Investments

Masters in Finance

NOVA SCHOOL OF BUSINESS & ECONOMICS

Spring 2025, Martijn Boons

Book chapters 1-4

Learning goals

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1. Economics: to understand the economic role of financial assets and markets, and the key trade-offs faced by investors

2. Institutions: to learn about the mechanics of real-world financial markets and contracts

3. Application: being able to value assets and construct “optimal” portfolios

Some knowledge of calculus, probability & statistics, and economics is expected! Excel is required, other programming languages may come in handy.

1. Overview of financial markets

Motivation: A simple economic framework

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End users of capital (producers/firms)

Assets	Liabilities/claims
• Land • Buildings • Brands • Org. capital • Growth options	• Op. liabilities • Bonds (debt) • Stocks (equity) • Etc.

- Financial liabilities from perspective of users
- Financial assets from perspective of investors
- Define how income is split across investors

Households (investors)

Savings

- Relationship most of the time is intermediated (banks, mutual funds, etc.); WHY?
  - Matching, diversification, monitoring etc.

Main categories of financial assets

1. <u>Equity</u>
   - Limited liability
   - “Owners” of the firm (most of the time…), in the sense that shareholders control managerial decisions (to some extent…)
   - Residual claimants: entitled to receive income generated by firm after all other claimants have received their share
   - Therefore, risky.

2. <u>Debt</u>
   - Promised payments (interest)
   - Varying maturities and default risk
   - Less sensitive to financial condition of issuer (especially if senior and/or collateralized)

3. <u>Derivatives</u>
   - Payoffs depend on performance of other securities
   - Examples: call options on stocks, commodity futures
   - Usually very risky

Key economic roles of financial assets and markets

1. Information production
   - Example: market deems firm's prospects in new geographic market to be good → higher share price → facilitates raising money (SEO vs IPO) for financing project

2. Consumption timing
   - Financial assets allow investors to substitute current consumption for future consumption

3. Risk sharing and allocation
   - Investors can easily hold diversified portfolios
   - More (less) risk-averse investors can hold less (more) risk through their portfolio choice

4. Separation of ownership and management
   - Firms have become too big to be owned by one agent and risk-averse agents want to diversify
   - Compensation packages include stocks and options to align manager's incentives with owners (=shareholders)

Financial markets are competitive (i)

- Many intelligent and well-funded economic agents constantly looking to make a profit by choosing their optimal portfolio
  - Portfolio: Active or passive collection of investment assets
    - Asset allocation: Choice among broad asset classes
    - Security selection: Choice of securities within each asset class

- Key implications:

1. Risk-return trade-off

   - To increase expected returns, investors must take on more risk.
   - Ceteris paribus, a more risky asset has a lower price.
   - Which promise is more valuable to you: A bond promising to pay 1000$ in 10 years issued by the United States government or by Nvidia?

Financial markets are competitive (ii)

2. Market efficiency

- In fully efficient markets when prices quickly adjust to all relevant information, no asset will be under- or overpriced.
  - What about Tesla?

- Grossman-Stiglitz Paradox (1980): Markets cannot be perfectly efficient – we can only get near-efficiency:
  - Investors will not rationally incur the expenses of gathering information unless they expect to be rewarded by higher gross returns compared with the free alternative of accepting the market price.

- Important implications: active portfolio management through asset allocation (``market timing’’) and security selection (``stock picking’’) only pays off when you have an informational advantage over other market participants
  - This simple idea spurred recent growth in passive management.

- Podcast: All else equal - Why good stocks are not good buys?

