves the following equation:

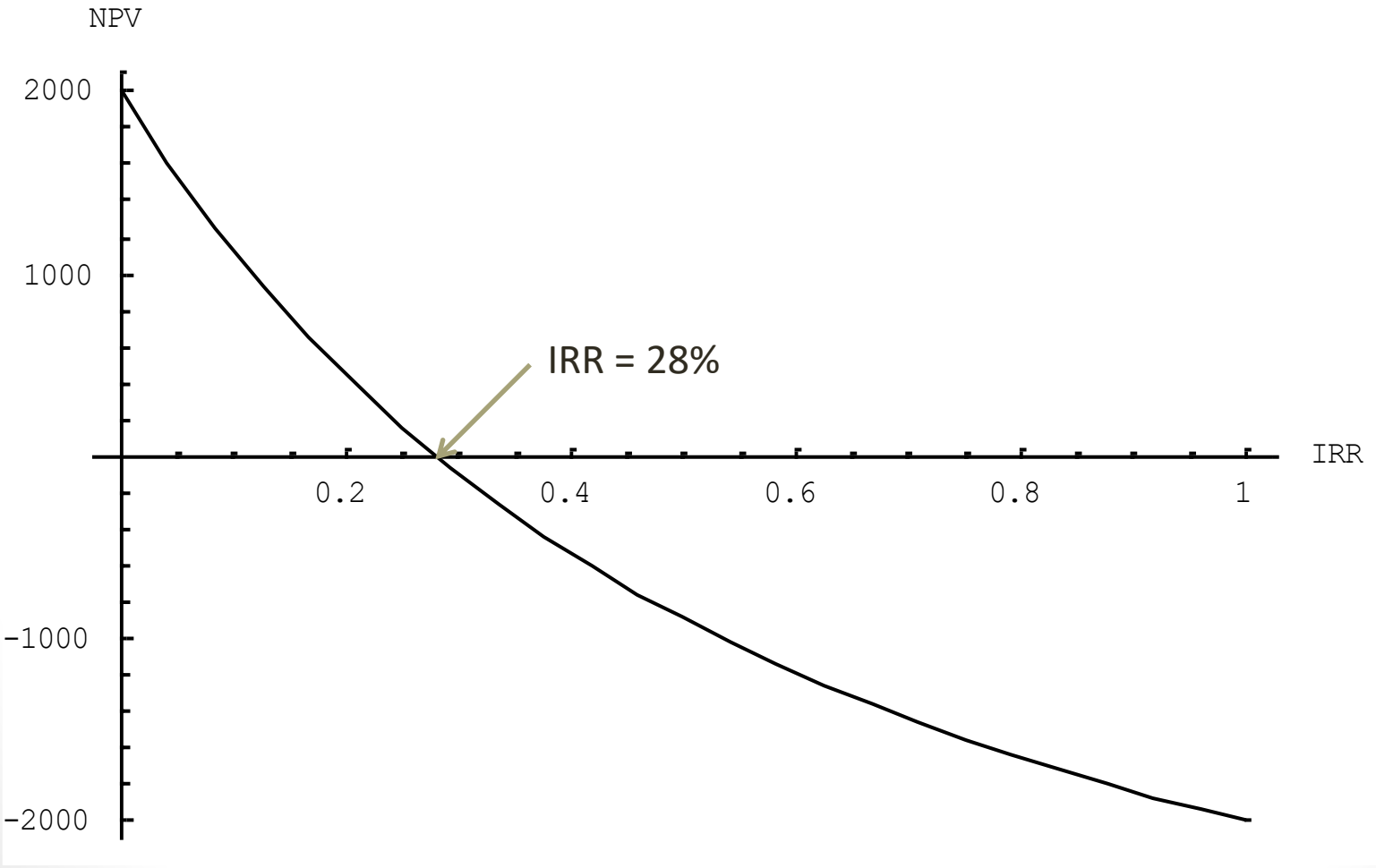
$$0 = -4{,}000 + \frac{2{,}000}{1 + IRR} + \frac{4{,}000}{(1 + IRR)^2}$$

- Set $1 + IRR = x$ and rearranging terms we have:

$$0 = -4{,}000x^2 + 2{,}000x + 4{,}000$$

- This a polynomial of order 2 that we can easily solve in order to calculate the IRR. This is equal to 28%.

5. Internal rate of return



5. Internal rate of return

- The order of the polynomial increases with the life of the project. For a 10-year project we solve a 10^{th} order polynomial.
- How we do that? NUMERICALLY (see Excel function IRR).
- **Proposition**: Consider a project for which $C_i < 0$ for $i \leq t$ and $C_i > 0$ for $i > t$ and $C_0 + C_1 + \cdots + C_N > 0$. Then it exists a unique IRR in the interval [0, 1] such as the NVP = 0. Also for OCC < IRR the NVP > 0 and for OCC > IRR the NPV < 0.
- If the conditions of the proposition are satisfied, the NPV and the IRR rules are equivalent.

5. Internal rate of return

- **Disadvantages**:
  - Multiple IRRs, especially when cash flows change sign more than one time. In that case we can use this framework of analysis to plot the *NPV profile.* This can gives us an idea for which discount rates the NPV is positive.
  - In mutually exclusive projects choosing the one with the largest IRR is not equivalent to value maximization.
    - Differences in scales. The IRR tends to prefer projects with low initial investment which don't have always the largest NPV.
    - Differences in the pattern of cash flows over time. The IRR tends to prefer projects which have large positive cash flows in the earlier years. This is not always equivalent with value maximization especially when discount rates are low.

CHAPTER 8

FINANCIAL ANALYSIS

1. The goal of financial analysis

- Financial analysis is about:
  - Analyzing financial statements to understand the firm's overall performance.
  - Use **financial ratios** to get a snapshot for the current situation of the firm.
- Two broad categories of financial ratios:
  - Ratios related to investment decisions.
  - Ratios related to financing decisions.
- Financial statements include:
  - Balance sheet: A snapshot of the assets and the sources of the money used to buy these assets.
  - Income statement: Shows the profitability of the firm during a period of time.

2. Financial statements

- **Balance sheet**
  - **Assets** (in declining order of liquidity)
    - **Current assets**: Cash, marketable securities, accounts receivables, inventory.
    - **Long-term investments**: Securities that the firm has no intention to sell the following years.
    - **Tangible assets**: Property, plants and equipment.
    - **Intangible assets**: Patents, trademarks.
  - **Liabilities**
    - **Current liabilities**: Debt due to be repaid next year, accounts payables.
    - **Long-term liabilities**: Debt or leases not to be repaid next year.
  - **Equity**
    - **Common stock**: The initial capital received by the firm when it has issued equity.
    - **Retained earnings**: Net income minus the dividends paid out.
    - **Treasury stocks**: The book value of stocks brought back by the firm.
- Assets = Liabilities + Equity

2. Financial statements

Table 1: IBM balance sheet, 2014			
Assets		**Liabilities**	
Current Assets		**Current Liabilities**	
Cash And Cash Equivalents	8,476,000	Accounts Payable	21,992,000
Short Term Investments	-	Short/Current Long Term Debt	5,731,000
Net Receivables	33,875,000	Other Current Liabilities	11,877,000
Inventory	2,103,000	**Total Current Liabilities**	39,600,000
Other Current Assets	4,967,000	Long Term Debt	35,073,000
Total Current Assets	49,421,000	Other Liabilities	27,153,000
Long Term Investments	16,712,000	Deferred Long Term Liability Charges	3,691,000
Property Plant and Equipment	10,771,000	Minority Interest	146,000
Goodwill	30,556,000	Negative Goodwill	-
Intangible Assets	3,104,000	**Total Liabilities**	105,663,000
Accumulated Amortization	-	**Stockholder Equity**	
Other Assets	2,160,000	Misc Stocks Options Warrants	-
Deferred Long Term Asset Charges	4,808,000	Redeemable Preferred Stock	-
Total Assets	117,532,000	Preferred Stock	-
		Common Stock	52,666,000
		Retained Earnings	137,793,000
		Treasury Stock	-150,715,000
		Capital Surplus	-
		Other Stockholder Equity	-27,875,000
		Total Stockholder Equity	11,869,000
		Total liabilities and stockholder equity	117,532,000

2. Financial statements

- **Income statement**: Shows the net income applicable to common stockholders.
  - Gross profit = Revenues – cost of goods sold
  - Operating income = Gross profit – operating expenses
  - Net income for continuing operation = Operating income – depreciation – interests – taxes
  - Net income = Net income for continuing operations ± income for discontinuous operations

2. Financial statements

Table 2: IBM income statement, 2014	
Total Revenue	92,793,000
Cost of Revenue	46,386,000
Gross Profit	46,407,000
Operating Expenses	
Research Development	5,437,000
Selling General and Administrative	22,438,000
Non Recurring	-
Others	-
Operating Income or Loss	18,532,000
Income from Continuing Operations	
Total Other Income/Expenses Net	1,938,000
Earnings Before Interest And Taxes	20,470,000
Interest Expense	484,000
Income Before Tax	19,986,000
Income Tax Expense	4,234,000
Minority Interest	-
Net Income From Continuing Ops	15,752,000
Non-recurring Events	
Discontinued Operations	-3,729,000
Extraordinary Items	-
Effect Of Accounting Changes	-
Other Items	-
Net Income	12,023,000
Preferred Stock And Other Adjustments	-
Net Income Applicable To Common Shares	12,023,000

3. Measuring performance

- **Market value added** = Market value – book value of shareholders equity.
  - At the end of 2014 the market capitalization of IBM was $147.31 billion. So the market value added = 147.31 – 11.869 = 135.321.
- **Market-to-book ratio**: The fraction of market to book value of equity.

$$Market - to - book\ ratio = \frac{market\ value}{book\ value}$$

  - For IBM this is equal to 147.31/11.869 = 12.41.
- Performance is based on market value. But this can be a noisy measure:
  - Market values are formed based on expectations about *future* not current performance.
  - Market values are affected by macroeconomic events.

3. Measuring performance

- To overcome these problems we turn on accounting measures of performance.
- **Economic value added (EVA)**: The profit after deducing all costs *including the cost of capital.* The firm creates value only if it can earn more than the cost of capital.

$$EVA = net\ income\ to\ investors\ - capital \times cost\ of\ capital$$

  - Net income to investors (stockholders + bondholders) at time t = net income + after-tax interest
  - Capital = equity + long-term debt at time t-1.
  - The capital invested in IBM at the end of 2013 was $55.648 billion.
  - The net income for investors at the end of 2014 was 12.023 + (1 – 0.21)×0.484 = 12.405.
  - The cost of capital is estimated to be equal to 8%.
  - EVA = 12.405 – 55.648×0.08 = 12.405 – 4.452 = 7.953 billion.

3. Measuring performance

- We can re-express EVA as follows:

ROC

$$EVA = \left(\frac{net\ income\ to\ investors}{capital} - cost\ of\ capital \right) \times capital$$

- **Return on capital (ROC)**: The income to investors per dollar invested by them.
- When ROC > cost of capital then EVA > 0.
- ROC and other accounting-based rates of return can be used to measure performance.
  - For IBM, ROC = 12.405/55.648 = 22.3%.
- **Return on equity (ROE)**: The income to stockholders per dollar invested by them.

$$ROE = \frac{net\ income}{book\ value\ of\ equity}$$

  - For IBM, ROE = 12.023/22.792 = 52.75%.

3. Measuring performance

- **Return on assets (ROA)**: The net income to the firm's investors per dollar of the firm's total assets.

$$ROA = \frac{net\ income\ to\ investors}{total\ assets}$$

  - For IBM, ROA = 12.405/126.223 = 9.82%.
- **Advantages**: As they are not based on market values they provide a measure of current performance without being affected by future expectations and macroeconomic events.
- **Drawbacks**:
  - Using book values we do not fully account for the true value that the firm has created through intangible assets. If we have done that the value of capital would increase and accounting-based returns will decrease.
  - Firms that brought back substantial amount of equity (like IBM) show very high ROE.

4. Measuring efficiency

- **Asset turnover ratio**: The volume of sales generated per dollar of total assets.

$$Asset\ turnover = \frac{sales}{total\ assets}$$

  - For IBM, Asset turnover = 92.793/126.223 = 73.5%.
- **Profit margin**: The proportion of net income on sales.

$$Profit\ margin = \frac{net\ income}{sales}$$

  - For IBM, Profit margin = 12.023/92.793 = 12.95%.
- If we take into account the revenues generated for bondholders we define the **operating profit margin** as:

$$Operating\ profit\ margin = \frac{net\ income\ to\ investors}{sales}$$

  - For IBM, Operating profit margin = 12.405/92.793 = 13.36%.

4. Measuring efficiency

- We can decompose the ROA to the asset turnover and the operating profit margin as follows:

$$ROA = \frac{net\ income\ to\ investors}{total\ assets}$$

$$= \frac{sales}{total\ assets} \times \frac{net\ income\ to\ investors}{sales}$$

- This is the **Du Pont formula**.
- This formula explains the reported ROA. For example, ROA could be low either because
  - Asset turnover is low (the firm does not make an efficient use of its assets).
  - Operating profit margin is low (the firm does not operate efficiently as a large part of the revenues goes to cover the costs).

5. Measuring leverage

- Bondholders receive a fixed stream of payments which are certain.
- Stockholders income varies according to the profits of the firm.
- Debt (which is used to buy new assets) increases stockholders return in good times and reduces it in bad times. For that reason, it is said to create **financial leverage**.
- Leverage ratios measure how much financial leverage has been taken by the firm.
- **Long-term debt ratio**: The proportion of long-term debt to long-term capital.

$$Long\ term\ debt\ ratio = \frac{long\ term\ debt}{long\ term\ capital}$$

  - For IBM, the long-term capital = 35.073 + 11.869 = 46.942 and the long-term debt ratio = 35.073/46.942 = 74.7%.
- **Long-term debt-equity ratio**:

$$Long\ term\ debt\ equity\ ratio = \frac{long\ term\ debt}{equity}$$

  - For IBM, Long-term debt-equity ratio = 35.073/11.869 = 295%.

5. Measuring leverage

- **Total debt ratio**:

$$total\ debt\ ratio = \frac{total\ liabilities}{total\ assets}$$

  - For IBM, total debt ratio = 105.663/117.532 = 90%.
- To measure the ability of the firm to repay its debt we use the **times-interest-earned ratio** defined as:

$$times\ interest\ earned\ ratio = \frac{EBIT}{interests}$$

  - For IBM, times-interest-earned ratio = 20.470/0.484 = 42.29.
- If in the previous definition of EBIT we add back depreciation we calculate the **cash coverage ratio**.
- Leverage has a role to play in ROE.
  - If leverage = 0 then, ROE = ROA.
  - If the firms has issued debt then ROE exceeds ROA especially when the firm performs well.

6. Measuring liquidity

- We are interested to measure the ability of the firm to meet its obligations in cash at the time these are due. To do so, we examine several **measures of liquidity**.
- Current assets are the most liquid assets of the firm. These can be converted quickly and cheaply into cash.
- Of course to much liquidity is not always a good thing. It may indicate inefficient use of capital.
- **(Net) Working capital** = current assets – current liabilities
  - For IBM, working capital = 49.421 – 39.600 = 9.821
- **Net working capital-to-total assets ratio** is the ratio of net working capital to total assets.
  - For IBM, this is equal to 9.821/117.532 = 8.35%.

