

# Econ-266: Logistics

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# Econ-266: Logistics

- Slides for projection

<http://www.econ.jhu.edu/courses/266/index.html>

- The book

“Capital Markets: Institutions, Instruments and Risk Management” by Frank Fabozzi.

- Readings from Economist, NY Times, Wall Street Journal...

# Econ-266: Logistics

- Because it is an online course, assessment is going to be different from usual
- There will be no exam but 6 homeworks which include essay questions
- Essays questions account for majority of grade
- General rule
  - Just repeating material from slides=C
  - Just repeating material from slides + lectures = B
  - Making good arguments from readings = A

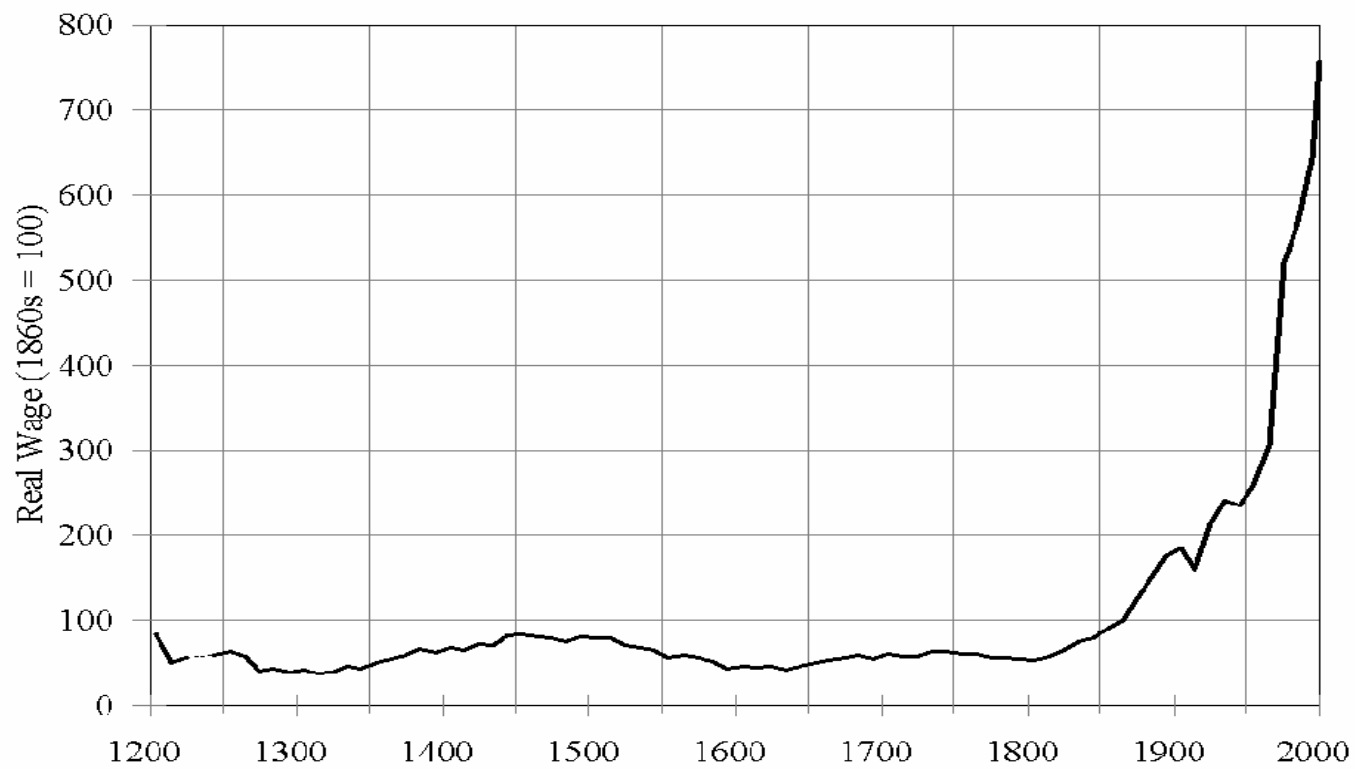
# Benefits of this Course

- An elective for the financial economics minor
- Topics that are important in economics/finance
- Skills that are useful in interviews/jobs

# Financial Intermediation

- Transfers money between surplus units and deficit units
- But subject to problems of asymmetric information
  - Adverse Selection (pre transaction)
  - Moral Hazard (post transaction)

# Real Wages 1200-Present



# Walter Bagehot

- 19<sup>th</sup> century sage of finance
- Wrote “A citizen of London in Queen Elizabeth’s time...would have thought it was of no use inventing railways...for you would not have been able to collect the capital with which to make them”. (Lombard Street)
- Contrasts with “A place like Lombard Street (London’s Wall Street), where in all but the rarest times money can always be obtained upon good security or upon decent prospects of probable gain, is a luxury which no country has ever enjoyed”.
- Good ideas get financed.

# 16<sup>th</sup> century thinking on debt

- “Neither a borrower nor a lender be  
For loan oft loses both itself and friend  
And borrowing dulls the edge of husbandry”

Polonius, Shakespeare

- Economics translation: due to adverse selection and moral hazard, don't undertake financial intermediation.



# Controversy in US history

- Aversion to finance was not just in the 16<sup>th</sup> century
- *“I believe that banking institutions are more dangerous to our liberties than standing armies.” - Thomas Jefferson*
- Hamilton disagreed:
- *“Most commercial nations have found it necessary to institute banks, and they have proved to be the happiest engines that ever were invented for advancing trade” .” - Alexander Hamilton*

# Industrial revolution in the UK

- Strength of UK in the 19<sup>th</sup> century affected by the size of its banking system

Bank Deposits in 1873	
London	£120,000,000
New York	£40,000,000
Paris	£13,000,000
German Empire	£8,000,000



*“Much more cash exists out of banks in France and German and in all non-banking countries, than could be found in England. But it is not attainable.”*

*“A million in the hands of a single banker is great power. But the same sum scattered in 10s and 50s through a whole nation is no power at all.”*

**-Walter Bagehot** (Lombard Street, 1873)

# Debt and equity finance

- Two basic kinds of finance: debt and equity
- Debt: Borrower promises to make fixed payments. Failure to pay implies bankruptcy.
- Equity: Person getting the funds promises a share of profits (residual claim) with limited liability.
  
- Adam Smith argued for debt finance because debtors prison would compel manager to work hard.
  
- John S. Mill was less pessimistic about working out incentive problem with equity finance.

# Debt and equity finance

- BIS estimates the GLOBAL stock of:
  - Debt = \$127 trillion
  - Equity = \$67 trillion

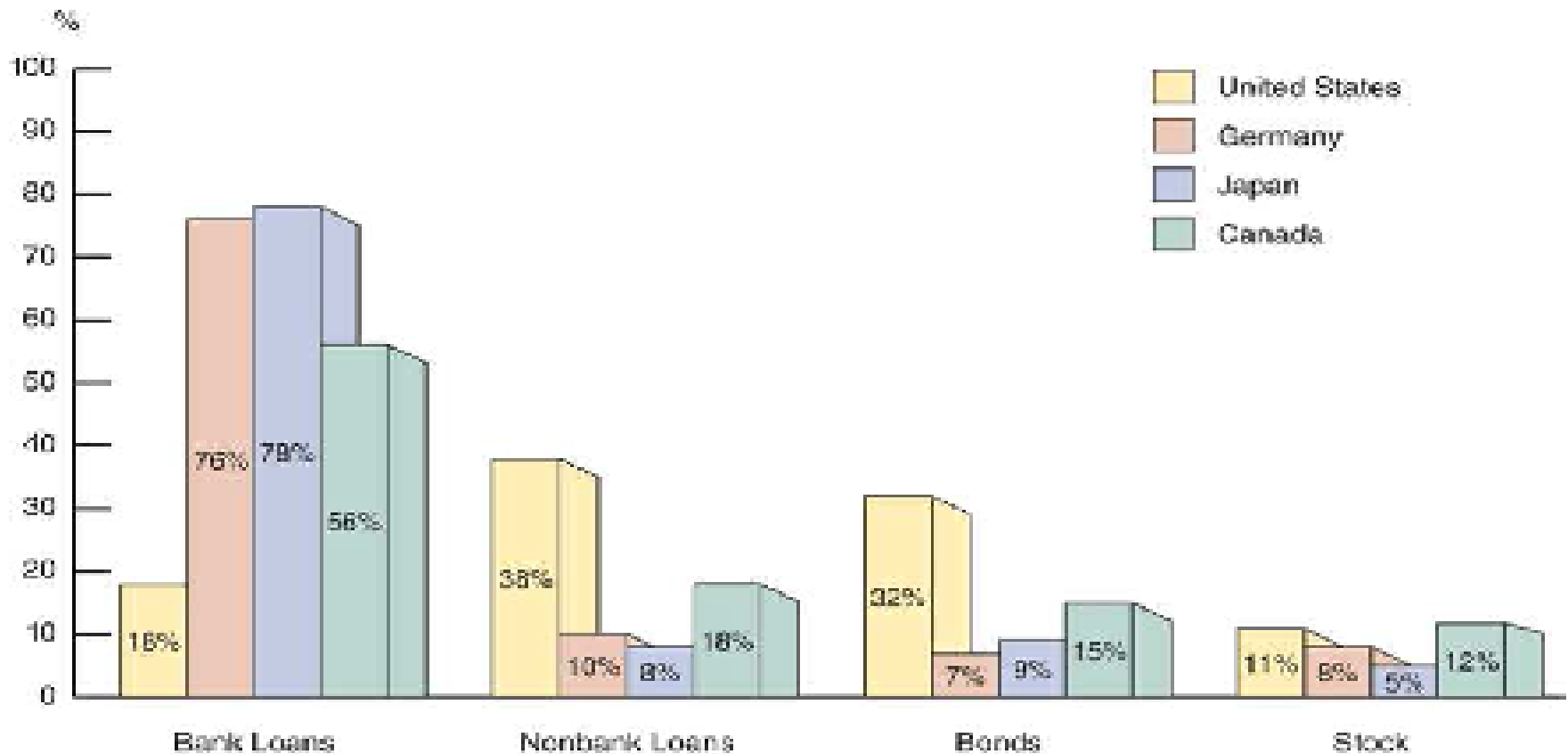
# Debt and equity finance and corporation tax

- Project costs \$1,000,000 and generates \$200,000 in profits
- If no leverage, pay corporate tax on \$200,000  
( $\$200,000 @ 21\% = \$42,000$ )
- Balance of \$158,000 is paid out as dividend to shareholders
- Now suppose borrow \$500,000 and raise rest as equity
- Interest is \$50,000 leaving profits of \$150,000
- Corporate tax is \$31,500
- Balance of \$118,500
- Total payments to debt and equity is \$168,500
- Recent tax reform limited but did not eliminate tax deductible interest

# Direct versus indirect finance

- Direct finance is where a stock or bond is sold directly to the investor.
- Stocks and bonds are placed with investors with the assistance of an investment bank (or underwriter).
- Underwriter may make have a bought issue or best effort issue.
- Indirect finance is where borrowers borrow from/lend to a financial institution
  - A loan is a non-tradeable form of debt, generally issued by a financial intermediary

# Sources of business finance by country today



Source: Andreas Hackethal and Reinhard H. Schmidt, "Financing Policies: Measurement Concepts and Empirical Results," Johann Wolfgang Goethe-Universität Working Paper No. 125, January 2004. The data are from 1970-2000 and are gross flows as percentages of the total, not including trade and other credit data, which are not available.

# Legal systems

- There are a number of legal systems
  - Common Law (UK/US)
  - Civil Law (France, Louisiana)
  - German
  - Scandinavian
- Different balances of private ownership and the state and degrees of flexibility
- Some argue that common law helped the emergence of the industrial revolution



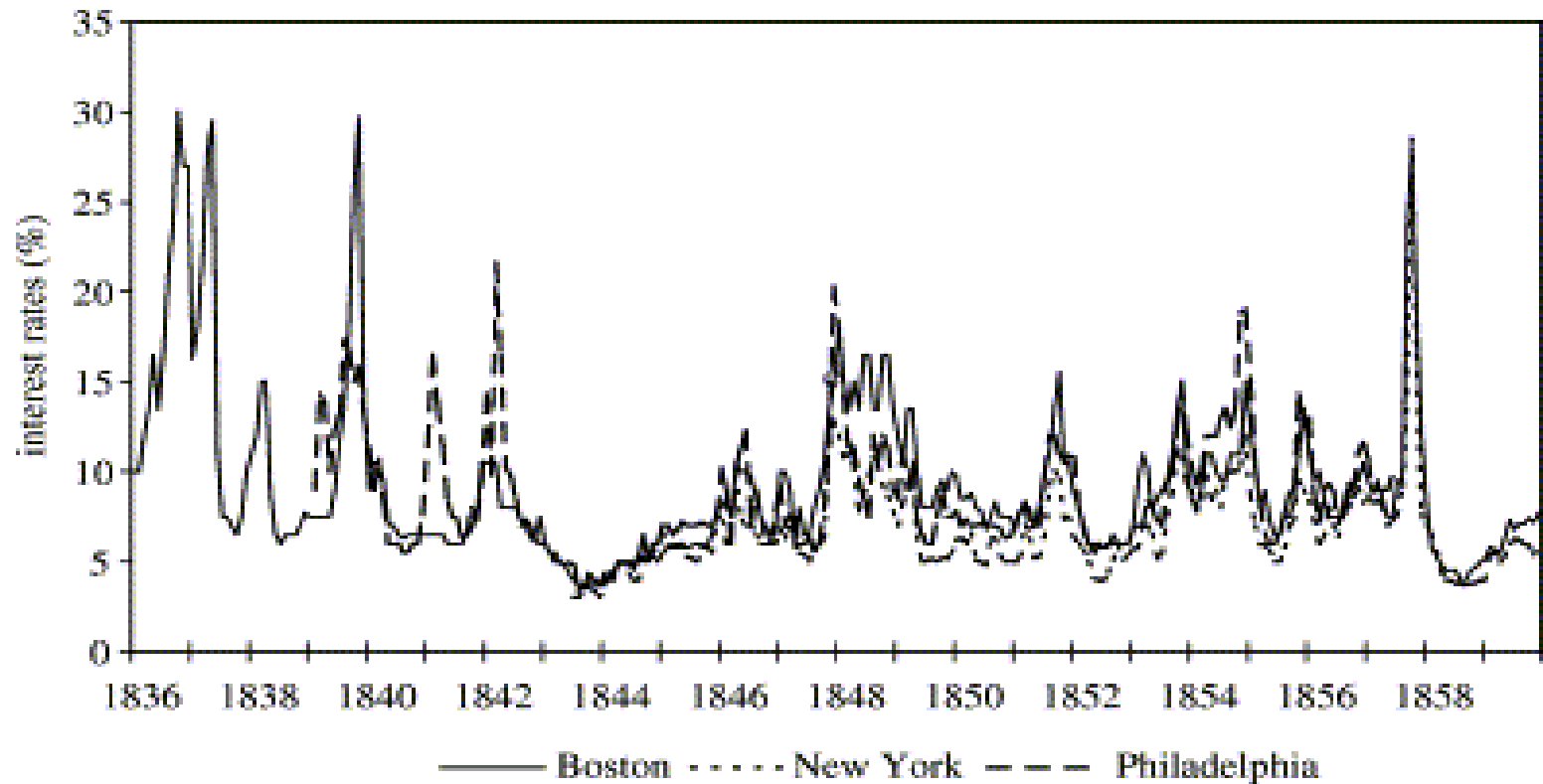
# Nineteenth century reforms

- End of debtors prison
- Limited liability in equity contracts
- Start of accounting law/practices
- Growth of stock exchanges
  - Earlier stocks began to be traded. Dutch East India company was a leading early example.

# Fractional Reserve Banking

- Wealthy individuals would give money to goldsmiths for safe keeping.
- Receipts that they got became early banknotes.
- Goldsmiths began lending out money---fractional reserve banking.
- Central banks began in Europe around 1700 and eventually got a monopoly on issuing bank notes in most countries.
  - Central banks initially motivated by financing government but later became a lender of last resort to commercial banks.
  - There are still some places where commercial banks issue notes.
- In the US, First Bank of the United States ran from 1791 to 1811
  - Pressured banks to limit their issuance of banknotes and was unpopular.
- Second Bank of the United States ran from 1816 to 1836

# Volatile money market rates in the “Free Banking Era”



# National Banking Era

- After the end of the Second Bank of the United States, control of banks reverted to states (“Free Banking Era”)
- Banks were very short-lived
- During civil war, Office of the Comptroller of the Currency was set up to manage national banks
  - Subject to federal regulation
  - National banks could buy government bonds and issue notes up to 90 percent of the value of bonds---national bank notes
  - State banks were taxed and this drove them to convert to national banks
- Period from 1863-1913 is known as the National Banking Era

# Gold standard

- Gold was the unit of account in the 19<sup>th</sup> century
- Hamilton set up a **bimetallic system** with gold and silver as legal tender and with an exchange rate between them.
- Attempts made to fix the exchange rate which led one metal to be effectively the sole currency.
- US Treasury issued US notes in the civil war (fiat money)
- Reverted to a single gold standard in Coinage Act of 1873
  - Reverted to pre-civil war price of \$20.67/ounce by 1879
  - Stayed on gold standard till 1933 (except during WW1)
- Bryan (presidential candidate 1896) campaigned unsuccessfully on a platform of expanding money supply by going back to a bimetallism.
  - Tension between farmers and borrowers vs. financial institutions

# Financial panics

- Late 19<sup>th</sup> century early 20<sup>th</sup> century characterized by a string of financial panics each causing severe recession
- Bagehot was well aware of risk of panics
- Run on a bank is a self-fulfilling prophesy
- Panic of 1873 and 1893 caused by failure of railroads
  - 1873 panic and restricted money supply led to the “Long Depression”
- Financial panics were more severe and disruptive in the US

# 1907 Panic

- Has a lot in common with other panics
- Initial shock was very small
- Augustus Heinz tried to manipulate the price of United Copper.
- Failed and lost money.
- Started a run on “trusts”
- Eventually led to a run on the entire banking system
- Stopped only by loans from JP Morgan and the clearing house.
- Highlighted need for a lender of last resort.

# Formation of the Fed

- Motivation for founding the Fed was as a lender of last resort to curb financial panics
- Founded in 1913....later than other central banks.
- Combination of 12 regional banks that are (kind of) privately owned and the Board of Governors (federal agency)
- Motivated by fears of domination by Washington or New York Fed
- Allowed to issue Federal Reserve notes
- US notes continued to be issued by Treasury until 1971



# Early years of the Federal Reserve

- Reserve banks could purchase Treasuries (interest bearing) and pay for them with Federal Reserve notes (not interest bearing)
- Profitable!
- Reserve banks did this initially to improve their earnings.
- Realized these open market operations could change the liquidity in the banking system.
- Led to efforts to coordinate across regional banks.

# Great Depression

- Started with a stock market crash in 1929.
- Led to a string of bank failures and bank runs. Number of banks in US fell from 25,000 to 15,000.
- Federal reserve did not prevent bank failures and allowed the money supply to contract.
- Fed's ability to act was constrained by the gold standard
  - Banks converted notes to gold.
  - 40 percent gold backing was required of Federal reserve notes
- Deflation and 25 percent unemployment

# Federal Reserve in Great Depression

- Fed did not do well in the Great Depression
- A blunder was that when commercial banks started raising reserves, Fed thought that they were about to increase lending
- Doubled reserve requirements in 1936 and 1937
- Caused another economic downturn

# Great Depression and Gold Standard

- Every major currency abandoned the gold standard in the Great Depression, starting with the UK.
- Countries which left the gold standard earlier had faster recoveries.
- US banned private ownership of gold, and changed the price from \$20.67 per ounce to \$35 per ounce.
- US still converted dollars-gold at \$35 per ounce until 1971 but only for foreign central banks.

# Reforms in the 1930s

- Federal Open Market Committee to control open market operations
  - 7 Board governors and 5 regional Fed presidents.
- Glass-Steagall Act
  - Established Federal Deposit Insurance
  - Separates commercial and investment banks
  - Prohibits commercial banks from trading stocks
  - Ceilings on interest rates (Regulation Q)
- Formation of Securities and Exchange Commission
- No major financial crises for 70 years.

# Bretton Woods system

- Bretton Woods system constructed by Allies in 1944
- Established fixed exchange rates (that were however changed from time to time) relative to gold/the dollar
- Required significant foreign exchange controls
- Lasted until early 1970s when floating exchange rates began
- Founded International Monetary Fund
  - Maintaining fixed exchange rates and short term loans
- Founded World Bank
  - Longer term loans for development to emerging markets

# Triffin Dilemma

- Dollar was reserve currency and CBs could exchange dollars for gold
- Demand for dollar reserves kept rising, but volume of gold was fixed
- By early 1960s, value of dollar reserves exceeded gold
- In 1971, Nixon suspended gold convertibility
- In 1971, Smithsonian accord devalued the dollar
- Floating exchange rates began in 1973

# Money and capital markets

- Debt with maturity of one year or less is called money market
- Everything else is the capital market
- Money market plays a key role in financial system



# Primary versus secondary markets

- If new securities are being issued to raise money, this is the primary market.
  - IPO is the case of shares where new security is being created
  - Seasoned issue is where more of a security is being issued
- Trading of existing securities is the secondary market

# How Firms Issue Securities

- Raise capital from a wider range of investors through *initial public offering, IPO*
  - *Seasoned equity offering*: The sale of additional shares in firms that already are publicly traded
- Public offerings are marketed by investment bankers
- Registration must be filed with the SEC and must give a prospectus to public
- For big issues join with a syndicate of investment banks

# IPOs

- Investment banks facilitate IPOs by underwriting
- Challenging to know the price (unlike for a seasoned offering)
- Investment bank faces risk of getting stuck with the security
- Investment bank tries to minimize volatility of share price
- IPO usually includes lock-up period
- Charges between 2 and 10 percent of value (for stock)
- Offerings are usually underpriced to produce a first day pop
  - Average first day return 20% over the past 30 years
  - But prices then subsequently underperform
- Q. If markets were perfect how much would investment bank earn?

# IPO: Asymmetric Information Issues

- Firm doesn't know anything about pricing or rules for IPOs
- Investors see no track record
- Going public makes it easier for the managers to shirk
- Investment Bank can help resolve at least the first two by reputation for not ripping off either side too much too often

# Shelf registration

- IPO has to be registered with the SEC though there are some exceptions
- Corporation can register an IPO but not actually go ahead with it
- Can be *shelf registration* for 2 years

# Direct Listing: An Alternative

- A different way is that existing (private) shareholders can sell directly to the public
- No middleman and no new shares issued
- May get better price
- No lock-up period
- Been tried with mixed success typically by small to medium sized firms. Spotify was a recent direct listing.

# Two good principles

- Diversify holdings
- Understand exactly what you are investing in
  
- Very hard for individuals to do both
- That's where banks can come in

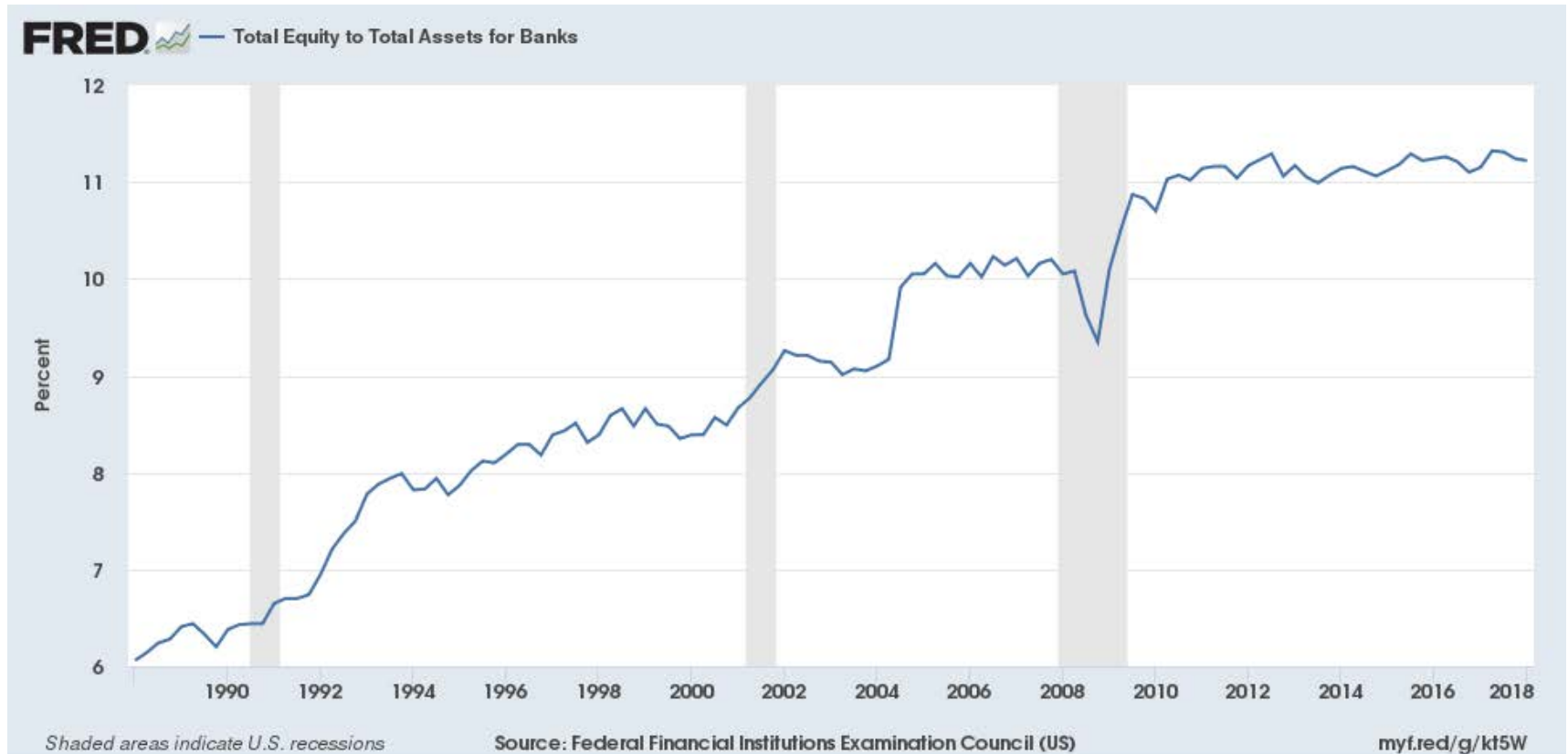
# Commercial banks

- Commercial banks take deposits and make loans
  - Contrast with investment banks, shadow banking.
- Balance sheet of US commercial banking system (2017)

<b>ASSETS</b>	<b>\$BN</b>	<b>LIABILITIES</b>	<b>\$BN</b>
Cash and Securities	5,889.4	Deposits	12,075.1
Loans	7,829.8	Borrowing	2,085.5
Business	2,116.3	Other liabilities	793.9
Consumer	1,425.1	Total Liabilities	14,954.5
Real Estate	4,288.4	Net Worth	1,850.0
Other assets	3,085.3		
Total assets	16,804.5	Liabilities+Net worth	16,804.5



# Leverage of commercial banks



# ROA and ROE

- Return on Assets is Profit/Assets
- Return on Equity is Profit/Equity
- Return on Equity is the return to the owners of the bank
- $ROE = ROA * (Assets/Equity)$
- ROA is currently around 1 percent for major US banks
- ROE around 10 percent

# Banking concentration in the US

- Banks in the US are less concentrated than in most other countries
- But tending to become more concentrated
  - Mergers
  - Bank Failures
- Interstate banking used to be restricted
- More concentrated banks have economies of scale and scope
- But less competition and too big to fail

# Bank holding company

- A bank holding company is a corporation that itself owns one or more banks
- Structure used by most US banks including all the biggest ones
- The parent company or one of its subsidiaries can engage in activities that the bank itself cannot
- A financial holding company is a kind of bank holding company which includes banks and a company offering nonbank financial services (Citigroup)

# Maturity Transformation

- A key role of banking is maturity transformation
- Loans are long-term; deposits are not.

# Diamond-Dybvig model

- Three periods: 0, 1 and 2
- 100 consumers at time 0
- 25 want to consume at time 1, 75 want to consume at time 2 but at time 0 they don't know which type they are
- Type 1 consumers: Utility is  $1 - (1/c_1)$
- Type 2 consumers: Utility is  $1 - (1/c_2)$
- At time 0 utility is

$$0.25 * \left(1 - \frac{1}{c_1}\right) + 0.75 * \left(1 - \frac{1}{c_2}\right)$$

# Diamond-Dybvig model

- Each consumer has \$1 and can invest it in a project
- Project will cost \$1 at time 0, be worth \$1 at time 1 and \$2 at time 2.
- Along comes a bank and offers a deposit, paying \$1.28 at time 1 and \$1.80 at time 2.
- The bank can do this if 25 consumers are impatient (check).
- The consumer prefers the bank deposit (check)
- Problem: if I am patient but the other patient consumers demand their money at time 1, it is rational for me to demand my money at time 1.
- Bank run as self-fulfilling prophesy.

# Types of bank loans

- Syndicated loans. Made by two or more banks, for reasons of diversification.
- Revolvers. Loan facilities that may be drawn on.
- Leveraged loans. Loans made to riskier borrowers.



# Loan covenants

- In banking, lenders put covenants in loan agreements restricting borrower behavior and/or requiring borrower to maintain earnings
- Lender can demand repayment (or force other actions) if borrower takes forbidden actions, like borrowing too much more money
- Cov-lite loans: Risky loans with few covenants
- Fell away in the crisis but have made a comeback

# Bank runs

- Bank runs were common in the 19<sup>th</sup> century and the Great Depression
- Mechanisms to prevent it
  - Suspension of convertibility
  - Deposit Insurance
  - Lender of last resort
- Deposit insurance and lender of last resort cause banks to take more risk

# Deposit Insurance/Lender of last resort

- FDIC Deposit Insurance is \$250,000 per account
- Funded by a levy on banks
- Commercial banks in the US have access to the Fed discount window
  - Collateralized loans at a rate slightly above federal funds rate.
  - Primary credit, secondary credit and seasonal credit
  - Generally not used much because of stigma.
    - Stigma may be worse than ever because individual borrowers identities revealed after 2 years.
    - Was widely used at times of disruptions (Sep 11 2001, Northeast blackout 2003).