Key trends in financial markets

- Globalization: more and more assets are easily investible for more and more investors

- Securitization and financial engineering: new assets tailored to demand of investors wanting to hedge a particular exposure or speculate in a particular direction. [Partly due to:]

- Technological advances: transaction costs have fallen considerably over time due to move from specialist to computerized market-making.
  - More recent trends include:
    - ➢ Algorithmic trading: computer program fully authorized to trade
    - ➢ High-frequency trading: sometimes at very high speed
    - ➢ Dark pools (place bid/ask for everyone to see or “dark”)
    - ➢ PFOF (e.g., Citadel pays RobinHood a small fee to execute your orders on their app, which are uninformed)

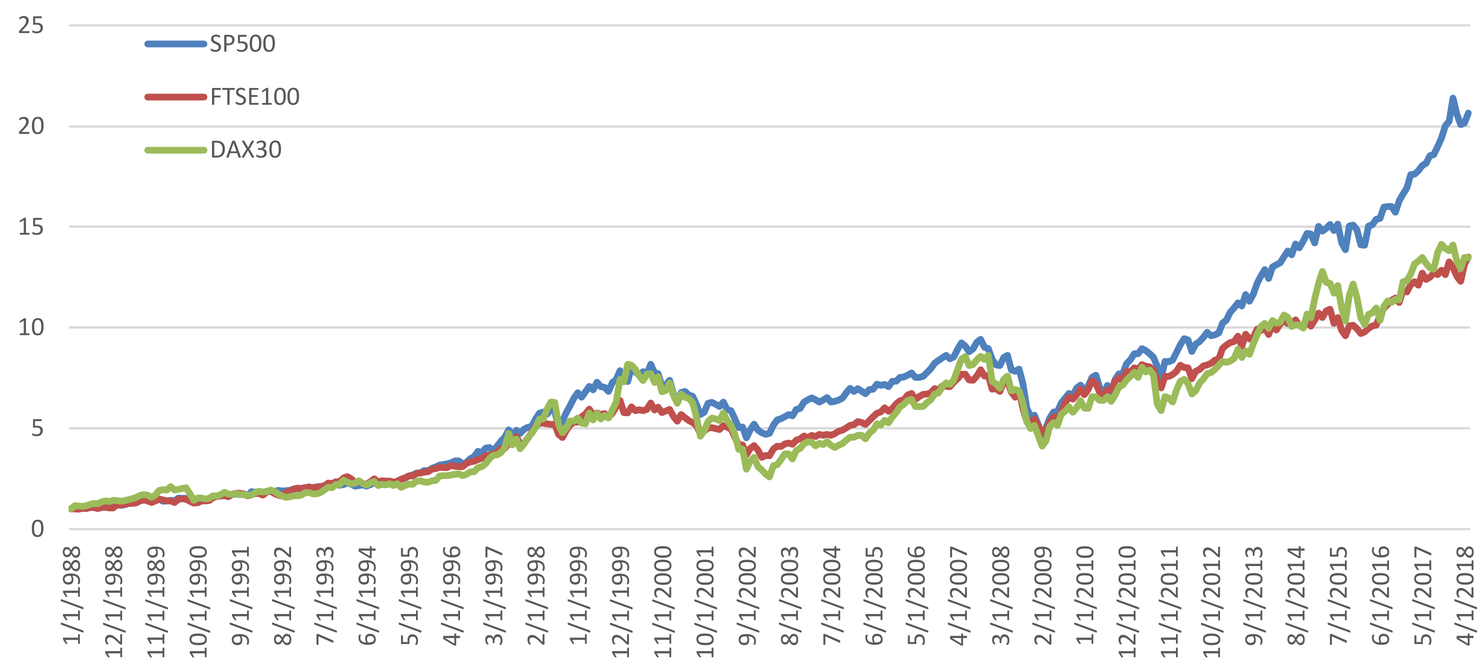
Open question: Are all these trends improving social welfare?