6. Measuring liquidity

- **Current ratio**: The ratio of current assets to current liabilities.
  - For IBM, this is equal to 49.421/39.600 = 1.25. So, IBM has $1.25 in current assets for every dollar in current liabilities.
- If we use only the most liquid current assets in the definition of current ratio we have the **quick ratio**.

$$quick\ ratio = \frac{cash + marketable\ securities + receivables}{current\ liabilities}$$

  - For IBM, this is equal to (8.476 + 33.875)/39.600 = 1.07.
- If we narrow even more the definition of "liquid" current assets we define the **cash ratio**.

$$cash\ ratio = \frac{cash + marketable\ securities}{current\ liabilities}$$

  - For IBM, this is equal to 8.476/39.600 = 0.21.

7. Interpreting financial ratios

- After calculating these financial ratios you need to judge if these are high or low.
- For some of them there is a natural benchmark. If EVA > 0 or ROC > cost of capital then the firm has created wealth for investors.
- But for others there is no such benchmark.
- Financial ratios varies across sectors.
  - High-tech companies hold huge amount of cash, utilities hold very little. Liquidity measures would be high for the former and low for the latter.
  - Oil companies and utilities invest in fixed assets, software and computer companies have mainly current assets. Leverage measures would be high for the former and low for the latter.
  - Food retailers generate high levels of sales with few assets (high asset turnover) but they have a low operating profit margin.

7. Interpreting financial ratios

- So, it makes sense to compare the firm's financial ratios with those of its main competitors in the market.
- It is also interesting to examine these financial ratios across time. This would indicate, for example, if the good performance of the firm is temporary (due to an unexpected event) or it persists for a longer time period.

CHAPTER 9

WORKING CAPITAL MANAGEMENT

1. Working capital for investment analysis

- This chapter is about the financial management of short-term (current) assets and liabilities of the firm.
- Current assets and liabilities are the two components of **working capital**.
- **Current assets**: Cash, marketable securities, inventory, accounts receivable.
- **Current liabilities**: Short-term debt, long-term debt to come due within a year, accounts payable, accrued expenses.
- A long-term investment requires an investment in short-term assets for the operation of the project. These investments create cash inflow and outflow.
- We are interested in the effect of working capital in cash flows.

1. Working capital for investment analysis

- **Current assets**: Not all components of current assets have a net effect on cash flows. Their change in volume cannot be considered a cash inflow or outflow related to the operation of the project.
- We remove:
  - Cash in excess of that which is required from the day-to-day operations.
  - Marketable securities.
- *Only inventory and accounts receivable affect working capital calculation for investment analysis.*
- **Current liabilities**: We remove all current liabilities which earn a market interest rate, that is short and long-term debt that matures within a year.
- *Only accounts payable and accrued* expenses affect *working capital calculation for investment analysis.*
- We define **noncash working capital** as:

$$noncash\ working\ capital = noncash\ current\ assets - noninterest\ bearing\ current\ liabilities$$

1. Working capital for investment analysis

- **How much investment in working capital we need to expect for a project?**
- Inventory increases along the increase in revenues or operating expenses.
- Accounts receivable can also be related to revenues.
- So, investment in working capital should be related to revenues or cost of goods sold.
- Based on that we can specify working capital requirements :
  - As a percentage of revenues
  - As a percentage of operating expenses
  - Based on the volume of sales

1. Working capital for investment analysis

- Companies also use other information to estimate working capital needs.
  - Experience from past projects
  - Overall working capital requirements
  - Industry practice
- Cash inflow or outflow is measured by the change in working capital.
  - An increase in working capital generates a cash outflow.
  - A decrease in working capital generates a cash inflow.
- *So an increase in working capital has a negative impact in cash flows and NPV*.
- Thus (all other being equal) if we decrease the working capital we increase the NPV of the project.

1. Working capital for investment analysis

- However, they are practical on how much we can lower working capital.
  - Reducing inventory may harm production or the ability to meet customers need.
  - Reducing accounts receivable may negatively affect revenues.
  - Increase accounts payable (above a limit) may affect the creditworthiness of the firm.
- So, working capital may decrease as long as the benefits offset the costs.
- At the point where the marginal benefits are equal to the marginal costs we have the optimal level of working capital that maximizes the NPV.

2. Components of noncash working capital

- **Accounts receivable**: Consists of bills awaiting payment from another firm (**trade credit**) or a customer (**customer credit**).
- Firms offer credit in order to generate sales that would not have been occurred otherwise. So, offering credit increase sales and revenues.
- It involves two costs:
  - The default of the customer
  - Loses interest that would have been generated if the customer pays in cash (this can be offset by charging customers interest costs)
- Firm should offer credit if the benefits exceed the costs.

2. Components of noncash working capital

- **Example:** A retail firm examines the possibility to extend credit to its customers. Current revenues are $10 million and the pre-tax operating income is $2 million. The tax rate is 40% and the cost of capital is 10%.
- If it offers 1-year credit the firm expects the following to happen:
  - Revenues will increase by $1 million. Pre-tax operating income will remain at the 20% of the revenues.
  - The firm can earn 5% interest rate by investing the cash elsewhere.
  - Bad debts are expected to be 5% of the credit sales.
  - The credit strategy will remain for 5 years.

2. Components of noncash working capital

- **Pro's**: Extra revenues as a consequence of credit sales.
- **Con's**: Additional costs in terms of interest lost and bad debts.
- We need to assess if Pro's > Con's. If this is true then the firm will grand credit to its customers.
- **How to do that?** Using the PV of the *incremental cash flows* generated by credit sales.
- **Year 0**: Initial investment of $1 million in accounts receivable.
- **Year 1 to 4**: See following table.

2. Components of noncash working capital

Pre-tax operating income	$0.2 \times 1{,}000{,}000 = 200{,}000$
-Interest foregone	$-0.05 \times 1{,}000{,}000 = -50{,}000$
Pre-tax operating profit	$150{,}000$
After-tax operating profit	$(1 - 0.4) \times 150{,}000 = 90{,}000$
Tax benefit of credit sales loses	$0.4 \times 50{,}000 = 20{,}000$
Total after-tax profit	$110{,}000$
-Bad debts	$-50{,}000$
Total incremental cash flow	$60{,}000$

- **Year 5**: The firm collects $950,000 of accounts receivable without making a new investment. The incremental cash flow is $110,000 + $950,000 = $1,060,000.
- The PV of incremental cash flows is:

$$PV = -1{,}000{,}000 + 60{,}000 \times annuity\ factor(4, 10\%) + \frac{1{,}060{,}000}{(1 + 10\%)^5}$$

$$= -151{,}163$$

- **Conclusion**: Offering credit will decrease the value of the firm by $151,163, so it should not take this decision.

2. Components of noncash working capital

- The **term of sale** specify how the credit will be offered. It includes the length of the period and the interest rate on the credit. Alternatively, the firm can offer a discount in customers pay on advance.
- Example: If the customer pays within 15 days of the sale he receives a 4% discount. Otherwise, he has an extra 45 days to make the payment. This is refereed as **4/15 net 60**.
- This 4% discount implies an effective interest rate r that the customer who buys with credit should pay.
- For \$1 of goods sold this is equal to:

$$\left(\left(\frac{1}{0.96}-1\right)+1\right)^{(365/45)} = 1+r \Rightarrow r = 39.25\%$$

45-day return

2. Components of noncash working capital

- **Accounts payable**: The unpaid bills from the part of the firm arises from the goods and services that it purchases.
- As goods and services are used in production, accounts payable tend to increase with revenues and current assets.
- All others being equal, the increase in accounts payable decrease working capital requirements and increase the value of the project.
- There may be a cost however, as there is a often a discount on the price if the firm pays immediately.
- This is an interest cost for paying latter. If this is higher than the cost of debt it is better for the firm to borrow and pay in cash (or negotiate better terms of sale).

3. Cash

- Cash is held in two forms:
  - Currency.
  - Investments earning no-interest or below-market interest rates (saving or checking accounts).
- Why to hold cash, given that it does not pay interest (or it pays to little)?
  - **Transaction motive (liquidity)**: To meet the needs that arise in the course of doing business. Depends on the sector and on seasonal factors.
  - **Precaution:** To meet unexpected needs. Depends on the volatility of revenues and costs and the access of the firm to external financing.
  - **Compensating balances**: This is a cash balance that a bank requires to provide the firm its services.

3. Cash

- **How much cash to hold?**
- If you are to choosing between cash and marketable securities you need to think of the costs that you incur by holding cash (the interest foregone) and the benefits (the transaction costs that you pay when you sell a security to pay your bills in cash).
- **Baumol model** sets an optimal cash balance according to the previous argument.

$$optimal\ cash\ balance = \sqrt{\frac{2 \times cash\ usage\ rate \times transaction\ cost}{interest\ rate}}$$

4. Marketable securities

- **Marketable securities**: Short-term investments that earn a market return, with little or no risk, and can be quickly converted in cash.
- The market for these securities is known as the **money market**.
- Marketable securities are *discount securities.* They don't offer a nominal interest. The return consists of the difference between the amount you pay to acquire the security and the amount you receive at maturity.
- The main money-market securities are:
  - **Treasury bills (Tbills)**: Short-term bonds issued by the US government. They are issued every week and have a maturity less than a year.
  - Unlike other bonds they are quoted on a *bank discount basis* (simple compounding as a percentage of face value). For example the price of a 180-day treasury bill with a face value of $100 is equal to $97.5. The quoted yield would be

$$yield\ on\ a\ bank\ discount\ basis = \left(\frac{100 - 97.5}{100}\right)\left(\frac{360}{180}\right) = 5\%.$$

4. Marketable securities

- This is not equal to the return that this investment provides The return can be calculated as:

$$return = \left(\frac{100}{97.5}\right)^{(365/180)} - 1 = 5.27\%.$$

- **Commercial papers**: Short-term debt issued by corporations.
- **Repurchase agreement (repo)**: A sale of a security with the agreement that the security will be bought back at a specified price at the end of the period. We can view that as a secured loan, where the security is the collateral of the loan.
- It is the most liquid money-market instrument as it can mature in a very short period, even after 1 day (overnight repo).
- Example: A dealer sells $50 millions of Tbills to a corporation at a price of $49.98 million agreeing to buy them back after 2 days for $50 millions. The **repo rate** is equal to:

$$repo\ rate = \left(\frac{50 - 49.98}{50}\right)\left(\frac{360}{2}\right) = 7.2\%.$$

- This is equivalent to the yields on a bank discount basis of Tbills. We can calculate the return of this investment using the same approach as in the case of Tbills.

CHAPTER 10

RISK-RETURN

1. Measuring the variability of an investment

- **Risk** is related to the *uncertainty* of an investment. Some possible outcomes are not desirables because they will cause a decrease in the value of the investment.
- The possibility of the appearance of these bad outcomes generates risk.
- Figure 1 (time-series plot) shows the annual returns of the US stock market during the last century.
- We observe large fluctuations from year to year. For example losses exceeds 25% in 5 years.
- Another way to present these data is by a histogram (see Figure 2).
- There is 6% probability to observe a return lower than 20% in the sample.

1. Measuring the variability of an investment

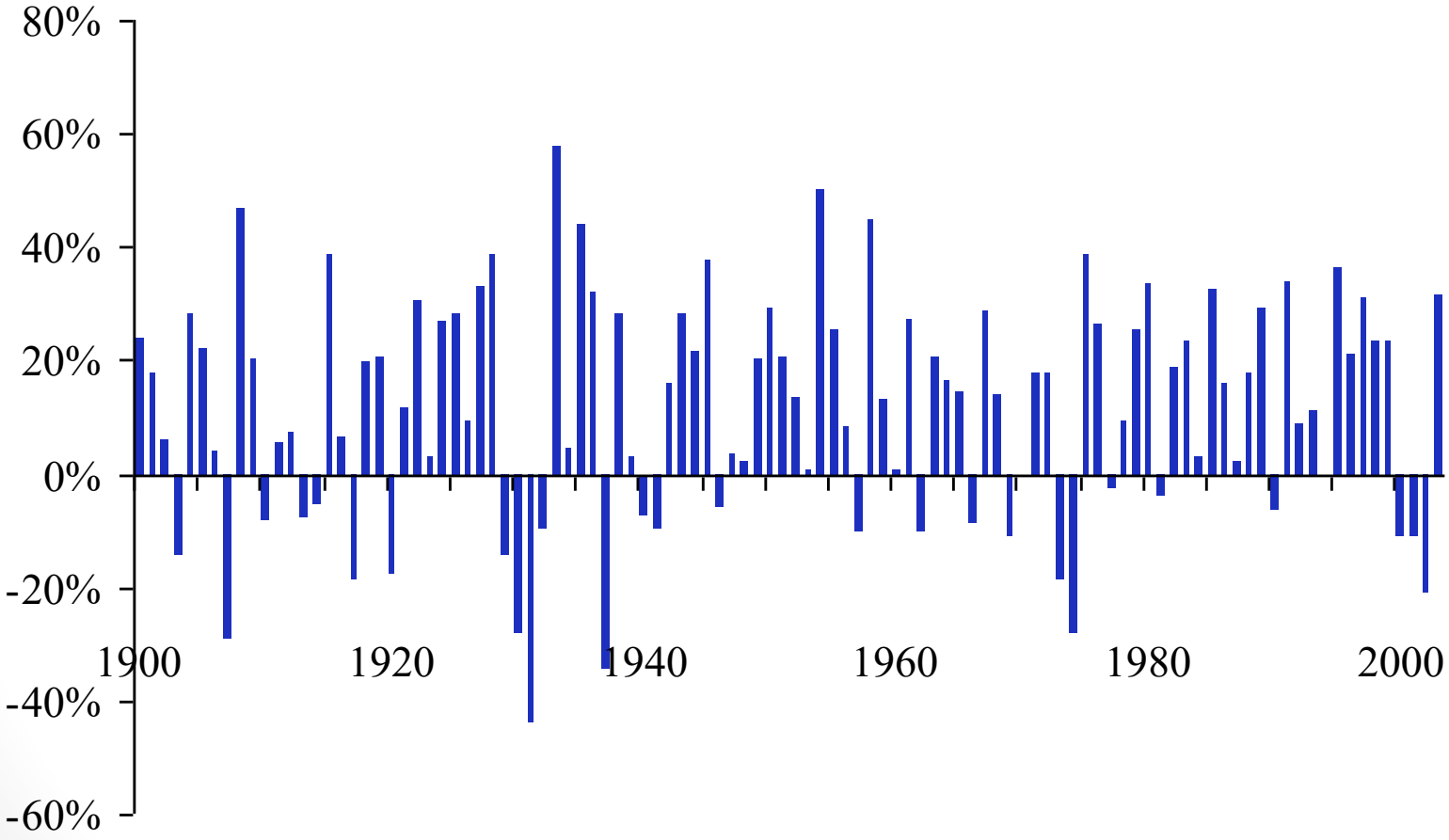


Figure 1: Historical returns of the US stock market, 1900 -2000.

