DATASCI 385 Quantitative Finance

Lecture 1: The investment environments

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Suggested reading: Investments Ch 1 & 17-19

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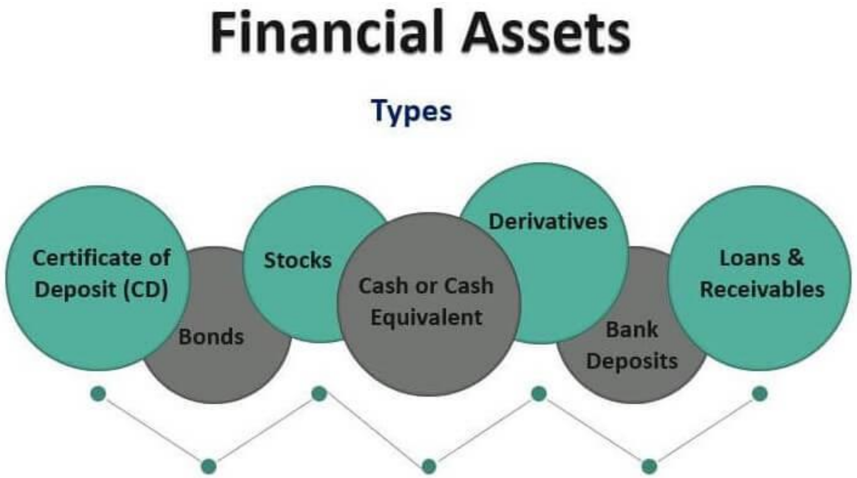
Real assets vs financial assets

- **Real assets**: land, buildings, machines, and knowledge that can be used to produce goods and services

- **Financial assets**: stocks, bonds, derivatives, and other claims to the income generated by real assets



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Real and financial assets to the economy

- **Real assets**
  - Determine the productive capacity of the economy
  - Generate net income to the economy

- **Financial assets**
  - Do not directly contribute to the productive capacity of the economy
  - Define the allocation of income or wealth among investors

A balance sheet example

Assets	$ Billion	% Total	Liabilities and Net Worth	$ Billion	% Total
Real assets			**Liabilities**		
Real estate	$ 28,816	23.5%	Mortgages	$ 10,437	8.5%
Consumer durables	5,411	4.4	Consumer credit	3,865	3.2
Other	628	0.5	Bank and other loans	1,207	1.0
Total real assets	$ 34,855	28.4%	Other	219	0.2
			Total liabilities	$ 15,727	12.8%
Financial assets					
Deposits and money market shares	$ 12,442	10.1%			
Life insurance reserves	1,647	1.3			
Pension reserves	26,069	21.3			
Corporate equity	18,106	14.8			
Equity in noncorporate business	13,044	10.6			
Mutual fund shares	8,764	7.1			
Debt securities	6,210	5.1			
Other	1,521	1.2			
Total financial assets	$ 87,802	71.6	*Net worth*	106,929	87.2
Total	$122,657	100.0%		$122,657	100.0%

Financial markets and the economy

- Financial assets and markets play crucial roles in developed economy

- *Role 1*: **Information rule**

  - Resource allocation through financial markets
    - Higher stock price -> easier and cheaper to raise capital for the firm (few shares needed)

    - But may not be most efficient all the time

  - Stock prices reflect investors' collective assessment of a firm's current performance and future aspects

Financial markets and the economy

- *Role 2*: **Consumption of timing**

  - Some individuals earn more than they currently wish to spend
    - In high-earning periods, invest savings in financial assets such as stocks and bonds

  - Others, for example, retirees, spend more than they currently earn
    - In low-earning periods, sell financial assets to provide funds for consumption needs

  - "Shift" your consumption over the course of your lifetime

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Financial markets and the economy

- *Role 3*: **Allocation of risk**
  - Investors can select security types with the risk-return characteristics that best suit their preferences
  - *Example*: Toyota raises the funds to build its auto plant by selling both stocks and bonds to the public
    - Optimistic or risk-tolerant investments buy shares of stock
      - More risk, more rewards
    - Conservative ones buy bonds
      - Provide fixed payments

