Introduction, Course Logistics, and Overview of Financial System

ECON 43370: Financial Crises

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The Financial System

- The financial system intermediates between savers and investors
  - Savers: those who have surplus funds now and want to consume in the future as opposed to the present (e.g. households, non-financial corporations)
  - Investors: those who want to engage in investment to undertake projects which will generate cash flows in the future but require up front funds they do not have (e.g. buy a house, build a factory, start a company)
- Financial intermediaries (e.g. banks, investment banks, pension funds, insurance companies) play the role of middleman – they take funds from savers and give them to investors
- Broadly speaking, a financial crisis is a situation in which the intermediation process breaks down

Why Not Direct Finance?

- Why not cut out the middleman and directly finance investment?
  - Sometimes it happens
    - An individual puts up $25,000 in an equity stake in a new restaurant directly to the chef/owner
    - A firm uses its retained earnings to finance investment
- But direct finance not particularly prevalent (with some exceptions). Why?
  - Scale: projects much bigger in scale than any one individual or small collection of individuals can fund
  - Asymmetric information: individual savers not experts in evaluating quality of investment opportunities (adverse selection) nor in monitoring the behavior of investors (moral hazard)
  - Liquidity/maturity mismatch: savers want easy, predictable access to their funds should spending needs arise, whereas most investment opportunities are very long term with uncertain payoffs

Financial Crisis

- Savers lend funds to intermediaries, who invest in projects on their behalf
- Most of the time this works reasonably well
- Financial crisis:
  - Savers begin to worry about the health of the intermediaries (or more generally the quality of the investments the intermediaries have undertaken)
  - They try to pull their funds out as a result in search of safety (i.e. cash)
  - But intermediaries cannot easily come up with cash – they have invested it
  - Trying to come up with cash forces them to cut back on financing investment and to sell assets
  - Selling assets (fire sale) depresses asset prices, makes intermediaries look even weaker, increases incentive of savers to "run" $\Rightarrow$ can be self-fulfilling
  - Available credit dries up, investment declines, and economy contracts

Questions

- In this course we'll be focusing on a series of interrelated questions:
  1. Why do we have financial crises?
  2. What are some facts about historical crises?
  3. Are crises inevitable?
  4. Are crises fundamentally the same or is each unique?
  5. How can policies be designed to effectively deal with crises?
  6. How can we design a regulatory/institutional framework to reduce/eliminate/mitigate crises?

Key Features of this Course

- This course is unique (both to me and to the economics major more generally)
- Key features:
  1. Discussion-based
  2. Student-led
  3. Writing intensive

Syllabus and Course Logistics

Balance Sheet

- A balance sheet is a static representation of the financial condition of an individual or institution
- Accounting fact:

$$\text{Assets} = \text{Liabilities} + \text{Equity}$$

- Asset: physical assets (e.g. factories) or financial claims (e.g. stocks, bonds) on other individuals or firms
- Liability: borrowed funds. Claims against an individual or institution (e.g. mortgage loan, student loan, C&I business loan)
- Equity: difference between market value of assets and value of liabilities
  - Equivalently called capital or net worth
- Insolvency: negative equity (liabilities exceed value of assets)
- Summarize balance sheets through T-accounts

Example Balance Sheets

- Household:

Assets		Liabilities + Equity	
Home	\$100,000	Mortgage	\$80,000
		Equity	\$20,000

- Bank:

Assets		Liabilities + Equity	
Loans	\$1,000,000	Deposits	\$800,000
Reserves (cash)	\$200,000	Equity	\$400,000

- Structured Investment Vehicle:

Assets		Liabilities + Equity	
MBS	\$1,000,000	Commercial Paper	\$900,000
		Equity	\$100,000

Leverage

- Leverage is the extent to which an individual or institution is using borrowed funds to finance assets
- Typically leverage ratio is defined as total debt to equity
- More convenient to think about leverage ratio as total assets to equity (two ratios just differ by one given balance sheet arithmetic). Sometimes called equity multiplier
- Profit = difference in earnings on assets minus cost of liabilities
- ROA: return on assets. Profit divided by assets
- ROE: return on equity. Profit divided by equity
- Relationship:

$$ROE = \frac{A}{E} \times ROA$$

Example

- Suppose balance sheet is:

Assets		Liabilities + Equity	
Assets	\$1,000,000	Debt	\$800,000
		Equity	\$200,000