1. Measuring the variability of an investment

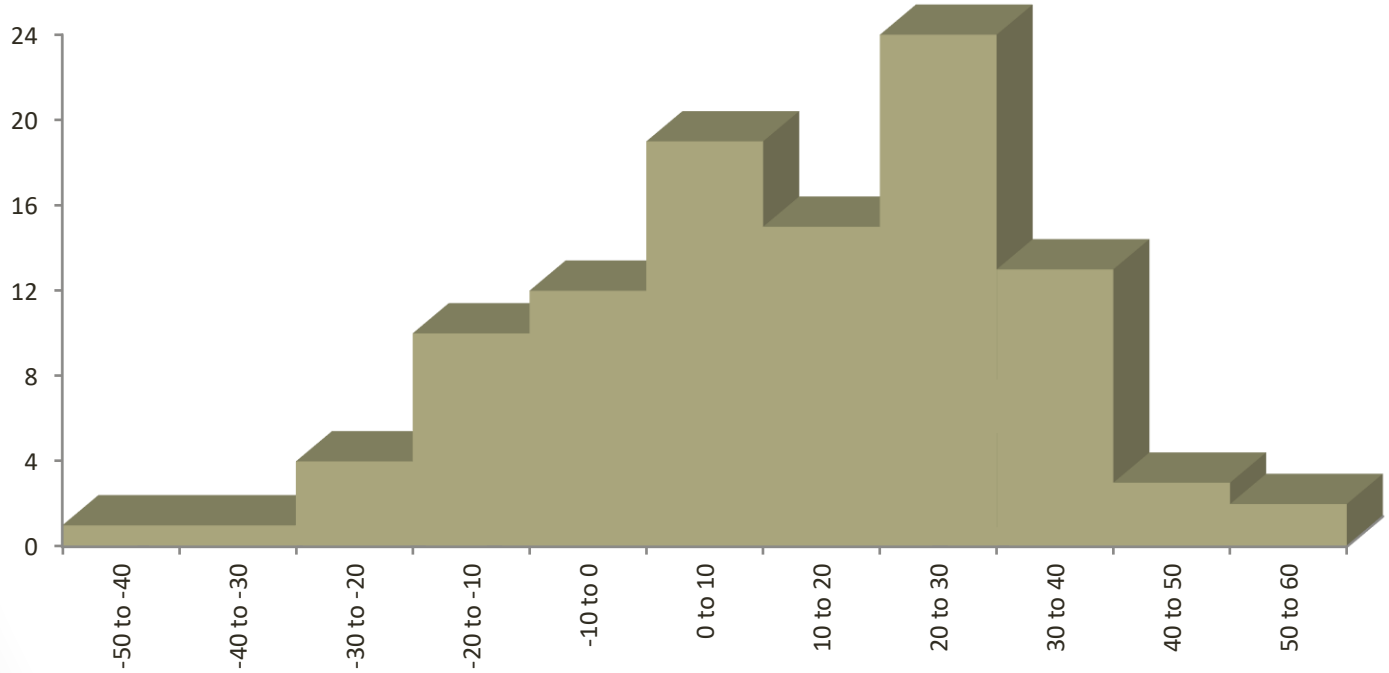


Figure 2: Histogram of US stock market annual returns, 1900-2000.

1. Measuring the variability of an investment

- The standard statistical measure of variability is the **variance** (denoted as σ^2) or the **standard deviation** (denoted as σ) .
- The larger the variance (standard deviation) the more probable for an investment to have extreme (bad or good) outcomes.
- To estimate these parameters you need to assume a model that will explain how the returns of the investment will evolve in the future.
- Given a sample we can calculate the **sample variance** (**sample standard deviation**). Under appropriate assumptions this is an estimate of the respective population parameters.
- If $R_1, R_2, \dots, R_N$ is a sample of N returns then the sample variance is given as:

$$s^2 = \frac{1}{N-1}\sum_{i=1}^{N}(R_i - \bar{R})^2$$

  where $\bar{R} = \frac{1}{N}\sum_{i=1}^{N} R_i$ is the sample mean.
- For the previous sample of US stock market annual returns the sample standard deviation (the square root of the sample variance) is equal to 20.1%.

2. Calculating portfolio risk

- Investors do not hold a single asset. They invest in a basket of securities, forming a **portfolio**.
- How to measure the variability of the portfolio, given that of the individual securities?
- Assume that the portfolio consists of two securities. Let denote as $E(R_1)$, $E(R_2)$ and σ_1, σ_2 the expected returns and the standard deviations of the two securities, respectively.
- Let also denote as x_1 and x_2 the fraction of wealth invested in the two assets. These are the **weights** of the portfolio.
- The expected return of the portfolio is the weighted average of the expected returns of the two assets:

$$E(R) = x_1 E(R_1) + x_2 E(R_2)$$

- If, for example, $E(R_1) = 10\%$, $E(R_2) = 15\%$ and $x_1 = 60\%$, $x_2 = 40\%$ then $E(R) = 0.6 \times 0.1 + 0.4 \times 0.15 = 0.12$, or 12%.

2. Calculating portfolio risk

- To measure the variance of a portfolio we need to define the **covariance** between the returns of the two securities.
- Covariance, denoted as $Cov(R_1, R_2)$, measures the linear association of the two returns.
- To better appraise that we can use the **correlation coefficient** defined as

$$\rho = \frac{Cov(R_1, R_2)}{\sigma_1 \sigma_2}$$

- This coefficient is between -1 and 1.
  - If $\rho = 0$ then the two returns are *uncorrelated*.
  - If $\rho > 0$ then the two returns are *positively correlated*. If R_1 increases then R_2 tends to increase.
  - If $\rho < 0$ then the two returns are *negatively correlated*. If R_1 increases then R_2 tends to decrease.

2. Calculating portfolio risk

- The variance of the portfolio is given as:

$$Var(R) = {x_1}^2{\sigma_1}^2 + {x_2}^2{\sigma_2}^2 + 2x_1x_2Cov(R_1, R_2)$$
$$= {x_1}^2{\sigma_1}^2 + {x_2}^2{\sigma_2}^2 + 2x_1x_2\rho\sigma_1\sigma_2$$

- If the standard deviation of the stocks is $\sigma_1 = 18.2\%$ and $\sigma_2 = 27.3\%$, and the correlation coefficient is $\rho = 0.4$, then

$$Var(R)$$
$$= 0.6^2 0.182^2 + 0.4^2 0.273^2 + 2 \times 0.6 \times 0.4 \times 0.4 \times 0.182 \times 0.273 = 0.033$$

- The standard deviation of the portfolio is $\sqrt{0.033} = 0.183$ or 18.3%.

2. Calculating portfolio risk

- **Comments**:
  - The important parameter of the portfolio variance formula is the correlation coefficient (or the covariance).
  - A correlation coefficient lower than 1 implies that the investor is rewarded in terms of risk-return tradeoff if he invests in the portfolio instead on an individual security.
  - **Why?** If the two securities are not perfectly positively correlated then when the one loses the other may win. This reduces the overall variability of the investment.
  - Inspect the expected return-variance relation of security #1 and that of the portfolio. For an extra 2% expected return the variability only increases by 0.1%.
  - The reduction of variability by investing in a variety of assets is called **diversification**.
  - *Financial theory dictates that because of the diversification any rational investor should invest in portfolios of assets rather than in individual securities. For this rational investor the risk of his/her position can be measured by the standard deviation of the portfolio.*

2. Calculating portfolio risk

- The effect of diversification increases we respect to the number of securities included in the portfolio.
- But even if we use a very large number of assets in the formation of the portfolio we cannot eliminate the risk of portfolio.
- Two kinds of risk:
  - **Unique or unsystematic or diversifiable risk**: The risk that can be eliminated through diversification. It is related to the individual business of a firm.
  - **Market or systematic or undiversifiable risk**: The risk that cannot be eliminated through diversification. It is related to economy-wide (macroeconomic) uncertainties that affect all businesses.
- **Well-diversified portfolio**: A portfolio in which the exposure to the unique risk of the assets has disappeared.

3. How individual securities affect portfolio risk

- Rational investors hold well-diversified portfolios. They are not interested on the risk of a security *in general* but *in the effect each security will have on the risk of the portfolio*.
- **Question**: How to measure this effect?
- The portfolio variance formula can be re-written as:

$$Var(R) = x_1\sigma_{1p} + x_2\sigma_{2p}$$

  where σ_{1p} and σ_{2p} is the covariance of the portfolio with security #1 and #2, respectively.
- This formula implies that $x_1\ \sigma_{1p}/Var(R)$ % and $x_2\ \sigma_{2p}/Var(R)$ % of the total risk is due to security #1 and #2, respectively.
- So, the effect of security #i on the portfolio risk is measured by the term $\sigma_{ip}/Var(R)$.

3. How individual securities affect portfolio risk

- From all well-diversified portfolios there is one with special interest. It is the **market portfolio**. It contains all securities traded in the financial market, with each asset weighted in proportion to its presence (market cap) in the market.
- Investors are interested on the effect of each security on the risk of the market portfolio. Following the previous discussion this is given by $\sigma_{im}/{\sigma_m}^2$ where ${\sigma_m}^2$ is the variance of the market portfolio.
- This coefficient is known as the **beta of the individual security i**. So, $\beta_i = \sigma_{im}/{\sigma_m}^2$.
- Since the market portfolio is only exposed to market risk, beta measures the exposure of the individual security to market risk.

3. How individual securities affect portfolio risk

- We can decompose the variability of the individual security as follows:

$$\sigma_i^2 = \beta_i^2 \, \sigma_m^2 + \sigma_\varepsilon^2$$

- If we invest in a well-diversified portfolio then $\sigma_\varepsilon^2 = 0$ and $\sigma_p^2 = \beta_p^2 \, \sigma_m^2 \Rightarrow \sigma_p = |\beta_p| \sigma_m$.
  - The risk of the portfolio is proportional to its beta.
  - The portfolio beta is a weighted average of the betas of the individual securities included in the portfolio.
  - These betas measure the exposure of each security to market risk.
- *The risk of a well-diversified portfolio depends on the market risk of the securities included in the portfolio. The market risk of the security is measured by its beta.*

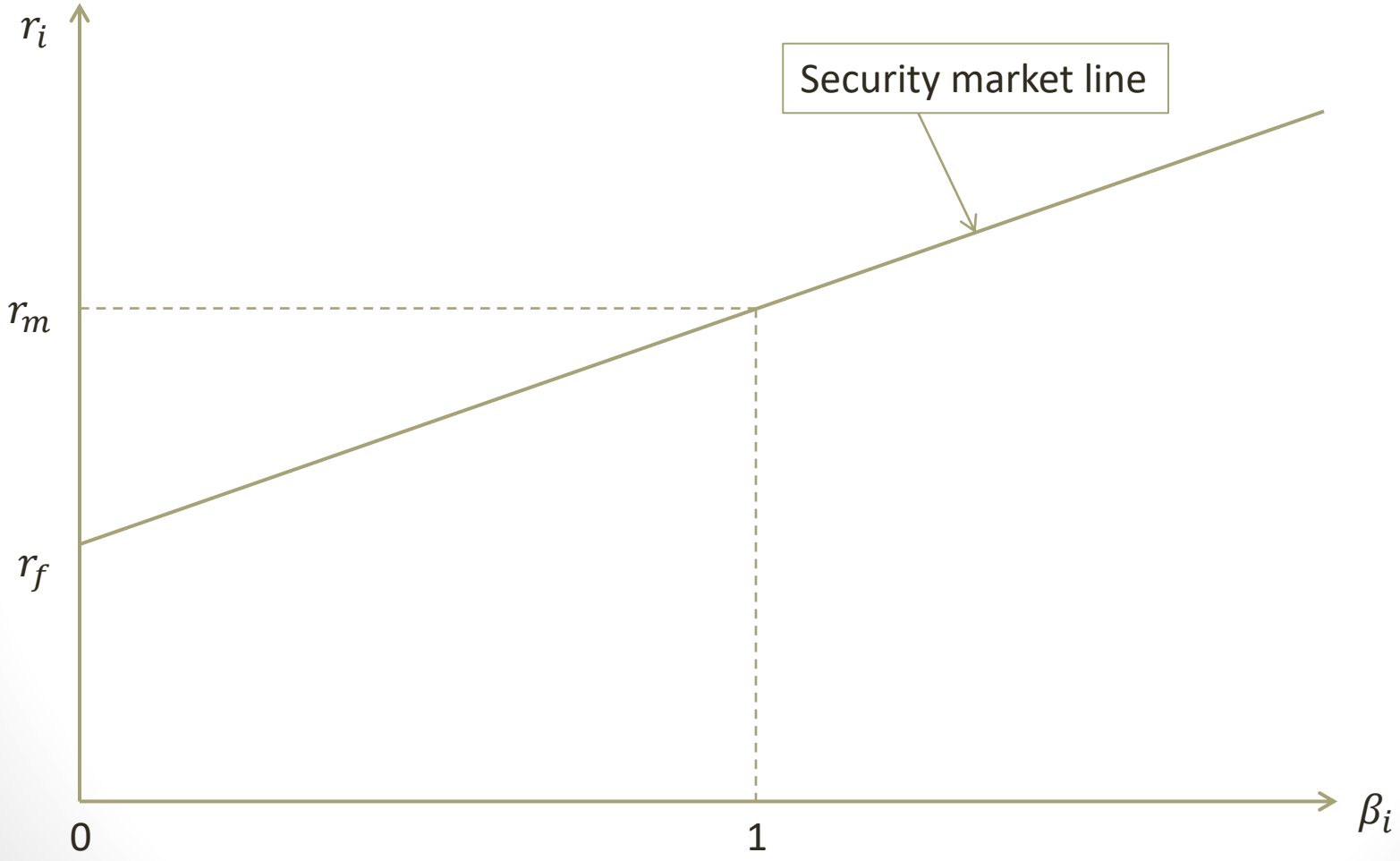
4. The CAPM

- An investment with fixed return (zero variability) will have a beta equal to zero. The return of this security is known as the **risk-free rate** (denoted as r_f).
- The market portfolio has a beta equal to 1. The expected return of the market portfolio is denoted as r_m.
- **Market risk premium**: This is defined as $r_m - r_f$.
- **Question**: What is the expected return of all other investments in the financial market?
- **Answer**: This is given by the following formula:
  - Denote as r_i the expected return of investment i (individual security of portfolio).
  - Denote as β_i the beta of this investment.
  - Then, $r_i = r_f + \beta_i(r_m - r_f)$.
  - This the **capital asset pricing model (CAPM)**.

4. The CAPM

- The CAPM states that the expected return of each security varies only with respect to its beta.
- Beta measures the exposure of the security to market risk.
- *So, expected returns depend only on the exposure of the security to market risk. Unique risk has nothing to do with expected returns.*
- The graphical illustration of the CAPM is the **security market line**. It is the line over which all investments lie.

4. The CAPM



4. The CAPM

- How to use the CAPM is practice?
- **Estimate the beta**: Econometric exercise:
  - Write the CAPM as a linear model $r_{i,t} - r_f = \alpha + \beta\left(r_{m,t} - r_f\right) + \varepsilon_{i,t}$.
  - Use historical time-series data on security i, $r_{i,t}$, and the market portfolio, $r_{m,t}$. Estimate coefficient β.
- **Estimate the expected return**: If the beta is estimated to be equal to 0.49, the risk-free rate is 1% and the market risk premium (long-term historical average) is estimated to be equal to 8%, then $r_i = 0.01 + 0.49 \times 0.08 = 4.92\%$.