The investment process

- An investor's *portfolio*: collection of investment assets

- Once the portfolio is established, it is rebalanced by
  - Selling securities and buying new securities
  - Adding funds to increase portfolio size
  - Selling securities to decrease portfolio size

- Investors make two types of decisions in constructing their portfolios
  - **Asset allocation**: choose among broad asset classes
  - **Security selection**: choose which securities to hold *within* each asset class
  - "*Top-down*" strategy: first asset allocation, then security selection
  - "*Bottom-up*" strategy: first security selection (may heavy represent one industry)

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Security analysis

- Security analysis involves the valuation of particular securities that might be included in the portfolio

- The intrinsic value of a stock depends on the dividends and earnings expected from the firm (fundamental analysis)

    - Macroeconomy and industry analysis

    - Firm specific analysis (equity valuation model and financial statement analysis)

Macroeconomy analysis

- The Global Economy
  - GDP growth, export prospects, price competition, exchange rate

- The domestic macroeconomy
  - Price to forecasts of earnings per share (EPS), GDP, unemployment rate, inflation, interest rates, sentiment

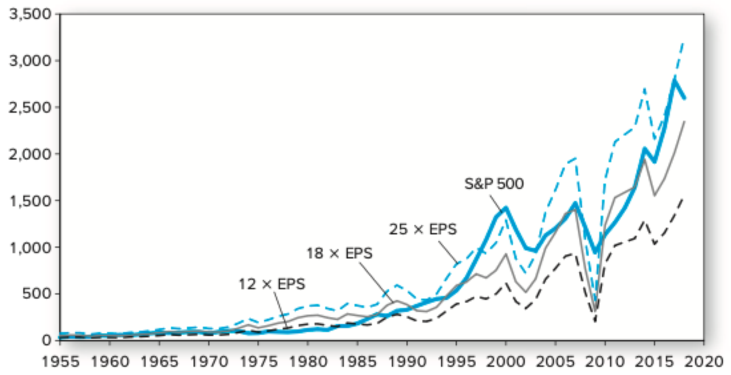

Figure 17.2 S&P 500 index versus earnings per share
Source: Authors' calculations using data from the St. Louis Federal Reserve Bank database (FRED).