Focus on US stock markets

- US markets are the core of the worldwide financial system

- NYSE and NASDAQ combined are much larger than other exchanges
  - ➢ 12 (6) times the size of the German (London) stock exchange

- However, considerable co-movement across markets.
  - Cumulative return since 1988 <u>in local currency</u>:



Indexes and portfolio weights

- Indexes like the S&P500 are value-weighted
  - Larger weight given to economically more important firms
  - Requires no rebalancing (except when the index is reconstituted or firms issue/repurchase shares), making them easy and cheap to track for funds and ETFs

- Suppose you have 125 to invest in the following two firms:

	A	B
# of shares outstanding	200	100
Price today	25	100
Price in 1 year	30	85

a. What is your annual return if you had bought a price-weighted portfolio (one of each share)?
   - (30+85)-(25+100)=-10 or a return of 1/5*(30/25)+4/5*(85/100) -1= -8%.
   - You own 1/200 of A and 1/100 of B, so not value-weighted.

b. What is your annual return if you had bought a value-weighted portfolio?
   - Relative weights equal (25*200)/[(25*200+100*100)]=1/3 in A and 2/3 in B
   - You would own 125/(25*200+100*100)]=0.83% of the shares of A and B, so 1.67 shares of A and 0.83 shares of B
   - Over the year, the change in value of your investment would be

   (1.67*30 + 0.83*85) -125 = -4.16 or return equal to 1/3*(30/25) + 2/3*(85/100) -1 = -3.3%

Example (Continued)

Price-weighted		
Weights today	0.20	0.80
Return	-0.08	
Weights in 1 year	0.26	0.74
Value-weighted		
Weights today	0.33	0.67
Return	-0.03	
Weights in 1 year	0.41	0.59
Equal-weighted		
Weights today	0.50	0.50
Return	0.02	
Weights in 1 year	0.59	0.41

- At the end of the year, you still own 0.83% of each company, so the portfolio is still value-weighted:
  1.67*30/120.83 = 30*200/(30*200 + 100*85) = 0.41 in A and 0.59 in B
  → There is no need to trade to keep the portfolio value-weighted!

c. What is your annual return if you had bought an equal-weighted portfolio?
- 62.5 invested in both A and B (62.5/25 shares of A and 62.5/100 shares of B)
- Change in value would be:

(62.5/25*30 + 62.5/100*85) - 125 = 3.125 or a return of 0.5*(30/25) + 0.5*(85/100) -1 = 2.5%

- At the end of the year, the portfolio is not equal-weighted anymore:
  62.5/25*30 / (62.5/25*30+ 62.5/100*85) = 30*200/(30*200 + 100*85) = 0.59 in A and 0.41 in B
  → You will need to trade back to 50/50!
  → Rebalancing will be contrarian, which may be attractive.

2. Prices are present values

Outline

- Present values are the keystone to finance
- Some uses:
  - Determining fair prices of securities
  - Making capital budgeting decisions
- Present-value problems involve streams of cash flows:
  - Financing decisions: exchange future dollars for present dollars
  - Investing decisions: exchange present dollars for future dollars
- Three valuation topics
  1. Valuing certain cash flows
  2. Valuing uncertain cash flows
  3. The golden rule of finance: Net Present Value
- Standard methodology for valuation: Discount expected cash flow in period n, $E(C_n)$, at appropriate discount rate r_n that reflects both time value of money and risk: $E(C_n)/(1+r_n)$

Time value of money

- You can invest in two projects:

1) earns 100€ in one year or
2) earns 100€ in 10 years.

- Which do you prefer? Or, how much are you willing to pay for each investment?

  - Price 1 - Price 2 > 0 and this difference reflects time preference
    - Quantified using: Price 1 = $\frac{100}{(1+r_1)}$ vs Price 2 = $\frac{100}{(1+r_{10})^{10}}$
    - Here, r represents an interest (or discount) rate that allows you to calculate present (and future) values; r_n captures that appropriate rate varies with maturity n
      - Intuition: r_n is the per-period return that makes investors indifferent between investing 1$ for n periods or not investing at all.
      - ECB yield curve

Maturity-specific interest rates

- Derived from zero-coupon government bonds with market price P(n)
  - Pays a fixed cash flow of 100 in n years
  - Maturity n ranges from less than a year to over 30 years
  - More on bonds later in this course