5. Company cost of capital

- **Company cost of capital**: The expected return of the portfolio of all the company's existing securities.
- If the firm has issued equity (common stocks) and corporate bonds then the portfolio is a blend of the cost of debt and cost of equity (the expected return of the firm's stock).
- It is also known as the **weighted average cost of capital (WACC)**.
- Given that:
  - r_D is the return of the firm's bonds.
  - r_E is the return of the firm's common stocks.
  - D is the market value of bonds issued by the firm.
  - E is the market value of the stocks issued by the firm.
  - V is the total market value of the firm, $V = D + E$.
  - Then,

$$WACC = \frac{D}{V} r_D + \frac{E}{V} r_E$$

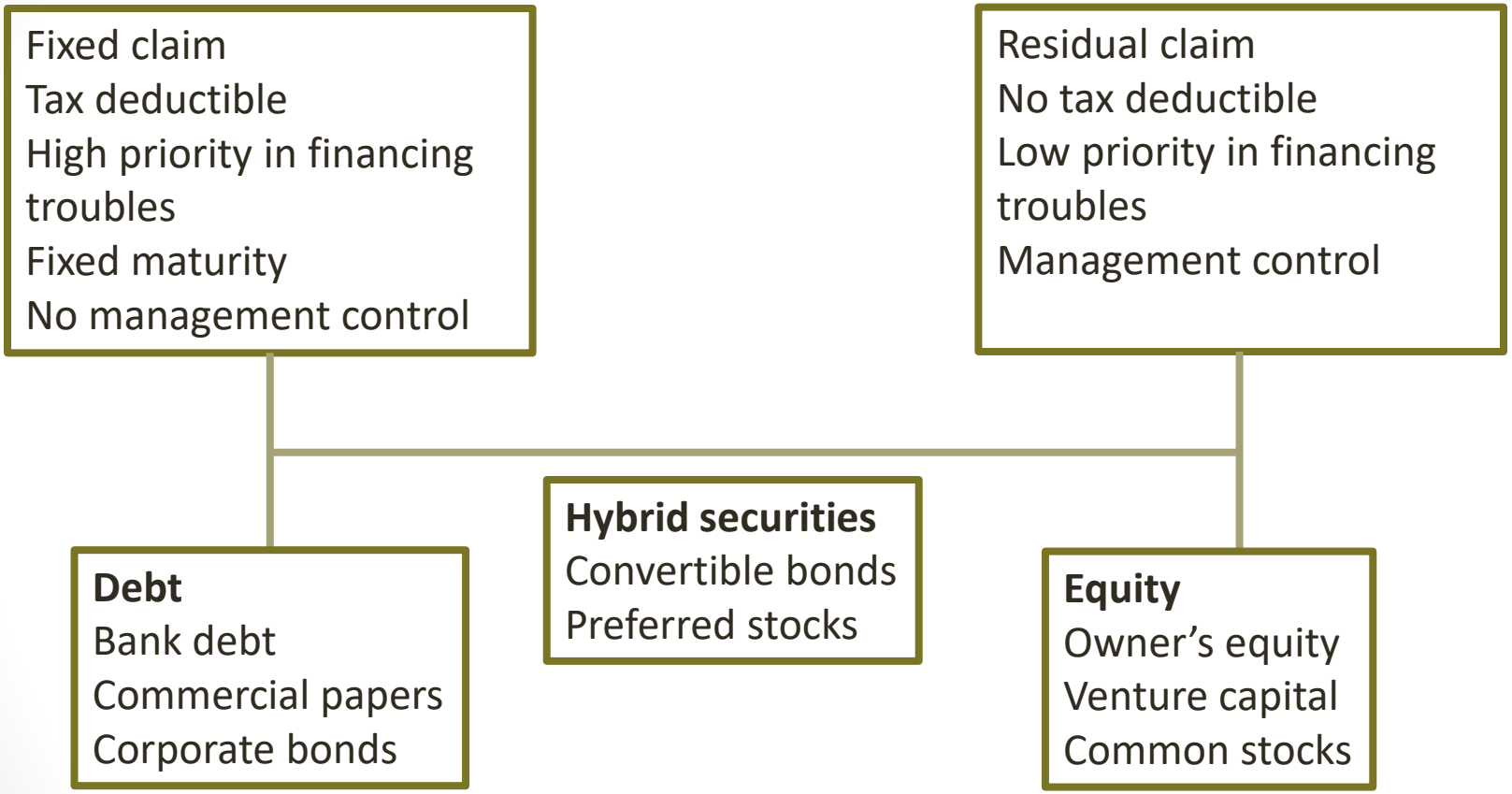
5. Company cost of capital

- **Project cost of capital**: The opportunity cost of capital (discount rate) used in the calculation of the NPV of a project. It reflects the risk exposure of the specific project.
- **Question**: In what cases the project and the company cost of capitals are equal?
- **Answer**: When the risk exposure of the project is similar to the overall exposure of the firm. For example, when the new project is an expansion of the firm's existing business.
- In general the opportunity cost of capital is the expected return of an investment in financial market with an equivalent risk exposure to that of the project.
- **BUT**, according to the CAPM, only the exposure of an investment in market risk is priced in the market. So, in the previous sentence we must add "…with an equivalent exposure to *market risk* to that of the project".
- So in order to set the discount rate in an NPV calculation we need to ask ourselves what is the systematic risk of the project, in other words, what is the correlation of the project's cash flows with those of the economy.

CHAPTER 11

CAPITAL STRUCTURE

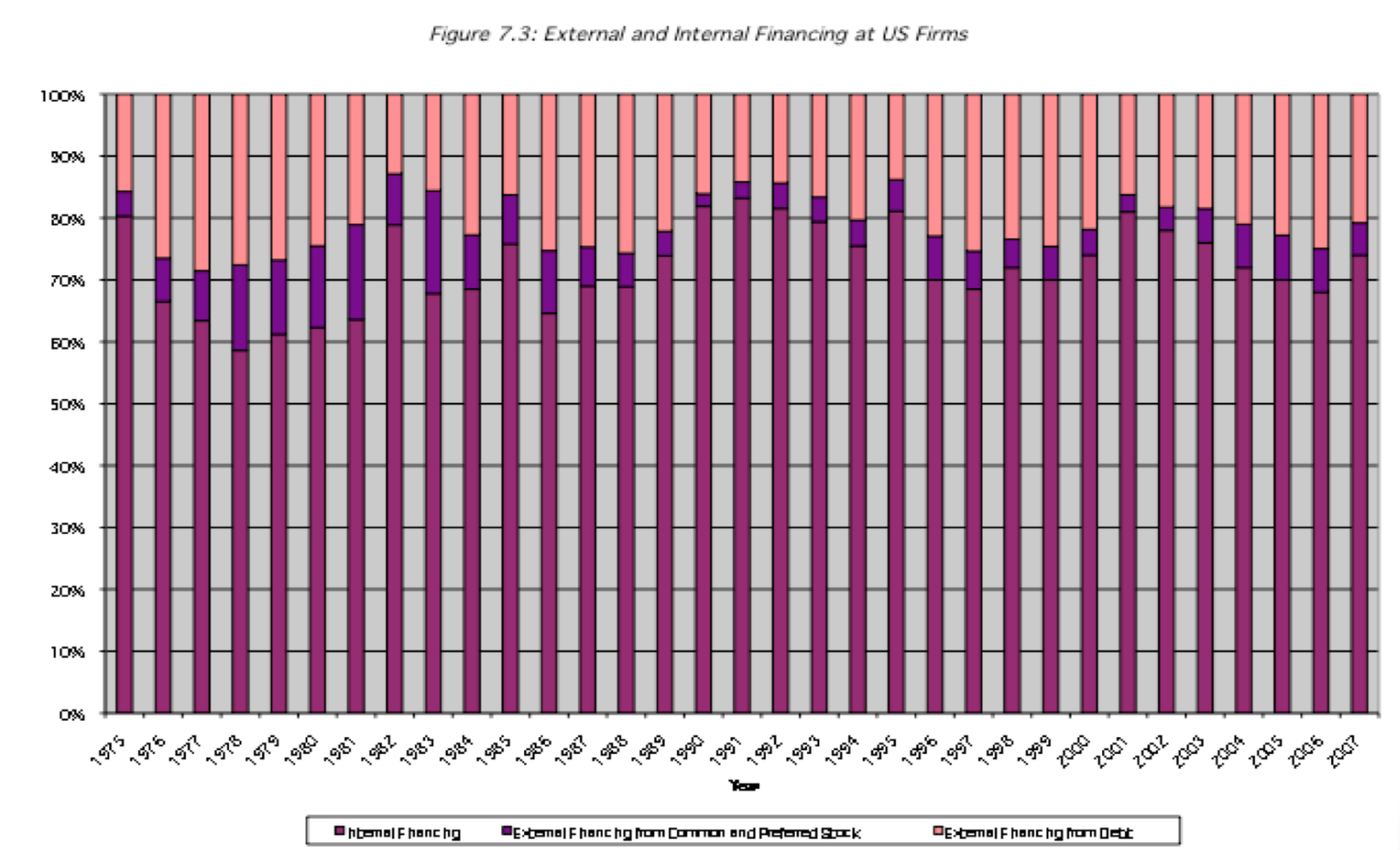
1. The choices in financing



1. The choices in financing

- Cash flows generated by the existing assets of the firm can be categorized as **internal financing (internal equity)**.
- Cash flows raised outside the firm can be categorized as **external financing**.
- Internal equity has several advantages:
  - For private firms external financing is difficult to raise, and when possible, it leads to the loss of control.
  - For publicly traded firms external financing is easier is to raise, but it is expensive in terms of issuance costs and loss of flexibility.
- … and limitations:
  - Internally generated cash flows may noy be sufficient to finance new projects.

1. The choices in financing



Source: Damodaran, 2nd edition.

2. What is the capital structure?

- **Capital structure**: The mix of debt and equity financing used by the firm to finance its projects.
- **Measuring capital structure**:
  - Use market values.
  - Use book values.
  - V = value of firm, E = value of equity, D = value of debt, then you can measure the capital structure using either the **debt ratio** (D/V), the **equity ratio** (E/V), or the **debt-to-equity ratio** (D/E).
- **Financing decision**: How should the firm finance its project? *In other words*, what capital structure should the financial manager choose?
- **Answer**: Choose the capital structure that maximizes the market value of the firm.

2. What is the capital structure?

- **How to do that?**
- We need a model of capital structure that will tell us for which debt ratio the value of the firm is maximized.
- **Do we have this ONE model?**
- Not entirely. But we have made considerable progress these last 60 years.
- **In this chapter** :
  - We are going to present the evolution of financial theory.
  - Its implication for an optimal capital structure policy.
  - Explain the different capital structures that we observe in different sectors of the economy (see following table).

2. What is the capital structure?

Industry	Book Debt Ratio (in %)
Internet information providers	0
Major integrated oil and gas	10
Semiconductors	11
Communication equipment	16
Biotechnology	17
Consumer appliances	21
Railroads	40
Gas utilities	45
Hotels	56
Airlines	96

Book debt ratios for a sample of firms, 2010. Source: Brealey, Myers and Allen, 11th edition

3. The Modigliani-Miller model

- Modigliani and Miller (1958) make the assumption of perfect capital markets. This implies the followings:
  - No transaction costs
  - Individuals can borrow and lend at the risk-free rate
  - There are no costs to bankruptcy or to financial distress
  - Firms issued two types of securities: risk-free debt and equity
  - There are no taxes
  - Corporate insiders and outsiders have the same information
  - Managers always maximize shareholders' wealth
  - Operating cash flows are completely unaffected by changes in capital structure
- Financial theory has evolved by relaxing one-by-one some of these assumptions.

3. The Modigliani-Miller model

- **Firm U**: **Unlevered firm** which finances the projects with equity capital, $V_U = E_U$.
- **Firm L**: **Levered firm** which finances the projects with both equity and debt, $V_L = E_L + D_L$.
- Except from their capital structures these two firms are identical and they produce the same perpetual cash flow CF.
- Consider an investor who buys $x\%$ of U.
- He/she will buy $x\%$ of U's shares. The value of the investment is $xE_U = xV_U$. The total cash flow returned to him/her by U would be xCF.

3. The Modigliani-Miller model

- Consider now an investor who buys $x\%$ of L.
- He/she will buy $x\%$ of L's shares and $x\%$ of L's debt. The value of the investment is $xE_L + xD_L = xV_L$. The total cash flow returned to him/her by L would be $x(CF - I) + xI = xCF$, where I is the interest payments of the L's debt.
- Both strategies end up with the same cash flows. So, they should have the same value, which implies that

$$xV_U = xV_L \Rightarrow V_U = V_L$$

- **Modigliani-Miller (MM) proposition 1**: *The value of the firm is independent of its capital structure.*
- **Implications**:
  - There is no optimal capital structure.
  - The value of the firm is determined by its real assets and not by the types of securities it issues to acquire them.
  - Financial manager should only care about investment decisions as financing decisions are irrelevant for firm value maximization.

3. The Modigliani-Miller model

- In Ch. 10 we have defined the weighted average cost of capital (WACC) as:

$$WACC = \frac{D}{V} r_D + \frac{E}{V} r_E$$

- According to MM proposition 1 the value of the firm is independent of its capital structure. So, if we change the debt ratio (and the equity ratio) the value remains the same.
- But the value of the firm (assuming a perpetual cash flow of CF) is equal to:

$$V = \frac{CF}{WACC}$$

- So, since the value (and the cash flows) are independent of the capital structure the $WACC$ will also be independent of the capital structure.