- Suppose assets earn 6 percent, debt costs 3 percent:

$$Profit = 0.06 \times 1,000,000 - 0.03 \times 800,000 = 36,000$$

$$ROE = \frac{36,000}{200,000} = 0.18$$

$$ROA = \frac{36,000}{1,000,000} = 0.0360$$

$$Leverage = \frac{1,000,000}{200,000} = 5$$

$$5 \times 0.036 = 0.18 \checkmark$$

Example with Alternative Capital Structure

Assets		Liabilities + Equity	
Assets	\$1,000,000	Debt	\$200,000
		Equity	\$800,000

- Suppose assets earn 6 percent, debt costs 3 percent:

$$Profit = 0.06 \times 1,000,000 - 0.03 \times 200,000 = 54,000$$

$$ROE = \frac{54,000}{800,000} = 0.0675$$

$$ROA = \frac{54,000}{1,000,000} = 0.054$$

$$Leverage = \frac{1,000,000}{800,000} = 1.25$$

$$1.25 \times 0.054 = 0.0675 \checkmark$$

- More leverage magnifies return on equity!

Liquidity

- Liquidity refers to the ease and speed with which an asset can be converted to cash
- Tradeable stocks and bonds: quite liquid in sense transactions cost to selling (i.e. liquidating) on short notice are quite small
  - Still some price uncertainty
  - Invest $100 in marketable security, you are not sure how much cash you'll be able to get out tomorrow
  - Short term government bonds have very little price variability, longer term bonds and stocks have much more price variability, cash has "no" price variability (at least in nominal terms)
  - In this sense, even though market liquidity is similar, short term bonds are nevertheless more liquid than stocks
- Physical assets (e.g. houses, factories) are much less liquid. Difficult to sell on short notice
- Financial assets without active markets are difficult to sell at a fair price on short notice

Financial Ratios

- In addition to leverage ratio / equity multiplier, other important ratios are:
  1. Capital ratio: ratio of equity to assets (inverse of leverage ratio / equity multiplier)
  2. Liquidity ratio: ratio of liquid assets (cash and cash equivalents, e.g. short term government bonds) to liabilities
  3. Reserve ratio (commercial bank): ratio of reserves (cash) to deposits (short term liabilities)
- Regulation imposes minimum values of these ratios on different classes of institutions
- Why?

Credit Risk

- Credit risk: risk that assets will underperform, resulting in losses that lead to a decline in equity
  - e.g. a loan a bank has made goes into default, resulting in an equity "write down"
  - The more capital/equity an institution has, the bigger the loss it can handle (i.e. a bigger "cushion") before becoming insolvent
  - Highly levered institution has little cushion
  - Bankruptcy: legal situation where creditors force insolvent institution to re-organize so that creditors can get out what they can
  - A 100 percent equity financed institution cannot go bankrupt
- Why mandate capital ratios? There is an externality of sorts
  - Levered institution is exposed to upside risk but downside risk is limited to its capital
  - Creditors bear the downside risk
  - Institutions have incentive to take on too much leverage

Liquidity Risk

- Liquidity risk: risk that creditors (e.g. depositors) will withdraw / not roll-over funds
- If institution does not have sufficient liquid assets, it may have to sell assets to come up with cash to pay off creditors
- To the extent to which these assets are illiquid, it may have to do so at depressed, "fire sale" prices
- Which could result in losses
- Which could ultimately result in insolvency
- Because institutions have limited downside risk and because liquid assets (i.e. cash) typically have low returns, they do not want to hold much liquidity
- Hence, require them to do so (e.g. reserve requirements for commercial banks)
- Not all debt is alike: short term debt (e.g. deposits) much more susceptible to liquidity risk than long term debt

Money

- Actually a bit of a tricky and nebulous concept
- A medium of exchange (transactions media) that facilitates exchange (solves double coincidence of wants problem)
- Money is debt: fixed face value claim on something that we use in exchange
- Government created money: currency
  - Historically was commodity-based: could redeem currency for fixed quantity of specie (e.g. gold or silver)
  - Now fiat money: currency not backed by anything other than "full faith and credit" of issuing government
- Privately created money: bank debt
  - e.g. demand deposit / check: claim on assets of issuing bank. Can demand conversion into currency "on demand"
  - This bank debt circulates and is used in transactions – it is money
- M1: currency in circulation plus demand deposits