P/E ratio: 29.5 as of Aug 2026

Industry analysis

- The profitability varies with industry and firms within an industry

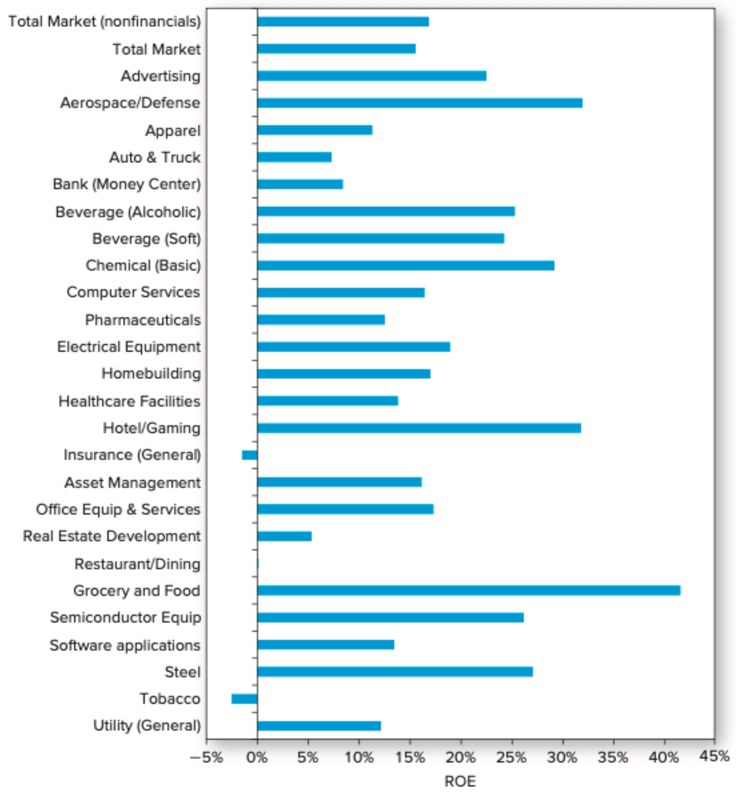

Figure 17.5 Return on equity by industry, 2018

Source: Professor Aswath Damadaran, http://pages.stern.nyu.edu/~adamodar/.

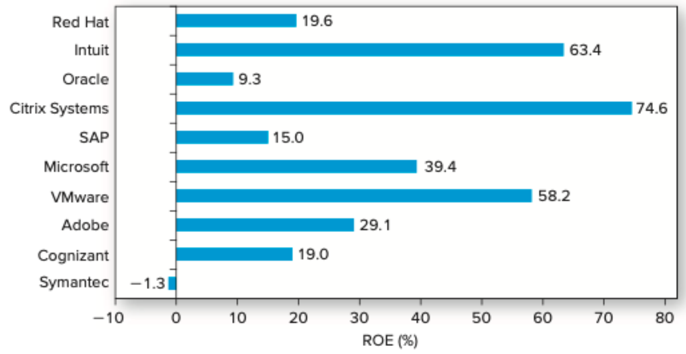

Figure 17.7 ROE of major software development firms

Source: Yahoo! Finance, **finance.yahoo.com**, March 1, 2019.

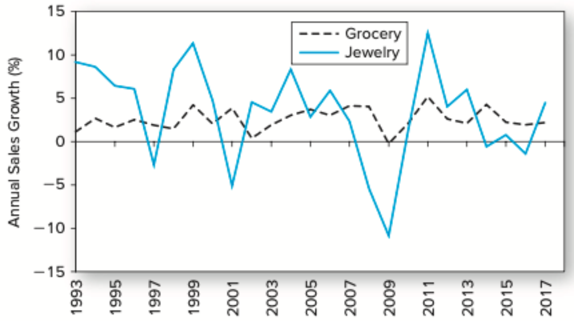

Figure 17.8 Industry cyclicality: Growth of sales, year over year, in two industries; sales of jewelry show much greater variation than sales of groceries

Source: U.S. Census Bureau.

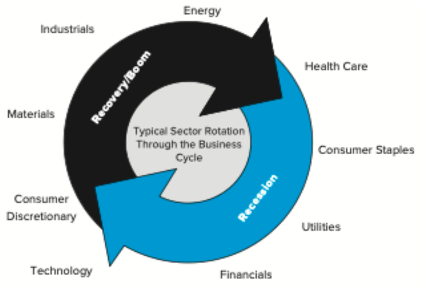

Figure 17.10 Sector rotation

Source: Sam Stovall, *BusinessWeek Online*, "A Cyclical Take on Performance."

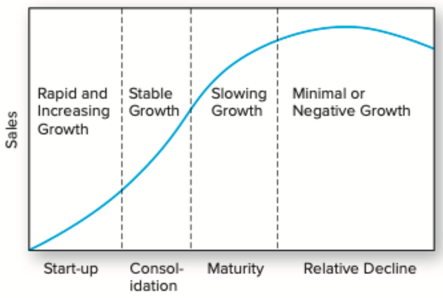

Figure 17.11 The industry life cycle

Firm specific analysis

- Current and prospective profitability of a form to assess fair market value

Table 18.1

Financial highlights for Microsoft Corporation and the software applications industry