# Bank regulation

- Banks get a charter either from the national government becoming a national bank
  - Regulated by OCC, FDIC and Federal Reserve (if members of Fed system)
  - Bank holding companies must be members of the Fed system
  - Federal Reserve is the main supervisor for the largest banks
- State banks usually regulated by FDIC (if insured deposits) and state regulator
  - May or may not be a member of the Federal Reserve system
  - Most are not

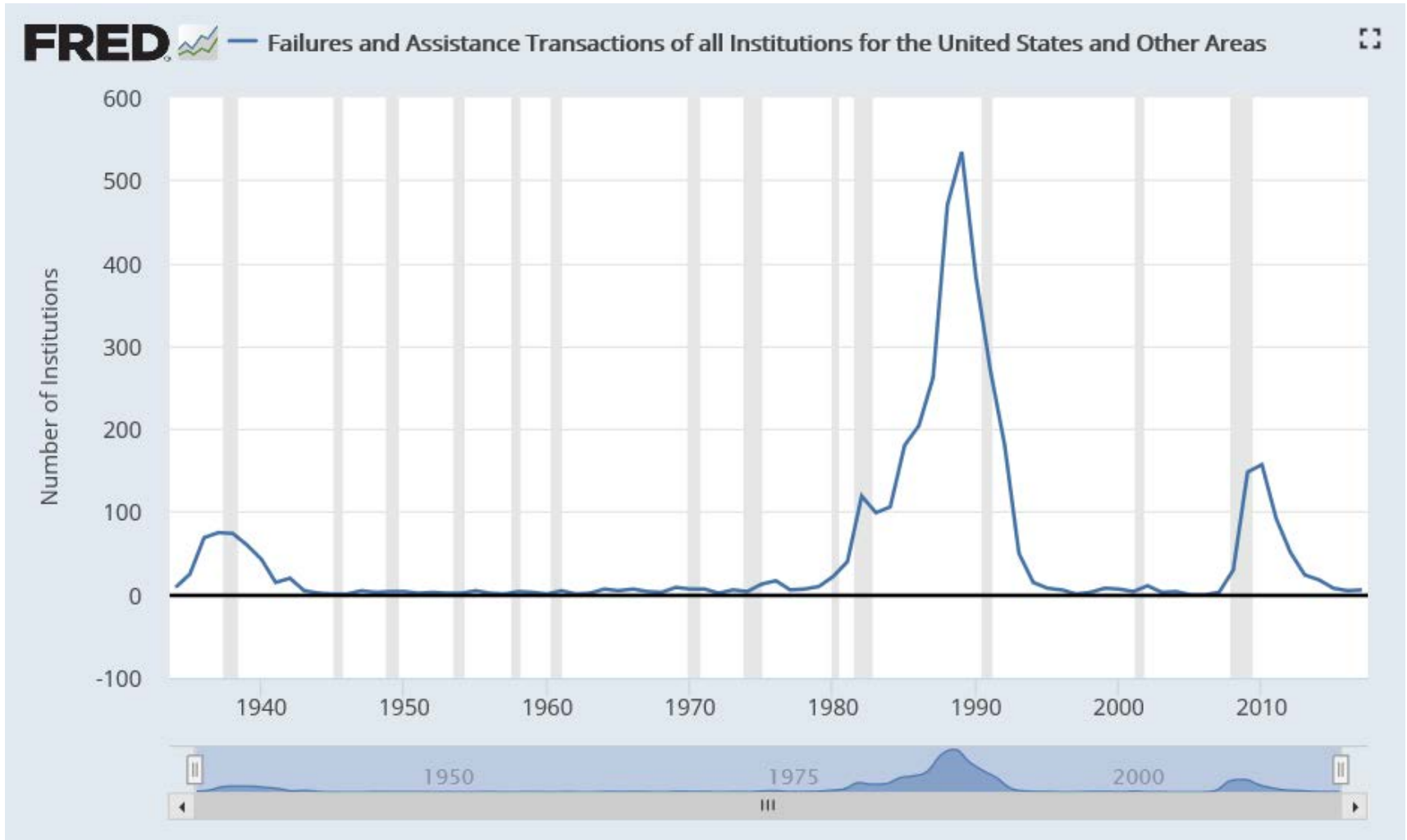
# Bank regulation

- Thrifts are chartered at federal level or state level
- At least 65 percent of assets in the form of mortgage loans or consumer loans
- Have FDIC insurance and are regulated by FDIC and also OCC (federal) or state regulators
- Credit unions are chartered at federal or state level
- Most often run as nonprofits.....tax advantages
- Insured by National Credit Union Share Insurance Fund

# S&L Crisis

- High interest rates on deposits with lower fixed mortgage rates left S&Ls insolvent
- Made worse by phasing out of ceilings on deposits (Regulation Q)
- Federal Savings and Loan Insurance Corporation had negligible reserves
- Banks sought riskier loans
- Regulatory forbearance in the hope that they would “grow out” of their problems
- Many S&L institutions collapsed in the late 1980s at a cost of about \$100 billion from taxpayer funds
- FSLIC was abolished and surviving S&L institutions were insured by FDIC

# FDIC Insured Bank Failures by year 1934-2017



# Mechanics of FDIC bank failure

- FDIC can seize a failing bank
- Options are
  - Another bank acquires the failing bank (purchase and assumption)
  - Another institution acquires the insured deposits and the FDIC takes over the rest
  - There is no buyer and the FDIC winds down the failed bank (deposit payoff transaction)
- Typically the bank is seized on a Friday
- FDIC procedures do not apply to a failed bank holding company and would be resolved through bankruptcy
- Dodd-Frank act requires large banking organizations to have resolution plans (“living wills”)



# Rating banks

- CAMELS rating system based on
  - Capital adequacy
  - Asset quality
  - Management
  - Earnings
  - Liquidity
  - Sensitivity to risk
- Ratings 1 to 5 (5 very concerned)
- CAMELS ratings are confidential

# Basel Accords

- Basel Committee on Bank Supervision (BCBS) provides recommendations on banking regulations
- Includes US and large advanced and emerging foreign economies
- Has no direct legal authority
- Basel 1 was the first agreement issued in 1988
  - Capital to risk-weighted asset ratios
  - Different assets given different risk-weightings
  - Basel 2 was an update
- Basel 3 was another update after the crisis that we will discuss later
  - Still being phased in

# Different types of capital

- Common equity (total assets-total liabilities-preferred stock)
- Tier 1 capital adds in reserves
- Tier 2 capital adds in subordinated debt and preferred stock

# Risk weighted assets

- Basel principal is that assets get put in different categories.
- Can be done by standardized method
- Basel 1 weights:
  - 0%. Sovereign bonds of advanced economies.
  - 20%. US agencies bonds. Municipal bonds.
  - 50%. Mortgages.
  - 100%. Loans
- Suppose bank has \$10 million in each category. Their risk-weighted assets are \$17 million
- Or can use internal ratings method

# Capital ratio requirements

- Common Equity/RWA should be at least 4.5%
  - No dividends unless it is 7%
  - Additional countercyclical buffer of 2.5% coming to 9.5%
- Tier1 Capital/RWA should be 6%
- Tier 2 Capital/RWA should be 8%

# Value at Risk

- Value at risk gives a quantile of forecasted distribution of returns
- Can be used for capital ratios
- Value at risk models are controversial

# Value at Risk, JP Morgan and London Whale

- London Whale (Bruno Iksil) caused JP Morgan's VaR to be breached
- Trades were very profitable
- JPMorgan revised VaR to be *less* stringent
- Trading loss on Whale portfolio was \$6 billion

# Maturity transformation and banks

- Mismatch of maturities of assets and liabilities is the source of instability in Diamond-Dybvig model.
- Also causes a direct risk to bank health
- Short-term liabilities and long-term assets threaten banks if short rates rise above long rates
- Cause of demise of savings and loan industry in the 1980s
- Regulators press banks to limit maturity mismatch



# Low interest rates and banking

- Interest rates have been low (negative in some countries)
- Banks find it hard to set negative rates for depositors
- Compresses their net interest margins
- Makes banks less profitable and able to lend

# Payments systems

- Checks are a dominant payment system
  - Federal Reserve provides check clearing services
  - So does Electronic Payments network (private sector alternative), run by the Clearing House Association
- Fedwire is a payments system for large transfers between banks
  - Real time
- Credit cards and stored value cards are also part of payment system

# Reserve Requirements and Fractional Reserve Banking

- Suppose that all money is deposited in the banking system and banks keep a percentage  $r$  of money as reserves, lending out the rest
- Start with \$100 (monetary base)
- Deposit in a bank
- Bank makes a loan of  $\$100(1-r)$ , deposited in a bank
- Bank makes a loan of  $\$100(1-r)*(1-r)$
- And so on
- In the end, the money supply is

$$100[1 + (1-r) + (1-r)^2 + (1-r)^3 \dots] = \frac{100}{r}$$

# Money multiplier in fractional reserve banking

- Suppose cash-deposit ratio is  $c$
- And reserve ratio is  $r$
- Then money multiplier is

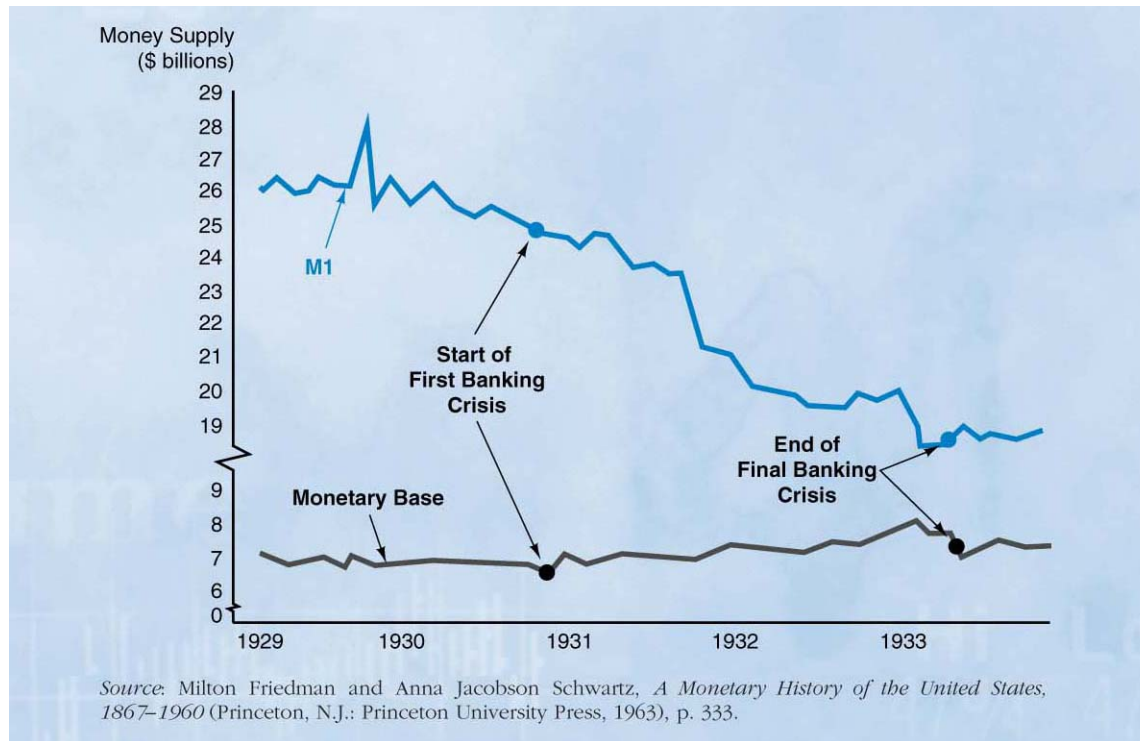
$$\frac{1+c}{r+c}$$

- If no cash is withheld,  $c=0$ , and this reduces to  $1/r$ .

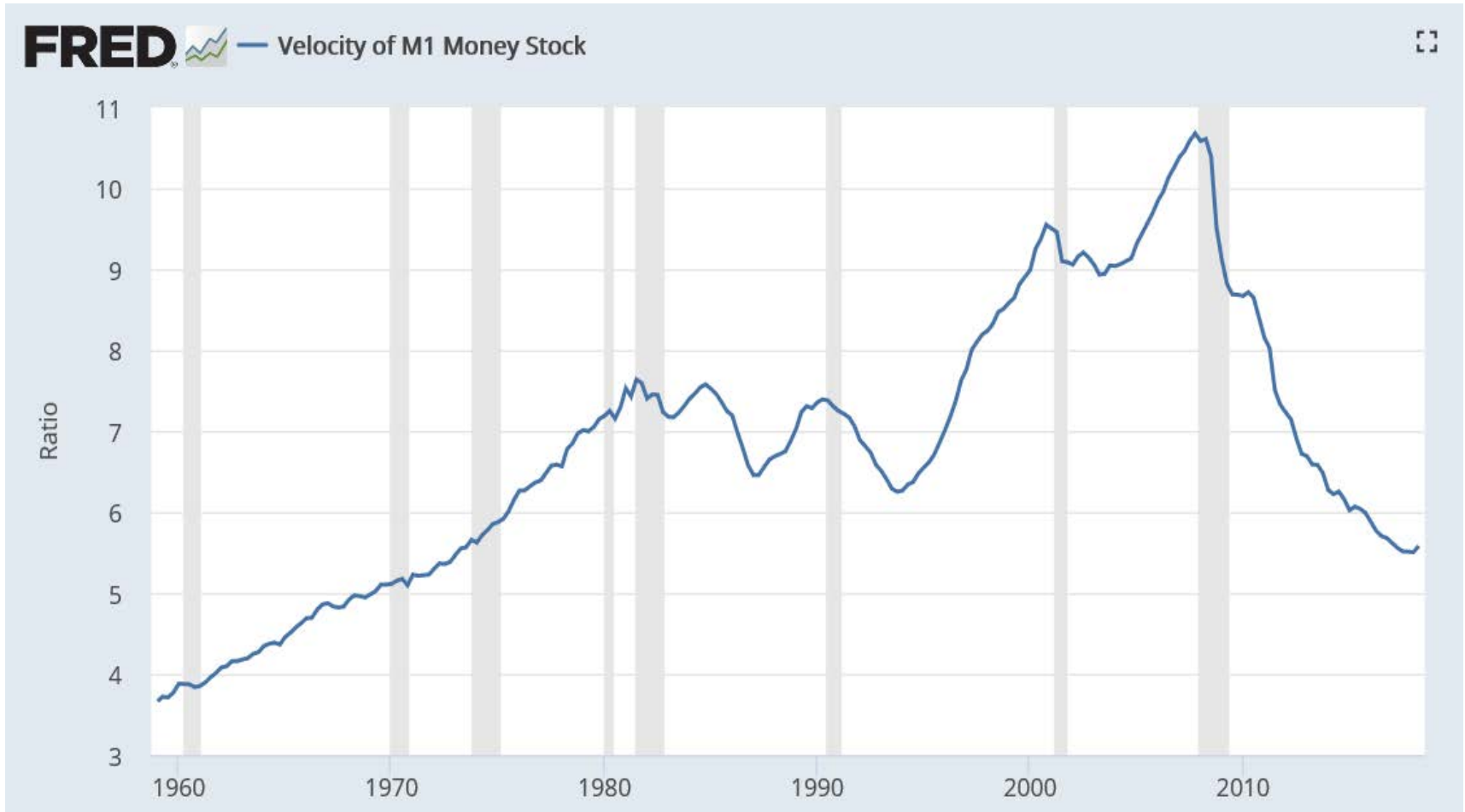
# Money supply

- Narrowest measure of money supply is cash and reserves at the central bank (monetary base)
- About 2/3rds of US cash is estimated to be held overseas
- M1 includes checking accounts
- M2 adds in other deposit accounts
- Velocity of money is nominal output divided by money supply
- Velocity has been unstable in recent decades

# Money supply and monetary base 1929-1933



# Money Velocity



# Letters of credit

- Important function of banks in international trade
- US importer is afraid that it will pay for goods and not receive them
- Foreign exporter is afraid that it will ship goods and not get paid
- Letter of credit is a promise by a bank to make payment to the exporter if the goods are delivered



# Investment banks

- Financial institutions that meet long term capital needs of business and governments
- Separate from commercial banks by Glass-Steagall act
- Core activities underwriting, advising on merger and acquisitions
- Gramm-Leach-Bliley act allowed broke firewall between investment and commercial banks in 1999
- The largest investment banks either failed or became bank holding companies in 2008
- There are still some independent investment banks...e.g. Blackstone Group, Houlihan Lokey.

# Investment banks activities

- Public offerings
- Trading of securities
- Securitization of assets
- Mergers and acquisitions
- Financial restructuring advice
- Securities finance
- Prime Brokerage
- Creation of derivative instruments
- Asset Management

# Volcker Rule

- Volcker rule restricts any institution that takes insured deposits, including investment banks, from prop trading and owning a hedge fund or private equity funds.
- There are exceptions
- Dividing line between prop trading and market making is blurry
- Concern that it may have unintended consequence of worsening liquidity

# Goldman Sachs revenues in 2017

- Traditional investment banking: 21%
- Institutional client services: 37%
  - Investing on their own account (prop trading) and for clients
- Investment management: 18%

# Buy side/sell side terminology

- Buy side means buyers of securities (pension funds, hedge funds, investment managers)
- Sell side. Firms that execute trades, create debt and equity securities, or provides advice. Investment banks are sell side.

# The Money Market

- Treasury bills
- Certificates of Deposit
- Interbank Loans
  - Eurodollars
  - Federal Funds
- Commercial Paper
- Repurchase Agreements (RPs)

# Bank Discount Rate (T-Bills)

$$r_{BD} = \frac{10,000 - P}{10,000} * \frac{360}{n}$$

$r_{BD}$  = bank discount rate

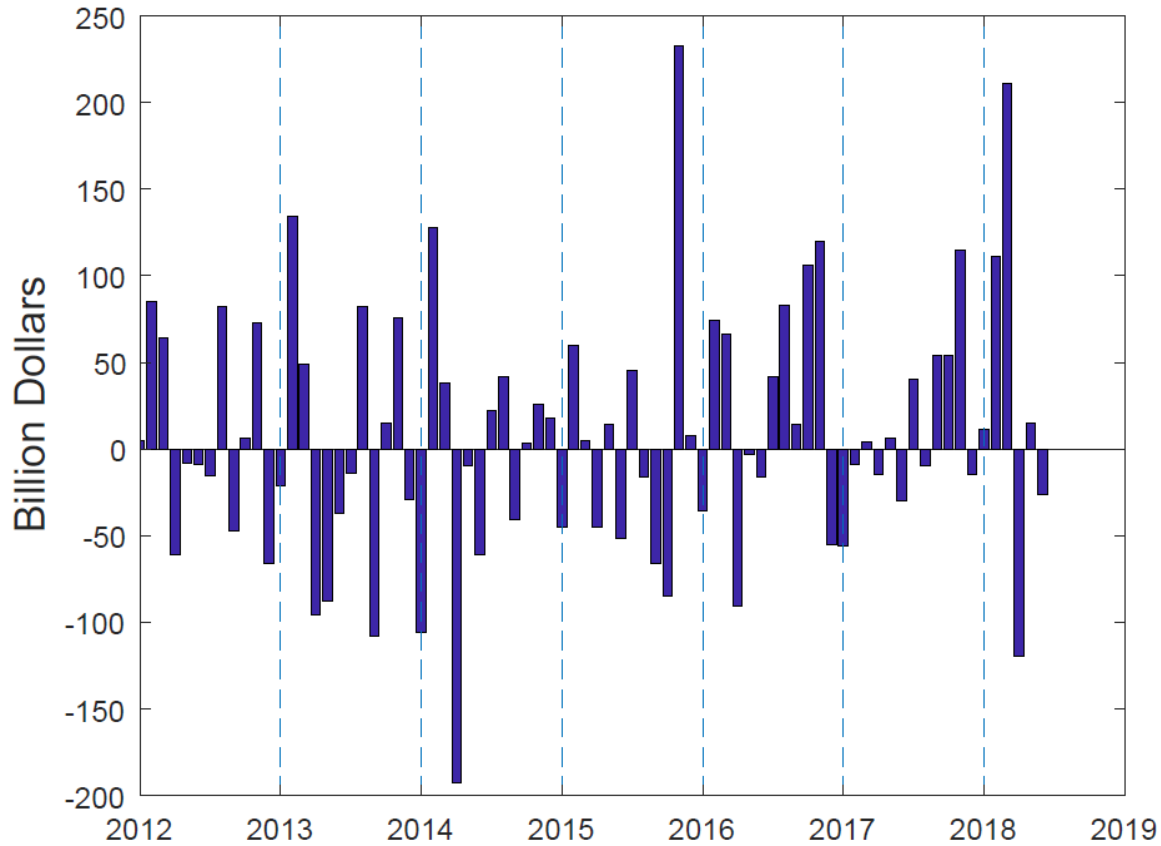
$P$  = market price of the T-bill

$n$  = number of days to maturity

Example: 90-day Tbill,  $P=9,875$

$$r_{BD} = \frac{10,000 - 9,875}{10,000} * \frac{360}{90} = 5\%$$

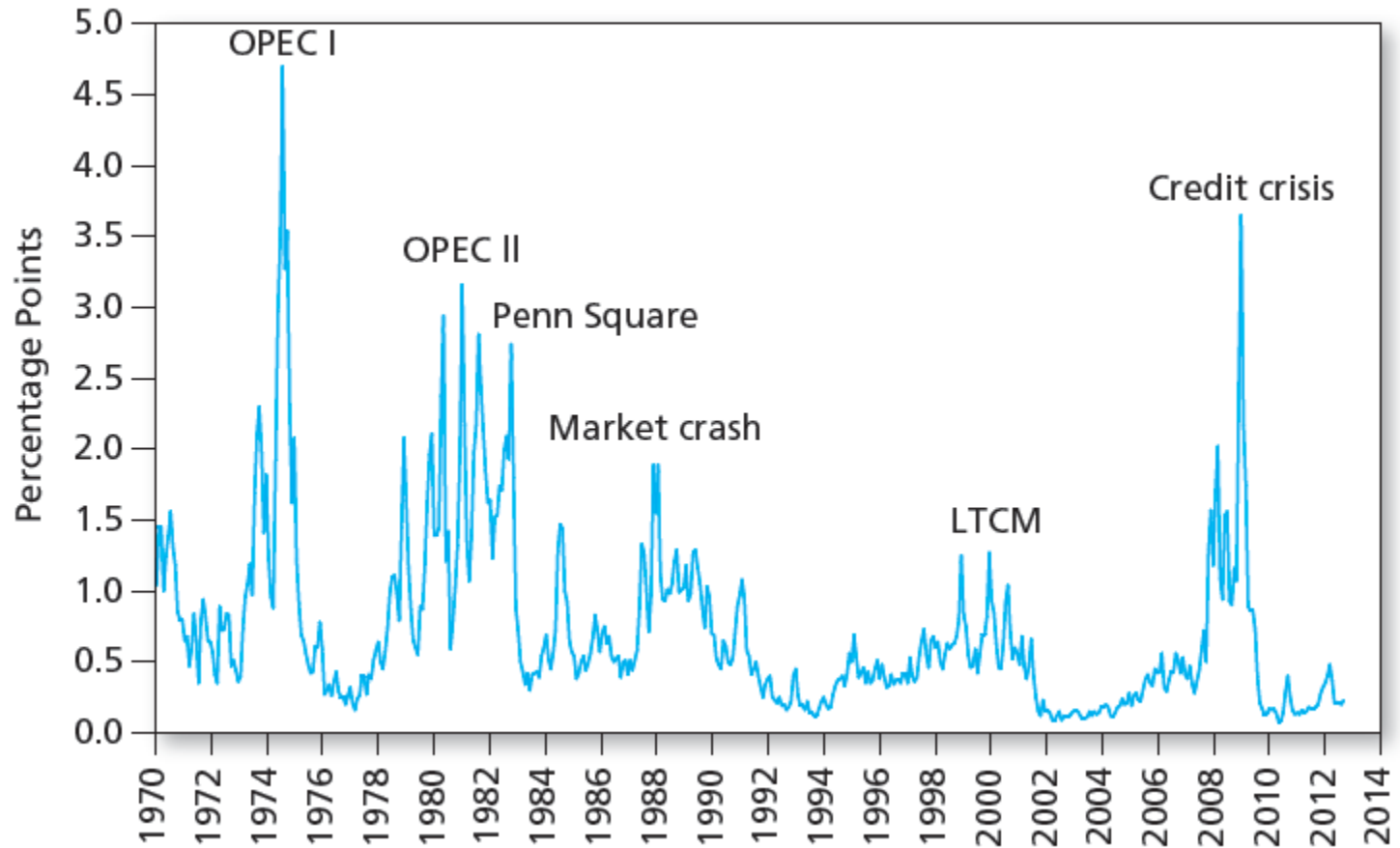
# Treasury bill net issuance by month



Source: SIFMA



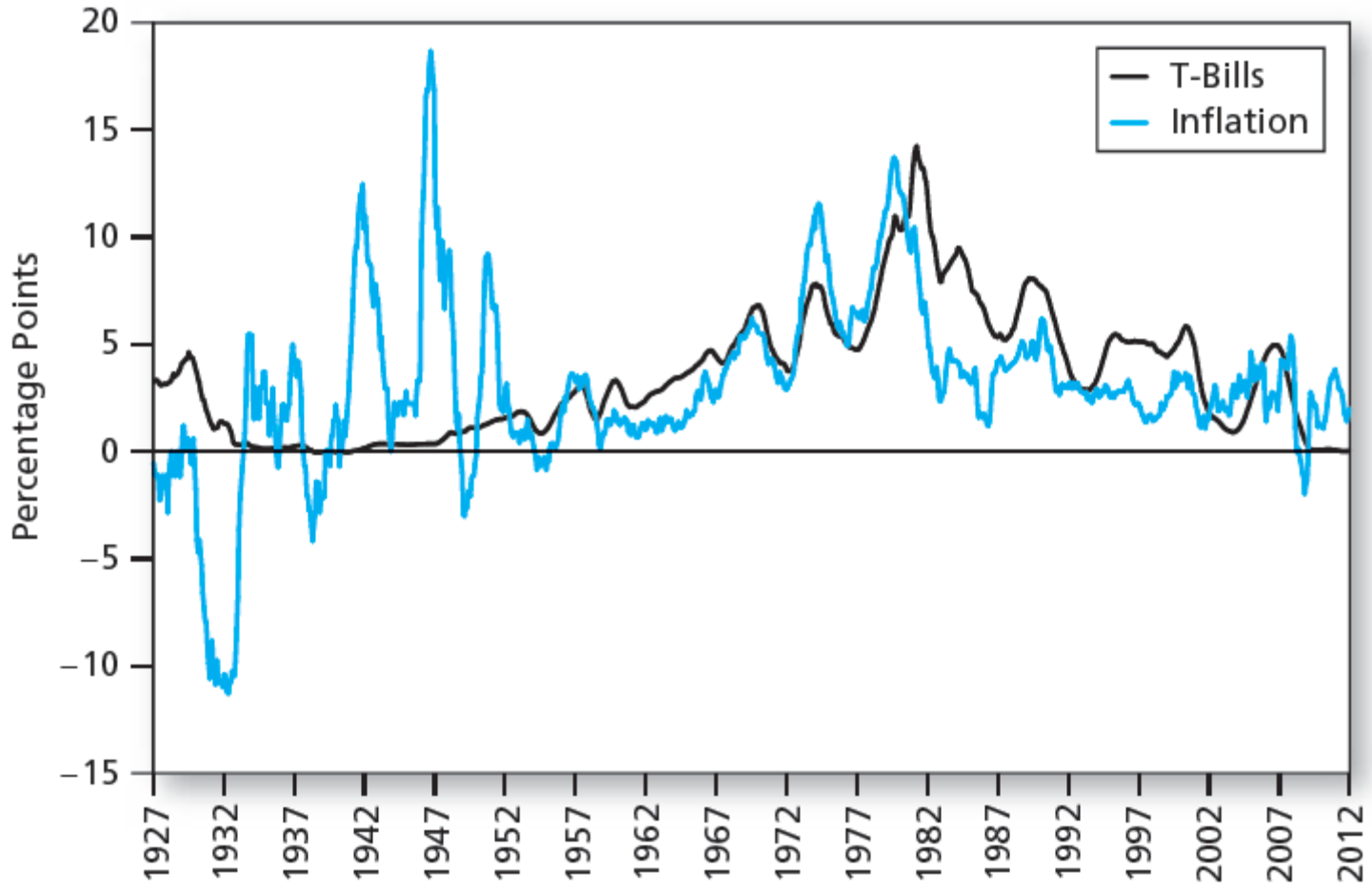
# The Spread between 3-month CD and Treasury Bill Rates



# History of T-bill Rates, Inflation and Real Rates, 1926-2012

	<b>Annualized Average Rates</b>		
	<b>T-Bills</b>	<b>Inflation</b>	<b>Real T-Bill</b>
All months	3.55	3.04	0.52
First half	1.79	1.74	0.10
Recent half	5.35	4.36	0.95

# Interest Rates and Inflation, 1926-2012



# Repo Agreement

- Selling an asset with an explicit agreement to repurchase the asset after a set period of time
  1. Bank **A** sells a treasury security to Bank **B** at  $P_0$
  2. Bank **A** agrees to buy the treasury back at a higher price  $P_f > P_0$
  3. Bank **B** earns a rate of return implied by the difference in prices

$$i_{RA} = \frac{P_f - P_0}{P_0} \times \frac{360}{\text{days}}$$

# Legal status of repo contracts

- Assets of bankrupt firm are normally subject to automatic stay
- If applied to repo, it would mean that the lender could not sell collateral
- Ambiguous for a long time
- Congress in 1984 exempted repos from automatic stay
- Essential to growth of repo

# Repos and shorting

- Say I want to bet that an asset price will fall
- Would like to short it
- Related to repo
- Lend money, getting the security as collateral (repo)
- Sell the security
- Buy it back to get my money back

# Settlement conventions

- When you do a trade, the actual delivery of the security comes later
- Stocks and non-government bonds settle T+2
- Treasuries and options settle T+1
- Foreign exchange settle T+2 (except Canadian \$-US \$ which is T+1)
- Sometimes settlement problems occur
- Extreme case is Herstatt risk
- Move towards perfectly synchronized settlement (DvP)

# Commercial Paper

- Like a bill used for short term financing by large corporations and financial institutions.
- Can be collateralized or uncollateralized
- CP offerings typically accompanied by backup line of credit from commercial bank.
- Rated A1-A3 by S&P (P1-P3 by Moody's, F1-F3 by Fitch).
- Mostly Tier 1
- Maturity up to 270 days: usually less than a month.
- Defaults are rare (Penn Central in 1971 was a large default)



# Asset backed commercial paper

- Commercial banks making loans have to hold reserves
- Around 2000, banks developed a shortcut
- Put loan in a subsidiary (SPV) and financed it with commercial paper
- Neat trick until subsidiary unable to roll over commercial paper
- ABCP market froze in 2007 and CP could not roll
- Some programs defaulted; others were bailed out by the sponsoring bank
- Now regulators take account of “off-balance sheet” subsidiaries eliminating motivation for ABCP

# Asset backed Commercial paper



# Money Market Mutual Funds ( MMMF )

- U.S. MMMF assets totaled **\$2.8 trillion in January 2018** (\$3.6 trillion in 2008)
- In **1970s/80s**, MMMFs gave retail investors access to market rates as inflation began to exceed deposit rates.
  - MMMFs exempt from interest rate ceiling on deposits (Reg Q) at the time.
- **SEC** regulates MMMFs
  - Strict rules got stricter post crisis
  - Cannot hold a security with maturity  $> 1$  year
  - WAM must be  $\leq 60$  days (90 days before 2010). 10% must be able to be liquidated in 1 day
  - Max 5% exposure to any single issuer (other than the government and agencies)
- Nearly half of CP outstanding is held by MMMFs.

# Reserve Primary Fund “Breaks the Buck”

**September 15, 2008:** Lehman files for bankruptcy (defaults on its long-term and short-term (CP) debt).

- \$785 million Lehman holdings:
- Prior to market open on Sep 15, Fund’s assets at \$63 billion.

**September 16, 2008**

- Fund’s assets stood at \$23 billion.
- NAV dropped to \$0.97
- The Reserve Primary Fund (the oldest money market mutual fund in U.S. history) announces it cannot redeem at par. The fund “broke the buck.”