Publicly vs. Privately Created Money

- At least nominally, publicly created (fiat) money is riskless – currency is redeemable only for more currency, and government can (essentially costlessly) create currency
- Privately created money (bank debt), is not riskless
  - Issuing bank could run out of cash and not be able to honor withdrawals
  - Its assets could underperform and become insolvent, in which case creditors (e.g. deposit holders) can't get everything out they put in
- So why do people hold privately created money if it is riskier than publicly created money?
  - Not enough currency to go around
  - Currency is a pain – hard to carry around, easy to lose, easy to steal, harder to keep records
  - Bank debt may offer some return (currency does not)
- At fundamental level, a financial crisis is a situation where people become concerned and don't want to hold/accept certain kinds of privately created money, which forces issuers of bank debt to delever

Run on Deposits and Balance Sheet Shrinkage

- Suppose a commercial bank has initial balance sheet of:

Assets		Liabilities + Equity	
Loans	\$1,000,000	Deposits	\$800,000
Reserves (cash)	\$200,000	Equity	\$400,000

- Suppose deposit holders suddenly want cash – desired \$400,000 withdrawal
- Bank only has \$200,000 cash on hand
- To come up with the other \$200,000, it must sell loans (or assets more generally)
- Suppose to do so quickly, it must sell at a (50 percent) discount. Has to sell \$400,000 loans to raise \$200,000 in cash and suffers \$200,000 equity markdown

Assets		Liabilities + Equity	
Loans	\$600,000 -\$400,000	Deposits	\$400,000 -\$400,000
Reserves (cash)	\$0 -\$200,000	Equity	\$200,000 -\$200,000

Systemic Crises and Nature of Debt

- Liquidity risk can result in insolvency if assets must be sold at depressed, fire sale prices
- This is most likely if many financial intermediaries are doing this at the same time – i.e. a systemic event
- Not all debt is created equally
  - Very short term debt (deposits, commercial paper, repurchase agreements) are susceptible to runs and liquidity risk – these can be withdrawn or not rolled over on short notice
  - Longer term debt (i.e. a mortgage loan for a household) not susceptible to runs (or not as susceptible)
  - "Financial crises are every and always a problem of short term debt" – Doug Diamond
- This is a structural feature of the financial system – intermediaries have mismatched maturities of liabilities (shorter term) and assets (long term)
- Indeed, this is part of the benefit of intermediation – savers want short term, liquid assets (e.g. deposits) but also want (indirect) access to longer term, less liquid investments
- But this benefit comes with a cost – susceptibility to runs

Central Banks

- Central banks have been around for some time – oldest Sveriges Riksbank in Sweden (1668), with Bank of England (1694) shortly behind
- The US, in contrast, did not formally have a central bank until 1913 with the Federal Reserve (although there were a couple of forerunners, the First and Second Banks of the United States)
- Central banks provide regulatory oversight over a nation's commercial banking system and money supply and serve as a lender of last resort
- The lender of last resort function, meant to deal with liquidity crises / bank runs, was in fact that principal motivation behind the founding of the Federal Reserve (after the Panic of 1907)
- A central bank in a sense serves as a bank for other banks
- What is special about a central bank is that it can freely create liabilities – i.e. it is a monopoly supplier of base money
- This ability makes it well-suited to deal with liquidity crises

Central Bank Balance Sheet and the Monetary Base

- Hypothetical central bank balance sheet:

Assets		Liabilities + Equity	
Securities	\$1 billion	Reserves	\$1 billion
Loans	\$0.2 billion	Currency	\$0.2 billion

- The monetary base equals the liabilities of a central bank – reserves plus currency in circulation (reserves are currency not in circulation (i.e. in bank vaults) or electronic entries tantamount to demand deposits for commercial banks)
- Money supply (currency plus private bank debt) is a function of the monetary base – the amount of reserves influences how much private bank debt (i.e. demand deposits) the banking system can/will create
- Central banking is profitable – assets earn something, (historically) liabilities cost little or nothing – profits remitted to fiscal authority

Central Bank Liabilities

- Central bank liabilities are unique in that they don't really obligate the central bank to come up with anything – reserves can be converted to paper currency, and paper currency can be converted to more paper currency, which the central bank can freely create
- This has changed a little bit recently although not in a particularly important way – Federal Reserve is now paying interest on excess reserves, but it just creates more reserves to pay this obligation
- Historical conventional monetary policy in US: Fed rationed supply of reserves, resulting in an active interbank market for reserves. By adjusting supply of reserves, could influence the "price" of reserves (interest rate on interbank loans), the Federal Funds Rate (FFR)
- Changes in this interest rate would then impact other interest rates relevant for economic activity