- Hold-to-maturity (HTM) return $r_{HTM,n} = \frac{100}{P(n)} - 1$

- To make $r_{HTM,n}$ comparable for bonds with different n, we annualize, such that r_n is the Effective Annual Rate:

$$r_n = (1 + r_{HTM,n})^{1/n}$$

- Given the following prices of zero-coupon bonds issued by the US Treasury, what are the maturity specific interest rates r_n?

n in years	P(n)	$r_{HTM,n}$	r_n
0.5	97.36	2.7%	5.5%
1	95.52	4.7%	4.7%
25	23.30	329.2%	6.0%

Annual Percentage Rates

- We compound or discount treating r_n as an Effective Annual Rate (EAR):

$$C_0(1+r_n)^n \text{ or } C_n/(1+r_n)^n$$

- Some rates are quoted as Annual Percentage Rates (APR)
  - Given the compounding interval m, denote by r_m^* the APR, which is converted to an EAR r_m using

$$r_m = \left(1+\frac{r_m^*}{m}\right)^m - 1$$

  - E.g., m=2 means that $\frac{r_m^*}{2}$% of interest is paid every 6 months

- Example: payday loans
  - Borrow against salary to be received at the end of the month
  - Typical quotation of contract: 2.5% fee per week + 0.5% interest per day (all paid weekly)
  - What is the EAR on the typical contract?
    - ➢ Per week: (2.5%+0.5%*7) = 6%
    - ➢ EAR = 1.06^52 -1 = 1969%
    - ➢ Lawmakers have started asking questions about this practice (though you break-even if 1 out of 16 defaults every week)

Continuously compounded rates

- Rates may also be quoted using continuous compounding:

$$\lim_{m\to\infty}\left(1+\frac{r_m^*}{m}\right)^m = e^{r_m^*}$$

- The continuously compounded rate provides us with the EAR to be applied when the compounding interval *m* of an APR becomes infinite.

$r_m^* = \mathbf{10\%}$, m	r_m (=EAR)
1	0.1
12	$(1+0.1/12)^{12}-1 = 0.1047$
365	$(1+0.1/365)^{365} - 1 = 0.1052$
+∞	$e^{0.1} - 1 = 0.1052$

- For a continuously compounded rate r_n:
    - Present value = $C_n e^{-r_n * n}$
    - Future value = $C_0 e^{r_n * n}$

Present value of multiple cash flows

- Using the discount rate, or opportunity cost of capital, appropriate for a known stream of cash flows $\{C\}$, the present value is

$$PV(\{C\}) = C_0 + \frac{C_1}{(1+r_1)} + \frac{C_2}{(1+r_2)^2} + \cdots + \frac{C_n}{(1+r_n)^n} = \sum_{t=0}^{n} \frac{C_t}{(1+r_t)^t}$$

- The present value tells you how much you would be willing to pay for the stream $\{C\}$, in current euros or dollars

Example

- Your company possesses logging rights for a forest
  - If you log the area, you will receive $2M in 1 year and $2.5M in 2 years
  - Risk-free rate (discount rate) is 6% (= r_1 = r_2)

- What is the present value of the logging rights?

$$PV = \frac{\$2M}{(1+0.06)} + \frac{\$2.5M}{(1+0.06)^2} = \$4.1M$$

- Note, we can use the risk-free rate to discount, because the cash flows are said to be received without any risk or uncertainty!

Net present value (NPV)

- NPV corresponds to the PV of the project's cash flows net of initial investment

- Returning to our logging rights example:
  - Firm must purchase the logging rights for $3M
  - NPV of the project is then

$$\$4.1M - \$3M = \$1.1M$$

- Golden rule of finance: take all positive NPV projects!
  - Applies to capital budgeting, capital structure decisions, but also financial investments and arbitrage strategies!

Risk (i)

- You can invest in two projects:

1) earns 100€ with certainty in one year
2) earns 0€ or 200€ with equal probability in one year.