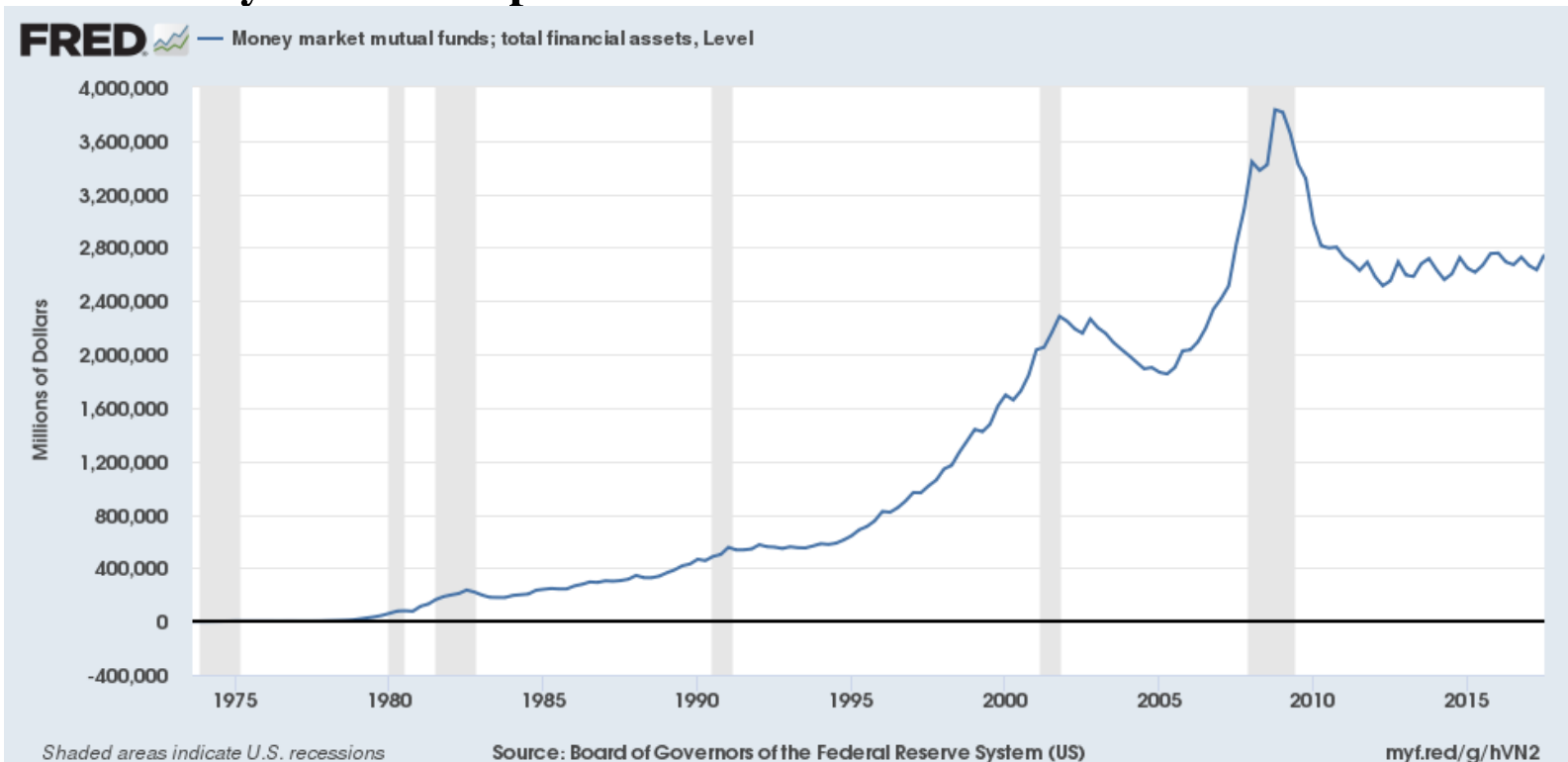
Illiquidity begets insolvency

- As investors withdrew funds, Lehman CP became a **greater share of total assets** for funds that held any Lehman CP.

# Fallout

**September 17, 18, 19: Run on MMMFs (\$172 bn in redemptions)**

- **Money funds dumped short securities on the market**



- **CP rates spiked dramatically**

# Commercial Paper (CP)

Large corporations are unable to issue CP for funding needs without MMMF buyers

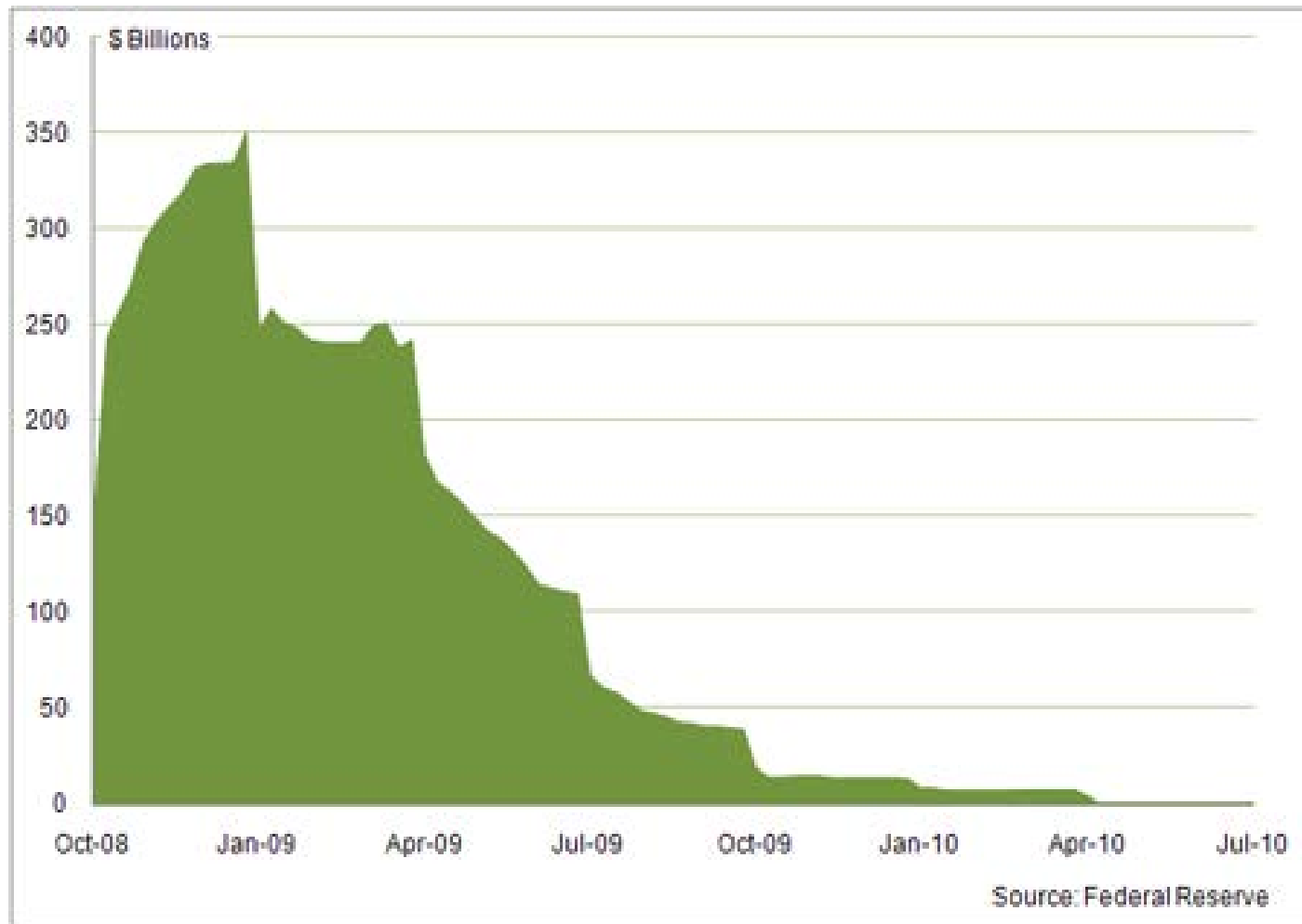


## Economic activity collapses . . .

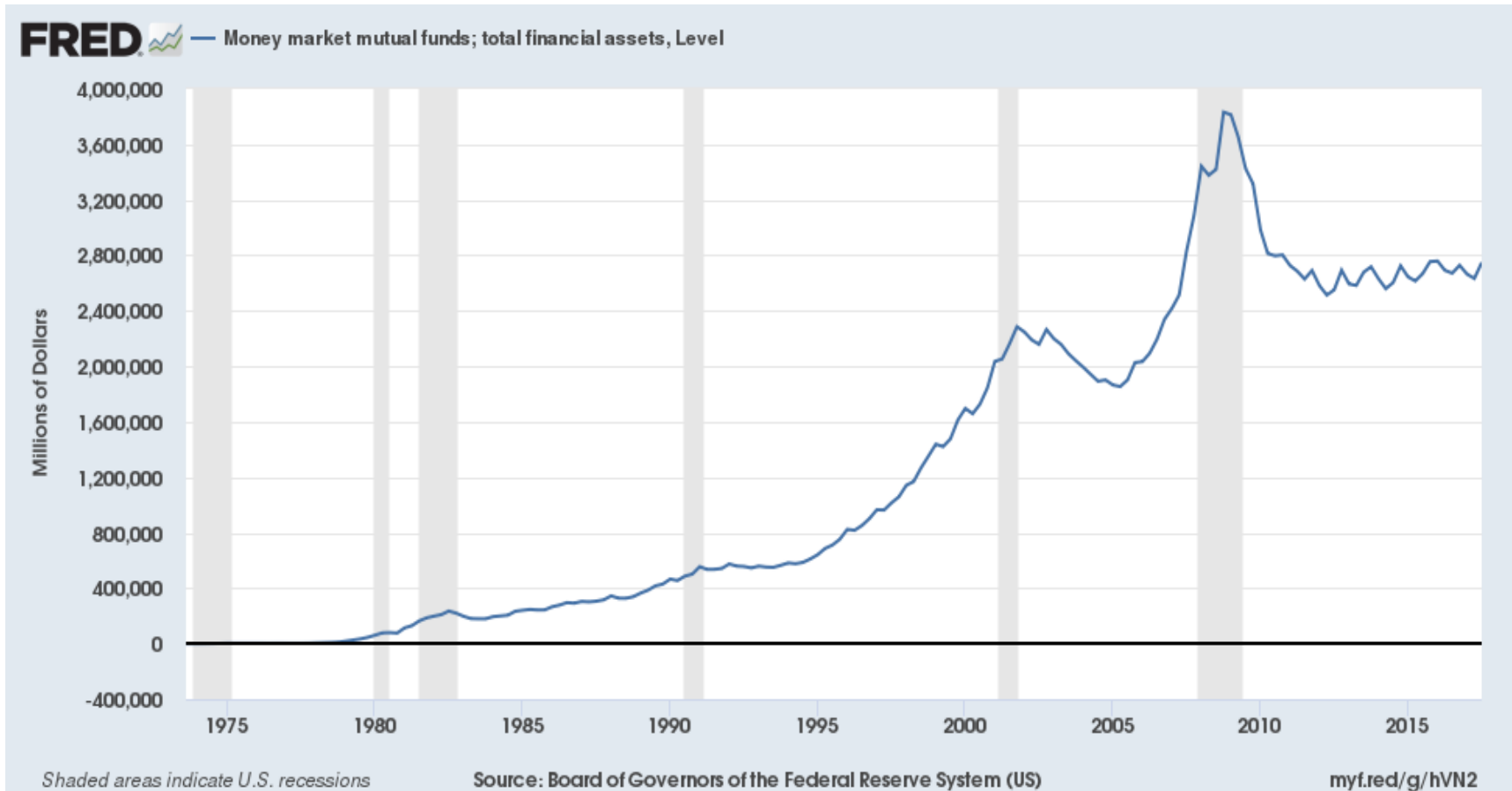
- September 29: **Government guarantees all existing investments** in money funds (over \$3 trillion is insured), but not new investments.

# CP Funding Facility

October 7: Fed introduces CPFF (**buy CP from issuers**)



# Money Funds Have Not Recovered

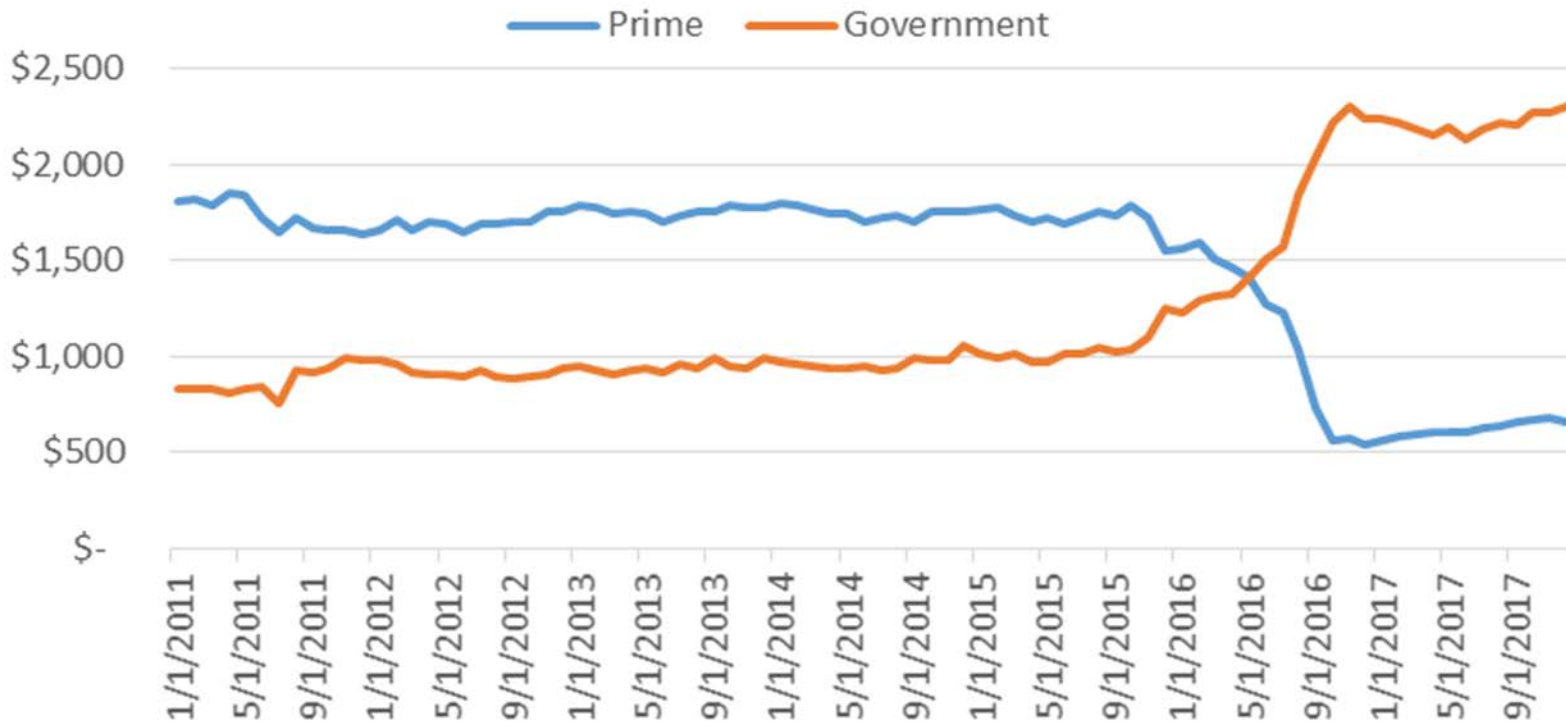




# Trends in Fund Type (\$bn)

**April 2016:** New MMMF disclosure rules took effect

➤ Increased reporting of data to both to regulators and investors.



**As of October 2016:** Institutional prime MMMFs report a floating NAV.

# Major Components of the Money Market

	<b>\$ Billion</b>
Repurchase agreements	\$1,141
Small-denomination time deposits and savings deposits*	7,202
Large-denomination time deposits*	1,603
Treasury bills	1,478
Commercial paper	1,445
Money market mutual funds	2,645

\*Small denominations are less than \$100,000.

Sources: *Economic Report of the President*, U.S. Government Printing Office, 2012; *Flow of Funds Accounts of the United States*, Board of Governors of the Federal Reserve System, September 2012.

# Eurocurrency Market

- About  $\frac{3}{4}$  eurocurrency deposits are euro**dollars** (rather than other currencies)
- **Eurodollars: Unsecured \$-denominated deposit** of non-U.S. domiciled bank
  - Historically, mostly in London. Now other offshore money centers (e.g. Cayman).
  - Not subject to U.S. regulation. Contract written under foreign law.
  - Developed in 1950s. Size estimated around \$2 tn.
  - Popularity quickly ballooned:
    - Evade confiscation of \$ deposits post WWII.
    - Petro dollar deposits.
    - Interest rate ceiling (regulation Q) on fed funds deposits (bank deposits in U.S.).

# The Birth of LIBOR

- Minos Zombanakis (Greek banker) arranged an \$80mn **syndicated floating-rate loan** for the Shah of Iran.
- A group of “**reference banks**” within the syndicate agreed to **report their funding costs** shortly before a loan rollover date.
- The **weighted average rate** was the next period’s loan price.

“In the early days it was very much like a **club**,” said Yassukovich, former chairman of the UK Securities Association.

“Any bank that submitted an unreasonably inflated interest rate would be ejected from the syndicate - and see a potentially valuable **relationship** with the borrower destroyed.” -*Zombanakis*

# Interbank Benchmark/Survey Rates

## **LIBOR:** Survey of eurocurrency rates in London

In 1986, LIBOR first calculated by British Bankers Association (BBA)

- US dollar (\$), Japanese yen (¥) and British pound (£).
- Rate used to set loan rates (commercial, consumer, mortgage, student), floating leg of swaps, settlement rate for IR futures.
  - Today, reference rate for ≈\$360 tn in derivatives contracts.

## **Other benchmark rates, inspired by LIBOR**

### **EURIBOR** (Euro Interbank Offer Rate)

- Survey of European banks' euro funding rate, introduced along with the euro currency in 1999. Larger set of banks surveyed, based in euro area.

### **OBFR** (Overnight Bank Funding Rate)

- Volume-weighted median of combined eurodollar and fed funds **transaction rates**. Published by New York Federal Reserve Bank since 2016.

# LIBOR Construction

7 maturities: O/N 1w 1m 2m 3m 6m 12m

5 currencies: ¥ € \$ £ CHF (only report highly traded currencies)

**Survey Participants:** 11 to 17 banks

**Quote captures:** 11am (London Time) Survey of own banks'

borrowing rate

- *“At what rate could you borrow funds, were you to do so by asking for and then accepting interbank offers in a **reasonable market size** just prior to 11am?”*
  - Liquid time of day, and early enough for use that day
  - Top and bottom quartiles are cut
  - Average the rest

# LIBOR Misreporting

➤ *Nature of misreporting?*

**Pre-crisis:** to help own position

**2008-09:** Trade volume declined in unsecured funding markets across the board, and rates spiked.

- **Counterparty risk** priced more heavily

## **LIBOR misreporting in the crisis**

- Poor credits did not want to report the rates at which they actually borrowed
- Feared others would perceive them to be even worse risks than they already were

# The Death of LIBOR

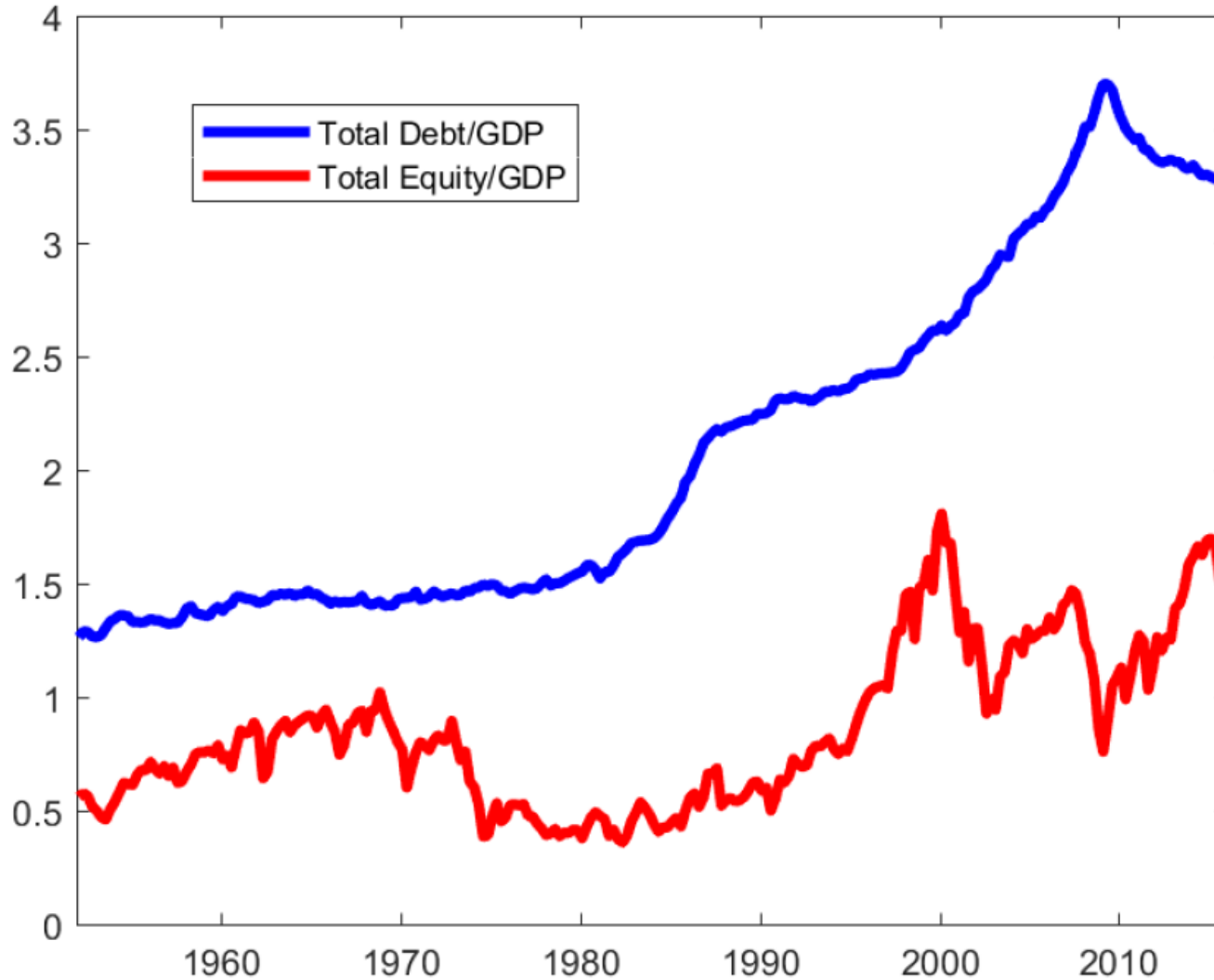
- Aim to phase out LIBOR by 2021
- Regulators and derivatives participants are taking differing routes to determine and administer replacements.
- US Alternative Reference Rates Committee favors SOFR



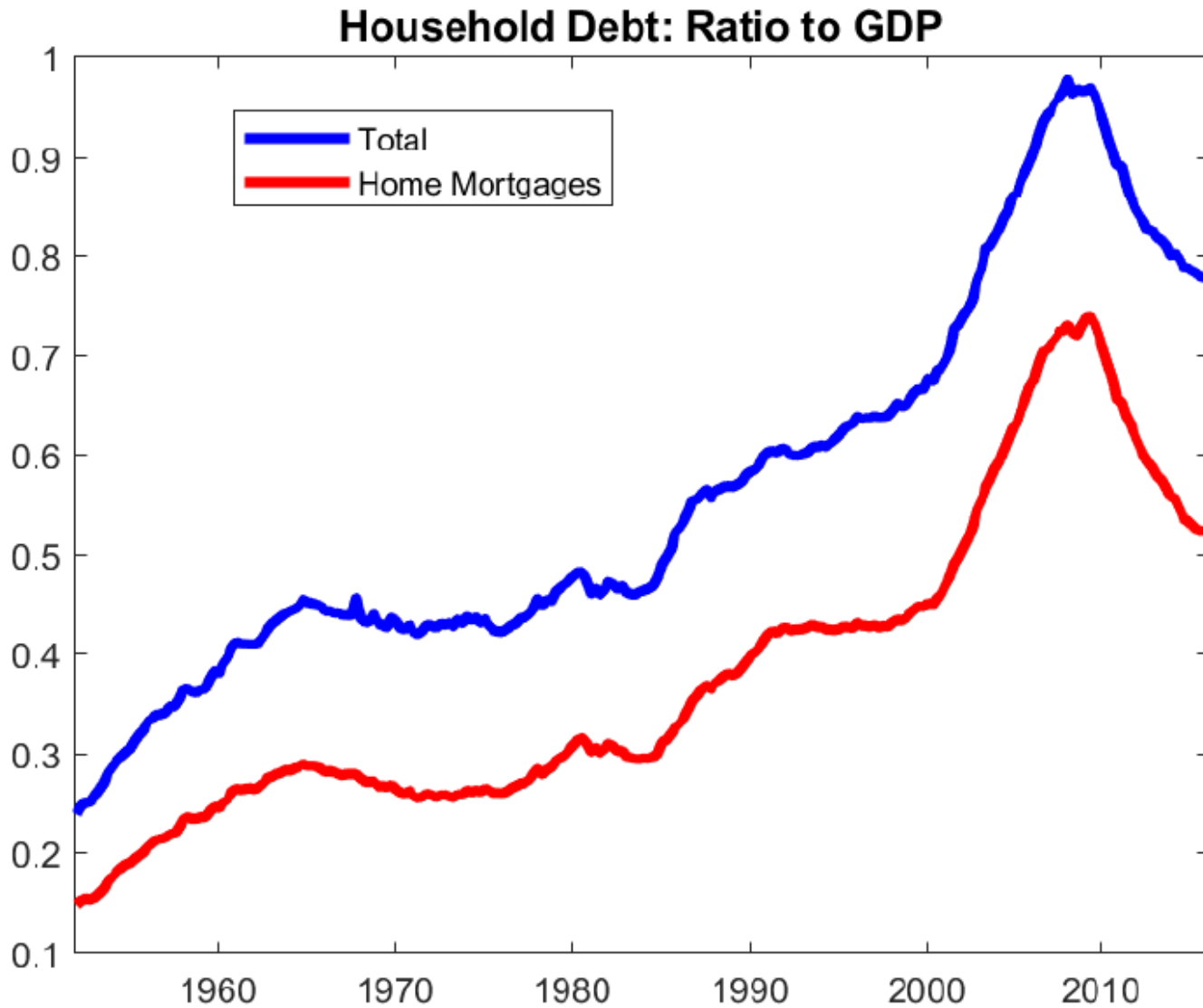
# SOFR

- “Secured Overnight Financing Rate” (SOFR), which
- Published by NY Fed
- Based on actual overnight Treasury repo transactions
- Median rate by dollar volume
- Good news for the borrower, bad for the saver/lender.