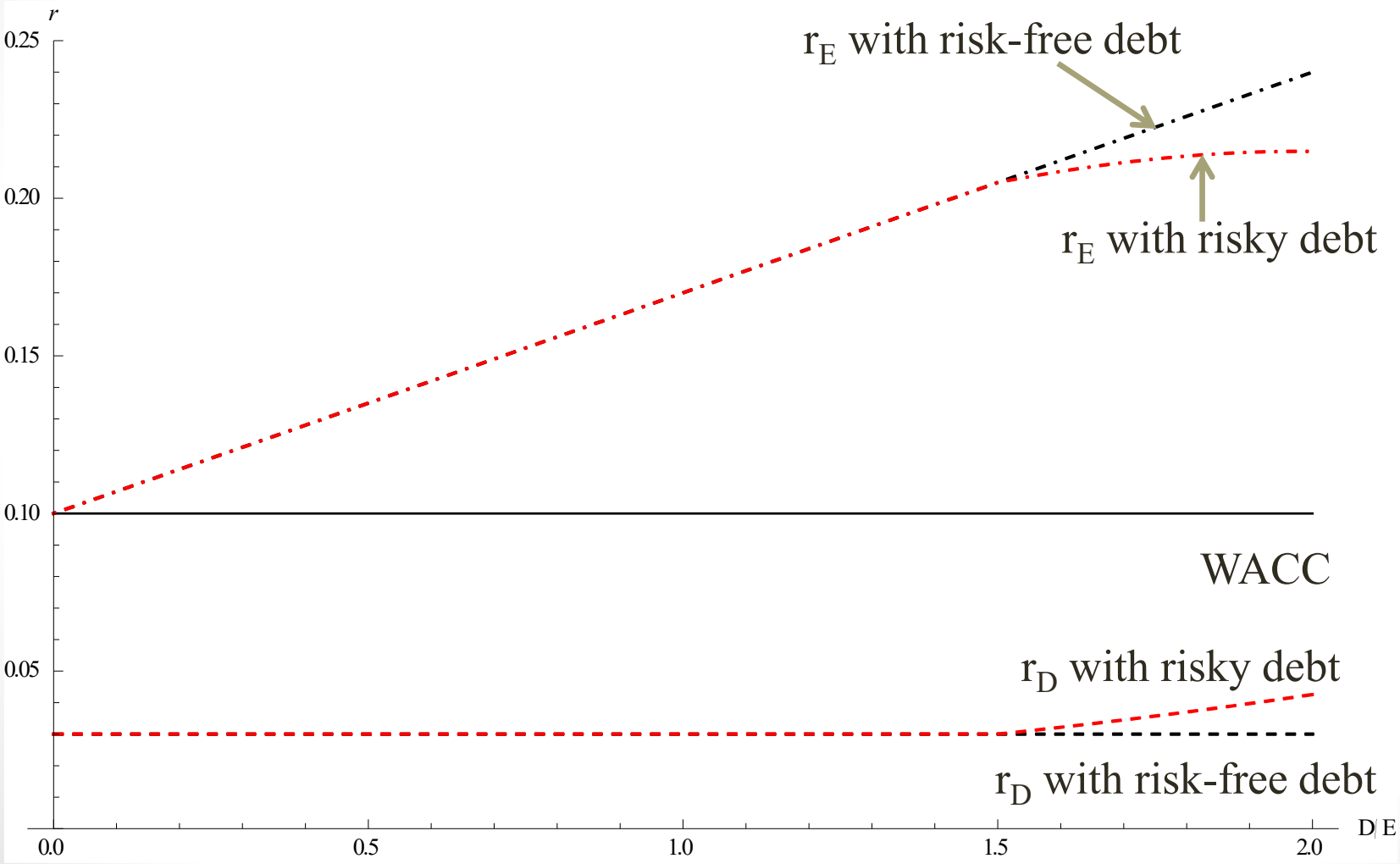
3. The Modigliani-Miller model

- This implies that D/V and E/V will change but the $WACC$ would remain constant. How this can happen?
- Something else in the formula should also change accordingly. This is the cost of equity r_E.
- If we solve the $WACC$ formula with respect to r_E we have that:

$$r_E = WACC + (WACC - r_D)\frac{D}{E}$$

- This is **Modigliani-Miller (MM) proposition 2**.
- *The expected return of the stock increases in proportion with the debt-to-equity ratio D/E.*
- We know that the expected return of a stock is related to its systematic risk (remember the CAPM).
- So, MM proposition 2 implies that a change in the capital structure affects the systematic risk of the stock. This is known as **financial risk**.
- As debt increases, shareholder's income can be more severely affected by the decrease on the company's operating income.

3. The Modigliani-Miller model



3. The Modigliani-Miller model

- **Example**: An all-equity financed firm has issued 1,000 shares at $10 each. Assume that the firm produces an annual operating income of $1,500 in perpetuity which is paid as dividends to stockholders.
- The value of the firm is $V = 1000 \times 10 = 10{,}000$.
- The expected earnings and dividends per share are $1.5.
- The expected return of the stock is equal to the E/P or D/P ratio, $r_E = \frac{D}{P} = \frac{1.5}{10} = 15\%$.
- This is also the WACC of the firm (as $D = 0$).
- Assume now that the firm changes its capital structure. It issues $5,000 of perpetual debt with an interest rate of 10%. The annual coupon is $C = 5{,}000 \times 0.1 = 500$.
- With this amount of money it repurchases (buys back) 500 shares.

3. The Modigliani-Miller model

- According to MM proposition 1 the value of the firm does not change thus:

$$10{,}000 = 5{,}000 + 500 \times P_0$$

  where P_0 is the price of the stock with the new capital structure. Solving with respect to it we have that this is equal to \$10.
- The price of the stock has not change. The change in the capital structure has not created value for the shareholders.
- The annual income distributed to shareholders is now $1{,}500 - 500 = 1{,}000$. We have 500 remaining stocks so the dividend per share is now \$2.
- The expected return of the stock is $r_E = \frac{2}{10} = 20\%$.
- So, stockholders demand an extra 5% of expected return to be compensated against their exposure in financial risk.

3. The Modigliani-Miller model

- We could reach the same answer using MM proposition 2. In fact, we know that the WACC is 15% and the $\frac{D}{E} = \frac{5{,}000}{5{,}000} = 1$. So,

$$r_E = 0.15 + (0.15 - 0.1) \times 1 = 20\%$$

4. The value of the firm given corporate taxes

- MM model implies that capital structure policy is irrelevant for firm value maximization.
- If one wants to empirically test that he/she can take a large number of firms across sectors and expects to see debt ratios to vary randomly from firm to firm and industry to industry. However, as the table in the beginning of the chapter indicates this is not the case.
- So something is missing from the model. These can be found in the assumptions of the model.
- First, we have excluded taxes (corporate and personal).
- We are going to examine what are the implications of the model assuming :
  - Corporate taxes
  - Corporate and personal taxes

4. The value of the firm given corporate taxes

Income statement		
	Firm U	**Firm L**
EBIT	$1,000	$1,000
Interests	0	80
Pretax Income	1,000	920
Tax at 35%	350	322
Net income	650	598
Total income to bondholders and stockholders	0 + 650 = 650	80 + 598 = 678
Interest tax shield (Interest × 0.35)	0	28

4. The value of the firm given corporate taxes

- Firm L provides an extra $28 of income to its bondholders and stockholders.
- This is equal to $Interest \times corporate\ tax\ rate$ and it is known as the **interest tax shield.**
- This interest tax shield is the *tax advantage of debt*.
- Firms can report interests as pre-tax expenses and thus lower their pre-tax income. The tax advantage of debt increases with respect to the interest tax shield.
- **How this interest tax shield affects the value of the firm?**
- Assume that firm U and L have the same operating income $EBIT$ in perpetuity.
- Firm U cash flow is equal to $EBIT(1 - \tau_c)$ which is given to stockholders.

4. The value of the firm given corporate taxes

- If r is the $WACC$ of U, then the value of firm U is equal to

$$V_U = \frac{EBIT(1-\tau_c)}{r}$$

- Firm L cash flow:
  - to stockholders is equal to $(EBIT - I)(1-\tau_c)$
  - to bondholders is equal to I
  - So, the total cash flow to both of them is $(EBIT - I)(1-\tau_c) + I = EBIT(1-\tau_c) + \tau_c I$.
  - So Cash flow of L = Cash flow of U + interest tax shield.
- The value of L is equal to:

$$V_L = \frac{EBIT(1-\tau_c)}{r} + \frac{\tau_c I}{r_D} = V_U + \tau_c D$$

4. The value of the firm given corporate taxes

- The last formula implies that *the value of the levered firm is equal to the value of the unlevered firm plus the PV of the interest tax shield (equal to $\tau_c D$).*
- So as the firm increases its debt D then its value also increases. The model implies that firm value is maximized when the firm 100% debt-financed!
- This is not reasonable. No firm follows this financing policy.
- There is something missing from the model. We need to relax more assumptions to get a model closer to reality, and a model more useful to financial managers.

4. The value of the firm given corporate taxes

- **Example**: Consider a firm for which the value of debt and equity are equal to \$1,000 and \$500, respectively. The debt is perpetual and pays a coupon rate of 8%. The number of shares outstanding is 10. Thus the price of the stock is \$50. The firm's operating income is equal to \$100 in perpetuity and the tax rate is 50%.
- The value of the firm is $V = 1{,}000 + 500 = 1{,}500$.
- The previous formula implies that

$$1{,}500 = \frac{100(1 - 0.5)}{r} + 0.5 \times 1{,}000 \Rightarrow r = 5\%$$

- This is the $WACC$ of the firm if it were all-equity financed.
- The firm decides to change its capital structure. It issues 10 new shares at \$50 each and uses the \$500 to repay an equal amount of debt. So the value of debt is now \$500.

4. The value of the firm given corporate taxes

- Using again the previous formula we can determine the value of firm with the new capital structure.

$$V = \frac{100(1 - 0.5)}{0.05} + 0.5 \times 500 = 1{,}250$$

- As expected the firm value has decreased since the value of debt has also decreased.
- The value of equity is now equal to $E = 1{,}250 - 500 = 750$ and the stock price is $750/20 = 37.5$
- So, the decrease in the value of the firm is followed by a decrease in the stock price.

5. The value of the firm given corporate and personal taxes

- We can generalize the previous model by assuming that personal taxes on the income from debt and equity also exists.
- In that case we can write the model as:

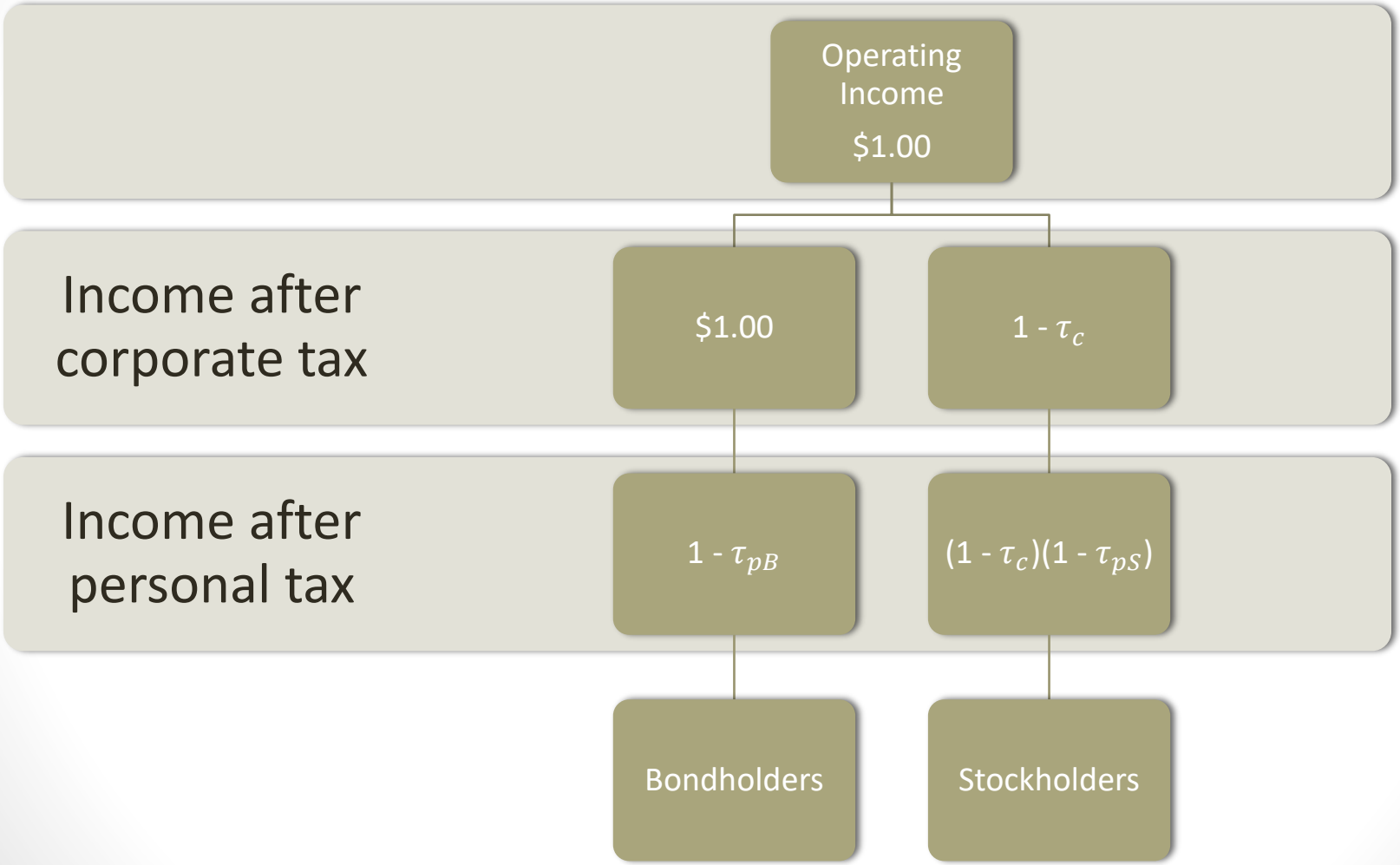
$$V_L = V_U + \left(1 - \frac{(1-\tau_c)(1-\tau_{pS})}{1-\tau_{pB}}\right) D$$

- τ_c is the corporate tax rate, τ_{pS} the personal tax rate for stockholders and τ_{pB} the personal tax rate for bondholders.
- In this model we define the

$$relative\ tax\ advantage\ of\ debt\ over\ equity = \frac{1-\tau_{pB}}{(1-\tau_c)(1-\tau_{pS})}$$

- If this is larger(smaller) than 1, then the increase on debt increases(decreases) the value of the firm.

5. The value of the firm given corporate and personal taxes



5. The value of the firm given corporate and personal taxes

- Now several scenarios are possible:
  - $\tau_{pS} = \tau_{pB}$, then the effects of personal taxes are perfectly offset and we return back to the previous model in which the PV of interest tax shield was equal to $\tau_c D$.
  - $(1-\tau_c)\left(1-\tau_{pS}\right) = 1-\tau_{pB}$, then the effects of all taxes are perfectly offset and we return back to MM proposition 1.
- **Question**: Can we reach a conclusion about the model based on observed tax rates?
- In general, corporate and personal tax rate on debt are close to each others, whereas the personal tax rate on equity is considerably lower.
- This implies that the relative tax advantage of debt over equity is marginally higher than 1.
- *So, there is a tax advantage of debt but its effect on the value of the firm is very low.*
- For example, if $\tau_{pB} = 35\%, \tau_{pS} = 12\%$, and $\tau_c = 32\%$, then the relative tax advantage is 1.086, and the term in the parenthesis is (1 – 1/1.086) = 0.079.
- For $1 increase on debt, firm value would increase by 7.9 cents.