- Which do you prefer? Or, how much are you willing to pay for each investment?

- For most people, Price 1 - Price 2 > 0 and this difference reflects risk preference
  - Quantified as: Price 1 = 100/ (1+ $r_{risk-free}$) vs Price 2 = 100 / (1+ r_{risky}), where

$$r_{risky} = r_{risk-free} + \text{risk premium}$$

- The risk premium is higher for stocks than for bonds, for instance.
- Both $r_{risk-free}$ (gov't bond yield curve) and risk premium (equity yield curve derived from dividend futures) can vary with maturity n

Risk (ii)

- You can invest in two projects and each project gives 0 or 200 with equal probability in one year. However:

  1. earns 0 when the economy is doing worse than average and 200 when the economy is doing better than average
  2. earns 200 when the economy is doing worse than average and 0 when the economy is doing better than average

- Which do you prefer? Or, how much are you willing to pay for each investment?
  - For most people, P1 < P2, because people like that 2. pays off exactly when times are bad.
  - Quantified as P1 = 100 / (1+$r_{risky,1}$) vs P2 = 100 / (1+ $r_{risky,2}$) and $r_{risky,1}$ > $r_{risky,2}$

- The appropriate risk premium for a cash flow is higher the more it covaries with the market or business cycle.
  - What does covariation mean exactly? By how much higher?
  - We will study asset pricing models that answer these questions by defining: risk premium = amount of risk x price of risk.

Prices, discount rates, and (expected) returns

- Asset price conditional on all information available at time t (today):

$$P_t = \frac{E_t[C_{t+1}]}{(1+r_1)} + \frac{E_t[C_{t+2}]}{(1+r_2)^2} + \frac{E_t[C_{t+3}]}{(1+r_3)^3} + \cdots$$

can be restated as:

$$P_t = \frac{E_t[C_{t+1}]}{(1+k)} + \frac{E_t[C_{t+2}]}{(1+k)^2} + \frac{E_t[C_{t+3}]}{(1+k)^3} + \cdots$$

- k is the single discount rate that when applied to all expected future cash flows (dividends for stocks, coupons for bonds) gives you as present value the price P_t of the asset.
  - k = expected return on the asset when $r_1 = r_2 = r_3 = \cdots$
  - k ≈ average expected return over the life of the asset when $r_1 \neq r_2 \neq r_3 \neq \cdots$

- To see the meaning of k, define an asset's return:

$$r_{t+1} = \frac{P_{t+1} + C_{t+1}}{P_t} - 1,$$

- Taking expectations, we have:

$$E_t[r_{t+1}] = \underbrace{\frac{E_t[P_{t+1}]}{P_t}}_{Expected\ capital\ gain} + \underbrace{\frac{E_t[C_{t+1}]}{P_t}}_{Dividend\ or\ coupon\ yield} - 1 = k,$$

since $E_t[P_{t+1} + C_{t+1}] = P_t(1+k)$ (under the assumption that k does not change).

Returns and expected returns

- Intuitively, we thus decompose returns in three parts:

$$r_{t+1} = E_t[r_{t+1}] - discount\ rate\ news + cash\ flow\ news$$

One of the most important decompositions in empirical finance!

- When realized returns r_{t+1} do not equal expected returns $E_t[r_{t+1}] = k$, this happens because of unexpected changes in
  1. the discount rate
     - ✓ Changes in risk-free rate (time value of money)
     - ✓ Changes in risk premium (quantity and/or price of risk)
  2. Expected future cash flows

- For small time intervals, the contribution of $E_t[r_{t+1}]$ is also small.
- Question: The S&P500 dropped by 2% over the last week, was that discount rate or cash flow news?