# U.S. Debt & Equity-to-GDP (1950-2017)

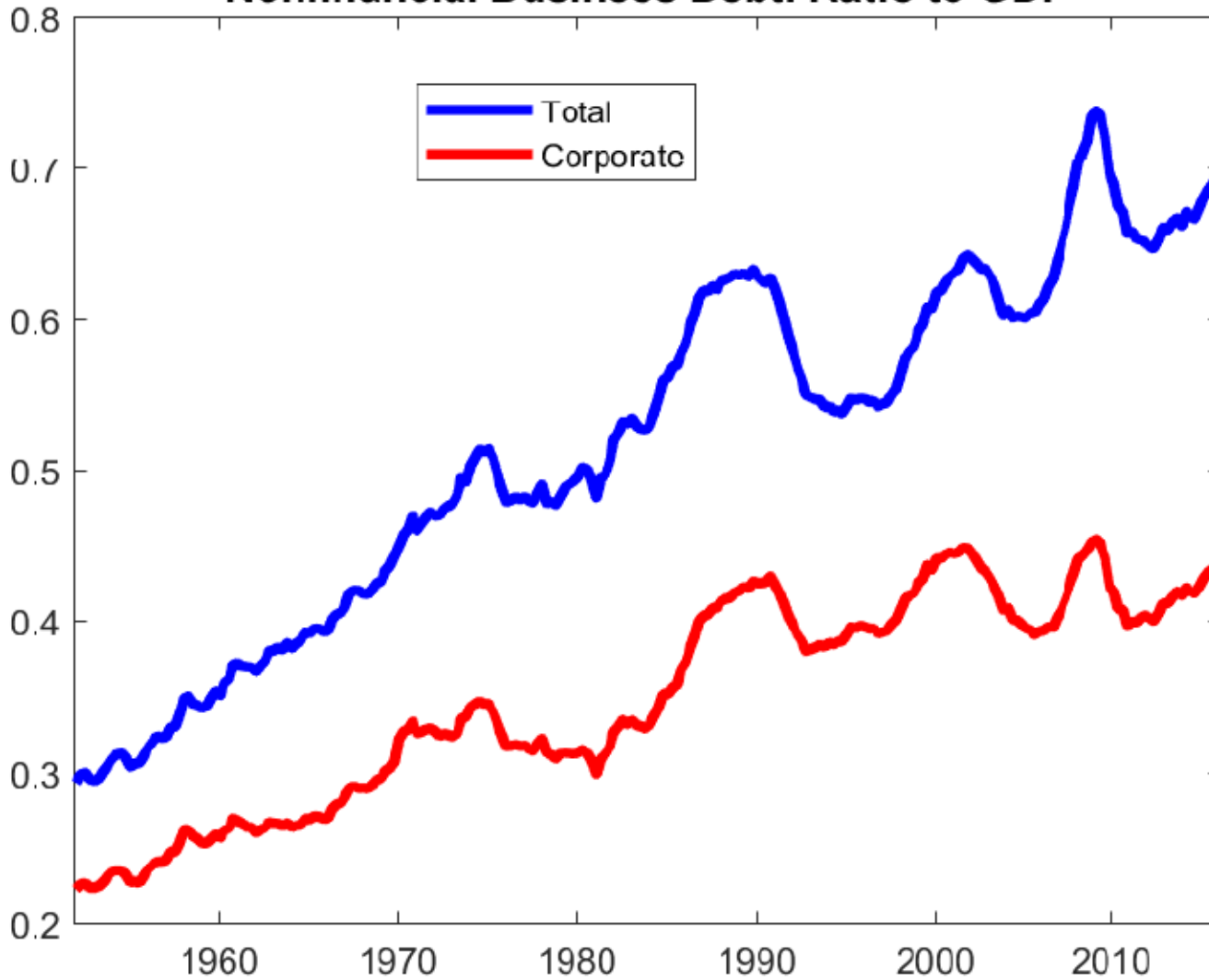


# Household (1950-2017) Debt-to-GDP Ratio

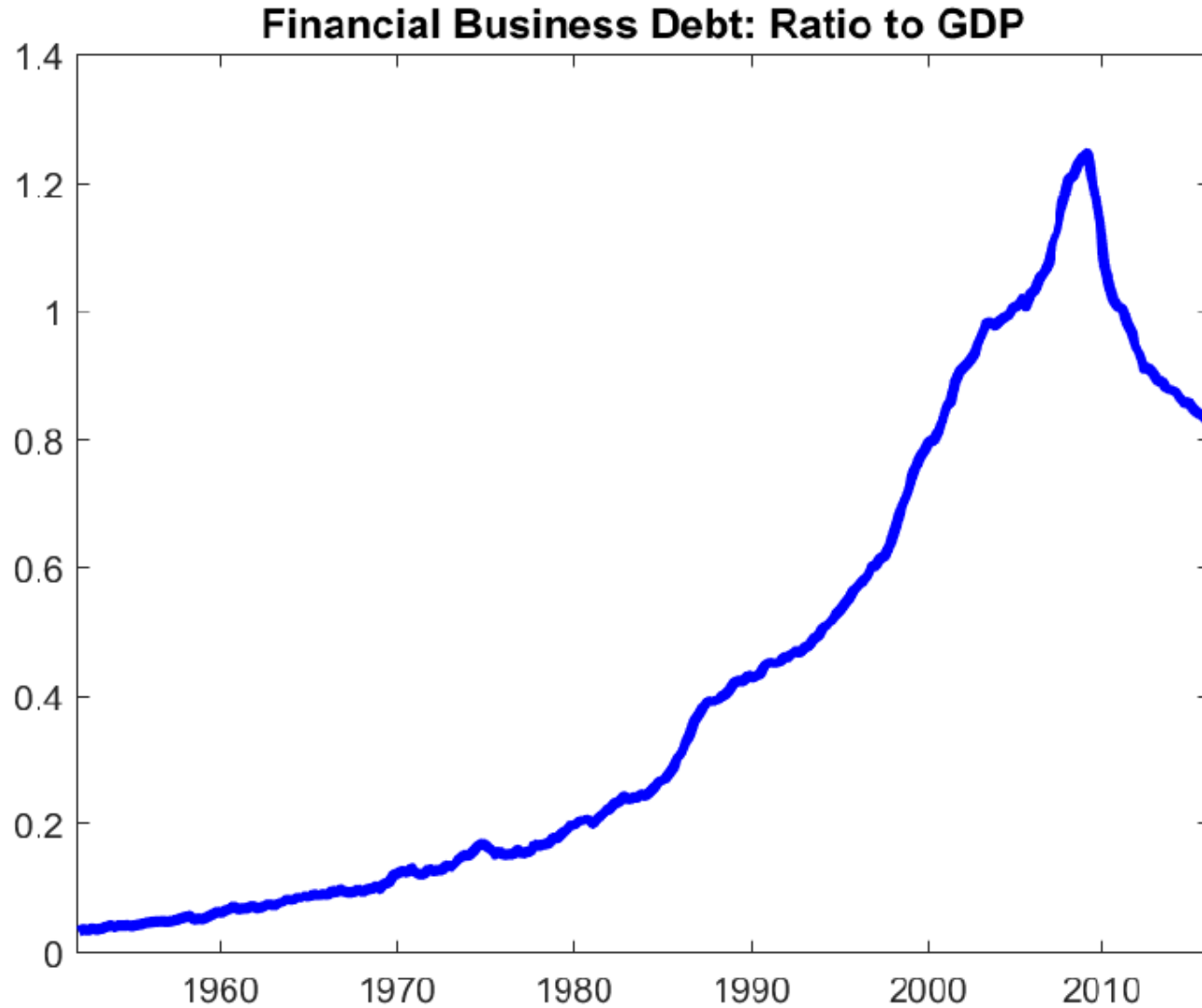


# Nonfinancial Business (1950-2017)

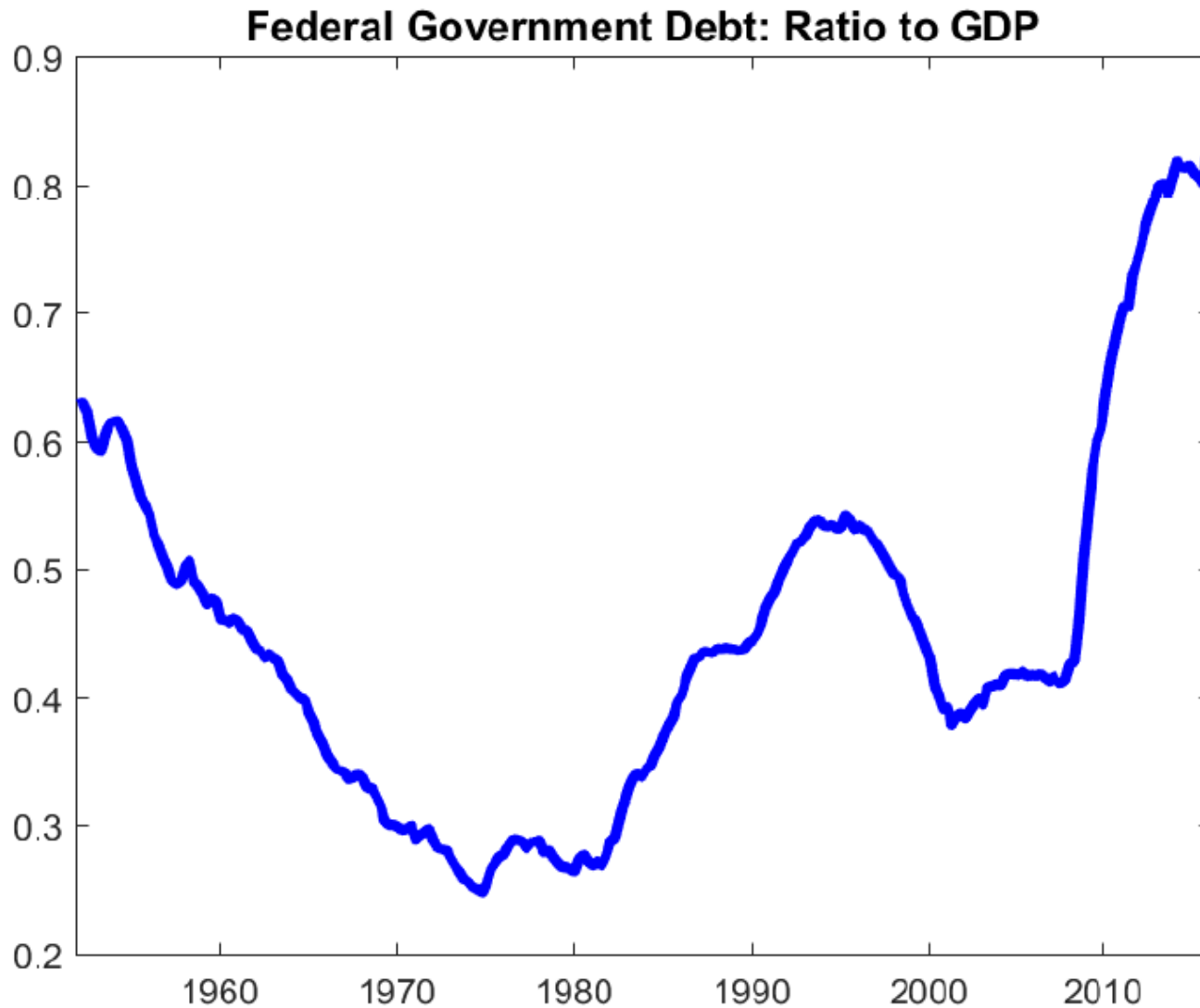
## Nonfinancial Business Debt: Ratio to GDP



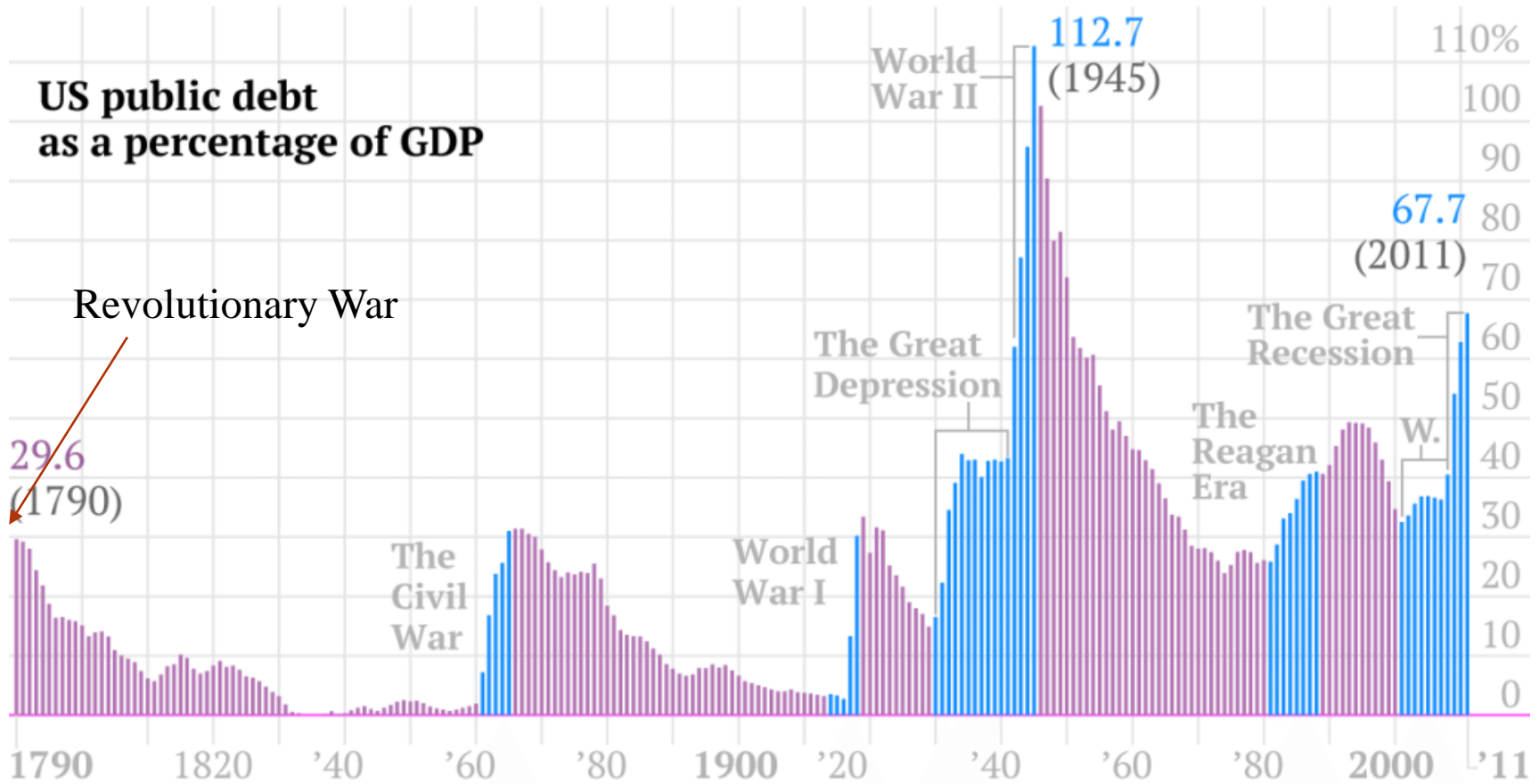
# Financial Business (1950-2017)



# Federal Government (1950-2017)



# Long History of U.S. Government Debt/GDP

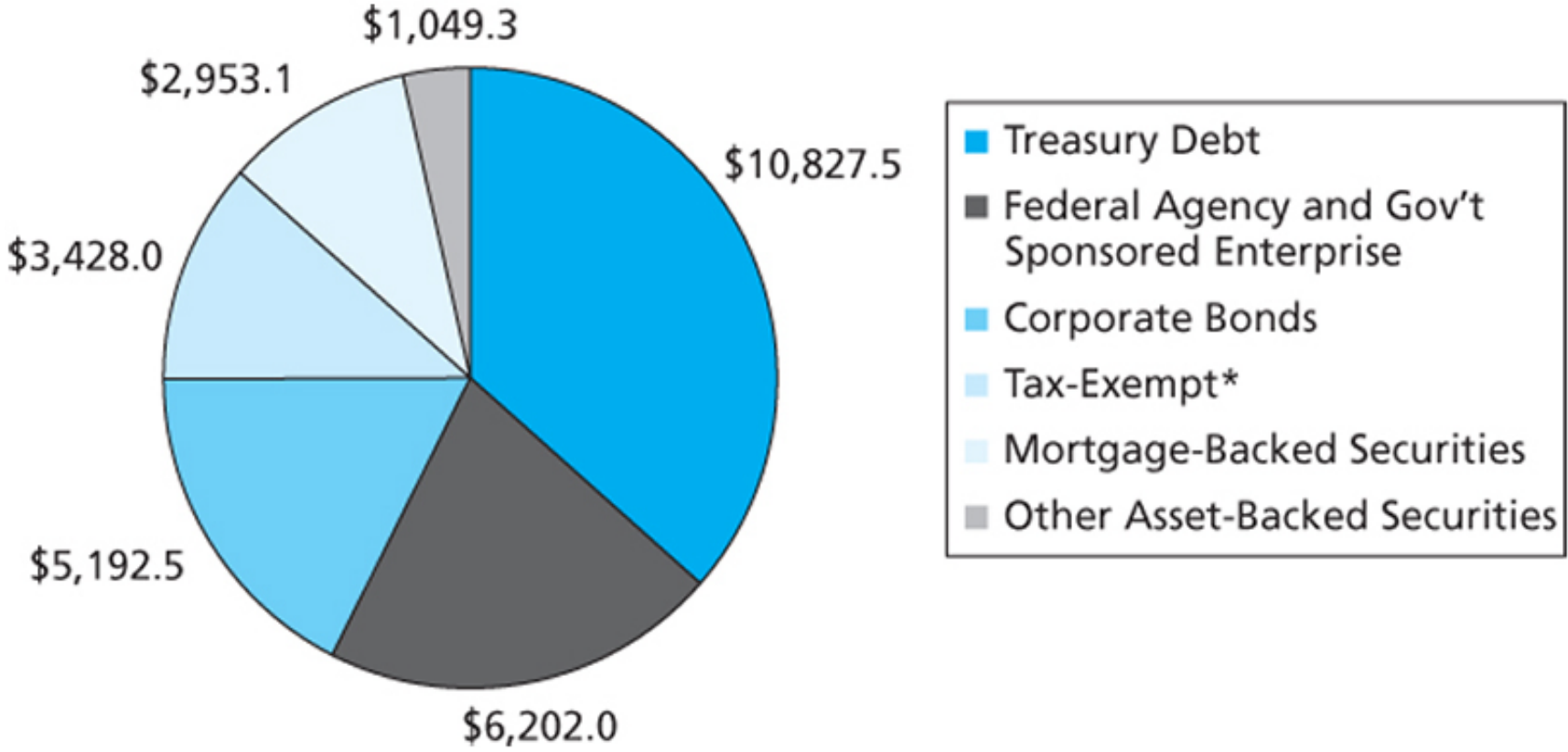


# The Bond Market

- Treasury Notes and Bonds
- Inflation-Protected Treasury Bonds
- Federal Agency Debt
- International Bonds
- Municipal Bonds
- Corporate Bonds
- Mortgages and Mortgage-Backed Securities



# Major Components of the Bond Market



# Treasury Notes and Bonds

- Maturities
  - Notes – maturities up to 10 years
  - Bonds – maturities in excess of 10 years
  - 30-year bond
- Par Value - \$1,000
- Quotes – percentage of par

# Bond Characteristics

- Face or par value
- Coupon rate
  - Zero coupon bond

# Listing of Treasury Issues

## U.S. Government Bonds and Notes

Representative Over-the-Counter quotation based on transactions of \$1 million or more.

Treasury bond, note and bill quotes are from midafternoon. Colons in bond and note bid-and-asked quotes represent 32nds; 101:01 means 101 1/32. Net change in 32nds. n-Treasury Note. i-inflation-indexed issue.

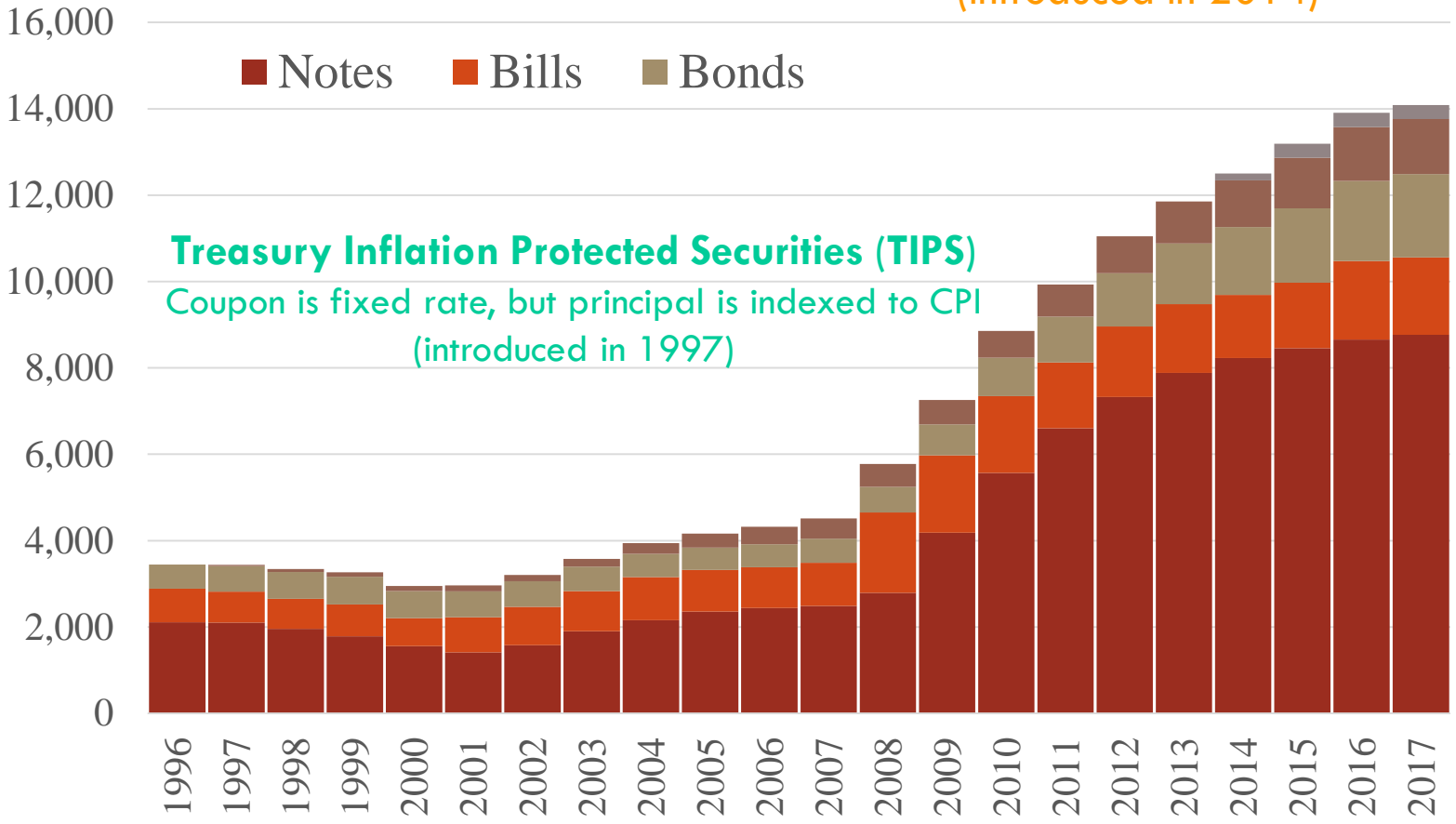
Treasury bill quotes in hundredths, quoted in terms of a rate of discount. Days to maturity calculated from settlement date. All yields are to maturity and based on the asked quote. For bonds callable prior to maturity, yields are computed to the earliest call date for issues quoted above par and to the maturity date for issues quoted below par.

\*-When issued. Daily change expressed in basis points.

U.S. Government Bonds and Notes						Treasury Bills											
RATE	MATURITY MO/YR	BID	ASKED	CHG	ASK YLD	RATE	MATURITY MO/YR	BID	ASKED	CHG	ASK YLD	MATURITY	DAYS TO MAT	BID	ASKED	CHG	ASK YLD
3.125	Jan 07n	99:29	99:30	----	4.83	2.375	Apr 11i	99:11	99:12	+2	2.53	Mar 22 07	64	4.96	4.95	+0.02	5.06
2.250	Feb 07n	99:24	99:25	----	4.88	4.875	Apr 11n	100:16	100:17	+3	4.73	Mar 29 07	71	4.96	4.95	+0.01	5.07
6.250	Feb 07n	100:02	100:03	----	4.88	4.875	May 11n	100:17	100:18	+3	4.73	Apr 05 07	78	4.96	4.95	+0.01	5.07
3.375	Feb 07n	99:25	99:26	----	4.97	5.125	Jun 11n	101:17	101:18	+4	4.73	Apr 12 07	85	4.96	4.95	----	5.08
3.750	Mar 07n	99:23	99:24	+1	4.97	4.875	Jul 11n	100:18	100:19	+4	4.73	Apr 19 07	92	4.98	4.97	+0.02	5.10
3.625	Apr 07n	99:18	99:19	----	4.99	4.625	Dec 11n	99:15	99:16	+4	4.74	Apr 26 07	99	4.96	4.95	----	5.09
5.750	Aug 10n	103:09	103:10	+2	4.73	3.375	Jan 12i	104:01	104:02	+3	2.50	May 03 07	106	4.96	4.95	+0.01	5.09
4.125	Aug 10n	98:00	98:01	+3	4.73	4.875	Feb 12n	100:24	100:25	+4	4.70	May 10 07	113	4.96	4.95	----	5.10
3.875	Sep 10n	97:03	97:04	+3	4.73	3.000	Jul 12i	102:17	102:18	+2	2.49	May 17 07	120	4.97	4.96	+0.01	5.11
4.250	Oct 10n	98:10	98:11	+3	4.73	4.375	Aug 12n	98:13	98:14	+4	4.69	May 24 07	127	4.97	4.96	+0.01	5.12
4.500	Nov 10n	99:05	99:06	+3	4.73	4.000	Nov 12n	96:13	96:14	+4	4.71	May 31 07	134	4.95	4.94	+0.01	5.10
4.375	Dec 10n	98:22	98:23	+3	4.74	10.375	Nov 12	104:11	104:12	+2	4.87	Jun 07 07	141	4.94	4.93	+0.01	5.10
4.250	Jan 11n	98:07	98:08	+3	4.74	3.375	Feb 13n	95:17	95:18	+4	4.72	Jun 14 07	148	4.94	4.93	----	5.10
3.500	Jan 11i	103:26	103:27	+3	2.48	3.625	May 13n	94:02	94:03	+5	4.71	Jun 21 07	155	4.94	4.93	----	5.11
5.000	Feb 11n	101:03	101:04	+3	4.69	1.375	Jul 13i	96:09	96:10	+4	2.49	Jun 28 07	162	4.94	4.93	----	5.11
4.500	Feb 11n	99:04	99:05	+3	4.73	4.250	Aug 13n	97:10	97:11	+6	4.72	Jul 05 07	169	4.95	4.94	----	5.13
4.750	Mar 11n	100:01	100:02	+3	4.73	5.250	Nov 28	104:12	104:13	+8	4.92	Jul 12 07	176	4.95	4.94	----	5.13

# Treasury Securities Outstanding, by Type (\$bn)

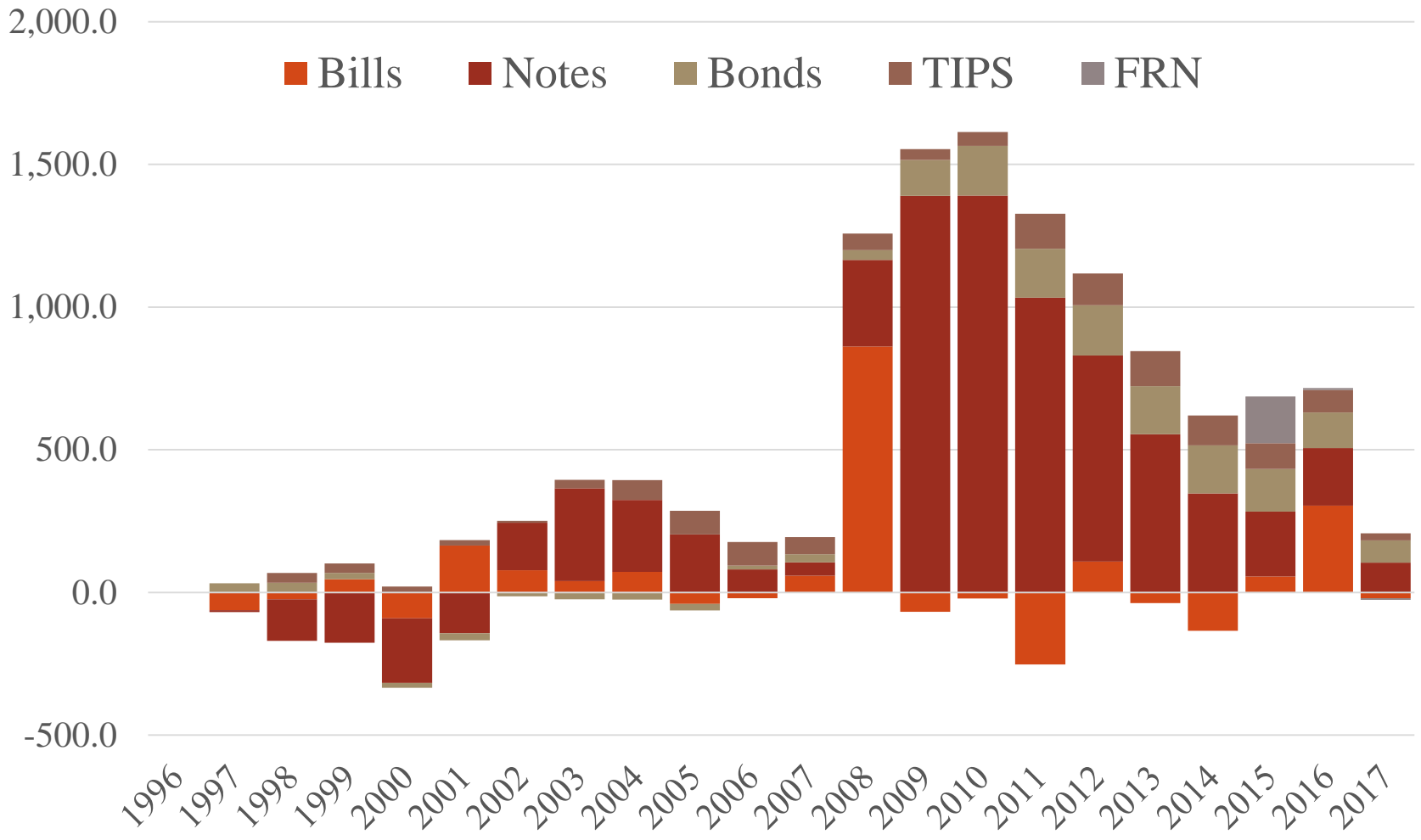
**Floating Rate Notes (FRNs)**  
 Rate is indexed to 13-week Treasury bill  
 (introduced in 2014)



■ Notes ■ Bills ■ Bonds

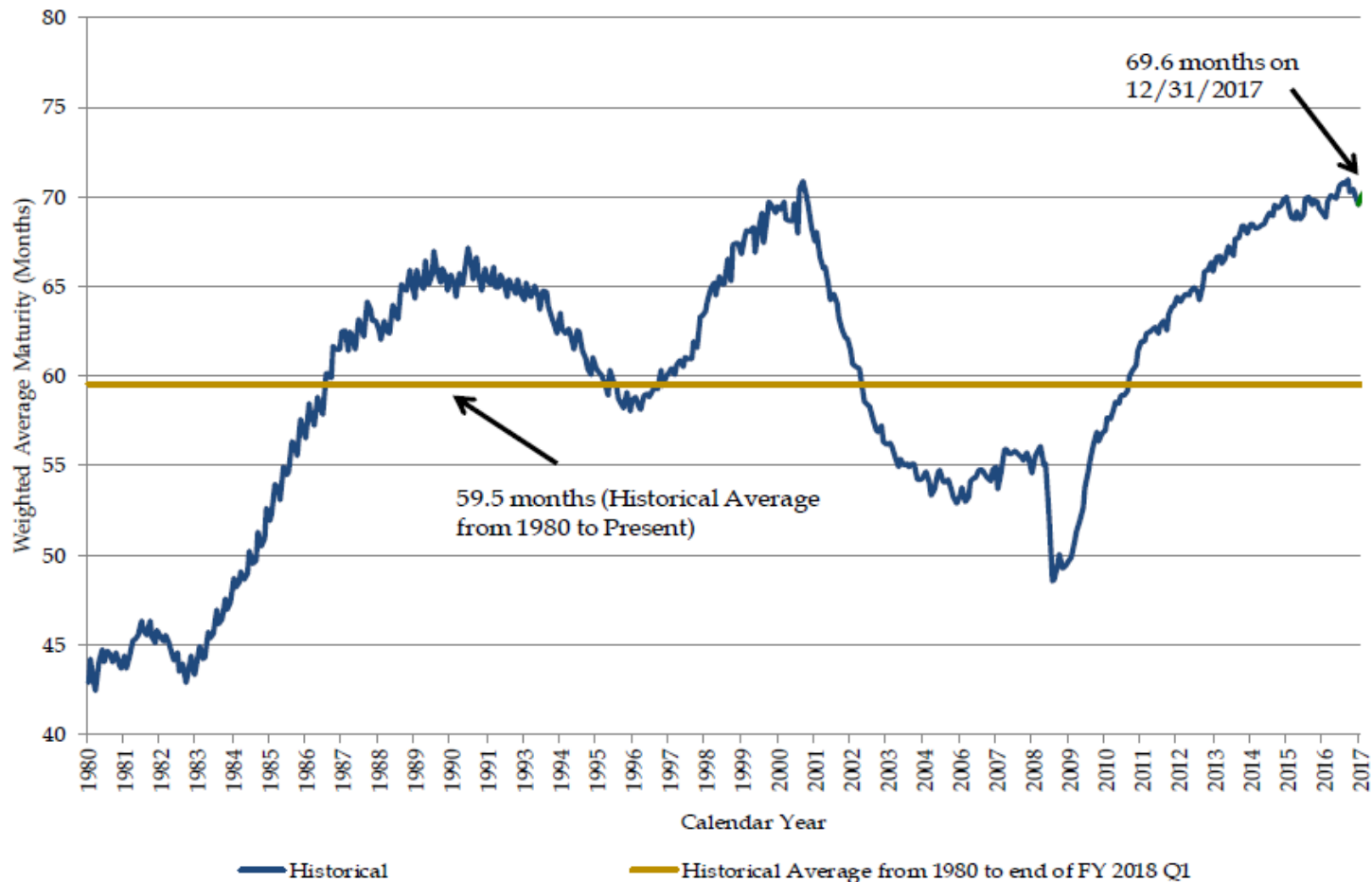
**Treasury Inflation Protected Securities (TIPS)**  
 Coupon is fixed rate, but principal is indexed to CPI  
 (introduced in 1997)

# Net Issuance (\$bn)

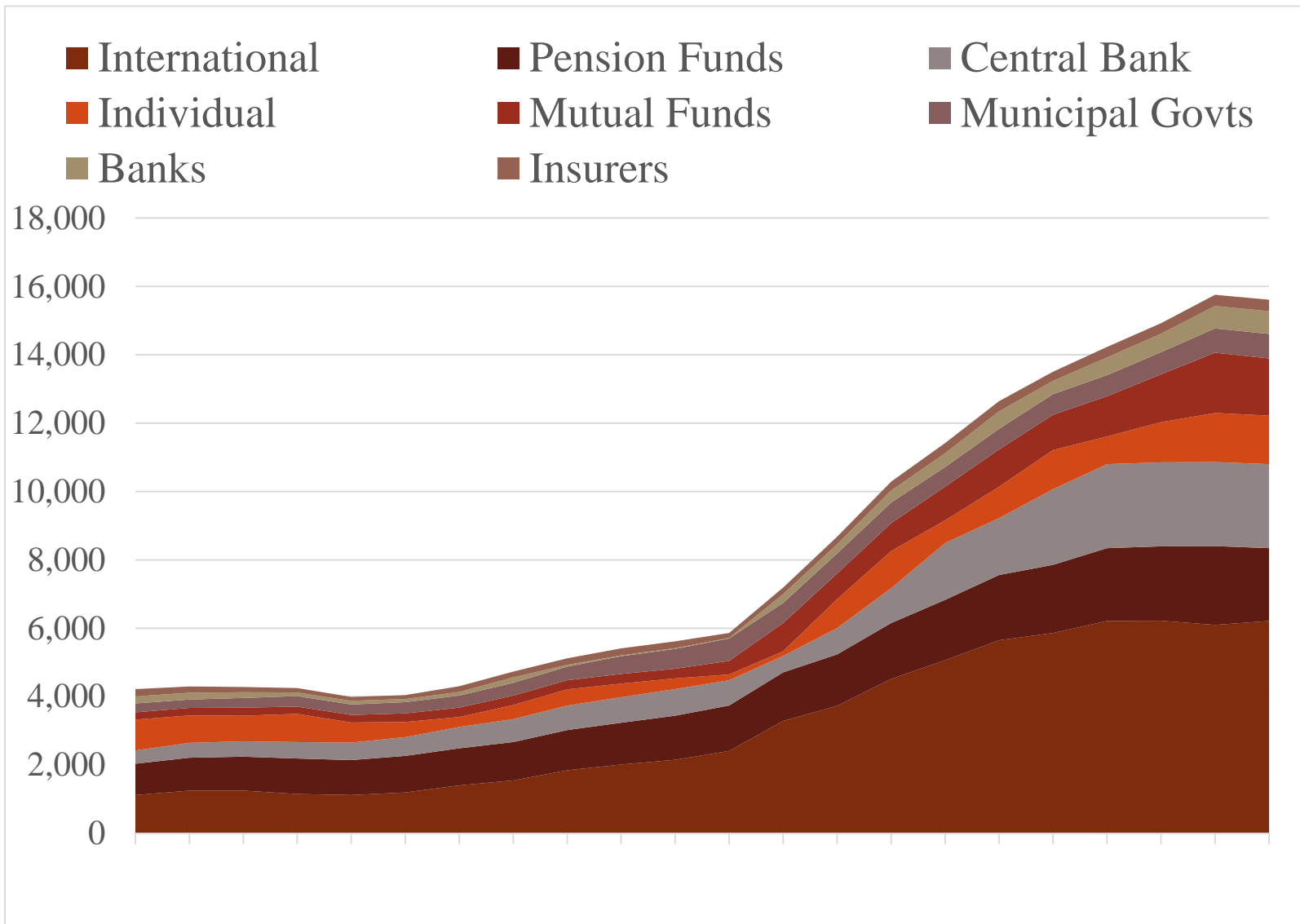


# Treasury Borrows Long

## Historical Weighted Average Maturity of Marketable Debt Outstanding



# Demand (\$bn)





# On-the-run and off-the-run

- Treasury at present issues
  - 4 week, 13 week, 26 week and 52 week Bills
  - 2, 3, 5, 7 and 10 year notes
  - 30 year bonds
  - 2 year FRNs
  - 5, 10 and 30 year TIPS
- Mantra of Treasury is regular and predictable issuance
- For any type, the most recently issued is called the on-the-run
- By market convention, in the US, most liquidity is in the on-the-run