Price per share	$111.98	
Common shares outstanding (billion)	7.67	
Market capitalization ($ billion)	$858.6	
Latest 12 months		
Sales ($ billion)	$118.48	
EBITDA ($ billion)	$ 49.58	
Net income ($ billion)	$ 33.54	
Earnings per share	$ 4.31	
Valuation	**Microsoft**	**Industry Average**
Price/Earnings	22.43	39.94
Price/Book	9.33	8.03
Price/Sales	7.25	6.42
PEG	1.76	1.99
Profitability		
ROE (%)	39.35	13.47
ROA (%)	9.44	
Operating profit margin (%)	32.83	21.35
Net profit margin (%)	28.31	10.45

Source: Microsoft data from **finance.yahoo.com,** February 28, 2019; industry data courtesy of Professor Aswath Damadaran, **http://pages.stern.nyu.edu/~adamodar/.**

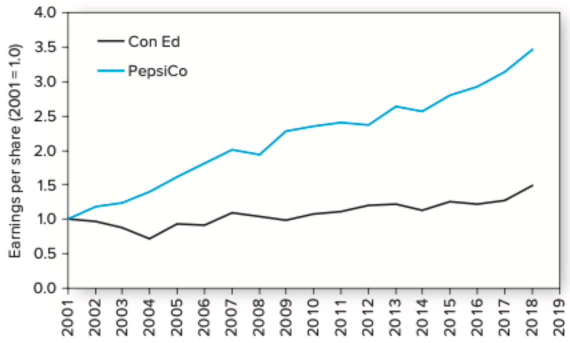

Figure 18.4 Earnings growth for two companies

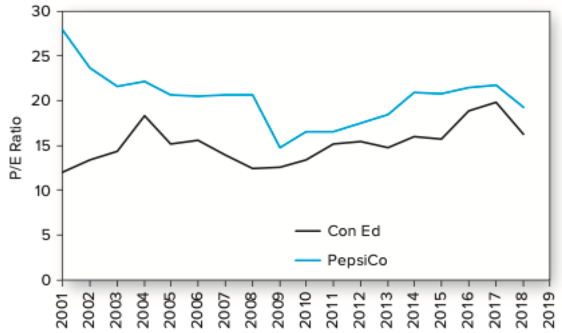

Figure 18.5 Price–earnings ratios

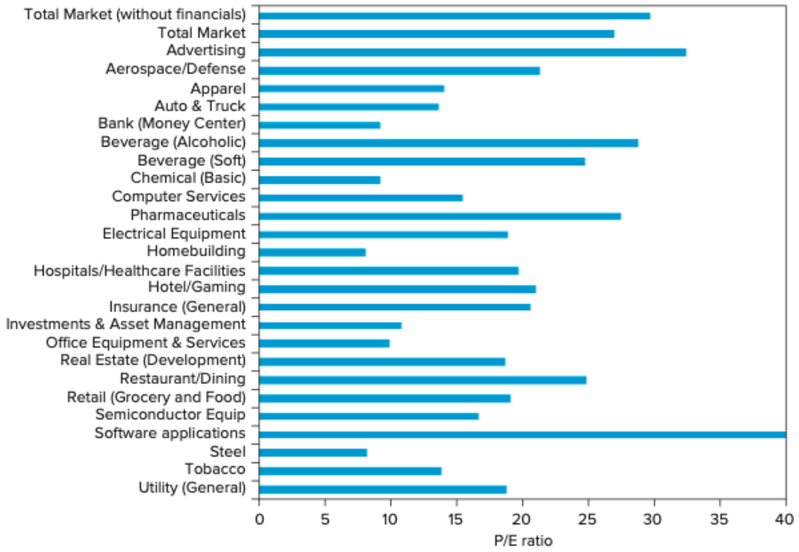

Figure 18.6 P/E ratios for different industries

Source: Website of Prof. Aswath Damodaran, **pages.stern.nyu.edu/~adamodar/,** February 27, 2019.