Returns and inflation (1/2)

- Inflation: rate at which overall price level rises over time

- With higher inflation, investors demand a higher nominal interest rate (growth rate of money) to obtain positive real returns (growth rate of purchasing power)

- Nominal discount rates rates thus reflect
  1. Real risk-free rate that compensates for delaying consumption (time value of money)
  2. (Expected) inflation: compensation for (expected) rise in prices of consumption goods
  3. Risk premia: compensation for bearing risk (among other risks, inflation risk, because inflation is uncertain)

$r_{nominal,risky}$ = $r_{real,risk-fre}$ + expected inflation + risk premium

Returns and inflation (2/2)

- Inflation risk: an example
  - Consider $1,000 nominal bond maturing in one year with a $100 default-free interest payment (10% nominal return)
  - Real cash flow – i.e. how much you will be able to consume? – is however risky, since (realized) inflation is random:

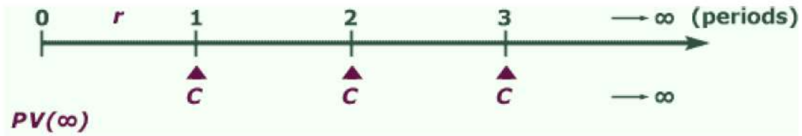
(1+real return) = (1+nominal return) / (1+inflation)

- This means that long-term Treasury bonds are actually risky too
  - Long-term treasury bonds possibly even riskier than some stocks, because long-term inflation is highly uncertain.
  - Fortunately, nowadays, inflation-linked bonds are available.

Shortcuts to calculate present values

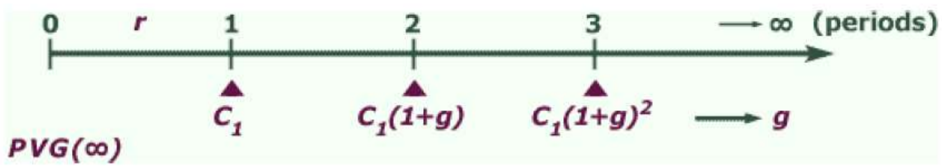
- Given a constant discount rate *k:*

1a. Perpetuity: Fixed cash flow C received forever at the end of every period



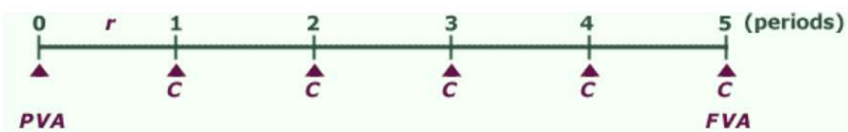
→ $P = \frac{C}{k}$ (→ $k = \frac{C}{P}$)

1b. Growing perpetuity: Cash flow grows periodically at a rate g and that is received forever at the end of every period



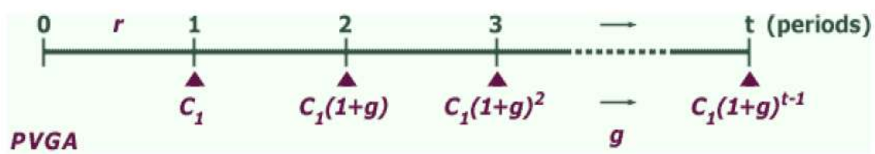
→ $P = \frac{C}{k-g}$ (→ $k = \frac{C}{P} + g$)

2a. Annuity: Cash flow C received at the end of a total of n periods



→ $\frac{C}{k}(1 - \frac{1}{(1+k)^n})$

2b. Growing annuity: Cash flows grows at a rate g and is received at the end of a total of n periods



→ $\frac{C}{k-g}(1 - \frac{(1+g)^n}{(1+k)^n})$

- The annuity formulas are easily derived as the difference between two perpetuities

Example

- Take company Alfa
  - Expected to generate per-share dividends of $1 over the next year
  - Dividends expected to grow at 2% per year “forever”
  - Appropriate discount rate is 8%

Q1: What is Alfa’s current stock price?
  - Growing perpetuity: 1/(8%-2%)=16.67

Q2: What is the fraction of the price coming from dividends after year 10?
  - Dividend in year 11: 1*(1+2%)^10=1.22
  - Present value: [1.22/(8%-2%)]*(1/(1+8%)^10) = 9.41
  - Fraction: 9.41/16.67 = 0.56

- General result: for the average stock (and the stock market as a whole), most of the value is due to long-term dividends
- Then, why do managers seem to care mostly about short-term earnings targets?