# Treasuries and repos

- Might want to borrow a Treasury
- Can do so in a repo
- General collateral is that any Treasury can be delivered
- Special is for a particular issue
- Special repo rate is below general collateral repo rate
- On-the-run securities have low yield (high price) but can often be used to borrow cheaply because they are special
- Special rate cannot be above GC rate

# Treasury and fails

- Until 2009, if you were supposed to deliver a Treasury and didn't, you delivered it the next day at the same price
- Penalty for failing was that you were making a loan at a zero interest rate
- Now you pay a penalty that is 3 percent minus the funds rate, if the funds rate is less than 3; otherwise no penalty
- Before zero was the effective lower bound on a specials rate, now it can go to 3 percent below the funds rate

# Provisions of Bonds

- Secured or unsecured
- Call provision
- Convertible provision
- Floating rate bonds
- Preferred Stock

# Preferred Stock

- Shares characteristics of equity & fixed income
  - Dividends are paid in perpetuity
  - Nonpayment of dividends does not mean bankruptcy
  - Preferred dividends are paid before common
  - Preferred dividends come before common in bankruptcy
  - Generally holders do not have voting rights
  - Adjustable rate preferred stock pays a dividend that is tied to a benchmark interest rate

# Bond Pricing: Present value calculation

$$P_B = \sum_{t=1}^T \frac{C}{(1+r)^t} + \frac{ParValue}{(1+r)^T}$$

$P_B$  = Price of the bond

$C_t$  = interest or coupon payments

$T$  = number of periods to maturity

$r$  = semi-annual discount rate or the semi-annual yield to maturity

Price: 10-yr, 8% Coupon, Face = \$1,000

$$P = \sum_{t=1}^{20} \frac{40}{1.03^t} + \frac{1000}{1.03^{20}}$$

$$P = \$1,148.77$$

$$C_t = 40 \text{ (Semi Annual)}$$

$$P = 1000$$

$$T = 20 \text{ periods}$$

$$r = 3\% \text{ (Semi Annual)}$$

Can also be calculated using the Excel PRICE function

# Yield to Maturity

- Interest rate that makes the present value of the bond's payments equal to its price

Solve the bond formula for  $r$

$$P_B = \sum_{t=1}^T \frac{C}{(1+r)^t} + \frac{ParValue}{(1+r)^T}$$



# Yield to Maturity Example

$$950 = \sum_{t=1}^{20} \frac{35}{(1+r)^t} + \frac{1000}{(1+r)^{20}}$$

**10 yr Maturity      Coupon Rate = 7%**

**Price = \$950**

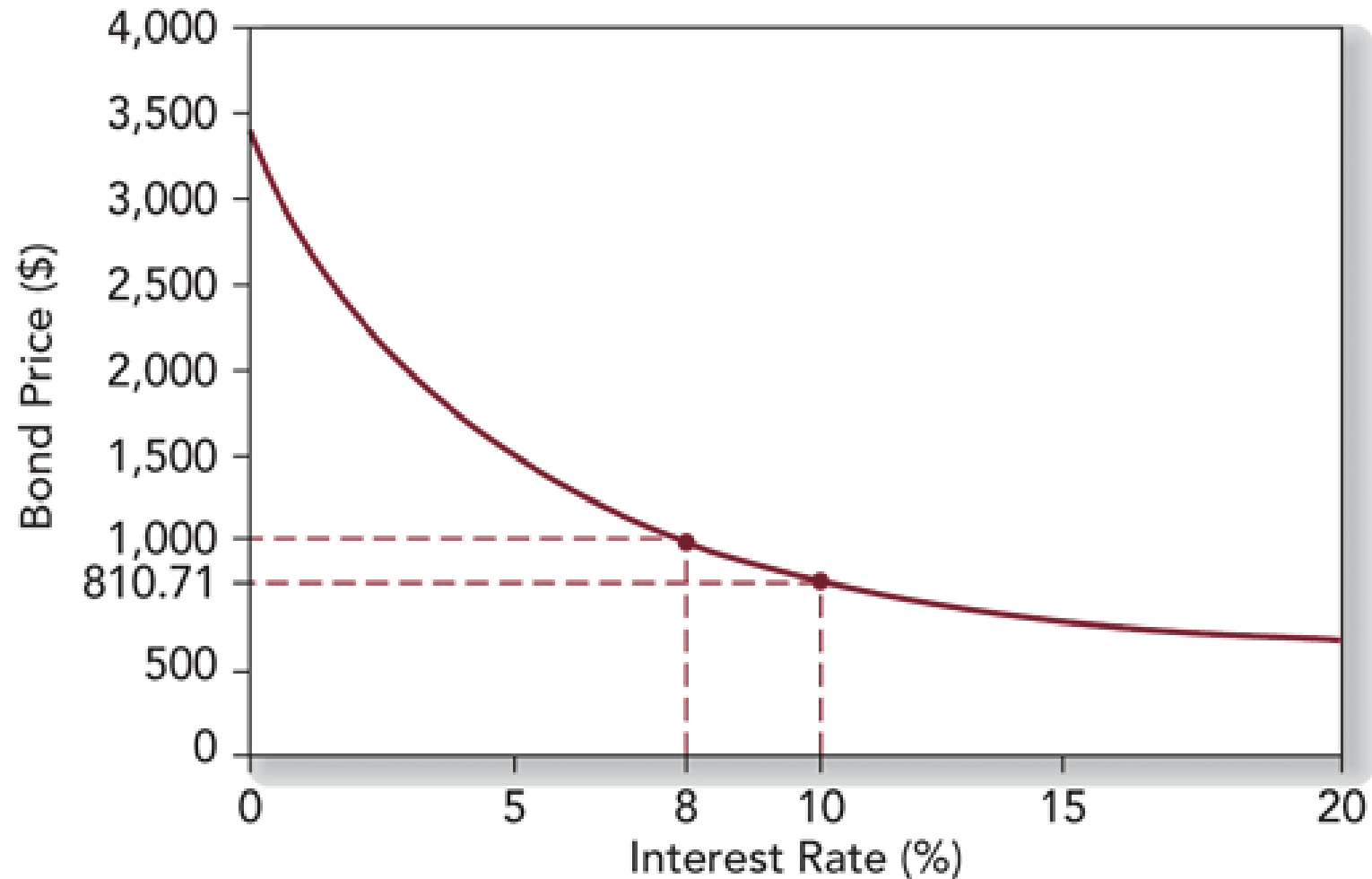
**Solve for  $r$  = semiannual rate**

$r = 3.8635\%$
----------------

# Bond Prices and Yields

- Prices and Yields (required rates of return) have an inverse relationship
- When yields get very high the value of the bond will be very low
- When yields approach zero, the value of the bond approaches the sum of the cash flows

# The Inverse Relationship Between Bond Prices and Yields



# Bond Prices at Different Interest Rates (8% Coupon Bond)

<b>Time to Maturity</b>	<b>4%</b>	<b>6%</b>	<b>8%</b>	<b>10%</b>	<b>12%</b>
1 year	1038.83	1029.13	1000.00	981.41	963.33
10 years	1327.03	1148.77	1000.00	875.35	770.60
20 years	1547.11	1231.15	1000.00	828.41	699.07
30 years	1695.22	1276.76	1000.00	810.71	676.77

# Holding-Period Return: Single Period

$$HPR = [ I + ( P_1 - P_0 ) ] / P_0$$

where

$I$  = interest payment

$P_1$  = price in one period

$P_0$  = purchase price

# Holding-Period Return Example

CR = 8%                      YTM = 8% N=10 years

Semiannual Compounding       $P_0 = \$1000$

In six months the rate falls to 7%

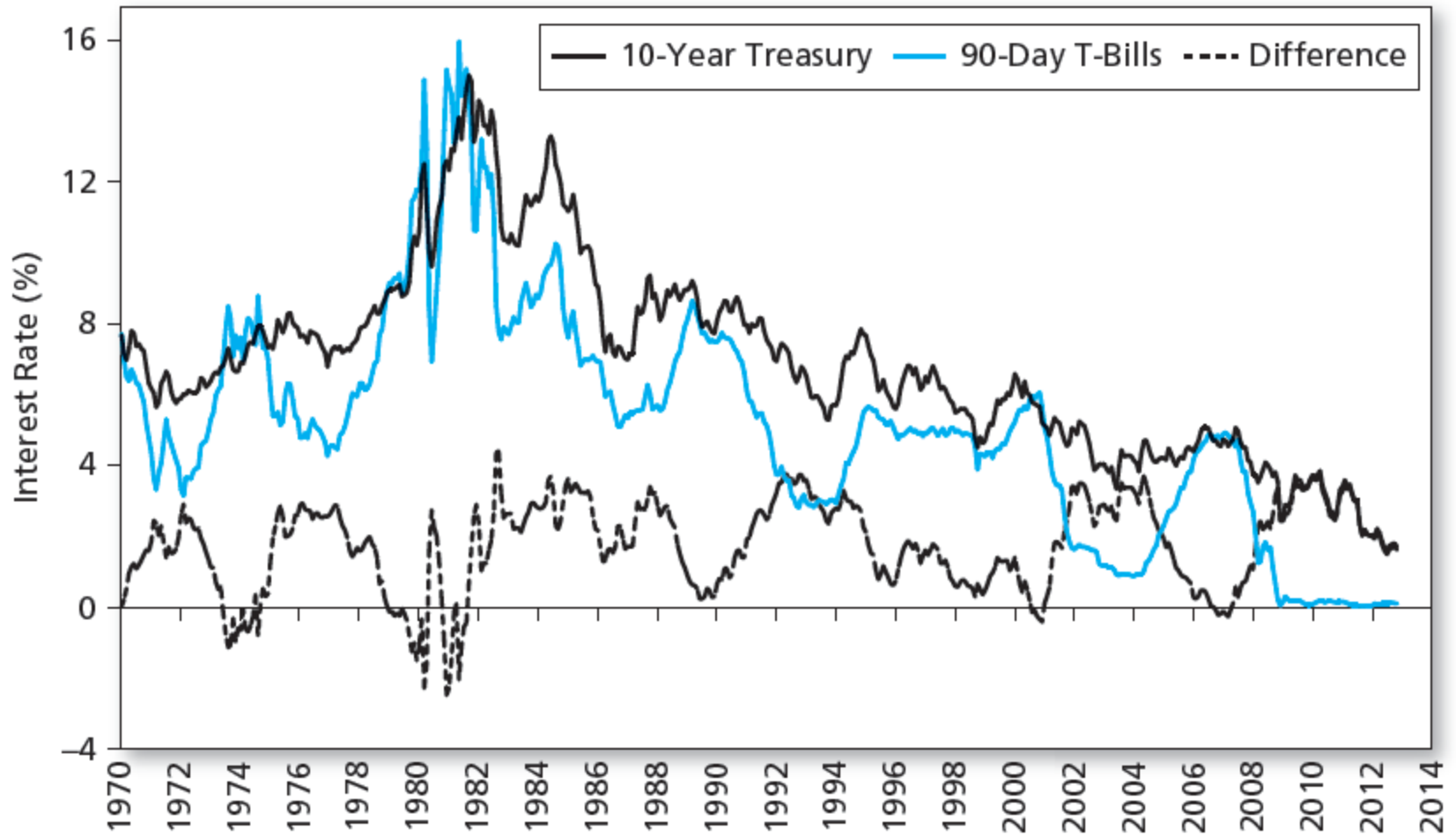
$$P_1 = \$1068.55$$

$$\text{HPR} = [40 + (1068.55 - 1000)] / 1000$$

$$\text{HPR} = 10.85\% \text{ (semiannual)}$$

Note that HPR and yield are two completely different things

# Treasury yields



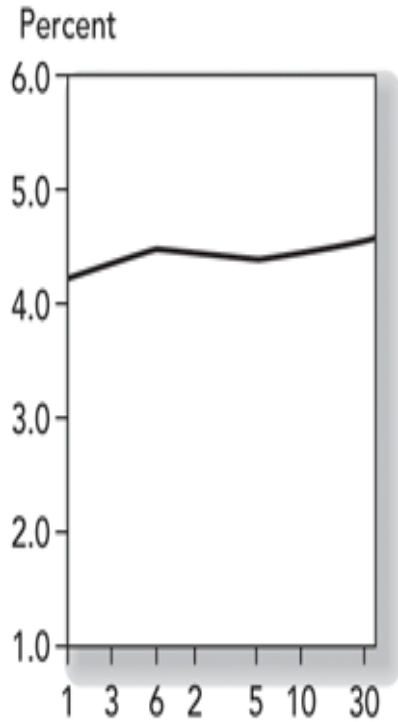
# Overview of Term Structure

- Information on expected future short term rates can be implied from the yield curve
- The yield curve is a graph that displays the relationship between yield and maturity



# Treasury Yield Curves

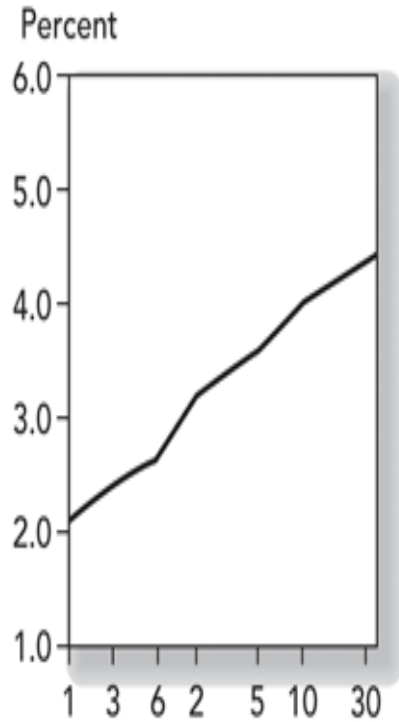
Treasury Yield Curve  
Yields as of 4:30 P.M. Eastern time



Months Year Maturities

A. (January 2006)  
Flat Yield Curve

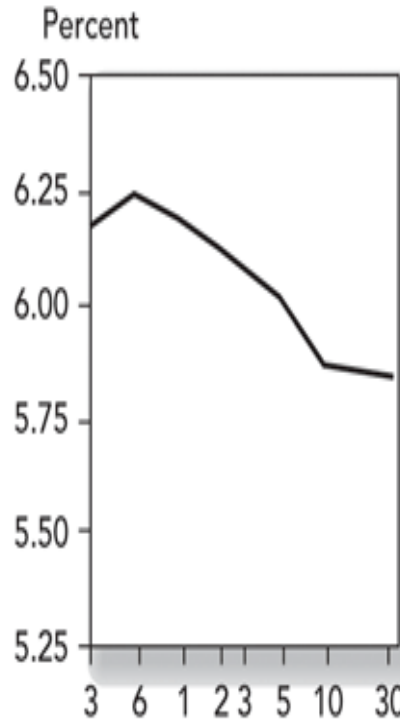
Treasury Yield Curve  
Yields as of 4:30 P.M. Eastern time



Months Year Maturities

B. (January 2005)  
Rising Yield Curve

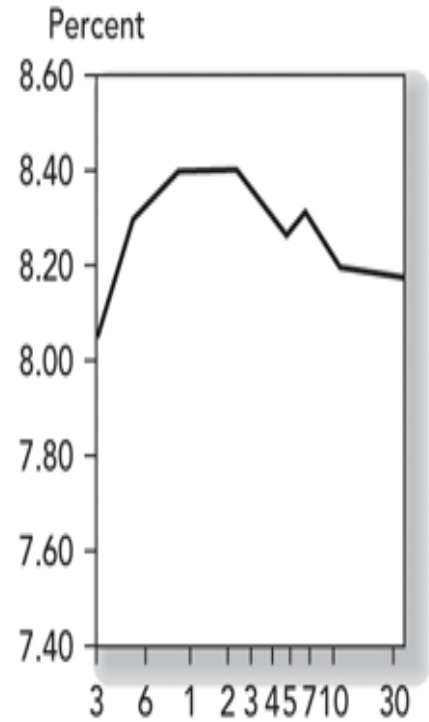
Treasury Yield Curve  
Yields as of 4:30 P.M. Eastern time



Months Year Maturities

C. (September 11, 2000)  
Inverted Yield Curve

Treasury Yield Curve  
Yields as of 4:30 P.M. Eastern time



Months Year Maturities

D. (October 4, 1989)  
Hump-Shaped Yield Curve

# Expectations Hypothesis

- n-year yield is the average of the expected one year rates over the next n years

$$y_t(n) = \frac{1}{n} \{ y_t(1) + E y_{t+1}(1) \dots + E y_{t+n-1}(1) \}$$

- In practice, long-term yields are usually higher than the average expected short rate, due to a term premium

# Term premia

- Liquidity premium hypothesis
  - Compensation for price risk
- Market segmentation or preferred habitat hypothesis

# Treasury Auction Format

## Single price Sealed Bid Auction

- Common format.

**Bid are ranked:** most attractive (lowest yield) to least.

- Accepted until quantity bid = quantity offered.

**Stop-out** is the highest accepted bid (lowest yield).

**SINGLE PRICE** Allocation: All bidders receive the same yield.

Rationale: encourages aggressive bidding because winners will not necessarily pay the price they bid. Rather, it assures awarded bids.

- If bid rate below winner, then get a more favorable rate than you bid.
- If bid rate above winner, then you will not get filled.

# Auction Stop Out Rate

Bidder ID	AUCTION SIZE	Bid Rate	STOP OUT RATE
	1000		3.14%
	Orders Submitted		Orders Cumulative
B	10	2.00%	10
O	100	2.90%	110
C	20	2.95%	130
D	40	2.95%	170
E	60	3.00%	230
A	60	3.02%	290
G	10	3.05%	300
H	120	3.05%	420
I	100	3.10%	520
J	100	3.10%	620
L	100	3.11%	720
N	200	3.12%	920
F	100	3.14%	1020
K	200	3.15%	1220
M	100	3.20%	1320

**COUPON** = stop-out rate rounded down to the nearest eighth.

Set to make auction price close to face value.

$$\text{Bidders' share at stop-out rate} = \frac{(\text{Auction Q} - \text{Cumulative Q up till Stop-Rate})}{\text{Total Q at Stop-Out Rate}}$$

# AUCTION CYCLE

## Auction Schedule

- Gives auction date, settlement & original-issue maturity months in advance.

## Auction Announcement: details upcoming auction

- Released 1-2 weeks prior to auction
- Reveals issue **size**

“**When-Issued**” trading: begins once announcement is made.

- WI trades are **forward contracts**
  - *Forward contract: Agree on price today to buy/sell at some future date*
  - *WI trading occurs in other markets too, e.g. IPOs, corporate bonds).*
- Settlement is **auction date + 3**

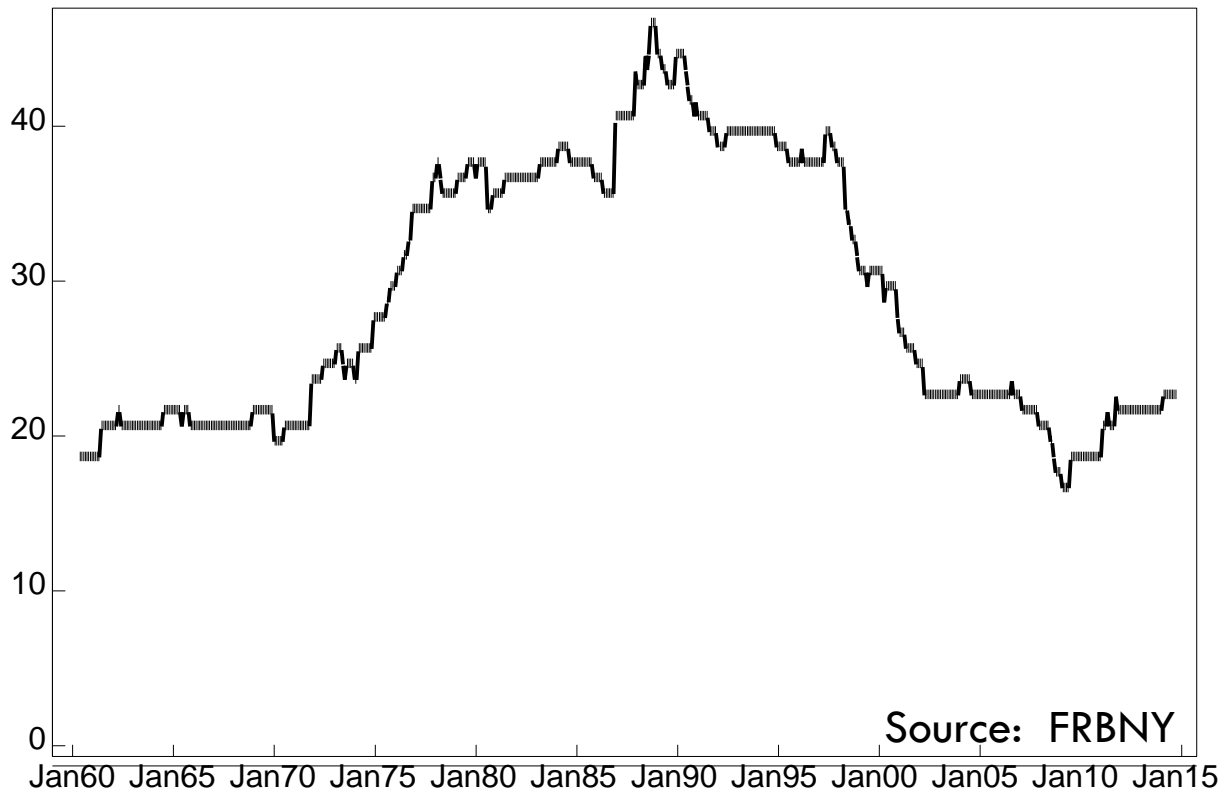
## Auction Date

- Bidders submit **Quantity x Yield** to Fed (conducts auctions for Treasury: 277 in 2017)
  - May enter multiple bids for own account and/or customers.
  - Most bids given just before auction closing time.
- Within 2 minutes of auction closing time, **results are released.**

# Primary Dealers

## Subset of securities dealers

- Required to participate in auctions of Treasury debt.
  - Bid for own account.
  - Periodically reviewed on performance.
- Trade directly with the Fed



# Salomon Scandal

- Potential strategy is to buy in the when issued market and then again at the auction
- Shorts in WI market have to obtain the security and can only buy it from you
- Illegal short squeeze strategy
- Treasury rule is that no participant can bid more than 35% including when issued holdings
- Salomon violated this three times in 1990-1991 by bidding too much, submitting bids on behalf of customers that were really for them, or getting accomplices to bid and sell immediately to Salomon
- After 3 instances, SEC noticed and Salomon nearly went bankrupt



# 10 year yields around auction

Day	Yield relative to day 0
-4	-2.76
-3	-2.25
-2	-0.41
-1	-0.78
+1	-0.56
+2	-1.23
+3	-1.87
+4	-2.01

Source: Lou, Yan and Zhang (2013)

- **Implication: Short in when issued market; buy on auction day**

# STRIPS

- **Separate Trading of Registered Interest and Principal of Securities**
- Created by dealer selling each component of Treasury security as a separate security
- All notes and bonds eligible
- A 10 year Treasury note becomes 21 securities
- Can be reconstituted
- Coupon STRIPS are fungible, meaning that STRIPS from different securities with the same date are assigned the same CUSIP number
- Principal STRIPS are not
- Principal and Coupon STRIP prices can differ even for the same maturity date

# Treasury floating rate notes

- New innovation
- Two year maturity
- Pay a coupon quarterly
- Coupon is 13 week T Bill rate + spread
- Spread is determined at auction

# Listing of Corporate Bonds

ISSUER NAME	SYMBOL	COUPON	MATURITY	RATING		HIGH	LOW	LAST	CHANGE	YIELD %
				MOODY'S/S&P/	FITCH					
Gatx	GMT.IK	8.875%	Jun 2009	Baa1/BBB/BBB-		107.545	107.538	107.545	-0.100	5.433
Marshall & Isley	MI.YL	3.800%	Feb 2008	Aa3/A+/A+		98.514	98.470	98.514	0.064	5.263
Capital One	COF.HK	7.686%	Aug 2036	Baa2/BBB-/BBB-		113.895	113.390	113.733	0.257	6.621
Entergy Gulf States	ETR.KC	6.180%	Mar 2035	Baa3/BBB+/BBB		99.950	94.616	99.469	0.219	6.220
AOL Time Warner	AOL.HG	6.875%	May 2012	Baa2/BBB+/BBB		107.205	105.402	106.565	0.720	5.427
Household Intl	HI.HJG	8.875%	Feb 2008	Aa3/AA-/AA-		100.504	100.504	100.504	-0.109	5.348
SBC Comm	SBC.IF	5.875%	Feb 2012	A2/A/A		102.116	102.001	102.001	-0.156	5.415
American General Finance	AIG.GOU	5.750%	Sep 2016	A1/A+/A+		101.229	101.135	101.135	-0.530	5.595

# Ratings

- Ratings are a way of mitigating information problems
- Ratings applied to debt securities
- Started with John Moody in 1909
- Originally based on an investor pays model
- Now switched to an issuer pays model

# Default Risk and Ratings

- Rating companies
  - Moody's Investor Service
  - Standard & Poor's
  - Fitch
- Rating Categories
  - Investment grade
    - BBB or higher for S&P
    - BAA or higher for Moody's and Fitch
  - Speculative grade/Junk Bonds

# Factors Used to assess financial stability

- Coverage ratios
- Leverage ratios

$$\frac{\text{Debt}}{\text{Equity}} \quad \text{or} \quad \frac{\text{Assets}}{\text{Equity}} = \frac{\text{Debt} + \text{Equity}}{\text{Equity}}$$

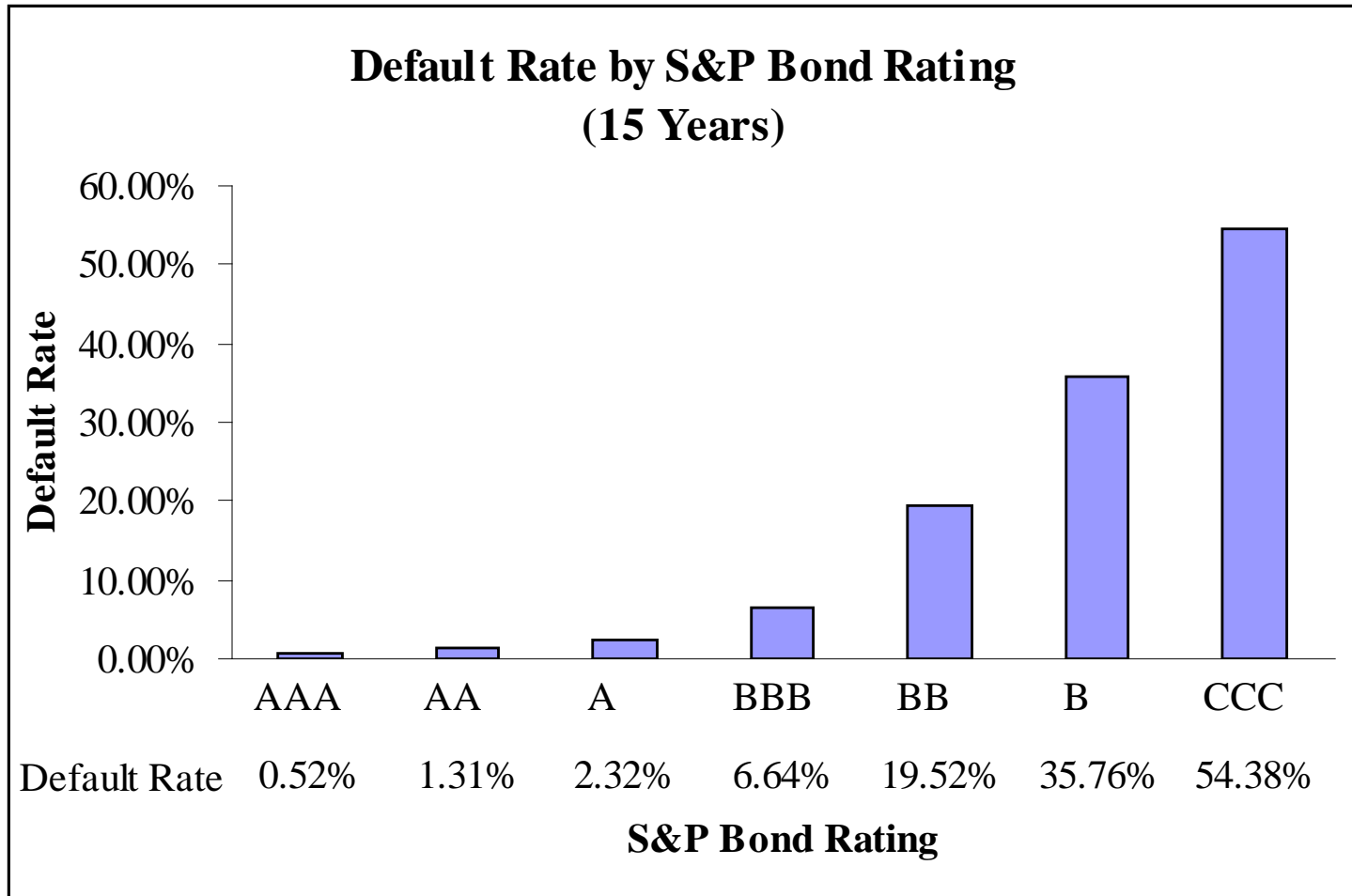
- Liquidity ratios
- Profitability ratios
- Cash flow to debt

# Financial Ratios by S&P Ratings Class

	3-year (2002 to 2004) medians						
	AAA	AA	A	BBB	BB	B	CCC
EBIT interest coverage multiple	23.8	19.5	8.0	4.7	2.5	1.2	0.4
EBITDA interest coverage multiple	25.5	24.6	10.2	6.5	3.5	1.9	0.9
Funds from operations/total debt (%)	203.3	79.9	48.0	35.9	22.4	11.5	5.0
Free operating cash flow/total debt (%)	127.6	44.5	25.0	17.3	8.3	2.8	(2.1)
Total debt/EBITDA multiple	0.4	0.9	1.6	2.2	3.5	5.3	7.9
Return on capital (%)	27.6	27.0	17.5	13.4	11.3	8.7	3.2
Total debt/total debt + equity (%)	12.4	28.3	37.5	42.5	53.7	75.9	113.5