Central Bank Balance Sheet Expansion

- Central banks can expand their balance sheet by creating liabilities (i.e. base money) and then either lending to institutions (e.g. discount window) or buying assets (open market operations, quantitative easing)
- Guiding theory of central banks as lenders of last resort: in a crisis, lend freely to fundamentally sound institutions at a penalty rate (Walter Bagehot, *Lombard Street* (1873))
- Crises are about liquidity – more demand for liquidity than intermediaries have
- Idea: central bank should supply the liquidity elastically
- Sound institutions: don't want to "bail out" insolvent institutions, just those suffering liquidity pressures
- Penalty rate: dissuade institutions that don't really need funds from taking them
- Want to avoid balance sheet shrinkage in a crisis

Asset Pricing

- Financial securities are claims issued by corporations to finance their activities
- Debt (e.g. bonds, bank loans) and equity (e.g. stock)
- Classical theory of asset pricing – price of an asset equals present discounted value of anticipated cash flows
- Cash flows from debt: periodic coupon payments plus face value (if held to maturity)
- Cash flows from equity: dividends
- Capital gains: selling a security prior to maturity (there is no maturity for equity)
- Securities differ in expected return (discount rate used to price them) because of risk

Bond Prices and Yields

- Bonds are debt instruments promising fixed repayments over the life of the bond
- Face/par value: the stated value of the paper, due at maturity
- Privately created money (i.e. deposits): short term debt which (hopefully) trades at face value
- Some bonds may offer coupon payments (regular payments)
- Yield and price: different ways of quoting the same concept. Yield moves opposite price
- Yield: equates market price of bond to present discount value of cash flows

Price and Yield on a Discount Bond

- Easiest to see this with a discount bond
- Suppose bond has face value of \$100 and matures next period (i.e. entitles holder to face value)
- Suppose bond trades at \$95 (i.e. a discount relative to face)
- Then its yield satisfies:

$$P = \frac{FV}{1+i} \Rightarrow 1 + i = \frac{FV}{P} = 1.0526$$

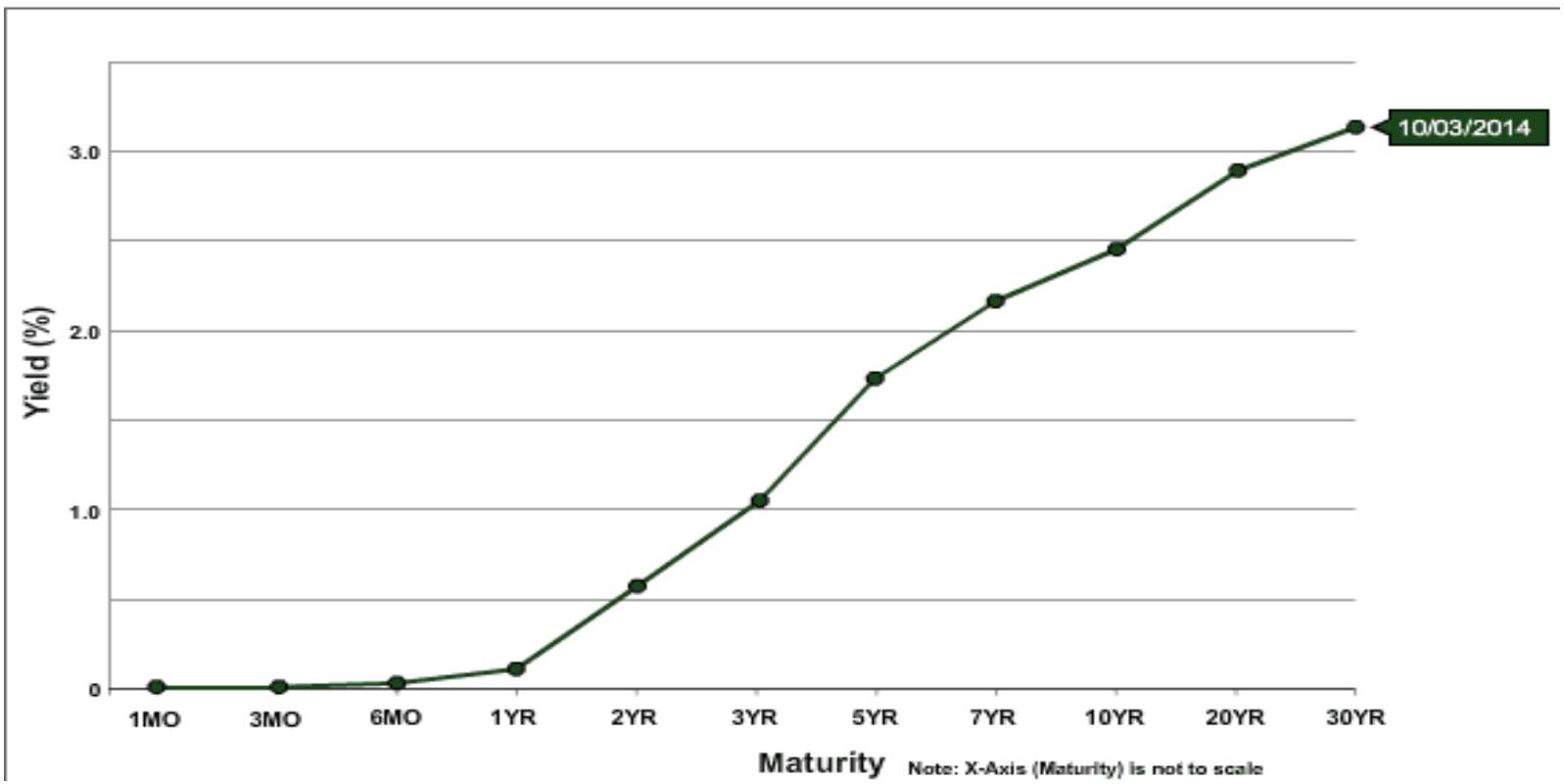
- Decrease in demand for bond: price falls, yield rises (i.e. savers demand a higher expected return to hold the paper)
- Many different kinds of bonds but basic idea that yields and prices move opposite the same