  - “Positive” interpretation: Changes (growth) in current earnings are a signal of future earnings
  - “Negative” interpretation: short-termism (bonuses tied to current earnings and will manager stay at the company for over 10 years?)
    - Institutional investors are concerned about this issue: https://www.blackrock.com/corporate/investor-relations/2018-larry-fink-ceo-letter
    - Solution: managerial compensation plans consist of stock (and option) elements that incentivize long-term growth

Some corporate finance

- In the real world, firms face a trade-off when deciding what to do with the earnings they generate: (i) pay out earnings as dividends now or (ii) reinvest earnings to potentially create more growth in earnings and thus dividends in the future.

- What will maximize the share price?

    - Cutting dividends to invest increases the share price if and only if the new investments have a return larger than the discount rate.

    - Intuitive, but let’s see this more formally.

Trading off dividends and reinvestment

- Consider the following situation in a firm
  - Current earnings per share: EPS
  - Discount rate (cost of capital): k
  - Return on investment: z
  - Payout rate: p (reinvestment rate: (1-p))

Time	0	1	2	3	4	…
Earnings		EPS	EPS+(1-p)EPS*z = (1+g) * EPS	(1+g)*EPS+(1-p)*(1+g)*EPS*z = EPS*(1+g)^2	EPS*(1+g)^3	
Dividends		p*EPS	p*EPS*(1+g)	p*EPS*(1+g)^2	p*EPS*(1+g)^3	
Reinvestment		(1-p)*EPS	(1-p) *EPS*(1+g)	(1-p)*EPS*(1+g)^2	(1-p)*EPS*(1+g)^3	

- Implied growth rate of dividends: g=(1-p)*z

- Stock price at t=0: EPS*p / (k-g)

Example continued

- What is the price of Alfa stock if EPS=1.25, k=8%, z=10%, and p=80%?
  - ➢ P = (EPS*p)/(k-(1-p)*z)=(1.25*80%) / (8%-2%) = 16.7

- What happens to the share price of Alfa as payout ratio and return on investment change?

		Return on investment (z)		
	Price	6%	8%	10%
Payout ratio (p)	70%	14.11	15.63	17.50
	80%	14.71	15.63	16.67
	90%	15.20	15.63	16.07

- With z>k: price of the stock decreases as payout increases, i.e., the firm should reinvest as much as possible
  - ➢ As time passes, return on investment will go down (competition), and the company must at some point start paying out dividends
- Conversely, with z<k: price of the stock increases in payout, as reinvesting destroys value
- With z=k: payout strategy doesn’t matter
  - ➢ In an efficient market, this is the relevant case and dividend policy is irrelevant!

3. Practicalities of trading in financial markets

Buy or sell? Long or short?

- Long position:
  - buy the asset today and sell it later
  - Return: $r_{t+1} = \frac{P_{t+1}+C_{t+1}}{P_t} - 1$
  - Profit from increase in the asset's price (and receive cash flow)

- Short position:
  - Borrow asset from a dealer/broker and sell it today. Close out the position later by buying the asset in the market and returning it to the party from which it was borrowed
    - Different from selling an asset you already own.
  - Return: $-r_{t+1} = 1 - \left(\frac{P_{t+1}+C_{t+1}}{P_t}\right)$
  - Profit from a decrease in the asset price (and need to reimburse dealer/broker for intermediate cash flows, like dividends)
  - In practice, short positions more costly (borrowing fee) and risky (return <-100% possible, recall risk) and not allowed for some investors (e.g., pension funds)
  - Wirecard scandal is a good example of why we need to allow short positions

Types of orders on an exchange

- Market Order:
  - Traders specify "buy" or "sell" (and quantity)
  - Priority is time – it is executed immediately
  - Trader receives current market price

- Limit Order:
  - Traders specify buying or selling price (and quantity)
  - Priority is price – it is executed if and when condition is met
  - A collection of limit orders waiting for execution is a *limit order book*.