6. The costs of financial distress

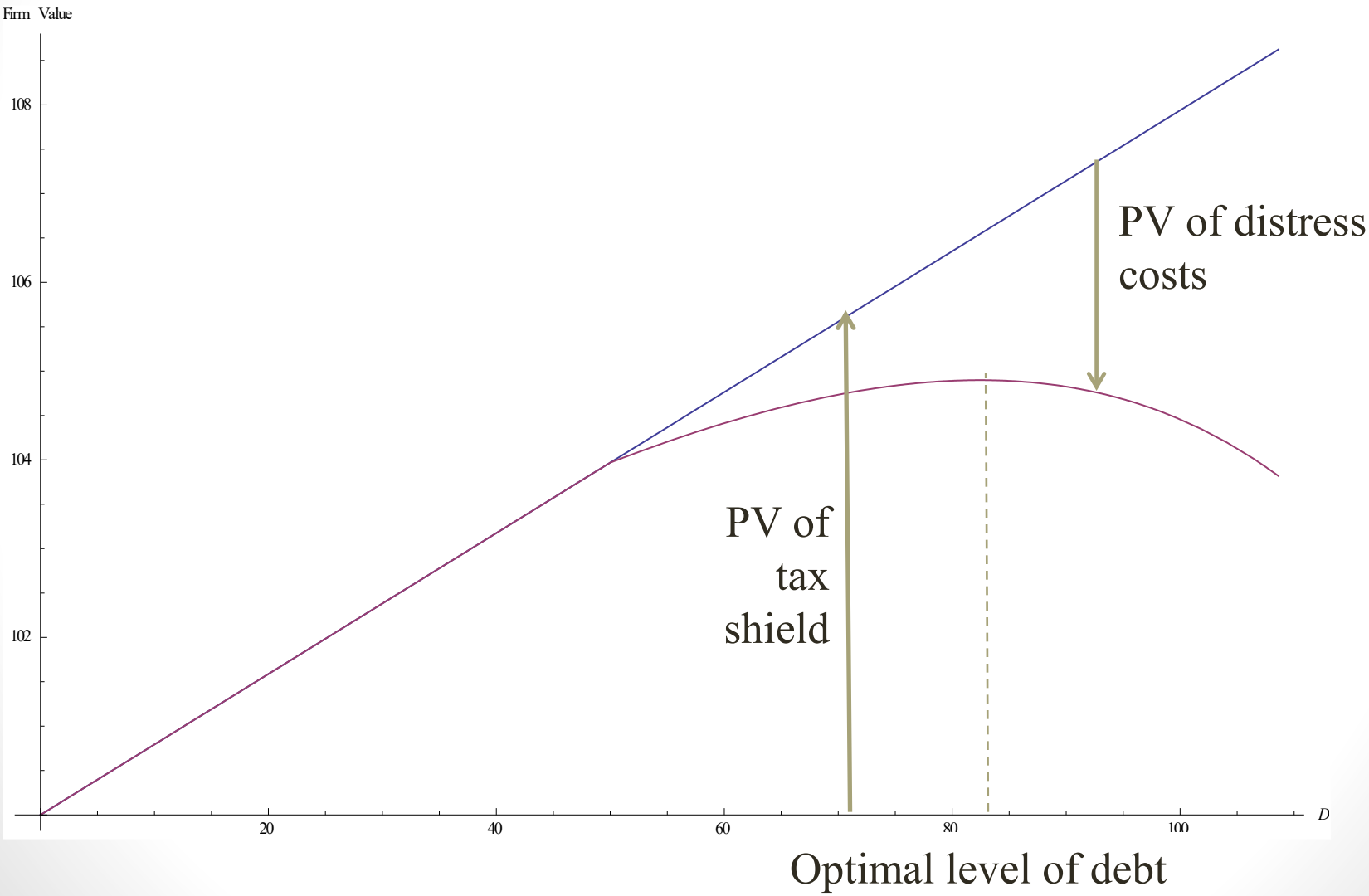
- Even if the benefit of an increasing debt ratio may be small when we consider both corporate and personal taxes the model still indicates that the optimal financing policy is to be 100% debt-financed.
- Again, no financial manager would agree with that. The reason is very simple. *As debt ratio increases, the probability that the firm will be financially distressed also increase.*
- **Financial distress** occurs when promises to creditors are broken or honored with difficulty.
- Financial distress:
  - Leads to bankruptcy
  - Indicates that the firm is threatened by this event without reaching it at the end.
- *Financial distress is costly*. When investors worry about the possibility that a firm will fall into financial distress the firm's market value starts to decrease, so that:

$$V_L = V_U + PV(tax\ shield) - PV(financial\ distress\ costs)$$

6. The costs of financial distress

- As debt ratio increases:
  - The PV(tax shield) increases.
  - **BUT** the PV(financial distress costs) also increases.
  - There is a trade-off between these two.
- The *optimal capital structure* is reached when the gains from the PV (tax shield) are exactly offset by the loss due to the PV(financial distress costs).
- This model is closer to reality. There is an optimal capital structure which is not the 100% debt-financed indicated by the previous model.
- This is known as the **trade-off theory of capital structure**.

6. The costs of financial distress



6. The costs of financial distress

- Financial distress costs can be separated into two categories:
  - Direct costs of bankruptcy: The administrative cost paid by the firm when it goes bankrupt.
  - Indirect costs of bankruptcy (these are the most important): Financial distress costs even when the firm does not go bankrupt at the end.
    - Related to an increase of default risk that arises well before the firm really defaults.
    - These can be manifested in 3 ways:
      1. Loss of revenues.
      2. Increase in working capital.

      } Decrease in cash flows

      3. Difficulty to raise new (cheap) capital from the markets.

6. The costs of financial distress

- Implications for capital structure policy:

Less debt	More debt
Volatile earnings / cash flows	**Stable earnings / cash flows**
Toy manufacturer	Utilities
Intangible / less-liquid assets	**Tangible / liquid assets**
Pharmaceutical	Real estate companies
Durable products requiring replacement	**Products not requiring replacement / services**
Car manufacturer	Retail firm

7. Agency costs

- Equity investors act as agents for the lenders of the firm, since they control investment and financing decisions of the firm.
- However, equity investors and lender may not always agree because they have different cash flow claims on the firm.
- These costs arising from the *conflict of interest* between stockholders and bondholders are broadly categorized as **agency costs of debt**.
- Agency costs are related to the violation of the usual objective of firm value maximization (an assumption of MM model) as stockholders pursue narrower self-interest instead at the expense of their creditors.
- As firm increases its debt, it exposes itself to greater agency costs.
- We can generalize the previous model as:

$$V_L = V_U + PV(tax\ shield) - PV(financial\ distress\ costs) - PV(agency\ costs)$$

7. Agency costs

- The conflict of interest appears in all three aspects of corporate finance:
  - Investment decisions
  - Financing decisions
  - Payout policy (determine how much to pay out as dividends).
- **Investment decisions**: The usual decision rule is that if the NPV > 0 then the project should be undertaken. Both stockholders and bondholders should agree on that.
- *This is not always the case.* For some of these projects stockholders may benefit but bondholders my be hurt.
- **Example: Risk shifting (Airline services)**
  1. Bondholders set the interest rate that reflects the risk level of the firm's projects (airline services).
  2. The firm announces to launch spacecrafts for space travels.
     - This is riskier than expected. Bond prices will fall in the markets to reflect higher risk.
  3. Bondholder's loss is the stockholder's gain = PV (of the project) + transfer of wealth from bondholders.
  4. The game can be more extreme if stockholders choose highly risky negative NPV projects. The wealth transferred from bondholders exceeds the negative NPV.

7. Agency costs

- **In general**, stockholders of levered firms gain when business risk increases. Financial managers who act strictly in their stockholder's interests (and against the interests of creditors) will favor risky projects over safe ones. They may even take risky projects with negative NPV.
- **Financing decisions:** The conflict of interest between bondholders and stockholders also arises when new projects have to be financed.
- The equity investor in a firm may favor new debt, using the assets of the firm as security and giving the new lenders prior claims over existing lenders. Such actions will reduce the interest rate of the new debt.
- In that case existing debt becomes riskier and less valuable. Transfer of wealth from the old to the new bondholders

7. Agency costs

- **Payout policy:** Stockholders and bondholders may also disagree on the amount of dividend payments.
- If the firm has excess cash and few good projects then the self-interest of stockholders would be that the cash is distributed to them.
- In contrast, bondholders prefer that the firm retain cash, since it can be used to make payments on the debt, reducing default risk.

7. Agency costs

- The previous discussion indicates that bondholders need a *protection* against stockholders action.
- This protection costs to the firm, defining the agency costs of debt.
- These costs have a negative impact on the firm value and increase along with the firm's debt ratio.
- These costs can be manifested in two ways:
  - Bondholders protect themselves demanding a higher interest rate.
  - Bondholders protect themselves by writing restrictive covenants (promises in the bond from the part of the borrowing firm):
    - Direct costs: Monitoring the covenants
    - Indirect costs: The firm cannot take some projects (even if they are profitable), use certain type of financing or change its payout policy.

8. Loss of flexibility

- The increase of debt can also cause a loss of flexibility from the part of the firm.
- When managers take a decision to increase the firm's debt they also consider the effects such decisions will have on the capacity of the firm to take new projects or meet unexpected future cash requirements.
- We can assume that the value of preserving financial flexibility should be related to:
  - Availability of projects.
  - Excess returns on projects.
  - Uncertainty about project needs and cash flows.
- For example, Microsoft and Intel, which earn large excess returns on their projects and face more uncertainty about future investment needs, will hold large cash balance and will have a low debt ratio (maintaining excess debt capacity) as the value of preserving financing flexibility is significant for them.

9. Summarizing the trade-off theory

- To appraise the optimal capital structure, we can examine the costs and benefits of debt vs. equity
- **The benefits of debt:**
  - Debt is tax deductible. *Implication: The higher the marginal tax rate, the greater the benefits of debt.*
  - Debt adds discipline to management. *Implication: As the separation between ownership and management increases, the benefits of debt goes up.*
- **The costs of debt:**
  - *Bankruptcy costs*. They depend on the probability of going bankrupt and the costs of going bankrupt (legal costs, losing customers, stricter terms from suppliers). *Implications: (1) Firms with more stable earnings should borrow more, (2) Firms with lower bankruptcy costs should borrow more.*

9. Summarizing the trade-off theory

- *Agency costs*. Actions benefited stockholders may hurt the lenders. The greater the potential for this conflict of interest the, the greater the cost borne by the borrower (as higher interest rates or more covenants). *Implication: Firms where lenders can monitor/control where their money is being used can borrow more.*
- *Loss of future flexibility*. Using up available debt capacity today will mean that you cannot draw it in the future. *Implications: (1) Firms that can forecast their future funding needs can borrow more, (2) Firms with better access to capital markets can borrow more today.*

10. CFO's opinion

- A survey of CFOs of large U.S. companies provided the following ranking (from most important to least important) for the factors that they considered important in the financing decisions:

Factor	Ranking (0-5)
1. Maintain financial flexibility	4.55
2. Ensure long-term survival	4.55
3. Maintain predictable source of funds	4.05
4. Maximize stock price	3.99
5. Maintain financial independence	3.88
6. Maintain high debt rating	3.56
7. Maintain comparability with peer group	2.47

11. The pecking order of financing choices

- There are some things that the trade-off theory *cannot* explain:
  - Profitable firms borrow the least.
  - Intra-industry differences in debt ratios.
  - Debt ratios are close to the ones back in the early 1900s when income tax rates were very low.

11. The pecking order of financing choices

- One of the assumptions of perfect capital markets is that insiders and outsiders have the same information.
- If this assumption is violated and insiders are more informed than outsiders, this is known as **information asymmetry.**
- Asymmetric information affects:
  - The choice between internal and external financing
  - Issuing new debt or equity
- It creates the following **pecking order (financial hierarchy):**
  a. Internal financing (retained earnings)
  b. New issues of debt
  c. New issues of equity (last resort)
- In this theory, there is no well-defined optimal capital structure. Each firm's observed debt ratio reflects its cumulative requirements for external financing.

11. The pecking order of financing choices

- We can summarize the pecking order theory of corporate financing:
  - Firms prefer internal financing.
  - To this end, they need to retain earnings for future investment opportunities. To do so, they set accordingly a payout ratio trying to avoid sudden changes in dividends.
  - A payout policy with sticky dividends from the one hand, and the unpredictable fluctuations in profitability and investment opportunities mean that retained earnings may be below or above capital expenditures. If it is more, the firm pays off debt or invests in marketable securities. If it is less, the firm uses its more liquid current assets (cash and marketable securities).
  - If external financing is required, firms first issue debt, then possibly hybrid securities (like for example convertible bonds), and finally equity as a last resort.

11. The pecking order of financing choices

Period	0	1	2	3	4	5	6
Earnings		2	2	6	6	7	7
Dividends		3	3	3	3	3	3
Interest				2	2	2	2
Retained earnings	80	79	38	39	40	42	44
External financing			50				
Investment			90				

Retained earnings = 79 – 1 – 40 = 38

11. The pecking order of financing choices

- The pecking order theory can explain things that the trade-off theory cannot.
  - Most profitable firms generally borrow less as they don’t need outside money.
  - Less profitable firms issue debt because they do not have internal funds sufficient for their investments and because debt is preferable to equity.
  - Intra-industry relationship between profitability and financial leverage.

12. Trade-off vs pecking order

- Debt ratios of individual firms seem to depend on:
  - Size
  - Tangible assets
  - Profitability
  - Market-to-book ratio
- The relation between size, tangible assets, M/B ratio (as a measure of growth opportunities) and debt ratio can be explained by the trade-off theory.
- The relation between profitability, M/B ratio (as another measure of profitability) and debt ratio can be explained by the pecking order theory.
- In which particular case the two theories work better:
  - Pecking order: Large, mature firms.
  - Trade-off: Younger, growth firms rely on equity issues as external financing.

CHAPTER 12

THE OPTIMAL FINANCING MIX

1. Finding the optimal mix

- In the previous chapter we presented the theory of capital structure.
- In this chapter we are going to apply it in practice to determine the optimal financing mix for a firm.
- Five ways to do that:
  - Minimize the cost of capital **(this will be presented and applied)**
  - Maximize the adjusted PV
  - Determine the debt level according the maximum probability of default we are willing to bear
  - Maximize the difference between ROE and cost of equity
  - Use comparable firms

2. Cost of capital approach

- We know from Chapter 6 that the cash flows to the firm:
$$CF\ to\ firm = EBIT(1 - \tau_c) + Dep - Inv$$
- This holds for a project but also for the firm overall.
- We also know that the cash flows to equity are given as:
$$CF\ to\ equity = (EBIT - Int)(1 - \tau_c) + Dep - Inv$$
- The last two formulas imply that:
$$CF\ to\ equity + CF\ to\ debt = CF\ to\ firm + \tau_c Int$$
- **Comments**:
  - The CF to firm is not equal to the sum of CF to investors because of the interest tax shields.
  - The CF to firm does not account for the financing decisions. It is the CF received by investors *under the assumption that the firm is all-equity financed.*

2. Cost of capital approach

- The value of the firm is equal to the value of equity plus that of debt.
- Assuming constant perpetual cash flows we have:

$$V = E + D = \frac{CF\ to\ equity}{r_E} + \frac{CF\ to\ debt}{r_D} = \frac{CF\ to\ firm}{after\ tax\ WACC}$$

- The **after-tax WACC** is defined as:

$$after\ tax\ WACC = r_D(1 - \tau_c)\frac{D}{V} + r_E\frac{E}{V}$$

- Thus we need to discount the CF to the firm with the after-tax WACC to get the value of the firm.

2. Cost of capital approach

- If we want to determine the optimal financing mix that maximizes the value of the firm we can accomplish that by *minimizing the cost of capital (i.e., the after-tax WACC)*.
- We need to make two assumptions
  - Debt ratio increases (decreases) by raising (retiring) debt and retiring (raising) equity. This is called **recapitalization**.
  - Cash flows (the nominator of value) are unaffected by firm's capital structure.

2. Cost of capital approach

- We can apply this approach using the following steps:
  - Estimate the cost of equity in different debt ratios.
    - Apply the formula:

$$\beta_L = \beta_U \left(1 + (1 - \tau_c)\frac{D}{E}\right)$$

      to estimate the levered beta at different D/E ratio.
    - Use the CAPM to estimate the cost of equity.
  - Estimate the cost of debt. The cost debt depends primarily on the default risk. Use credit ratings as a measure of default risk.
    - Estimate leverage ratios at each debt ratio.
    - Use these ratios to determine the rating.
    - Use the rating to determine the cost of debt.
  - Using the cost of equity and debt at different debt ratios, find the debt level that minimizes the cost of capital.