Sources of Risk on Debt

- Two principal sources of (nominal) risk:
  1. Default risk: risk that borrower will not make good on all or part of promised repayments
  2. Interest rate / duration risk: risk that price of bond will change (due to changes in underlying required returns)
- For well-functioning governments (US???), there is essentially no default risk on government debt
- Always some default risk on private debt (e.g. Aaa, Baa, etc.)
- Longer time to maturity: price more sensitive to interest rate movements and hence riskier
- There is also inflation risk – bond repayments are in nominal terms, which may be worth more (or less) in real terms than promised

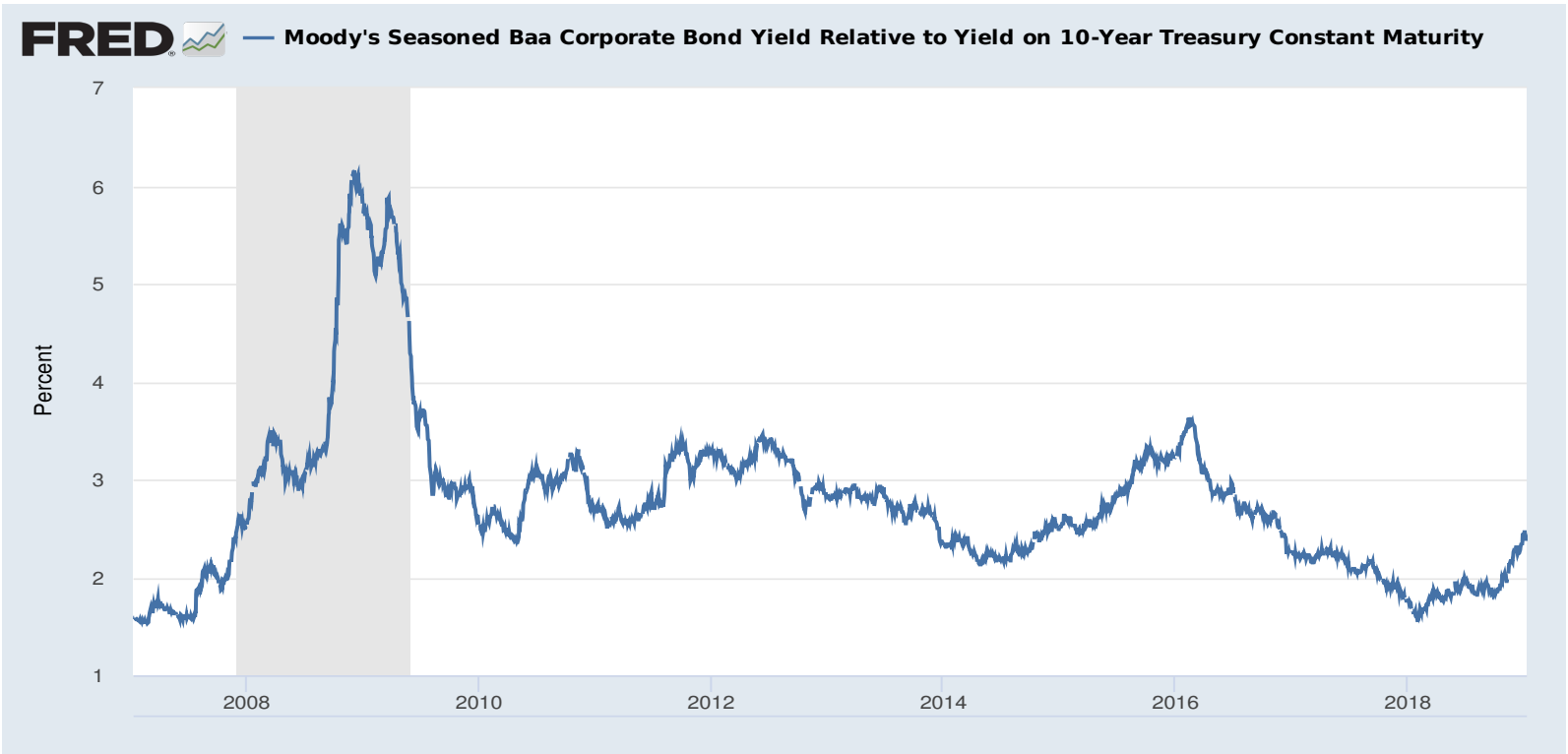
Yield Curve

- Yield curve: plot yields (interest rates) on debt with similar default risk against time to maturity
- Typically upward-sloping, though occasionally flat/inverted (usually prior to recessions)



Risk Premia

- Bonds with higher default probabilities typically trade at a discount to comparatively safer debt – lower price, higher yield
- Massive increase in interest rate spreads a defining feature of financial crises – "flight to safety"



Equity vs. Debt

- Equity vs. debt: the two means by which non-financial firms finance themselves
- Equity: issuing stock (common or preferred)
- Debt: bank loans, money markets (short term debt markets), capital markets (long term debt markets)
- Aside from tax differences, equity vs. debt differentiated in who gets upside: debt-finance, creditors don't have access to upside (fixed repayment)
- Equity finance not that important as source of external funds for firms (more so in US compared to rest of world). Costly State Verification: debt contracts optimal because only require monitoring by creditors in event debt contracts not honored
- Bank loans versus bonds: issue of asymmetric information (only large, well-established firms can tap capital markets)
- Short term versus long term debt: short term debt is susceptible to runs, but may provide disciplining device on managers

Bubbles

- In popular parlance, "bubbles" are situations in which a certain class of assets experiences rapid price appreciation followed by a "bursting" – big price decline