# Default Rates

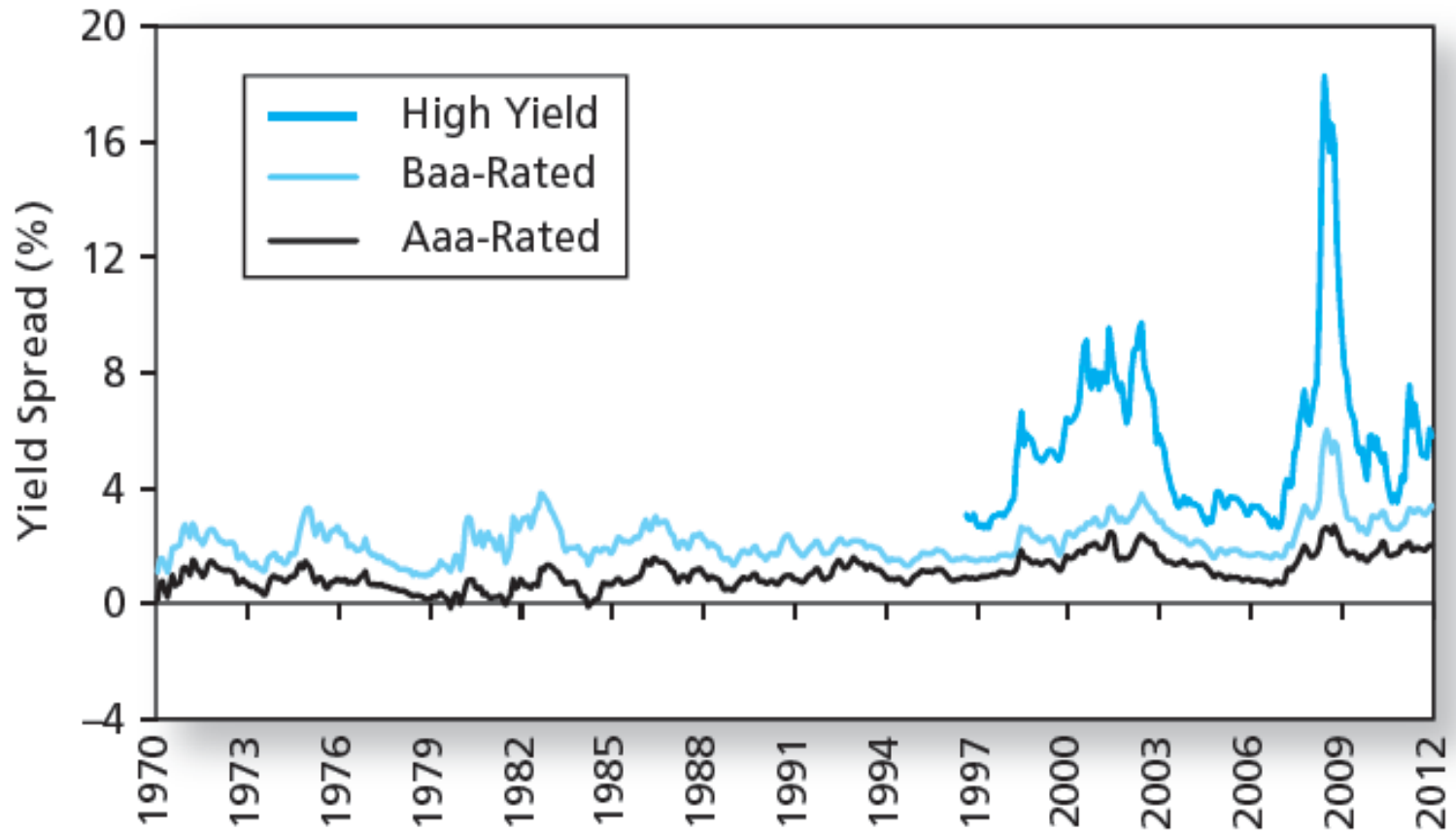


Source: "The Credit-Raters: How They Work and How They Might Work Better",  
Business Week (8 April 2002), p. 40

# Tension between corporate bond and shareholders

- Shareholders want more leverage; corporate bondholders want less
- Modigliani-Miller theorem says that bondholders will require so much extra return that higher cost of financing wipes out gains to leverage
  - Neglects many practical features like taxes
- Restrictions to make corporate bond more attractive
  - Sinking fund receiving profits
  - Convertibility
  - Collateral
  - Non-callable
- Smaller corporations issue *private placements* that are exempt from the SEC registration process but sold only to a small number of rich investors

# Yield Spreads between long-term corporates and Treasuries



# Provisions of corporate bonds

- Most corporate bonds are callable
- Bonds often have provision to prevent refunding in the first 5-10 years
  - Refunding means paying off with proceeds received from cheaper source
- Bonds may be convertible
- Occasionally, bonds may be puttable at set dates

# Government Sponsored Enterprises Debt

- Major issuers
  - Federal Home Loan Bank
  - Federal National Mortgage Association
  - Government National Mortgage Association
  - Federal Home Loan Mortgage Corporation

# Municipal Bonds

- Issued by state and local governments
- Types
  - General obligation bonds
  - Revenue bonds
- Maturities – range up to 30 years
- Tax considerations

# Municipal Bonds: Risks

- Credit risk
- Tax risk
- Financing mechanisms may be overturned by courts
  - Washington Public Power Supply System

# Other Municipal Products

- Tax exempt commercial paper
- (More common) Variable rate demand obligations (VRDO)
- Floating rate and inverse floating rate securities



# Credit risk in state and local debt

- States cannot declare bankruptcy
- States do have *sovereign immunity* (11<sup>th</sup> amendment)
- They can default and renegotiate with creditors
  - Most recently, Arkansas 1933
  - Maryland and 7 other states in the 1840s
- Puerto Rico couldn't declare bankruptcy until Congress passed an act giving them a form of bankruptcy
- Local governments can declare bankruptcy, but do so infrequently
  - Detroit is a recent large example

# Auction Rate Securities

- Related to adjustable rate preferred stock
- In between bond and money market
- Used since 1980s for municipalities (and others) to borrow long term at short rates
- Every 7-35 days securities existing and new investors bid on the interest rate
- Securities are given to those bidding the lowest rate (Dutch auction)
- If there aren't enough bidders, rate sets to a maximum rate and existing holders are locked in
- Happened in 2008
- Market is effectively dead

# International fixed income markets

- Developed countries have similar bond markets
  - Some (e.g. France, Germany) pay coupons annually
- Corporations sometimes issue bonds in foreign currencies
  - A Eurobond is denominated in a currency other than that of the issuer
  - Often useful to match revenue streams
- Until recently, emerging market governments could only borrow for short terms and in foreign currency
- Emerging markets are now issuing long-term debt even in their own currencies

# Sovereign bond defaults

- No mechanism for international bankruptcy
- Collective Action Clauses---supermajority agree to a restructuring
- Collective Action Clauses depend on the jurisdiction under which bond is issued
- All Eurozone bonds issued after 2013 have CACs
- Argentina restructured debt in 2001 but the debt was written under US law, which let hedge funds buy up the debt cheap and use legal expertise to extract payment
- Debt prices of less creditworthy countries can depend on jurisdiction under which bonds are issued

# Mortgages

- US has a higher home ownership rate than most countries
- Reasons include:
  - Tax deductibility of mortgage interest
  - Fairly easy availability of mortgages
- Mortgages are loans secured by real estate
- Enormous market

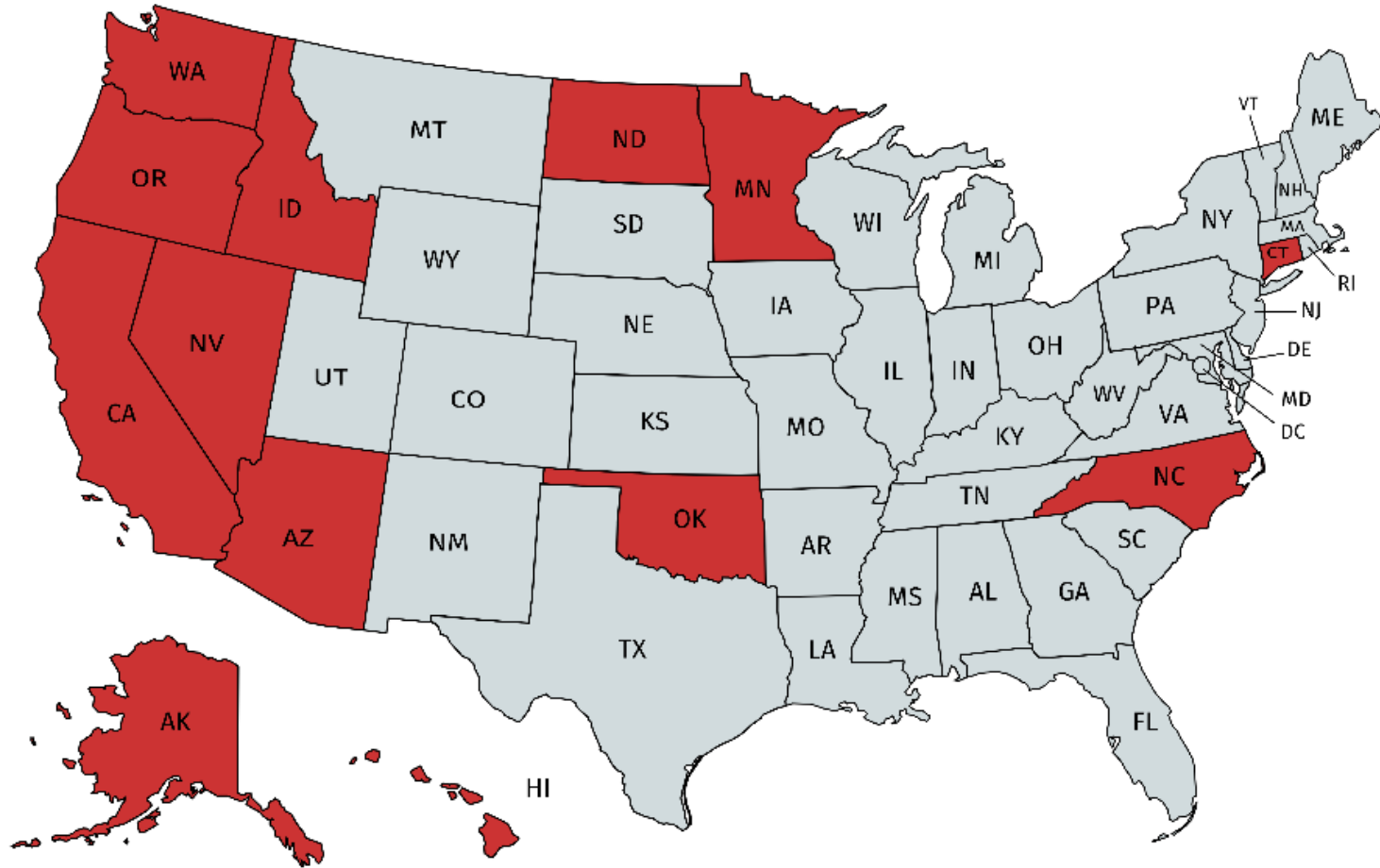
# Mortgages pre Great Depression

- Balloon mortgages with short terms and large downpayments (c. 50%)
- Massive defaults in the Great Depression
- Fannie Mae was created to buy mortgages from banks
- Long term mortgages were developed

# Mortgage choices

- Maturity (typically 30 years)
- FRM or ARM. Hybrid is a compromise.
- Conforming or nonconforming
- Points

# Nonrecourse mortgage states





# Standard features of mortgages

- Monthly payments
- Full amortization
- Escrow Account
- Prepayment option

# Securitization

- Traditional structure was mortgages were originated by banks and held on their balance sheet
- Very risky for a bank because of maturity mismatch (demise of thrifts)
- Led to switch from “originate to hold” model to “originate to distribute”
- Mortgages are bundled into MBS or pass-throughs.
- Investors are often pension funds that want longer maturity securities

# Changes in Housing Finance

## Old Way

- Local thrift institution made mortgage loans to homeowners
- Thrift's major asset: a portfolio of long-term mortgage loans
- Thrift's main liability: deposits
- “Originate to hold”

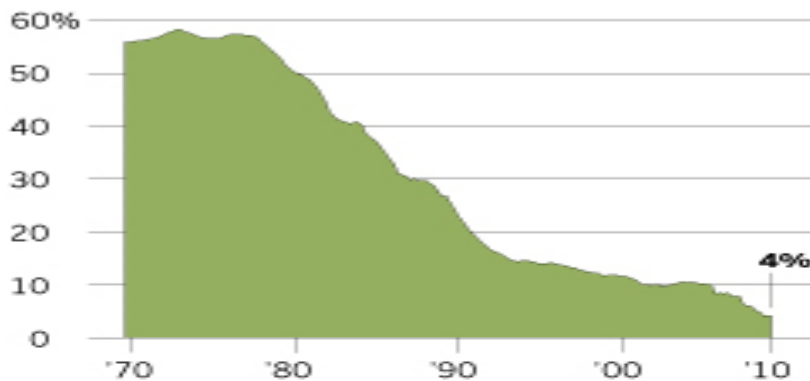
## New Way

- Securitization: Fannie Mae and Freddie Mac bought mortgage loans and bundled them into large pools
- Mortgage-backed securities are tradable claims against the underlying mortgage pool
- “Originate to distribute”

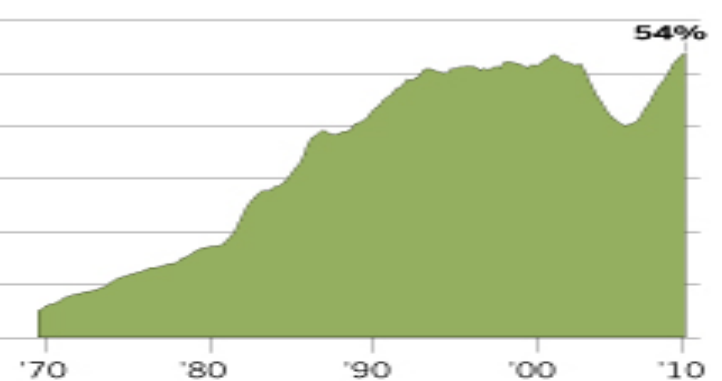
# Sources of mortgage finance

IN PERCENT, BY SOURCE

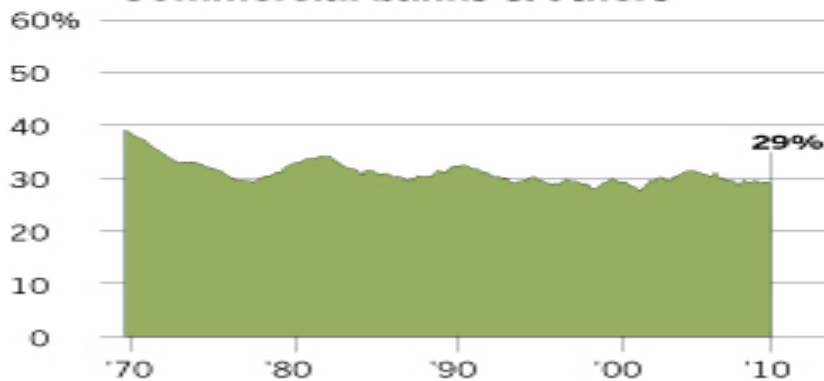
**Savings & loans**



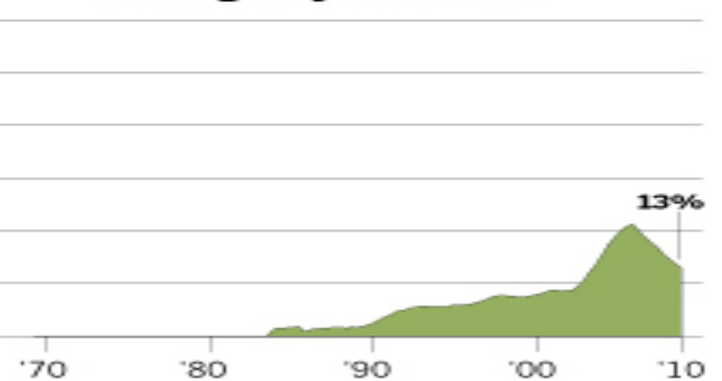
**Government-sponsored enterprises**



**Commercial banks & others**



**Non-agency securities**



SOURCE: Federal Reserve Flow of Funds Report

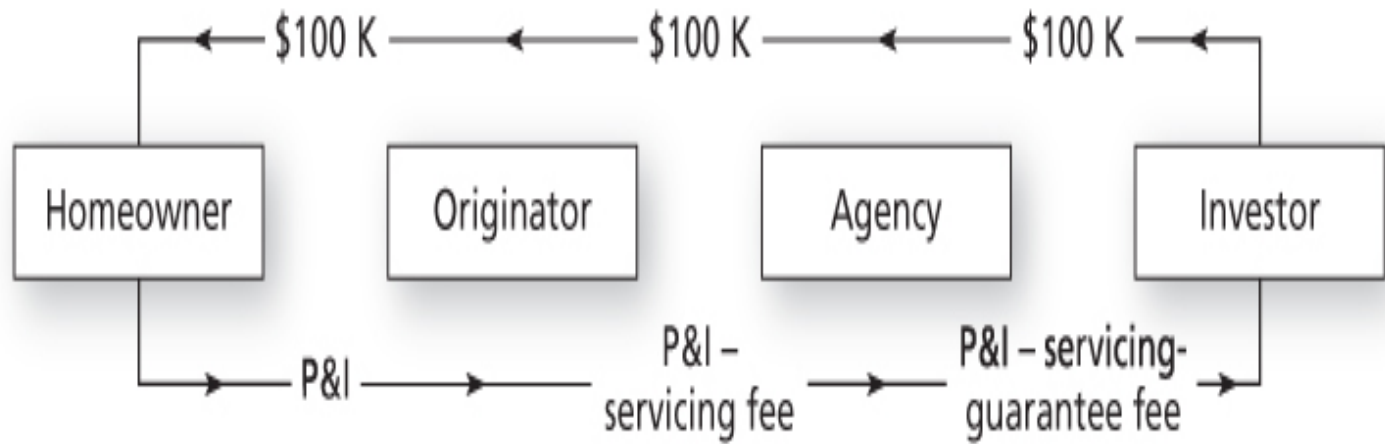
# Securitization

- Ginnie Mae issued first mortgage backed securities, insured by them against default
- Fannie Mae and Freddie Mac followed later
- Then private label mortgage backed securities
- Only conforming mortgages can be bought by Fannie/Freddie/Ginnie

# TBA Market

- TBA market is a forward market for agency MBS
- Agree to trade an MBS 1-33 months in the future with certain characteristics (agency, coupon, maturity)
- Seller gets to pick which specific pool to deliver
- Cheapest to deliver
- Enhances liquidity in MBS market because many MBS are fungible for the purpose of TBA

# Cash Flows in a Mortgage Pass-Through Security



# Adverse selection

- Adverse selection is a huge problem with securitization
- Originator picks the mortgages to include, but does not face the losses
- Post crisis reform requires originators to retain some skin in the game but only under limited circumstances

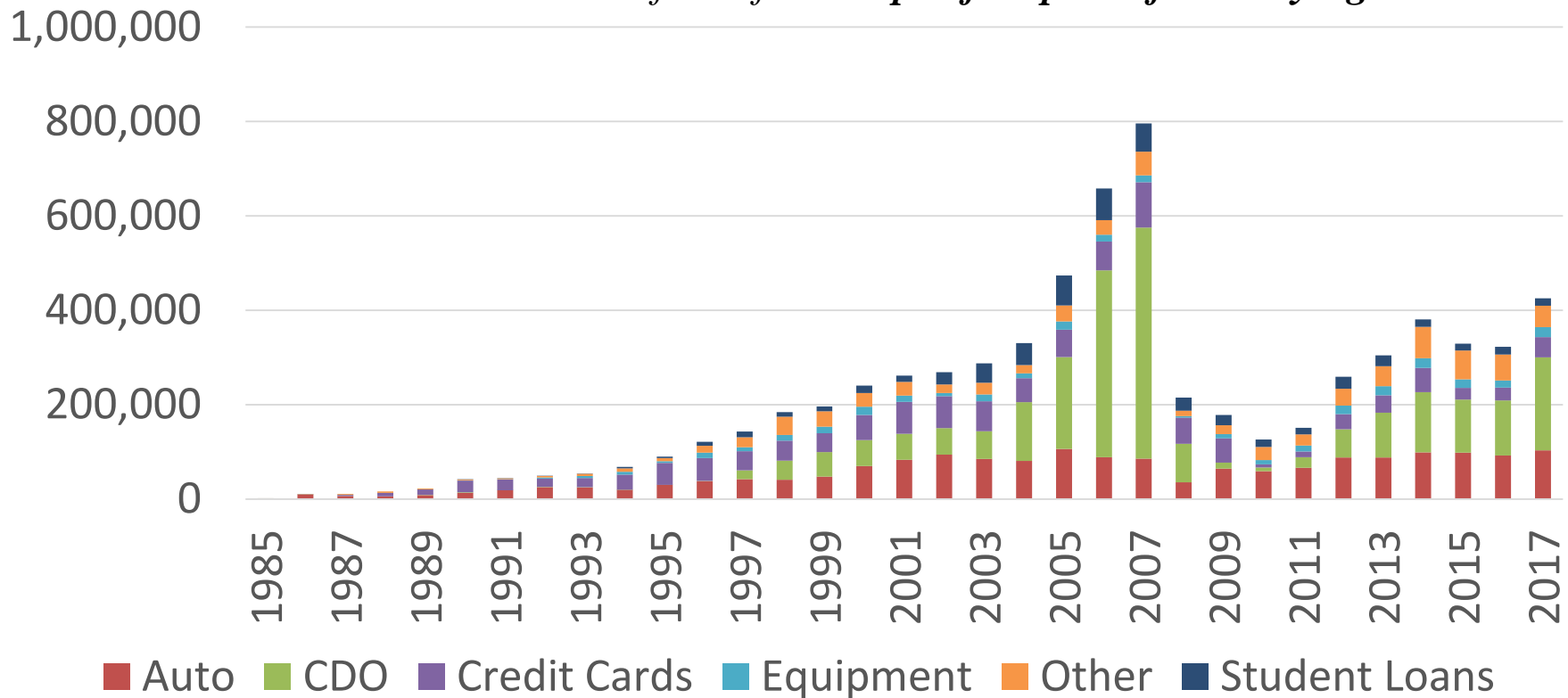


# Other securitizations

- Credit card receivables
- Auto loans
- Performing artists (David Bowie was the first in 1998)

# Asset-Backed Security (ABS) Issuance (non-mortgage)

**ABS:** *standardized security that is collateralized by the cash flows from a specified pool of underlying assets.*



# Risks to mortgage backed security

- Interest rate risk (present value goes down if rates rise)
- Default risk (negligible for agency MBS)
- Prepayment risk
  - Important and hard to model

# Structured securities

- Structured securities cater to different preferences of investors.
- Structured securities bundle loans or securities
- They are paid in a priority ordering
- If mortgages are put in a structured security, it is called a Collateralized Mortgage Obligation.
- Collateralized Debt Obligation is more general: not necessarily made up of mortgages

# Collateralized Debt Obligations

		Senior-Subordinated Tranche Structure	Typical Terms
		Senior tranche	70–90% of notional principal, coupon similar to Aa-Aaa rated bonds
		Mezzanine 1	5–15% of principal, investment-grade rating
Bank	Structured Investment Vehicle, SIV		
		Mezzanine 2	5–15% of principal, higher-quality junk rating
		Equity/first loss/residual tranche	<2%, unrated, coupon rate with 20% credit spread

# Example of CMO

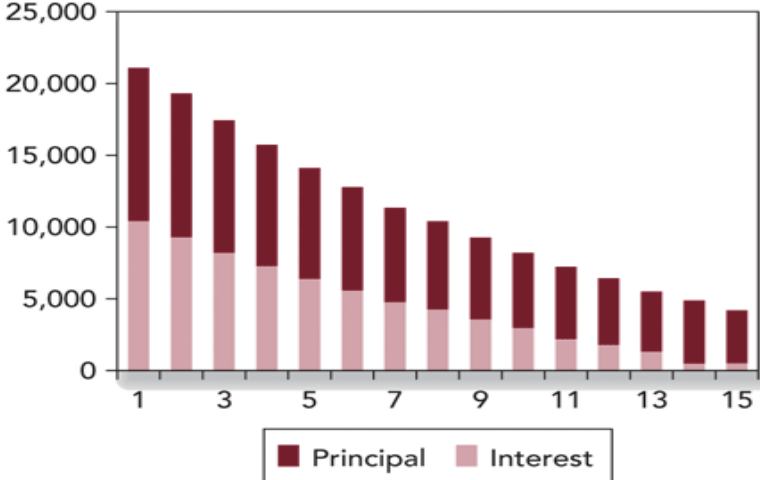
- \$500,000,000 in principal balances split into
  - A: \$300,000,000. Coupon 4%.
  - B: \$100,000,000. Coupon 4%.
  - C: \$100,000,000. Coupon 4%.

# What happens

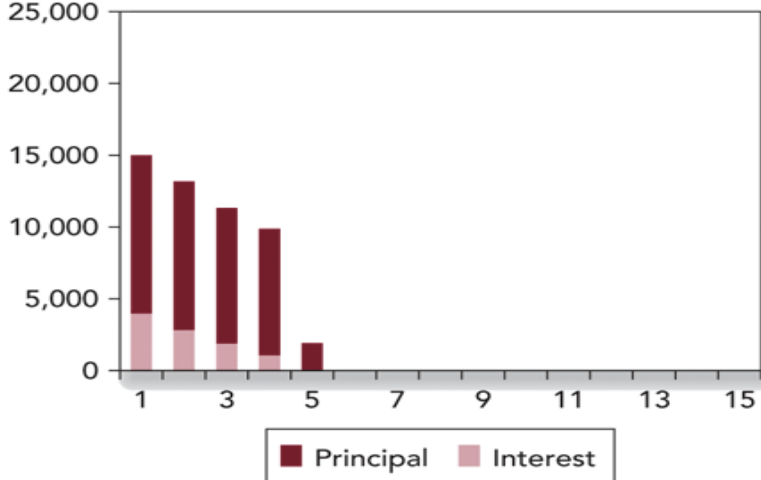
Month	A: Bal	A: Prin	A: Int	B: Bal	B: Prin	B: Int	C: Bal	C: Prin	C: Int
1	300M	1M	1.2M	100M	0	0.4M	100M	0	0.4M
2	299M	2M	1.196M	100M	0	0.4M	100M	0	0.4M
:									
70	500,000	500,000	2,000	100M	1M	0.4M	100M	0	0.4M
71	0	0	0	99M	1M	0.396M	100M	0	0.4M
:									
180	0	0	0	400,000	400,000	1,600	100M	200,000	0.4M
:	0	0	0	0	0	0			
360	0	0	0	0	0	0	100,000	100,000	400

# Cash Flows to Whole Mortgage Pool and Three CMO Tranches

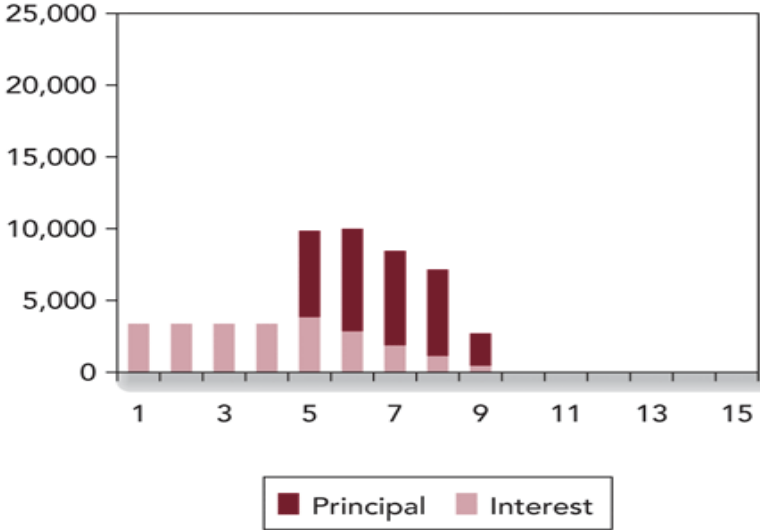
**A: Whole Mortgage**



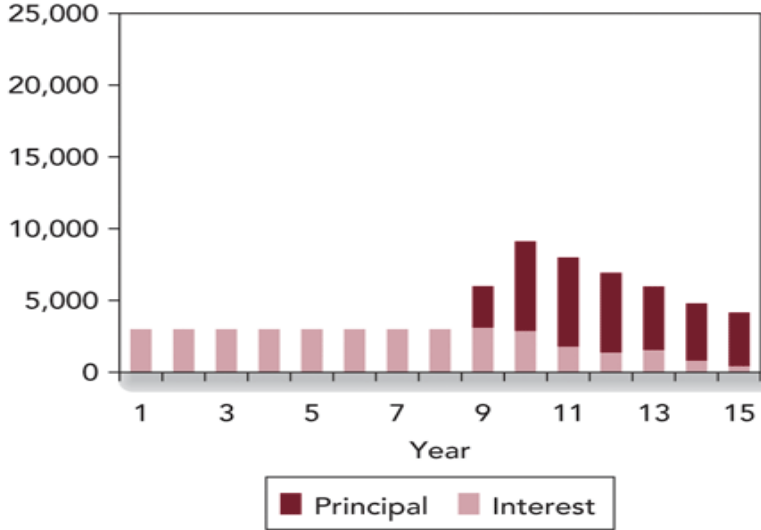
**B: Tranche A**



**C: Tranche B**



**D: Tranche C**



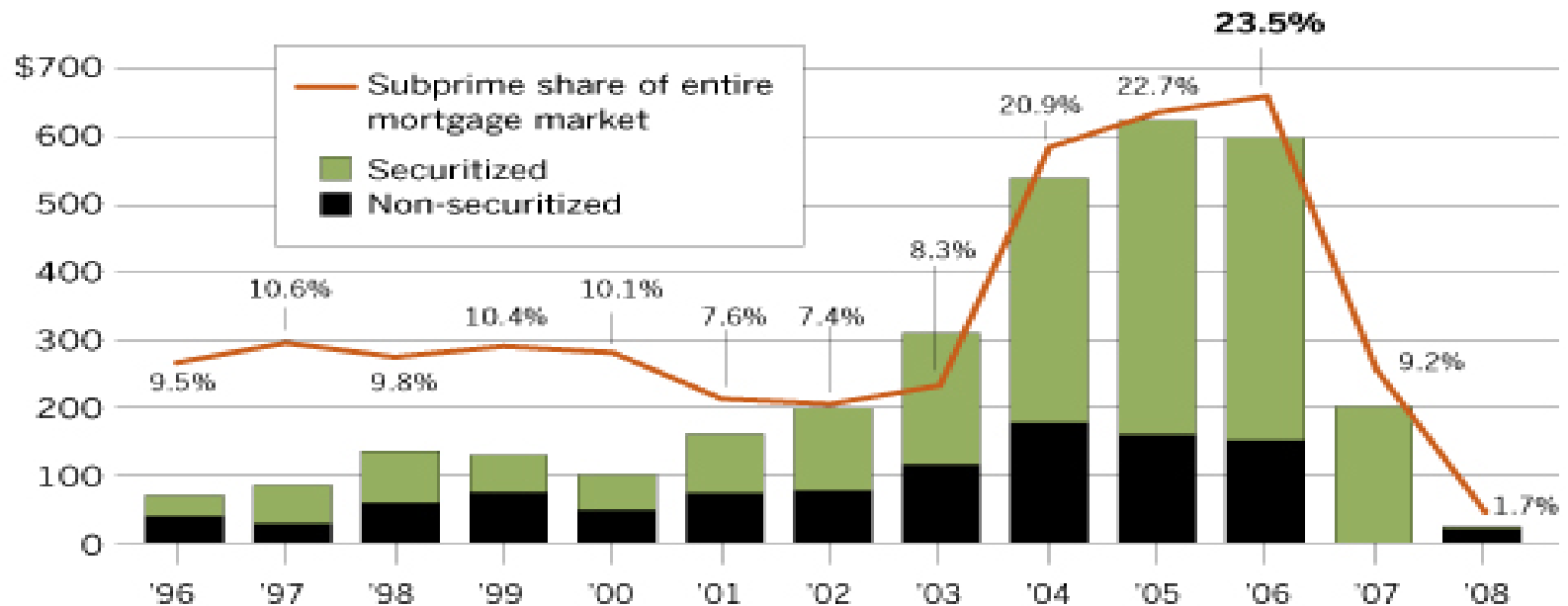


# CMO: Bottom line

- Junior tranches wait longer and get face more risk.
- Asymmetric information problems are reduced if the originator holds some of the equity/ $Z$ /junior tranche