3. Analyzing the capital structure of Ford

- We will use the cost of capital approach to find the optimal capital structure for Ford at the end of 2015.
- Ford has BBB/Baa2 rating from S&P/Moody's. The default spread ($cost\ of\ debt - risk\ free\ rate$) for this rating is estimated to be 2.25%. The risk-free rate is 1.8%, so we estimate Ford's cost of debt 2.25% + 1.8% = 4.05%.
- The beta = 1.13. Using the CAPM we estimate the cost of equity as $r_E = 0.018 + 1.13 \times 0.055 = 11.24\%$.
- Market value of equity is $47.5 billion.
- Market value of debt is estimated to be $115.6 billion.
- The value of Ford = 47.5 + 115.6 = 163.1 billion.
- The D/V = 71%, E/V = 29%.
- $After\ tax\ WACC = 0.0405(1 - 0.34)0.71 + 0.1124 \times 0.29 = 5.15\%$

3. Analyzing the capital structure of Ford

- *Cost of equity and debt ratio*:
  - Estimate the unlevered beta using the actual debt ratio. This is given as: $\beta_U = \frac{1.13}{1+(1-0.34)\left(\frac{115.6}{47.5}\right)} = 0.43$
  - Use this unlevered beta to calculate the levered betas and then the cost of equity at different debt ratio levels.
  - Assume that the D/V = 0.2.
    - The levered beta is $0.43\left(1+(1-0.34)\frac{0.2}{0.8}\right) = 0.50.$
    - The cost of equity is $0.018 + 0.5 \times 0.055 = 5.81\%.$
  - Working analogously we construct the following table.

3. Analyzing the capital structure of Ford

Table 1: Cost of equity and debt ratio		
Debt ratio	Beta	Cost of equity
0	0.43	5.24%
0.1	0.46	5.49%
0.2	0.50	5.81%
0.3	0.55	6.21%
0.4	0.62	6.75%
0.5	0.71	7.51%
0.6	0.86	8.65%
0.7	1.09	10.54%
0.8	1.57	14.32%
0.9	2.98	25.67%

3. Analyzing the capital structure of Ford

- *Cost of debt and debt ratio*:
  - The cost of debt is primarily a function of the default risk. We measure the exposure to default risk using the times-interest-earned ratio:

$$times\ interest\ earned\ ratio = \frac{EBIT}{Interests}$$

  - As the debt ratio increases, Interests also increase and this ratio decreases.
  - Next table reports the results of a cross-sectional analysis on the relation between this ratio, credit ratings and default spreads.
  - We will use this table as a guideline to compute the cost of debt at different debt ratios.

3. Analyzing the capital structure of Ford

Table 2: Times-interest-earned ratio and cost of debt			
If times-interest-earned ratio is			
Larger than	Smaller than	Rating	Spread
-∞	0.19	D2/D	20.00%
0.2	0.64	C2/C	16.00%
0.65	0.79	Ca2/CC	12.00%
0.8	1.24	Caa/CCC	9.00%
1.25	1.49	B3/B-	7.50%
1.5	1.74	B2/B	6.50%
1.75	1.99	B1/B+	5.50%
2	2.24	Ba2/BB	4.25%
2.25	2.49	Ba1/BB+	3.25%
2.5	2.99	Baa2/BBB	2.25%
3	4.24	A3/A-	1.75%
4.25	5.49	A2/A	1.25%
5.5	6.49	A1/A+	1.10%
6.5	8.49	Aa2/AA	1.00%
8.50	+∞	Aaa/AAA	0.75%

3. Analyzing the capital structure of Ford

- Assume that D/V = 0.4
  - $D = 0.4 \times 163.1 = 65.24.$
  - The interest payment is $0.0280 \times 65.24 = 1.83.$
  - The times-interest-earned ratio is $10.101/1.83 = 5.5.$ Using the previous table this corresponds to an A+ rating with spread of 1.10% and cost of debt 1.10% + 1.8% = 2.90%.
  - Working analogously we construct the following table.

3. Analyzing the capital structure of Ford

Table 3: Cost of debt and debt ratio						
Debt ratio	Debt	Interests	T-I-E ratio	Rating	Default spread	Cost of Debt
0	0	0	∞	AAA	0.75%	2.55%
0.1	16.31	0.42	24.3	AAA	0.75%	2.55%
0.2	32.62	0.83	12.1	AAA	0.75%	2.55%
0.3	48.93	1.25	8.1	AA	1.00%	2.80%
0.4	65.24	1.83	5.5	A+	1.10%	2.90%
0.5	81.55	2.36	4.3	A	1.25%	3.05%
0.6	97.86	2.98	3.4	A-	1.75%	3.55%
0.7	114.17	4.05	2.5	BBB	2.25%	4.05%
0.8	130.48	5.28	1.9	B+	5.50%	7.30%
0.9	146.79	10.72	0.9	CCC	9.00%	10.80%

3. Analyzing the capital structure of Ford

- *Cost of capital and debt ratio:*
  - Using the cost of equity and cost of debt calculated in the two previous steps we can compute the cost of capital.
  - For example when the D/V = 0.3, then $r_E = 6.21\%$ and $r_D = 2.80\%$. The cost of capital is

$$after\ tax\ WACC = 0.028(1 - 0.34)0.3 + 0.0621 \times 0.7 = 4.90\%$$

  - Working analogously we construct the following table.

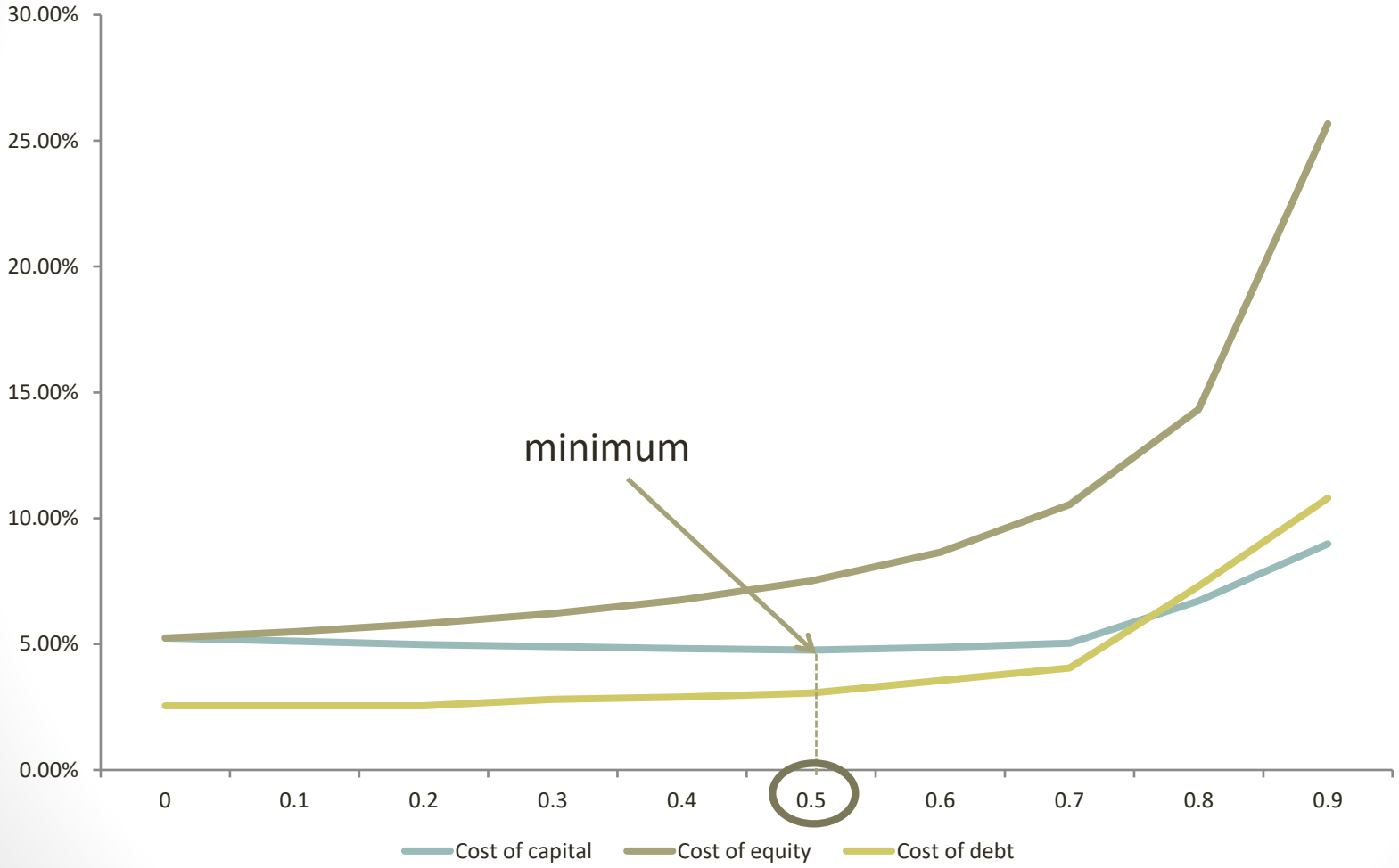
3. Analyzing the capital structure of Ford

Table 4: Cost of capital and debt ratio			
Debt ratio	Cost of equity	Cost of Debt	After-tax WACC
0	5.24%	2.55%	5.24%
0.1	5.49%	2.55%	5.11%
0.2	5.81%	2.55%	4.98%
0.3	6.21%	2.80%	4.90%
0.4	6.75%	2.90%	4.82%
0.5	7.51%	3.05%	4.76%
0.6	8.65%	3.55%	4.86%
0.7	10.54%	4.05%	5.03%
0.8	14.32%	7.30%	6.72%
0.9	25.67%	10.80%	8.98%

Optimal debt ratio

minimum

3. Analyzing the capital structure of Ford



4. Firm value at the optimal capital structure

- We would like to find firm value at the optimal debt ratio level that we found previously.
- Assume that the CF to the firm follow a growing perpetuity.
- If $FCFF$ is the current free CF to the firm, then

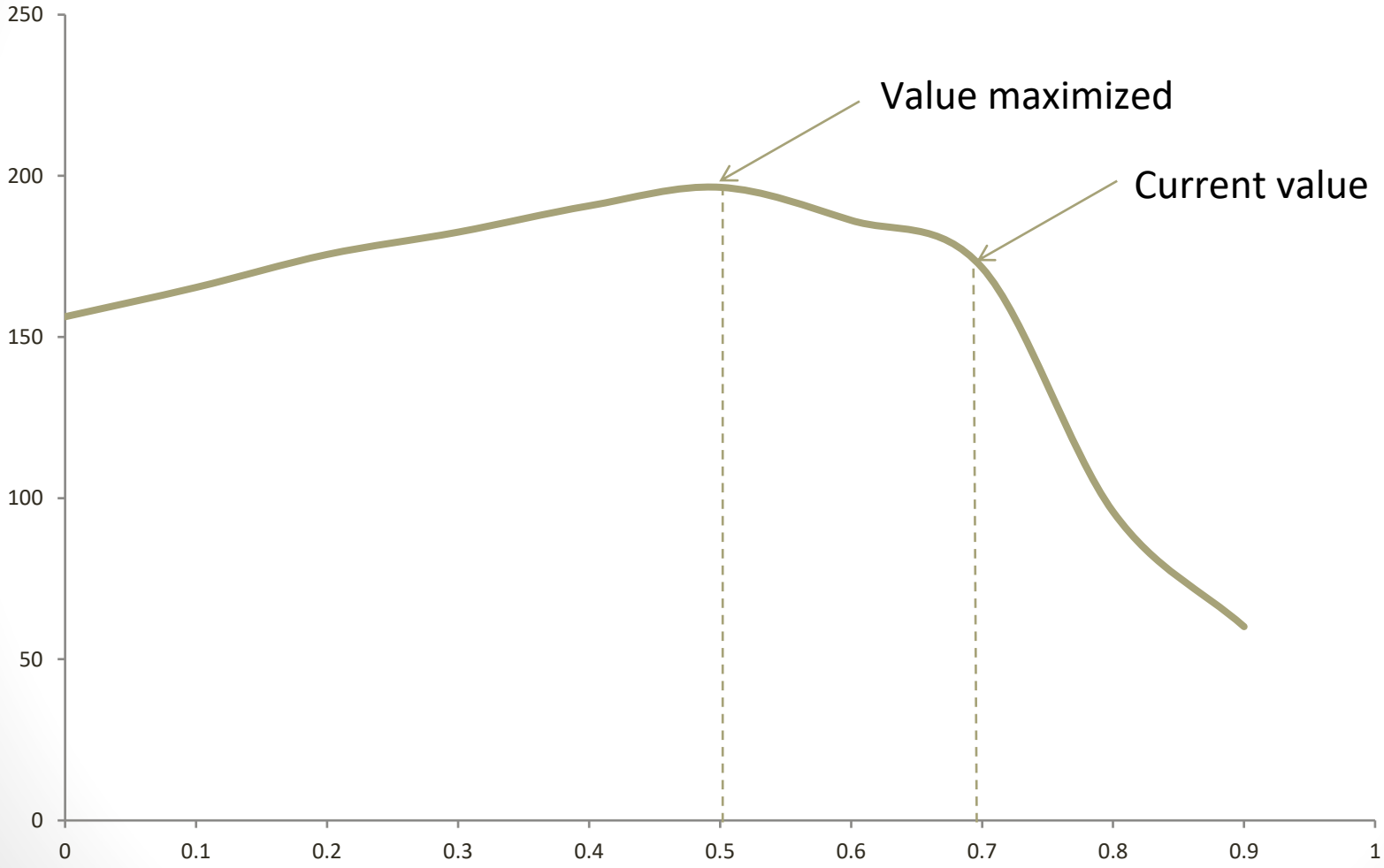
$$V = \frac{FCFF(1+g)}{after\ tax\ WACC - g}$$

- In order to find g we use the current value of 163.1, the current after-tax WACC of 5.15% and the $FCFF$ reported at the end of 2015 equal to \$3.554 billion. This gives us $g = 2.9\%$.
- If we move to the optimal capital structure the value of the firm equals:

$$V = \frac{3.554(1+0.029)}{0.0476 - 0.029} = 196.4$$

- The value of the firm would increase by 196.4 – 163.1 = 33.3 billion if we move to the optimal debt ratio.

4. Firm value at the optimal capital structure



5. The after-tax WACC in investment analysis

- If we discount the CF to the firm with the after-tax WACC *of the firm* we obtain the value of the firm.
- If we discount the CF to the firm of an *individual project* with the after-tax WACC *of the project* we obtain the NPV of it.
- When:
  - The risk of project is the same to the risk of the firm's existing assets.
  - The project would be financed with the same debt ratio as the firm overall.
- Then we can use the after-tax WACC of the firm as the discount rate for the NPV calculation of the project.

CHAPTER 13

PAYOUT POLICY

1. Introduction

- **Payout policy** (or **dividend policy**) determines how companies return cash back to its stockholders. Two ways:
  - Pay dividends
  - Buy back (repurchase) stocks
- **Question**: Is the wealth of shareholders affected by the payout policy of the firm?
- Of course we need to isolate the payout policy from investment and financing decision.
  - A firm can distribute dividends because its finances its projects by borrowing instead of using the excess cash.
  - A firm may not distribute dividends because it retains cash for future investments.
- **Right question**: What is the effect of a change in payout policy given investment and financing decisions?