- Bid-ask spread:
  - Difference between the bid and ask prices
  - Implicit cost of trading
    - You compensate the counterparty for providing liquidity (and market-making more generally) as well as information asymmetry.

- If you are uninformed, you typically want to make market orders in the most liquid period of the day.

FDX FedEx Corporation

NYSE Arca. FDX Go>>

Bid				Ask			
ID	Price	Size	Time	ID	Price	Size	Time
ARCA	90.04	100	14:05:22	ARCA	90.05	400	14:05:21
ARCA	90.03	302	14:05:25	ARCA	90.06	104	14:05:21
ARCA	90.02	204	14:05:25	ARCA	90.07	303	14:05:21
ARCA	90.01	1604	14:05:17	ARCA	90.08	303	14:05:18
ARCA	90.00	302	14:05:18	ARCA	90.09	303	14:05:18
ARCA	89.99	403	14:05:21	ARCA	90.10	404	14:04:55
ARCA	89.98	1003	14:05:14	ARCA	90.11	404	14:04:00
ARCA	89.97	1103	14:05:20	ARCA	90.12	802	14:05:23

Figure 3.4 The limit order book for FedEx on the NYSE Arca market

Source: New York Stock Exchange Euronext, www.nyse.com, June 22, 2012.

- If I want to buy a share of FedEx and I post a market order, at which price will that be executed?
- If I want to buy 500 shares of FedEx and I post a market order, at which price(s) will that be executed?
- If I post a limit order to buy 500 shares at a price of 90, where will I enter the order book? (Limit buy order)

Buying on Margin

- Definition:
  - Investor borrows part of the purchase price of a stock from a broker
  - Investor contributes the remaining portion

- "Margin" refers to the percentage or amount contributed by the investor
  - Initial margin is set by the regulator and depends on the asset
  - Maintenance margin
    - Minimum equity that must be kept in the margin account
    - Margin call if value of securities falls too much

- Goal: Leverage the investment

Maintenance margin details

- Investor pays $6,000 and borrows $4,000 from broker to purchase 100 shares at 100 $/share
- Initial balance sheet of the investor:

Assets			Liabilities and Owner's Equity	
100 shares	$10,000		Loan from broker	$4,000
			Equity	$6,000

Initial Margin = Equity / Value shares = [100*100- 4000] / 100*100 = 60%

- Suppose the stock drops by 30% to 70 $/share

Assets			Liabilities and Owner's Equity	
100 shares	$7,000		Loan from broker	$4,000
			Equity	$3,000

- New margin = [(100*70)-4000] / 100*70 = 0.43

  What is the return? 3000/6000 - 1 = -50% (=-30%*10/6)
- Suppose the maintenance margin is 30%. At what price would the investor get a margin call?

$$\frac{Equity}{Value\ shares} = 0.3 \Rightarrow \cdots \Rightarrow P = \$57.14$$

Note: buying on margin increases volatility and you need to pay interest over what you borrowed. (Movie)

Exercise

1. You expect a stock to pay a dividend of 5$ over the next year and that dividend is expected to grow at a rate of 6% in the 9 years after. After that, the growth is expected to slow down and hit 1% per year. Given a discount rate of 10%, what must be the price of the stock?

2. Suppose the stock is traded at a price of 70$ in the market, should you go long or short? What is the NPV of this investment? Is this a risk-free profit?

3. What is your return over the next year if, at the end of the 1st year and just before the first dividend is paid, the market price agrees completely with your expectations?

4. What is your return if you had used 50% margin (i.e., you invest 35$ of your own money and 35$ you borrow from the broker)? How much equity will you have in your margin account?