# Subprime Mortgage Originations

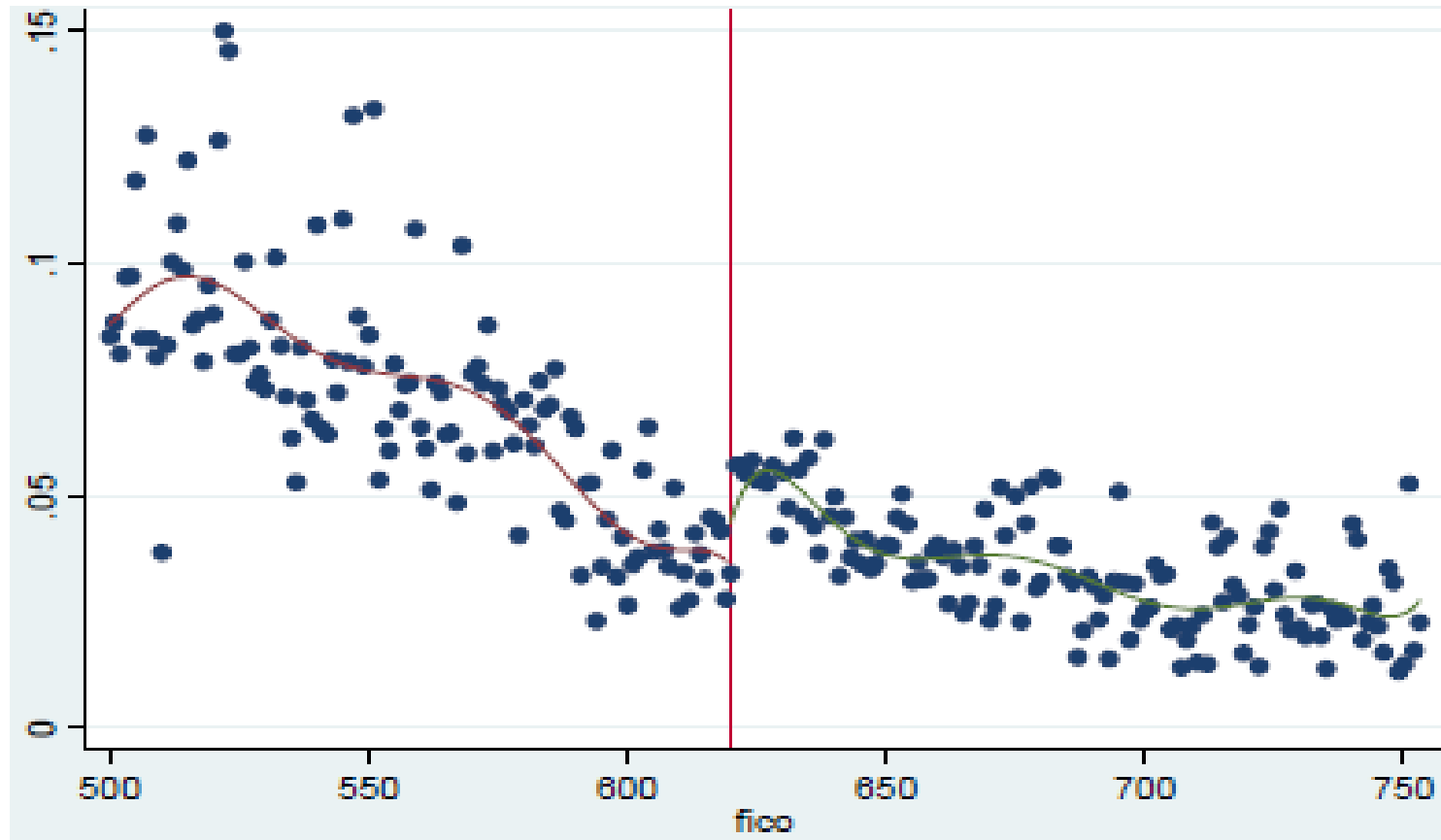
IN BILLIONS OF DOLLARS



NOTE: Percent securitized is defined as subprime securities issued divided by originations in a given year. In 2007, securities issued exceeded originations.

SOURCE: Inside Mortgage Finance

# Delinquency rates for loans made in 2002



Source: Keys et al. (2009)

# Example of a MBS (studied by FCIC)

**New Century Mortgage Corporation/Citigroup Global Market  
Whole Loan Trade**

**Trade Stips:**

- \$1.0 Billion pool (+5%/-10%)
- Price 102.55
- WAC 8.40% (1.5:1 buy-up/down) *8.61*
- WA margin 6.24 (0.5 buy-up down) *6.18*
- 3 month premium recapture
- 1 month EPD
- 60 Days Servicing Transfer
- Custodian is Deutsche Bank
- Max 25% credit/compliance due diligence
- Up to 100% appraisal due diligence
- No maximum diligence kicks
- Settlement on or about Aug 29, 2006

**Pool Parameters:**

- Max 20% fixed rate (incl 2nds) *?*
- ✓ Min WA FICO: 622
- ✓ No FICO below 500
- Max WA LTV (defined as OLV 1sts and Comb LTV 2nds): 81%
- Max WA CLTV (includind sil 2nds): 87.2% *87.82*
- ✓ Max WA DTI 42%
- ✓ Max 39% 40/30 *—*
- Max 19% IO (min WA FICO on these loans of 650) *WA 638 + 2pc 1 32.19%*
- ✓ Min 71% SFD
- ✓ Min 90% owner occupied
- ✓ Max 7.0% investor properties
- Max 5.50% second liens *? 10.94%*
- ✓ Min 36% Purchase *was called 49%*
- ✓ Max 42% stated doc *under 34.14*
- ✓ Max 1.6% limited doc *only doc used 2.69%*
- No NINA loans *✓*
- ✓ Min 70% prepayment penalty coverage *69.12%*
- ✓ Min 63% of loans with prepay terms 24 months or longer *59.60%*
- ✓ Min 13.0% of loans with prepay terms 36 month or longer *16.89%*
- Max 35% CA *30.22*
- Max 4% MI+IA+OH with not more than 2.0% of any one of these 3 states
- Max CLTV 100%
- Max 13% FICO < 550 (WA Comb LTV of which not more than 75.5) *9.55% WA CLTV 77.68*
- Min 21% 2yr full doc *21.50*
- Min 21% 1 yr full doc *19.09*
- Initial Cap 2.0%

*72.47*  
*47.57%*  
*17.52%*

# Example of a MBS (studied by FCIC)

- A sample (25%) of mortgages were checked
- Several did not meet the stipulations—simply dropped
- Some that were checked and failed were waived in anyway

# Example of a MBS (studied by FCIC)



## Loan Stratification Report

Loan Number(s) Specific

Documentation	Loan Count	Balance	Avg. Balance	Pct	Age	WAC	WAM	WLTV	WCLTV	% PPP	% Purch	% C/O	% FULL	% STD	% NOO	WA FICO	LTV >80%	LTV >90%	% CA
Full / Alt	10	2,231,810	223,181	0.23	4	8.20	6.18	86.44	94.32	84.87	82.39	0.00	1,000.00	0.00	0.00	574	51.69	25.54	23.81
Full Doc - 12 M BK STMTS	260	70,064,527	269,479	7.35	2	8.11	6.09	76.59	91.13	79.72	48.99	37.94	1,000.00	0.00	4.50	633	27.99	9.71	55.17
Full Doc - 1yr W2	1,234	221,818,375	179,756	23.26	2	8.08	6.18	77.30	84.01	76.68	26.22	62.46	1,000.00	0.00	3.53	608	38.92	9.63	22.60
Full Doc - 24 M BK STMTS	31	7,810,085	251,938	0.82	2	7.77	6.06	77.26	88.63	89.77	29.38	57.43	1,000.00	0.00	11.78	612	35.17	5.38	45.45
Full Doc - 2yr W2/Tax Returns	1,227	216,718,540	176,625	22.73	2	8.28	6.15	77.16	86.14	74.73	36.10	52.44	1,000.00	0.00	3.46	603	36.86	7.62	21.25
Full Doc - BUSINESS BANK	70	22,716,047	324,515	2.38	2	8.21	6.05	77.34	88.84	91.63	38.00	52.50	1,000.00	0.00	3.45	620	36.10	19.43	38.35
Full Doc - BUSINESS BANK	20	8,614,211	430,711	0.90	2	7.75	6.05	81.21	88.75	80.93	32.58	63.94	1,000.00	0.00	5.35	630	37.77	15.88	61.09
Full Doc 12mo Bk Statements	3	1,452,804	484,268	0.15	4	7.58	6.13	78.02	91.27	100.00	68.82	0.00	1,000.00	0.00	0.00	611	0.00	0.00	65.87
Limited Doc - 6 M BK STMTS	70	17,539,145	250,559	1.84	2	8.20	6.05	76.14	94.09	77.47	74.18	20.10	0.00	1,000.00	4.98	633	22.73	8.82	49.35
NINA <i>How slow</i>	14	4,342,270	310,162	0.46	2	7.34	6.10	73.04	73.66	61.51	32.06	65.37	0.00	1,000.00	0.00	719	0.00	0.00	39.61
Stated Doc	1,575	378,586,940	240,373	39.70	1	8.83	6.25	77.20	89.35	66.00	54.86	39.49	0.00	1,000.00	10.59	647	34.10	6.69	34.66
Stated Income/Stated Assets	1	171,000	171,000	0.02	5	10.38	6.05	90.00	90.00	0.00	100.00	0.00	0.00	1,000.00	100.00	641	100.00	0.00	0.00
Stated Income/Verified Assets	6	1,441,068	240,178	0.15	4	8.60	6.19	79.49	92.09	100.00	92.71	0.00	0.00	1,000.00	3.87	585	29.71	0.00	88.84
<b>Documentation Totals</b>	<b>4,521</b>	<b>953,506,822</b>	<b>210,906</b>	<b>100.00</b>	<b>2</b>	<b>8.42</b>	<b>6.19</b>	<b>77.20</b>	<b>87.52</b>	<b>72.74</b>	<b>43.09</b>	<b>47.88</b>	<b>1,783.14</b>	<b>1,216.86</b>	<b>6.49</b>	<b>626</b>	<b>35.12</b>	<b>8.21</b>	<b>31.12</b>

Source: FCIC

# Example of a MBS (studied by FCIC)

-----Original message-----

From [REDACTED]

Sent: Tuesday, August 29, 2006 11:59 AM

To: [REDACTED]  
[REDACTED]  
[REDACTED]

Subject: FW: Stips & Price (NCC0002) Today's Settlement

there are some very serious discrepancies here. we did this trade entirely off a stip sheet 3 months ago and I can't find out on the day of settlement that 2yr penalties are 16 points below the stips. why isn't this detected earlier? settlement date should be just for last minute checks on differences that arose based on changes in the pool from diligence. checks for stip compliance off reference pools should be done immediately upon receipt of the pool. for example, the stip was No NINA. so when the pool came in with NINA loans they should have been kicked back. i don't know who's supposed to do this, if it's 406, that doesn't make sense to me. 406 isn't the one losing money on the transaction by taking loans that don't meet the credit stips which is the position we are in now.

[REDACTED] for now, kick the NINA loans i'll send you a price adjustment for not meeting the other stips in a few mins.

# Who bought this MBS?

## Selected Investors in CMLTI 2006-NC2

*A wide variety of investors throughout the world purchased the securities in this deal, including Fannie Mae, many international banks, SIVs and many CDOs.*

	Tranche	Original Balance (MILLIONS)	Original Rating <sup>1</sup>	Spread <sup>2</sup>	Selected Investors
SENIOR 78%	A1	\$154.6	AAA	0.14%	Fannie Mae
	A2-A	\$281.7	AAA	0.04%	Chase Security Lendings Asset Management; 1 investment fund in China; 6 investment funds
	A2-B	\$282.4	AAA	0.06%	Federal Home Loan Bank of Chicago; 3 banks in Germany, Italy and France; 11 investment funds; 3 retail investors
	A2-C	\$18.3	AAA	0.24%	2 banks in the U.S. and Germany
MEZZANINE 21%	M-1	\$39.3	AA+	0.29%	1 investment fund and 2 banks in Italy; Cheyne Finance Limited; 3 asset managers
	M-2	\$44.0	AA	0.31%	Parvest ABS Euribor; 4 asset managers; 1 bank in China; 1 CDO
	M-3	\$14.2	AA-	0.34%	2 CDOs; 1 asset manager
	M-4	\$16.1	A+	0.39%	1 CDO; 1 hedge fund
	M-5	\$16.6	A	0.40%	2 CDOs
	M-6	\$10.9	A-	0.46%	3 CDOs
	M-7	\$9.9	BBB+	0.70%	3 CDOs
	M-8	\$8.5	BBB	0.80%	2 CDOs; 1 bank
	M-9	\$11.8	BBB-	1.50%	5 CDOs; 2 asset managers
	M-10	\$13.7	BB+	2.50%	3 CDOs; 1 asset manager
	M-11	\$10.9	BB	2.50%	NA
EQUITY 1%	CE	\$13.3	NR		Citi and Capmark Fin Grp
	P, R, Rx: Additional tranches entitled to specific payments				

<sup>1</sup> Standard & Poor's.

<sup>2</sup> The yield is the rate on the one-month London Interbank Offered Rate (LIBOR), an interbank lending interest rate, plus the spread listed. For example, when the deal was issued, Fannie Mae would have received the LIBOR rate of 5.32% plus 0.14% to give a total yield of 5.46%.

SOURCES: Citigroup; Standard & Poor's; FCIC calculations



# Was it just information problems?

- There is reason to think that problems with MBS in the crisis were not just adverse selection
- Lehman, Bear Stearns failed *because* they held on to equity tranches
- They drank the cool-aid
- Cheng et al. (2014) find that securitization managers were as aggressive in buying houses (or more so) than control groups.

# Commercial mortgages

- Secured by apartment building, shopping centers, hotels etc.
- Nonrecourse loans
- Residential mortgages generally have no prepayment penalty
- Commercial mortgages have protection against prepayment
  - Lockout period
  - Prepayment penalties
- Can be formed into Commercial MBS (CMBS) usually issued by private entities

# Types of business

- Sole proprietorship. Just one person. Unlimited liability and taxed on individual return.
- Partnership.
  - General partners run it and have unlimited liability.
  - Limited partners are just investors and have limited liability.
  - Taxes on individual returns
- Corporation.
  - Mostly what we think of as business
  - Limited liability
  - Taxed as a corporation and then dividends taxed again

# Public and private ownership

- Public company means that the shares can be bought and sold by anyone
- Private equity is held by small number of firms/individuals and not traded
- Benefits of being public: more people can buy so may get a better price for shares
- Benefits of being private: easier to manage principal-agent problems less disclosure and less cumbersome regulation
- Over time, public companies are becoming fewer and bigger partly because of new rules on public companies

# Financial statements

- Public companies have to issue three kinds of statements
  - Income statement
    - How much company earned in profits
  - Balance sheet
    - Assets and liabilities
  - Cash flow statement
    - Cash in and out

# Sarbanes Oxley Act

- Act in 2002 following accounting scandals (Enron, WorldCom)
- Establishes provisions to improve reporting
  - Management is responsible for accuracy of financial statements
- Costly for small firms

# Rights issue

- Often existing holders have a right to buy new shares in a seasoned issue
- Gives rights to buy a share at a specified price
- Shareholder can
  - Exercise right
  - Sell right
  - Do nothing

# Rights issue

- Wyman enterprises has 1,000,000 shares worth \$20 each
- Wants to raise \$10,000,000
- Offers another 1,000,000 shares for \$10 in a 1-1 rights issue
- Value of company is \$30,000,000 and there are 2,000,000 shares
- Each new share is worth \$15.
- The right is worth \$5.



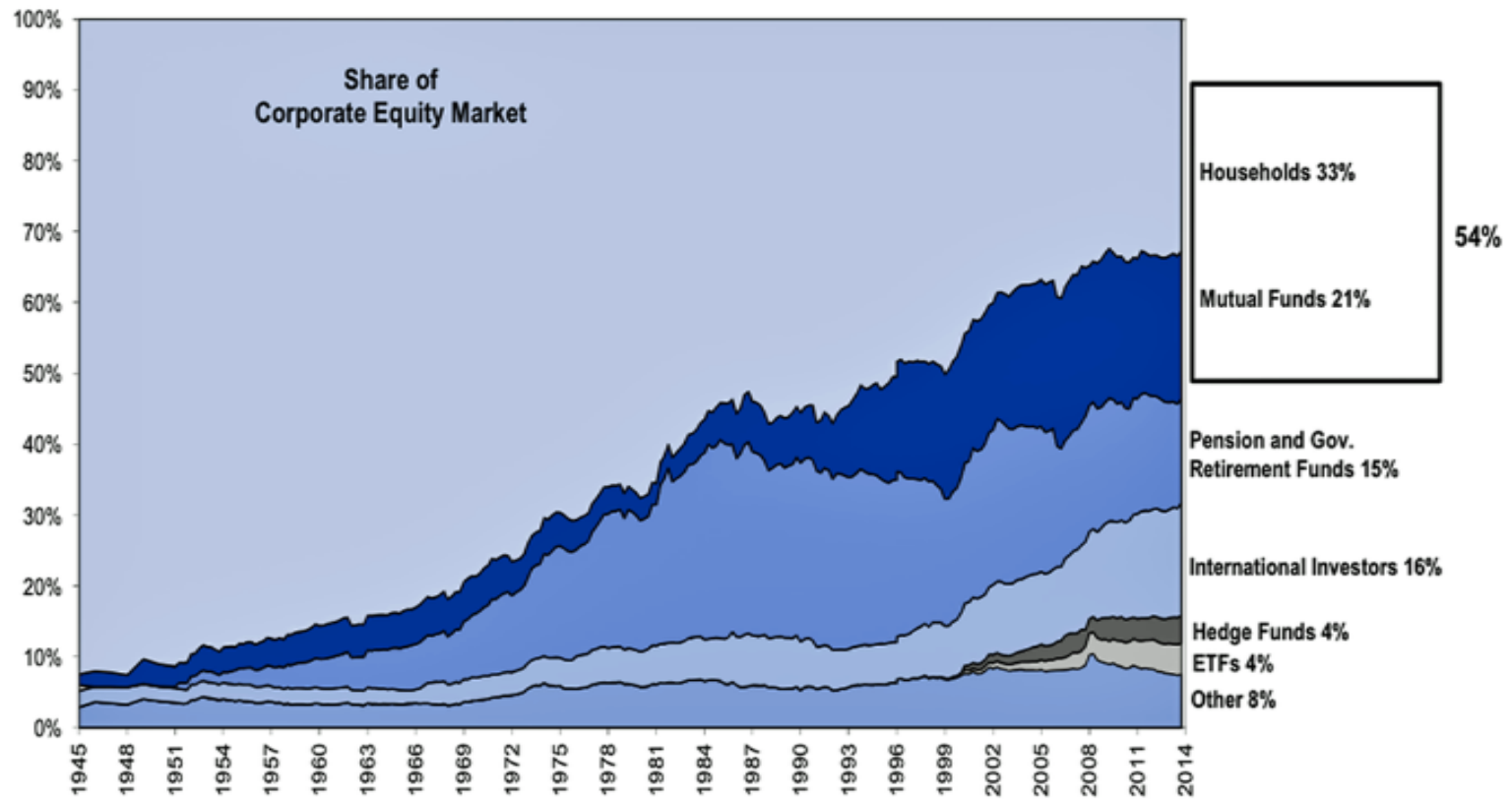
# Rights issue

- In a rights issue, you want to set the price low enough that most shareholders will exercise rights or sell them to somebody who will
- An underwriter can commit to taking up any unsubscribed portion.

# Other changes of ownership

- Mergers: Two firms become one
- Acquisition: One firm buys the other
- Hostile Takeover: Same as acquisition except the Board is against it
  
- All of these are facilitated by Investment Banks

# Who owns shares?



Source: Federal Reserve Board and Goldman Sachs Global Investment Research.

# Bankruptcy

- Two forms of bankruptcy:
  - Liquidation
  - Reorganization
- Bankruptcy can be:
  - Voluntary filed by the corporation
  - Involuntary filed by the creditors

# Bankruptcy

- In principle, an absolute priority of claims
  - Bankruptcy administration expenses
  - Wages and salaries
  - Taxes
  - Bondholders
  - Preferred stockholders
  - Common stockholders
- In practice, bankruptcy judges prefer agreed plans and so some compromises emerge that aren't exactly respecting priority.

# Prepackaged bankruptcy

- Bankruptcy can be slow and costly
- Firm and majority of its creditors can agree on a plan before filing for bankruptcy
- Then file formal bankruptcy
- Forces holdouts to accept the plan

# Stock index

- Stock index is a weighted average of individual prices of stocks in the index
- Have to choose what is in the index, and how to weight
  - Equal weighted or value weighted
- Dow Jones is equal weighted; S&P is value weighted
- Most indices do not include dividends; they are price indices
- Indices are usually denominated in local currency
- MSCI gives international stock indices in US Dollars

# Investing in an index

- Investor may buy stocks
- Or an index tracking mutual fund
- Or an Exchange-traded fund (ETF) designed to match the index
  - Spiders (S&P Depository Receipt) tracks S&P 500
  - Cube track Nasdaq 100
- ETFs consist of a share in a basket of securities corresponding to the relevant index
- There is a redemption procedure



# Conflict of interest

- Principal-agent problem between shareholders and managers
- Possible resolutions to underperforming managers
  - Incentive pay tied to share price
  - Shareholders can vote to replace the board and hire new managers
  - Acquisition by another firm
  - Acquisition can be financed by firm issuing more debt (leveraged buyout)
  - Some private equity firms specialize in buying out underperforming companies
- *Poison pill* is a common defense against takeovers

# Buying non-US equities

- Home bias is a general puzzle in equity markets
- Buying foreign stocks directly can be logistically difficult
- Mutual funds provide a solution
- International ETFs
- Tax costs to buying foreign equities

# American Depository Receipts

- ADRs are a well established way for US investors to invest in foreign stocks
- Institution in the US buys the foreign stock and then US investors can trade the claim to this stock
- Trades on US exchanges in US dollars
- Generally for the same price as the underlying share
- There are 3 levels of ADRs. The 3<sup>rd</sup> level requires full compliance with US SEC regulations.

# Real Estate Investment Trust (REIT)

- REIT is an equity investing in property
- Stringent conditions...pass through most income to investors
- Not subject to corporate tax
- Like a pass-through partnership, but available to all investors

# Real Estate Investment Trust (REIT)

- Equity REITS...invest directly in property (commercial, apartments etc.)
- Mortgage REIT invests in mortgages
- Hybrid REIT does both

# Buying on Margin

- Borrowing part of the total purchase price of a position using a loan from a broker
- Investor contributes the remaining portion
- Margin refers to the percentage or amount contributed by the investor
- You profit when the stock rises

# Buying on Margin

- Initial margin is set by the Federal Reserve
  - Currently 50%
  - Regulation T
- Maintenance margin
  - Margin call if value of securities falls too much
  - At least 25% by market convention

# Short Sales

- *Purpose*
  - To profit from a decline in the price of a stock or security
- *Mechanics*
  - Borrow stock through a dealer
  - Sell it and deposit proceeds and margin in an account
  - Regulation T applies
  - Closing out the position: Buy the stock and return to the party from which it was borrowed



## Example: Short Sale: Initial Conditions

Dot Bomb	1000 Shares
50%	Initial Margin
30%	Maintenance Margin
\$100	Initial Price

Sale Proceeds	\$100,000
Margin	\$50,000
Stock Owed	1000 shares

# Example

Short Sale: Dot Bomb falls to \$70 per share

## Assets

\$100,000 (sale proceeds)  
\$50,000 (initial margin)

## Liabilities

\$70,000 (buy shares)

## Equity

\$80,000

**Profit = Ending equity – Beginning equity**

= \$80,000 - \$50,000 = \$30,000

= Decline in share price x Number of shares sold short

## Example

### Short Sale: Margin Call

How much can the stock price rise before a margin call?

$$(\$150,000^* - 1000P)/(1000P) = 30\%$$

$$P = \$115.38$$

\* Initial margin plus sale proceeds

# Holding period return on a stock

- Return is capital gain plus dividend

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

- Or for longer horizons

$$R_{t,t+h} = \frac{P_{t+h} - P_t + D_{t+1} + D_{t+2} \dots + D_{t+h}}{P_t}$$

# Sharpe Ratio

- Let  $R_i$  be return on a stock (or asset)
- Sharpe ratio is

$$\frac{E(R_i) - R_f}{SD(R_i)}$$

- For a stock index, expected return is about 10% , risk-free rate about 3% and standard deviation about 16%.

$$SR = \frac{0.1 - 0.03}{0.16} = 0.44$$

# Stock Prices as a Random Walk

- Kendall (1953) found that log stock prices were approximately a random walk

$$p_t = p_{t-1} + \varepsilon_t$$

- Erratic market behavior, or
- A well functioning market (where prices reflect all available information) ?

# Efficient Market Hypothesis (EMH)

- EMH says stock prices already reflect all available information
- A forecast about favorable future performance leads to favorable current performance, as market participants rush to trade on new information.

# Versions of the EMH

- Weak (Past trading data)
- Semi-strong (All public info)
- Strong (All info)



# What firms do with earnings

1. Reinvest earnings
  2. Pay dividends
  3. Buy back shares
- Reinvesting earnings means lower dividends today but faster growth
  - Buying back shares also means lower dividends today but faster growth in dividends per share
  - Share buy backs are like dividends but firms prefer them because it is more flexible

# Market Types

- Quote driven
  - Prices quoted by dealers
- Order driven
  - Prices quoted by customers or dealers
- Brokered
  - Brokers arrange trades among clients

# Bid and Asked Prices

- Bid Price is price at which dealer will buy
- Ask Price is price at which dealer will sell
- $\text{Ask} > \text{Bid}$

# Microstructure background

- Market maker: posts bid and ask
- Market taker: accepts bid/ask
- Limit order book: set of unexecuted quotes
- Price-time priority
- Order flow: volume of market taker buys-sells

# Types of Orders

- **Market Order:**
  - Executed immediately
  - Trader receives current market price
- Price-Contingent or **Limit Order:**
  - Traders specify buying or selling price
- **Stop Order:**
  - If price falls to a certain level, sell for best possible price
- A large order may be filled at multiple prices

# Hypothetical example of an order book

Limit orders have been entered to buy/sell a security

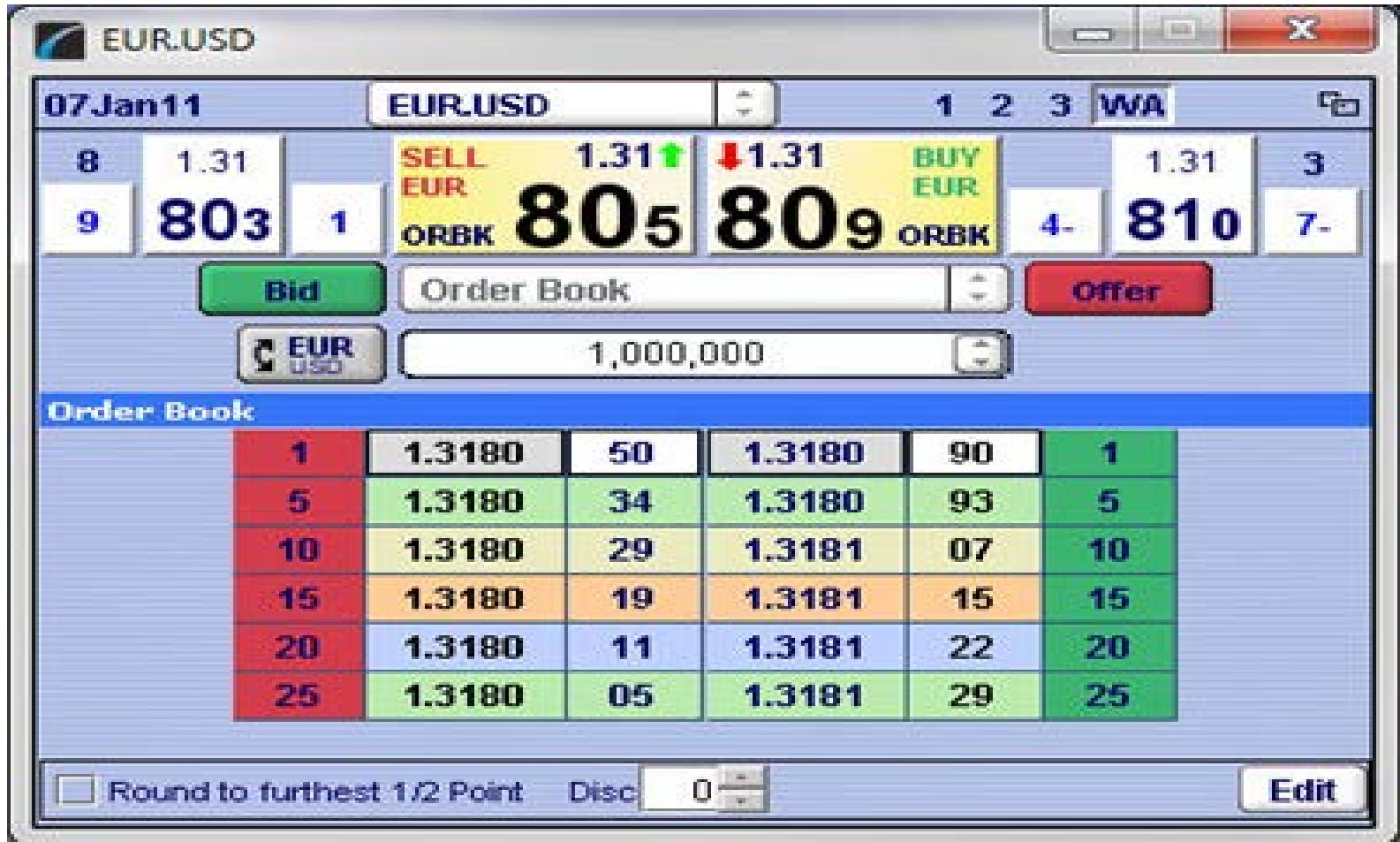
ORDERS TO BUY

ORDERS TO SELL

Price	Quantity	Price	Quantity
99.8	1,000	100.0	500
99.7	3,000	100.1	1,000
99.5	5,000	100.3	2,000
99.4	2,000	100.4	6,000
99.2	1,000	100.5	1,000

S

# Example of electronic limit order book (EBS)



# Measures of Liquidity

- Bid-ask spread
- Bid-ask spread for a fixed dollar amount
- Depth
- Trading volume
- Price impact of order flow



# Trading Mechanisms

- Broker/Dealer markets
- Specialists markets
  - Maintain a “fair and orderly market”
  - Have been largely replaced by ECNs
- Electronic communication networks (ECNs)
  - True trading systems that can automatically execute orders
- Dark pools
  - Ominous sounding name for private exchanges not available to the general public

# NYSE

- Opened in 1792
- Uses a system of specialists, now called designated market makers
- Now uses a hybrid of electronic and floor trading
- Was slow to adopt electronic trading, but merged with an ECN in 2006