2. Payout policy procedures

- **Cash dividends** are set by the board of directors and paid out to stockholders a few days later.
- Key dates and events:
  - **Dividend declaration date**: The date on which the board of directors declares the dividend that will be paid for that period. This is day the firm releases information to financial markets and, according to market efficiency, market reaction should occur this day.
  - **Ex-dividend date**: Until this date investors should have bought the stock to receive the dividend.
  - **Record date**: The company closes its stock transfer books and makes up a list of the stockholders that will receive the dividends.
  - **Dividend payment date**: Dividends are paid to stockholders in the list.

2. Payout policy procedures

- Instead of paying dividend to its stockholders, the firm can use the cash to **repurchase stock**.
- The reacquired shares may be kept in the company's treasury and resold if the company needs money.
- Four main ways to repurchase stocks:
  - **Repurchase tender offer**: The firm specifies:
    - A price at which it will buy back shares (it is typically set above the current market level)
    - The number of shares it intends to repurchase
    - The period of time for which it will keep the offer open
    - Shareholders can then choose whether to accept this offer
  - **Dutch auction**:
    - The firm states a series of prices at which it is prepared to repurchase stock.
    - Shareholders submit offers declaring how many shares they wish to sell at each price.
    - The company calculates the lowest price at which it can buy the desired number of shares.

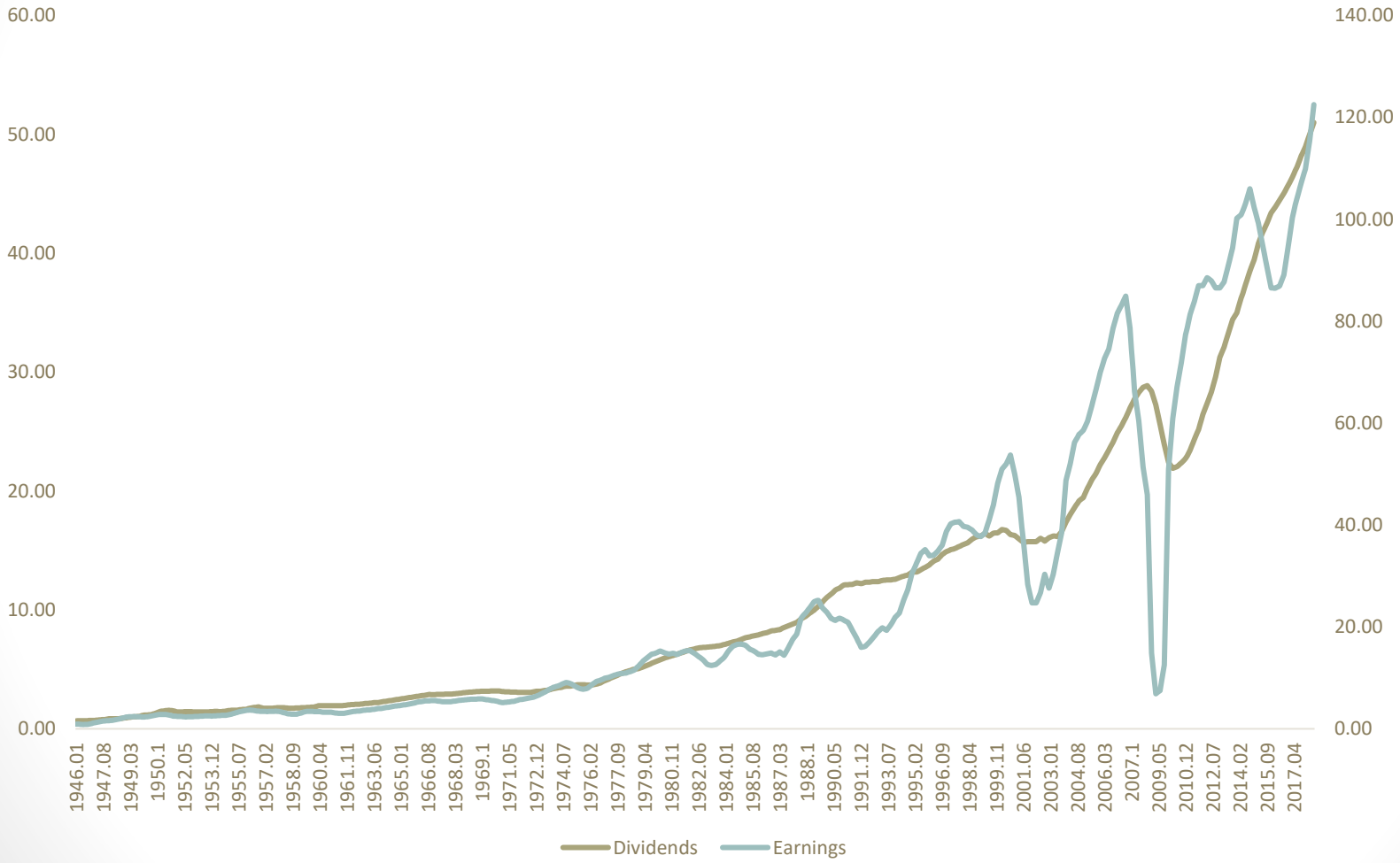
2. Payout policy procedures

- **Open market repurchase**: The firm buys its stock in the open market, just like any other investor.
- **Privately negotiated repurchases**: Private negotiation with a major stockholder to repurchase its stocks.

3. Empirical evidences

- Dividends tend to follow earnings.
- But firms do not change their cash dividends frequently. They change dividends to match long-term sustainable shifts in earnings. Implications:
  - Dividends are much smoother than earnings (see next figure).
  - Firms are reluctant to decrease dividends sending a negative signal to the market.
  - Dividends lag earnings.
- Dividends follow the life-cycle of firms.
  - High-growth firms with great investment opportunities do not usually pay dividends.
  - Stable firms with larger cash flows and fewer projects tend to pay more of their earnings out as dividends.
  - We can empirically show an inverse relation between expected growth rates in earnings per share and dividend payout ratios.

3. Empirical evidences



Earnings and dividends of the S&P500 index. Source: R. Shiller website.

4. The information in payout policy decisions

- Dividends payments and stock repurchases are important financial events.
- Investors and analysts use them to gather information about the profitability of a firm.
- However, what they are concerned for is not the level of dividends but any *change* in it.
- A higher dividend prompts a rise in the stock price, whereas a dividend decrease results in a fall in the price.
- Managers do not increase dividends unless they are confident that earnings will remain high in the future.
- Thus, the *changes* in dividends are viewed as an important indicator of the sustainability of earnings.

4. The information in payout policy decisions

- Stock repurchases are a way to hand cash back to shareholders.
- But unlike dividends, share repurchases are frequently a one-off event.
- A company that announces a repurchase program is not making a long-term commitment to earn and distribute more cash.
- The information in the announcement of a share repurchase program is different from the information in a dividend payment.
- Companies repurchase shares when:
  - they have accumulated more cash than they can invest profitably
  - they wish to increase their debt levels
- A share repurchase program is generally followed by an increase in the stock price because:
  - Investors are released knowing that the firm will distribute cash instead of investing in unprofitable projects
  - The firm can meet its obligations (debt)
  - Provides a signal of managers confidence about the future

5. The impact of payout policy in firm value

- We have seen that a change in payout policy may provide information about the future and so affect the stock price.
- But eventually this change in the stock price would happen anyway as information about the future earnings seeps out through other channels.
- *But does the payout policy change the value of the stock, rather than simply providing a signal of its value?*
- Economists fall into 3 groups:
  - **Dividend irrelevance**: Dividend policy does not impact firm value (Modigliani-Miller perfect capital market model).
  - **Dividends are "bad"**: Dividend payments decrease firm value. The firm should retain cash or repurchase stocks.
  - **Dividends are "good"**: Dividend payments increase firm value.

5.1. The Modigliani-Miller model

- Modigliani-Miller (1961) demonstrated that in perfect capital markets dividend policy does not affect the value of the firm.
- The choice to deliver value via cash dividends or using the same cash to repurchase shares is a matter of indifference to shareholders.
- The Miller-Modigliani argument is that investment decisions are completely independent of payout policy.

5.1. The Modigliani-Miller model

- **Illustration #1**: The table shows a firm balance sheet in market values. The firm undertakes a new project with an NPV of $2,000 that will be financed by the $1,000 cash held by it. The firm has also issued 1,000 stocks.
- The stock price is $12,000/1,000 = $12.

Balance sheet (market values)			
Assets		Liabilities	
Cash	1,000	Debt	0
Fixed assets	9,000	Equity	12,000
New project NPV (requires 1,000 investment)	2,000		
Total value	12,000	Total value	12,000

5.1. The Modigliani-Miller model

- The firm wants to give $1,000 in dividends (thus $1 dividend per stock).
- Since we want to isolate dividend policy from investment and financing decisions the only source left is to issue new shares to raise $1,000.
- We examine the balance sheet after: (1) the dividend is paid, (2) the new stock is sold and (3) the investment is undertaken.

New balance sheet (market values)			
Assets		Liabilities	
Cash	0	Debt	0
Fixed assets	9,000	Equity	12,000
New project PV	3,000		
Total value	12,000	Total value	12,000

5.1. The Modigliani-Miller model

- From the $12,000 of total value:
  - $1,000 belongs to the new stockholders
  - $11,000 belongs to the old stockholders
- So for the old stockholders the stock price is equal to $11,000/1,000 = $11. The stock price falls by the extra $1 dividend received.
- *You take it from the one pocket, and you give it to the other!*
- New stocks must be also worth $11. The company must issue $1,000/$11 = 91 new stocks.
- There is a *transfer of value* between the old and the new shareholders.
- The old ones suffer a loss which is offset by the extra dividend and the new ones gets the new shares issued by the firm.

5.1. The Modigliani-Miller model

- **Illustration #2:** Assume that the NPV project is negative. So, instead of using the $1,000 cash to finance it the firm decides to distribute this cash as dividend.
- The old and the new balance sheet after the dividend payout.

Old balance sheet (market values)			
Assets		Liabilities	
Cash	1,000	Debt	0
Fixed assets	9,000	Equity	10,000
Total value	10,000	Total value	10,000
New balance sheet (market values)			
Assets		Liabilities	
Cash	0	Debt	0
Fixed assets	9,000	Equity	9,000
Total value	9,000	Total value	9,000

5.1. The Modigliani-Miller model

- The stock price is equal to $10,000/1,000 = $10 before the dividend payment and $9,000/1,000 = $9.
- Again, the extra $1 dividend is offset by a decrease in the price of the stock.
- What if the firm decides to repurchase stocks instead of paying $1 of extra dividend per share?
- If it pays a fair price for the stock it will repurchase $1,000/$10 = 100 shares leaving 900 shares.
- With a total market value of $9,000 the stock price is still $9,000/900 = $10.

5.2. Dividends are "bad"

- The "dividends are bad" school argues that whenever dividends are taxed more heavily than capital gains, firms should pay the lowest cash dividend they can get away with.
- Available cash should be retained or used to repurchase shares.
- If dividends are taxed more heavily than capital gains, investors should pay less for stocks with high dividend yields.
- They should accept a higher *pretax* rate of return from securities offering returns in the form of dividends rather than capital gains.
- Of course, the *after-tax* rate of return should be independent of the payout policy, since this depends on the systematic risk of the security.

5.2. Dividends are "bad"

- **Illustration:** The stocks of firm A and B are equally risky. So, the after-tax rate of the return should be the same, equal to 10%. Investors expect these two stocks to give the same total pretax payoff of $112.50. But firm A does not pay dividend, so the payoff is considered as a capital gain.
- We find that firm's B stock selling for less than A's.
- The reason is obvious: Investors prefer stock A because its return comes in the form of capital gains. And, according to the table capital gains are less taxed than dividends. So, the difference between the stock prices of A and B is exactly the present value of the extra taxes investors face if they buy B.

5.2. Dividends are "bad"

	Firm A (no dividend)	Firm B (high dividend)
Total pretax payoff	112.50	112.50
Dividend	0	10
Next year's price	112.50	102.50
Today's price	100	97.78
Capital gain	112.50 – 100 = 12.50	102.50 – 97.78 = 4.72
Tax on dividends at 40%	0	0.4×10 = 4
Tax on capital gains at 20%	0.2×12.50 = 2.50	0.2×4.72 = 0.94
Total after-tax income	12.50 – 2.50 = 10	(10 – 4) + (4.72 – 0.94) = 9.78
After-tax return (perpetuity)	10/100 = 10%	9.78/97.78 = 10%

5.2. Dividends are "bad"

- The "dividends are bad" party seems to call not just for low payouts but for zero payouts whenever capital gains have a tax advantage.
- Few people would go quite that far. Nevertheless, the "dividends are bad" party argues that the market rewards firms with low payout ratios.
- It claims that firms that pay dividends and as a result have to issue shares from time to time are making a serious mistake.
- Any such firm is essentially financing its dividends by issuing stocks; it should have cut dividends at least to the point at which stock issues are not necessary.
- This would not only save taxes from shareholders but it would also have avoided the transaction costs of the stock issues.

5.2. Dividends are "bad"

- The previous analysis is based on the assumption that dividends are more heavily taxed than capital gains. But since 1986 in the US the tax rates on ordinary income and capital gains are the same.
- All tax disadvantages of dividends should had disappeared.
- However, even with the same tax rates, dividends carried a tax disadvantage because investor had no choice as to when to report the dividend as income; taxes were due when the firm paid out dividends.
- In contrast, investors retained discretionary power over when to recognize and pay taxes on capital gains since such taxes were not due until the stock was sold.
- This *timing option* allowed the investor to reduce the tax liability in one of two ways.
  - Take capital gains in periods of low income to offset against the gain.
  - Deferring a stock sale until investor's death could result in tax savings.
- The tax disadvantage of dividends may also affect investor's choices of stocks **(clientele effect)**:
  - Institutional investors or pension funds that pays low taxes may hold high dividend yield stocks.
  - Retail investors to prefer low-yield stocks. Moreover, this preference for low-yield stocks has been somewhat more marked for high-income individuals.

5.3. The dividends are “good”

- In spite the arguments of Modigliani-Miller are the tax disadvantage of dividends, firms continue to distribute dividends.
- The dividends are “good” school argues that they have some good reasons to do so.
- **Some investors like dividends**: Low taxed investors will prefer to invest on firms paying high dividends (they also avoid selling stocks paying transaction costs).
- **Dividend operate as an informational signal**:
  - When firms announce that they will increase dividends they commit to paying these dividends in the long term.
  - Their willingness to make this commitment indicates to investors that they believe they have the capacity to generate these cash flows in the long term.
  - This positive signal should therefore lead investors to reevaluate the cash flows and firm value and increase the stock price.
  - **Caution**: This argument is not very persuasive. Dividends maybe a costly way to convey information to the market!

5.3. The dividends are "good"

- **Payout policy and capital structure**:
  - We cannot isolate payout policy from capital structure, because firms can use it to change their dept ratios.
  - Increasing payout increases leverage.
  - A high extra dividend may be a transfer of wealth from bondholders to stockholders.
  - Generally bond prices decline upon the announcement of a large dividend payment.
- **Dividends reduce managerial power**: When forcing a firm to make a commitment to pay dividends could be an alternative to force managers to be disciplined in project choice and to reduce the cash available in discretionary uses.