Markets are competitive

- "No-free-lunch" proposition:
  - Expect to find few securities that are so underpriced/overpriced and represent obvious bargains
  - Two implications

- *Implication 1*: **Risk-return tradeoff**
  - There is always risk associated with return
  - Actual returns will always deviate from the expected return
  - E.g., S&P 500 index fell by 46% in 1931, gained 55% in 1933

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Markets are competitive

- *Implication 2*: **Efficient markets**
  - "Efficient market hypothesis": Security price reflects market consensus estimate of the security value

- Choose between two investment opportunities
  - **Passive management**: holds highly diversified portfolios without attempting to improve investment performance through security analysis
  - **Active management**: improves performance by identifying mispriced securities or by timing the performance of broad asset classes

Three major players in the financial market

- **Firms** are net demanders of capital

- **Households** typically are net suppliers of capital

- **Governments** can be borrowers or lenders
  - Tax receipts less than expenditure: borrower (since World War II, issue bonds)
  - Otherwise: lender (latter part of 1990s, e.g., education, small business, agriculture)

Financial intermediaries

- *Financial intermediaries* stand between security issuer (e.g., firm) and security owner (e.g., individual investor)
  - E.g., banks, investment companies, insurance companies, and credit unions
  - Issuers and owners do not need to directly contact each other
  - Assets and liabilities are overwhelmingly financial

Investment companies

- Pool and manage money of many investors
- Arise out of **economies of scale**: lower brokerage fees and research costs
- **Mutual funds**: have the advantage of large-scale trading and portfolio management
  - charge a fixed percentage of assets under management
- **Hedge funds**: pursue complex and higher risk strategies
  - Open to institutional investors, keep a portion of trading profits

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Investment bankers

- Advise the issuing corporation on the prices of the issued securities, appropriate interest rates, and so forth
  - E.g., SpaceX IPO involved: Goldman Sachs, Morgan Stanley and others
- Marketing the securities in the primary market
  - **Primary market**, where new issues of securities are offered to the public
  - **Secondary market**, where investors trade previously issued securities among themselves
- Investment banks originally separated from commercial banks last century by law, and then combined after 2008
  - E.g., Goldman Sachs, Merrill Lynch, and Lehman Brothers

Fintech and financial innovation

- Applies technology to financial market
- **Peer-to-peer lending**: link lenders and borrowers directly, without need of an intermediary like a commercial bank, e.g., LendingClub
- **Cryptocurrencies**: payment systems that bypass traditional channels such as credit cards, debit cards, or checks, e.g, bitcoin
- **Roboadvisors**: utilize algorithms to automate investment advice

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☐	597395	2729719	11.86%	60	Current		1	1	$0.47	$0.00	$0.47	$21.34	4393.44%	(1172.15%
☐	364753	199164	12.72%	36	Current		4	1	$2.69	$0.02	$2.71	$5.12	88.76%	(1039.86%
☐	372486	230592	14.74%	36	Current		26	3	$2.84	$0.03	$2.86	$2.98	3.79%	(33.01%)
☐	372486	229081	14.74%	36	Current		26	3	$2.84	$0.03	$2.86	$2.98	3.79%	(33.01%)
☐	373291	230590	13.47%	36	Current		27	3	$2.93	$0.03	$2.96	$3.07	3.69%	(29.74%)
☐	774349	5100137	14.82%	36	Late (31-120 days)		67	2	$3.32	$0.01	$3.32	$3.35	0.64%	8.43%

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	Note ID	Note Title	Investment	Status	Payments Received	Remaining Payments	Outstanding Principal	Accrued Interest	Principal + Interest	Asking Price	Order Expires On
☐	2384130	consolidation	$25.00	In Grace Period	$7.67	47	$21.11	$0.41	$21.52	$19.50	12/02/11
☐	4294790	Debt Loan	$25.00	In Grace Period	$3.66	54	$23.35	$0.42	$23.78	$21.95	12/02/11
☐	3437743	pay off debt	$25.00	In Grace Period	$5.07	51	$22.19	$0.30	$22.49	$20.45	12/02/11
☐	3634642	i would like to be debt free	$25.00	In Grace Period	$5.11	52	$22.67	$0.15	$22.82	$20.35	12/02/11
		Total: 4 Notes	$100.00		$21.51					$82.25	

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