- In economics, a bubble is situation in which an asset trades for more (or less) than its fundamental value (present discounted value of cash flows)
- If bubbles exist, should only observe them for very long-lived assets (e.g. stocks, land/housing)
- In practice very hard to tell, either in real time or ex-post
- But "bubbles" (popular parlance) are a key feature of historical financial crises – some class of asset does spectacularly well, institutions lever up, and then a price decline leads to fears which trigger a run

Increasing Complexity of the Financial System

- For much of the 20th century, financial intermediation was fairly boring
- "3-6-3 rule": bankers pay 3 percent for funds, lend at 6 percent, and are on the golf course by 3 pm
- For a variety of reasons, this began to change in the 1970s and 1980s
  - High inflation (plus regulation Q caps on interest on deposits)
  - Rise of large institutional investors (i.e. retirement savings)
  - Regulatory arbitrage (regulation of banking made traditional model less profitable, so funds flowed elsewhere)
- US regulatory infrastructure very fragmented: SEC, FDIC, Federal Reserve, Office of Thrift Supervision, etc.

Traditional Banking versus Shadow Banking

- Traditional banking: banks fund themselves with deposits (interest rate ceilings, deposit insurance), make traditional loans and keep loans "on balance sheet"
- "Shadow" banking system: fundamentally same intermediation going on, but more layers and more complex
- Institutions funded by other sources of short term debt (e.g. commercial paper, repurchase agreements)
- Institutions don't hold loans on balance sheet – these are sold and securitized (i.e. bundled together) and held "off balance sheet" but structured investment vehicles / special purpose vehicles
- Government has been a key player in push for securitization – Fannie Mae and Freddie Mac
- Securitization also arose because (i) desire to move assets "off balance sheet" to avoid capital requirements and (ii) demand for high quality collateral (i.e. mortgage backed securities, MBS) to make short term debt safe(r)