# Typical bid-ask spreads

- Foreign exchange: 0.01 or 0.02 percent
- Treasuries:  $1/64$  –  $1/32$  %
- Large cap stocks: 0.1%
- Small cap stocks: 1 percent
- Corporate bonds: 0.5-2 percent

# High Frequency Trading

- Computer algorithms executing trades is a development over the past 20 years
- Started in equities, but also common in other asset classes (e.g. foreign exchange)
- Automated execution. Computers interact directly with electronic limit order books.
- Latency: Time it takes to execute a trade. In competitive market, low latency is key
  - Fiber optic cable between London and Frankfurt: 8.35 milliseconds roundtrip
  - Microwave network: 4.6 milliseconds

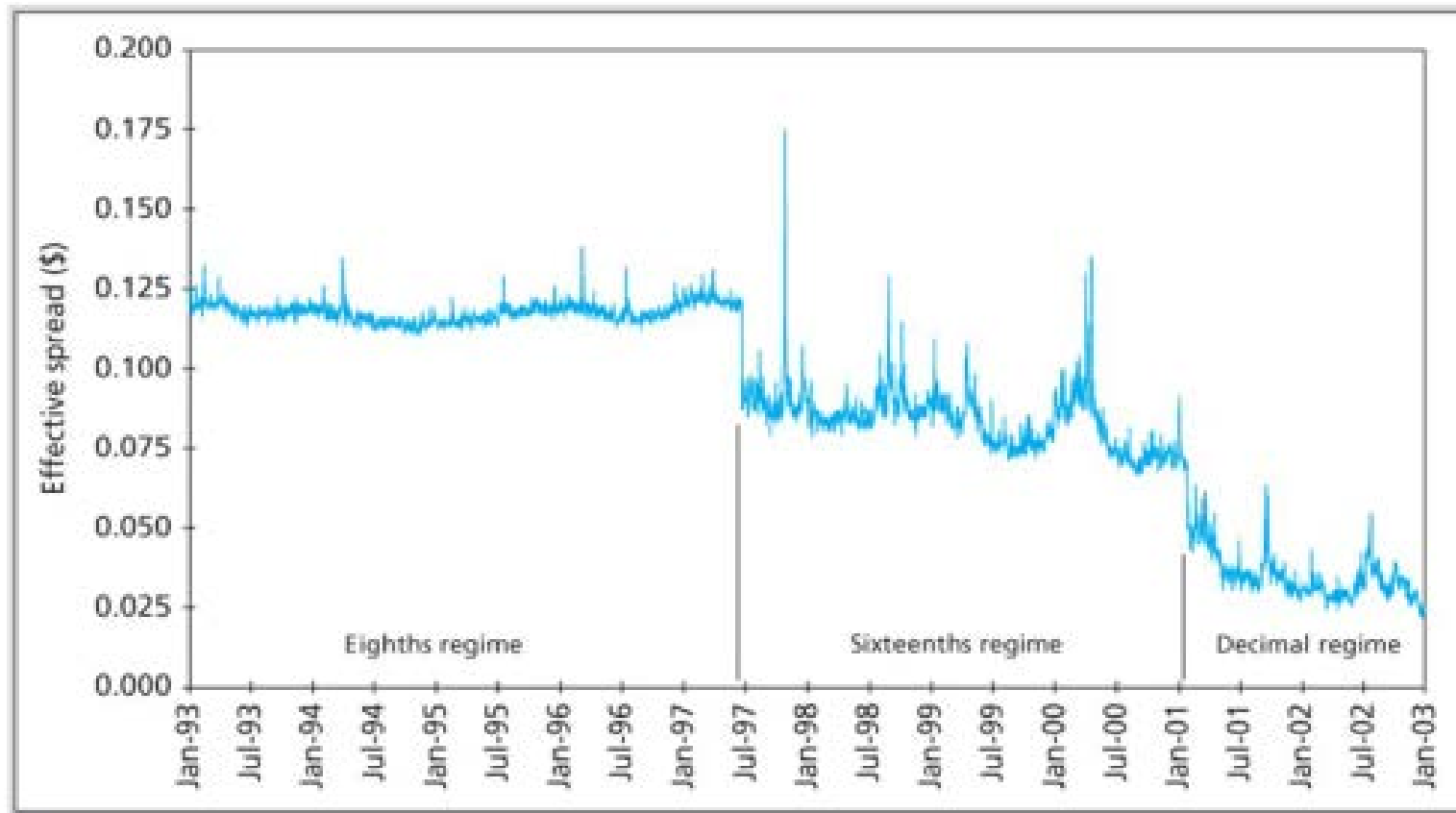
# High Frequency Trading

- Typically close positions at the end of each day
- Major hedge-funds use HFT
- Has become the main form of market making
- Led to lower bid-ask spreads

# Regulation NMS (National Market System)

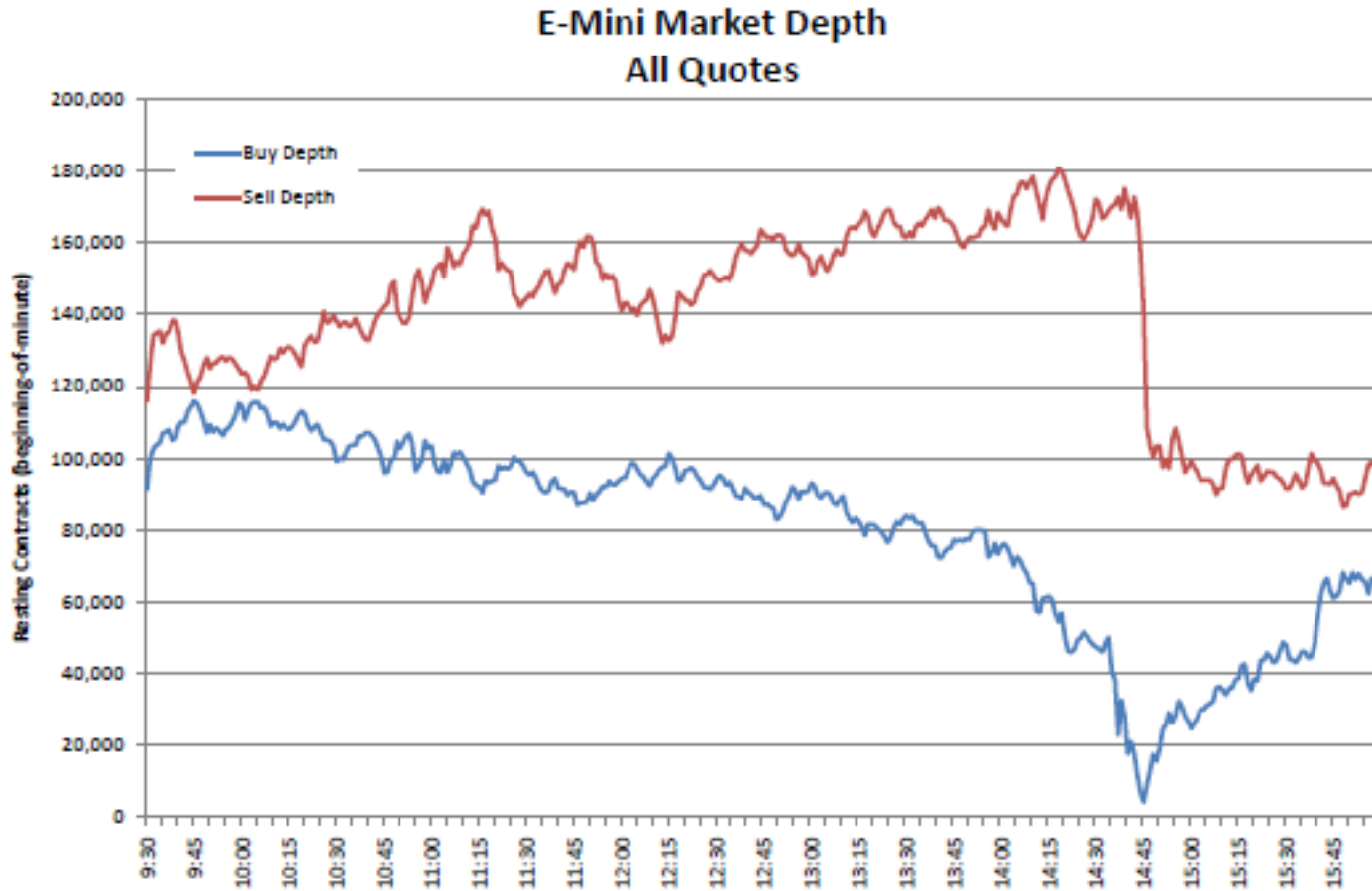
- SEC regulation implemented in 2007
- Trade-through rule: all participants have to respect the best bid or offer on any exchange (NBBO)
- Consequence was that NYSE floor trading could not compete...further impetus to electronic trading
- Market fragmentation may be an unintended consequence

# Effective Spread Fell Dramatically as the Minimum Tick Size Fell



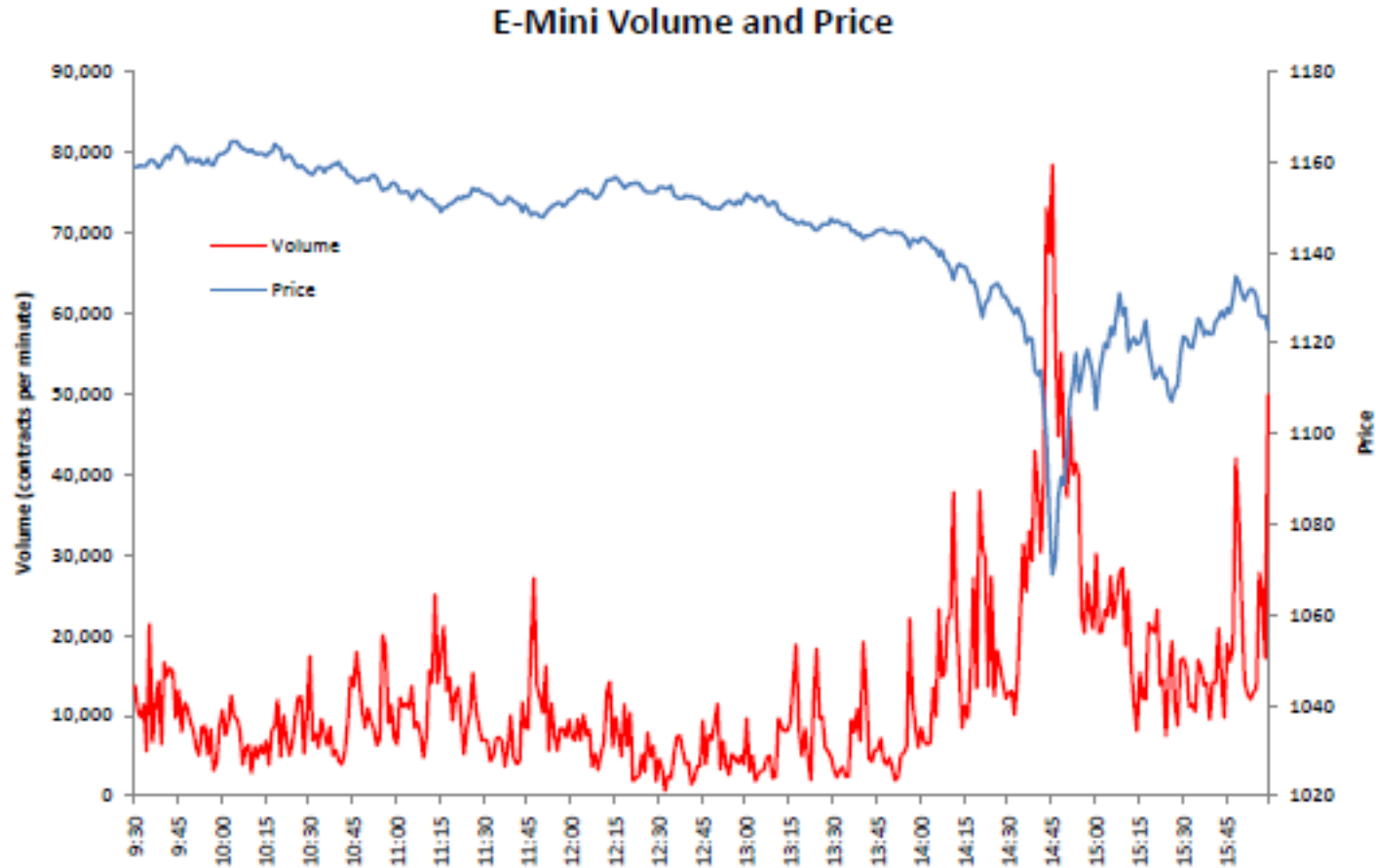
(Value-weighted average of NYSE-listed shares)

# Flash Crash (May 6, 2010)



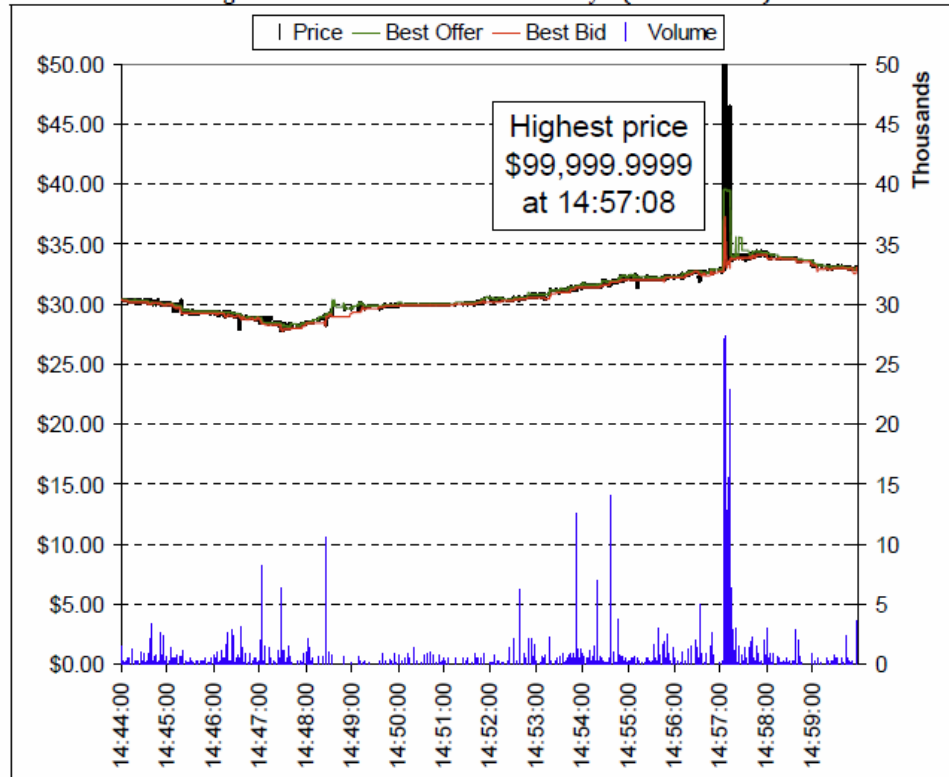


# Flash Crash (May 6, 2010)



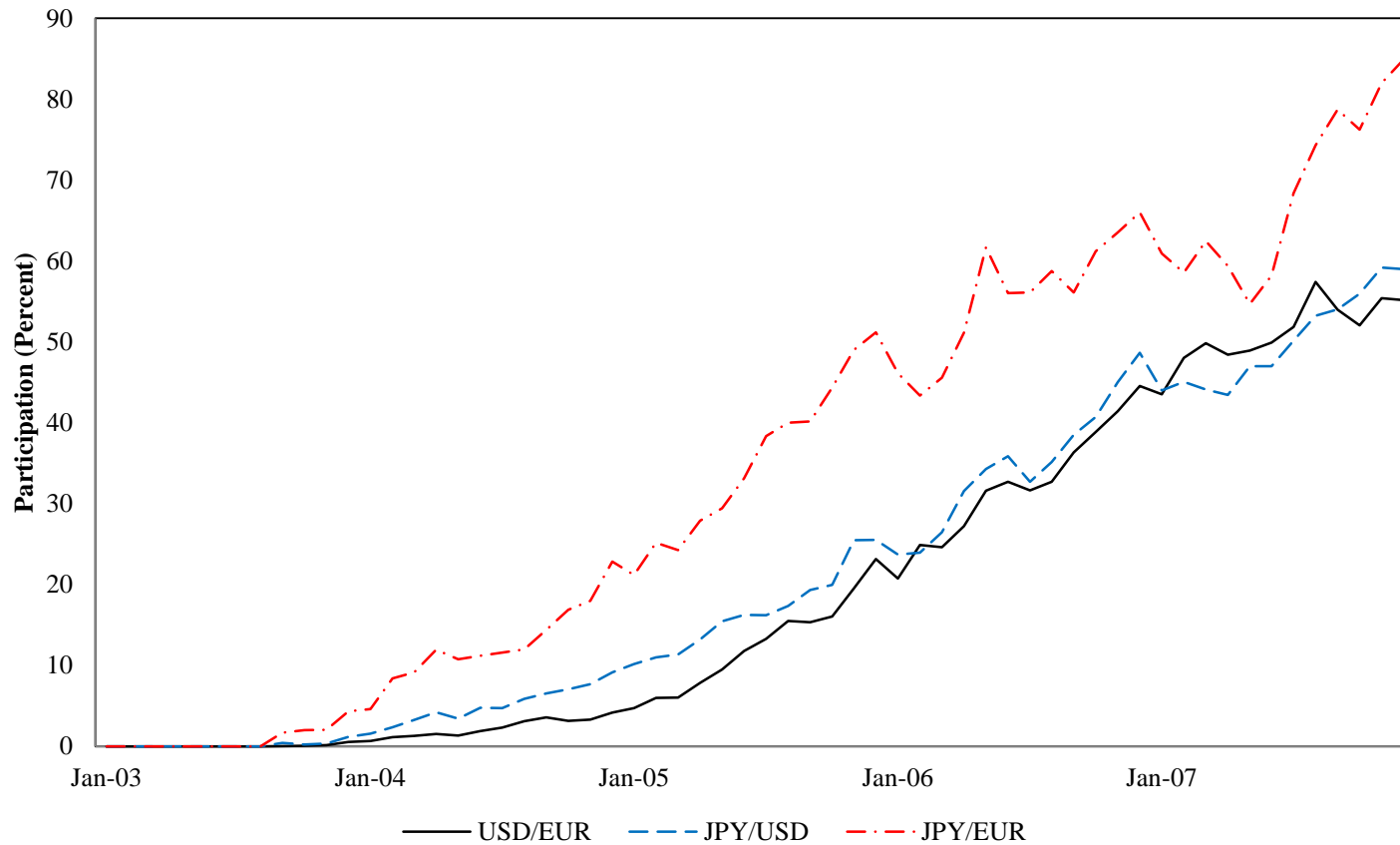
# Flash Crash

Figure 25: Price Chart # 1 for Sotheby's (Ticker = BID)

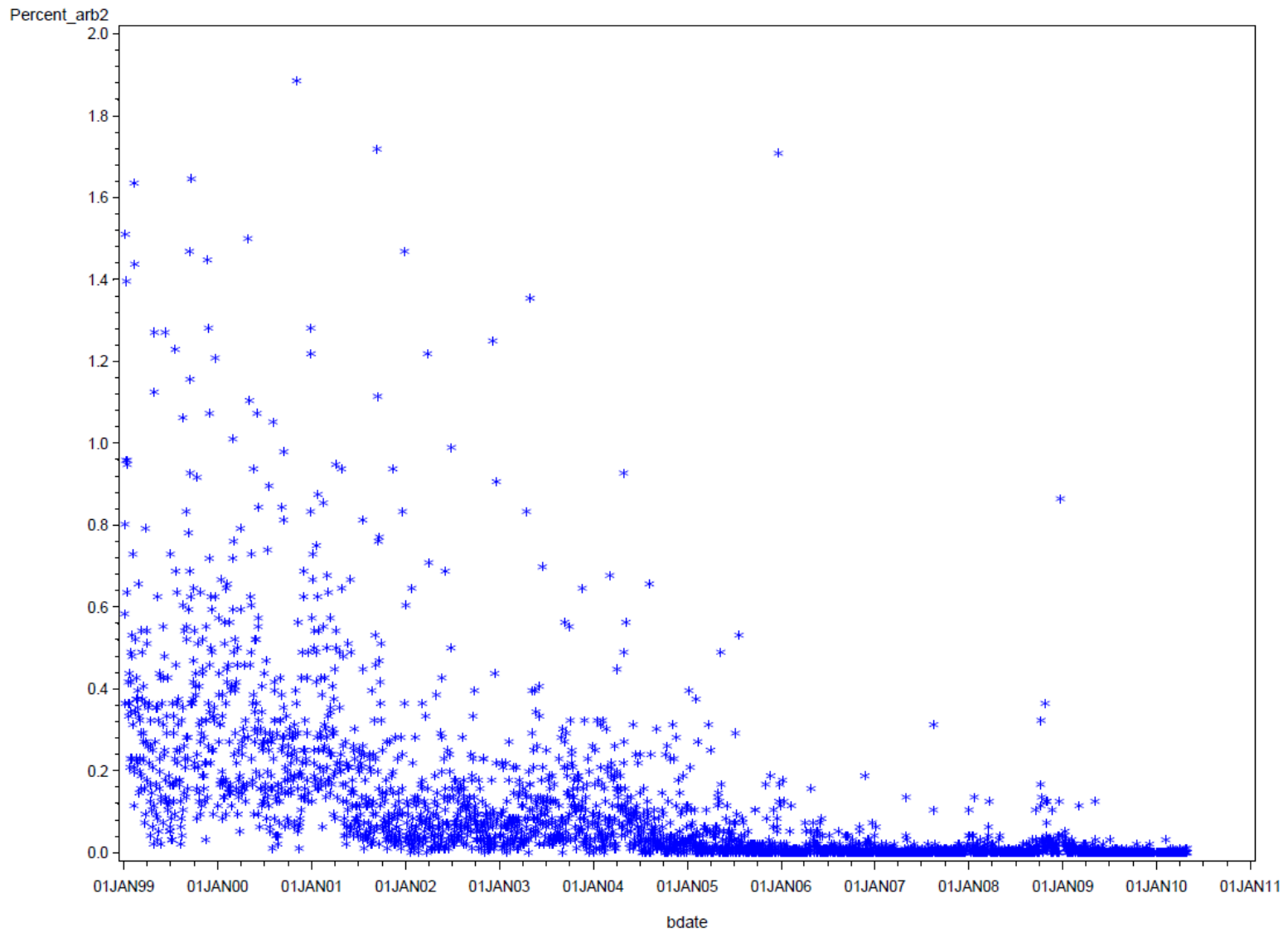


Sources: NYSE Trades and Quotes

# Participation Rates of Algorithmic Traders in Foreign Exchange (Chaboud et al. (2014))



## Arbitrage Opportunities Percent, Profit > 1.0002



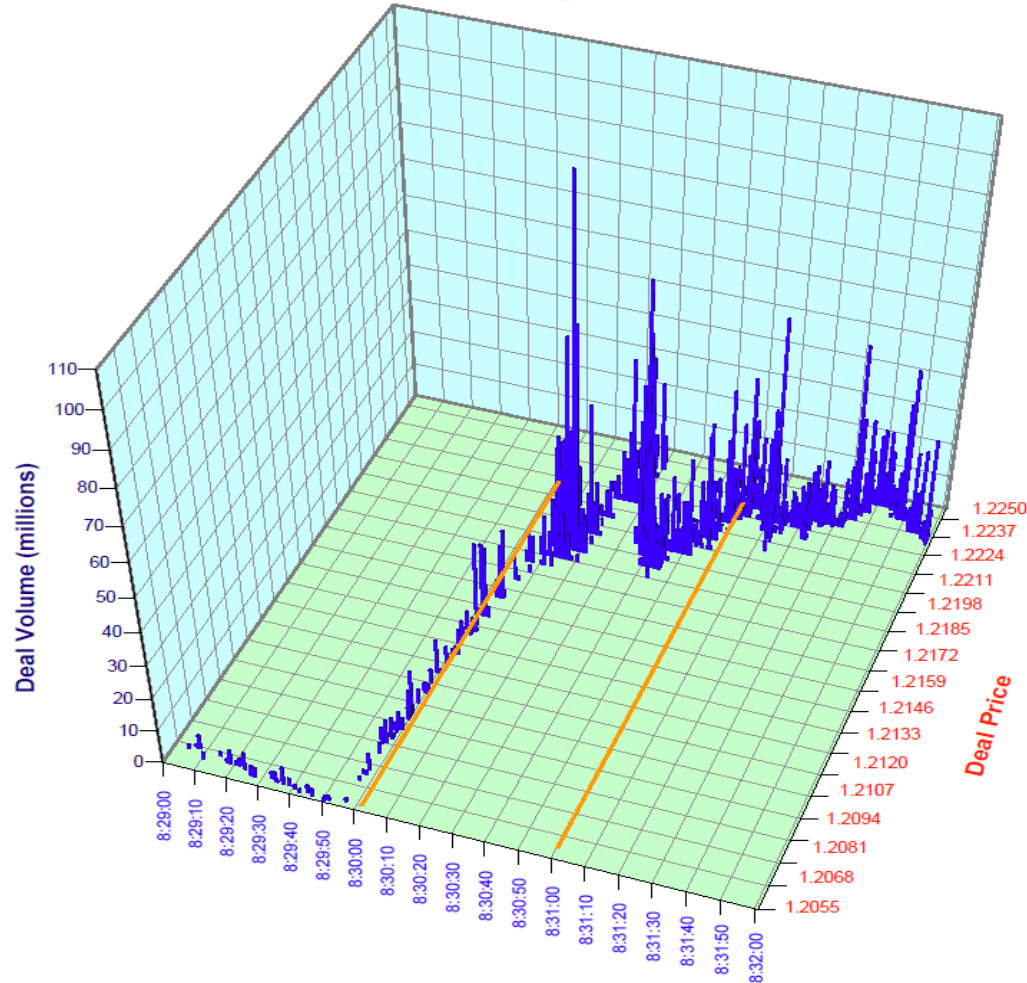
# Reactions to incoming data

- Chaboud et al. (2014) find that rise in HFTs has come about at a time when reactions to economic data are faster.
- Probably HFTs speed up the price impact

# Reactions to incoming data

Figure 5: Price and Volume (EUR/USD)

8:29 to 8:32 , 6-Aug-2004



# Dark Pools

- Order book is not visible (no pre-trade transparency)
- Dedicated to large investors
- Less price impact of a large trade
- Examples of mechanisms
  - Could automatically match buy and sell orders
  - Could identify participants who are on each side of the market and invite them to negotiate, but shunning participants who routinely fail to complete

# Role of central banks

- Central banks play many different roles in economies around the world
- 2 roles are key
  - Render the financial system less crisis prone.
  - Provide a “nominal anchor”



# Other roles

- Central banks play other roles as well
- Regulate financial institutions
- Provide infrastructure for the payments system  
(e.g., check clearing, wire transfer)
- Act as banker to the government  
(facilitate tax and spending payments, issue debt)

# For now

- We will focus mainly on the two key roles
- And talk about structure and governance issues

# Promote financial stability

- As we have emphasized throughout the course: financial systems are inherently prone to crisis
- No matter why they start, these crisis generally involve “runs” on banks and other institutions.
- Folks all try to pull their money out of risky and simply illiquid investments

# Panic of 1907

- One of a string of financial panics in late C19 and early C20
- Augustus Heinze had a short-squeeze scheme on United Copper. Lost \$50 million.
- Caused a bank run.

# Promote financial stability

- These panic moments can lead to collapse even if the original source of problem is modest (e.g. 1907)
- Even sound institutions can collapse because their assets can't be sold quickly (Diamond-Dybvig)
- To stem these crises, somebody with lots of resources needs to step in and assure folks that fundamentally sound institutions will be able to meet their obligations.

# Promote financial stability

- Before central banks, the richest folks in society might get together and try to stem crises.
- J.P. Morgan arranged a private coalition that helped stem the panic of 1907
- 1907 crisis led to creation of the Federal Reserve (1913)

# Promote financial stability

- Key aspect, as we've said before: lender of last resort (LOLR).
- The central bank stands ready to lend to any (*otherwise solvent*) institution facing a run-like situation (Bagehot).
- The *otherwise solvent* part can be quite tricky, and raises a vital governance issues

# Promote financial stability

- Democratic political systems (even effective ones) tend to be ill-suited to resolving politically contentious and murky issues on short notice.
- Solution? How about delegating LOLR-type roles to an agency in the standard way?



# Nominal anchor

- Second key role of CB is to provide a “nominal anchor”
- Idea of a nominal anchor is to keep the real value of the currency steady.

# Nominal anchor

- Prices and interest rates are stated in nominal (e.g., dollar) units.
- And we know that inflation can change the real value of a dollar
- Thus, economic decision-makers need to have a reasonable sense of the path of prices and inflation going forward.

# Nominal anchor

- Economies in which there is great uncertainty about the value of the currency over coming years tend to perform more poorly than economies with a more stable nominal environment.
- This may sound plausible, but you might think this would not be a big challenge.
- Providing a reliable “nominal anchor” turns out to pose major governance challenges similar to those discussed above.

# Nominal anchor?

## Inflation around the world

	1990-1999	2000-2009
Median	8	4
75 <sup>th</sup> Percentile	20	9
90 <sup>th</sup> Percentile	70	15

# Nominal anchor

- Government is monopoly supplier of the means of payment

# Nominal Anchor

- As monopoly supplier of the means of payment, government benefits from seigniorage
- Seigniorage: the one who creates and first spends money, gets something of value for (almost) nothing.  
(e.g., in the case of currency, you get \$1 of stuff and are only out the cost of production of a \$1 bill.)

# Aside: cost of producing currency

- Cost of printing a \$1 bill is about 5 cents
- Price goes up for higher denominations because of security measures (\$100 costs about 13 cents)
- Cite:  
[http://www.federalreserve.gov/faqs/currency\\_12771.htm](http://www.federalreserve.gov/faqs/currency_12771.htm)

# Nominal anchor

- Especially in times of stress, govt. may have an incentive to abuse the money creation privilege, leading to inflation
- We will talk more about the macroeconomics of this later, but if the amount of money (properly defined) is increased at a rapid enough pace, this must lead to inflation.



# Nominal anchor

- Suppose that the government gets far into debt and then...
- Govt. finds it politically or economically difficult to raise taxes enough to pay off the debt.
- If the debt is denominated in units of the currency it controls, the government can simply inflate away the real value of the debt

# Two key roles and governance

- The two key roles--providing a nominal anchor and providing an effective LOLR--are politically challenging.
- Have led to a growing international consensus favoring central bank “independence”
- Independence means that monetary policymakers are shielded from short-run political influence.

# CB governance

- In many nations around the world the move to independence came during the 1990s
- And is arguably the reason why inflation has been lower in recent years.
- For example, the Bank of England (one of the oldest central banks) was given independence only in 1997.

# CB governance, best practices

- Government should set broad macroeconomic objectives for the central bank.
- Policy should then be set by a board that is insulated, to the extent possible, from short-run political influence.
- For accountability, the board should provide copious communication about its policy actions and plans

# Objectives

- In general, all CBs have an objective to promote low and stable inflation
- Some banks are “single mandate” and have only this inflation objective.

# Objectives

- Dual mandate banks have an additional mandate to promote stable growth and/or promote the economy operating near its maximum sustainable level

# Fed objectives

- The Fed has a dual mandate to promote maximum employment and price stability.
- The FOMC interprets these as inflation near 2 percent and employment near its maximum sustainable level.
- Described more fully in the FOMC's statement of longer-term goals and policy strategy [http://www.federalreserve.gov/monetarypolicy/files/FOMC\\_LongerRunGoals.pdf](http://www.federalreserve.gov/monetarypolicy/files/FOMC_LongerRunGoals.pdf)).

# Fed Objectives

- Fed is the clearest example of a dual mandate central bank.
- Many others (such as the Bank of England and Swedish Riksbank) have a murkier stability of full employment mandate.



# Fed Governance

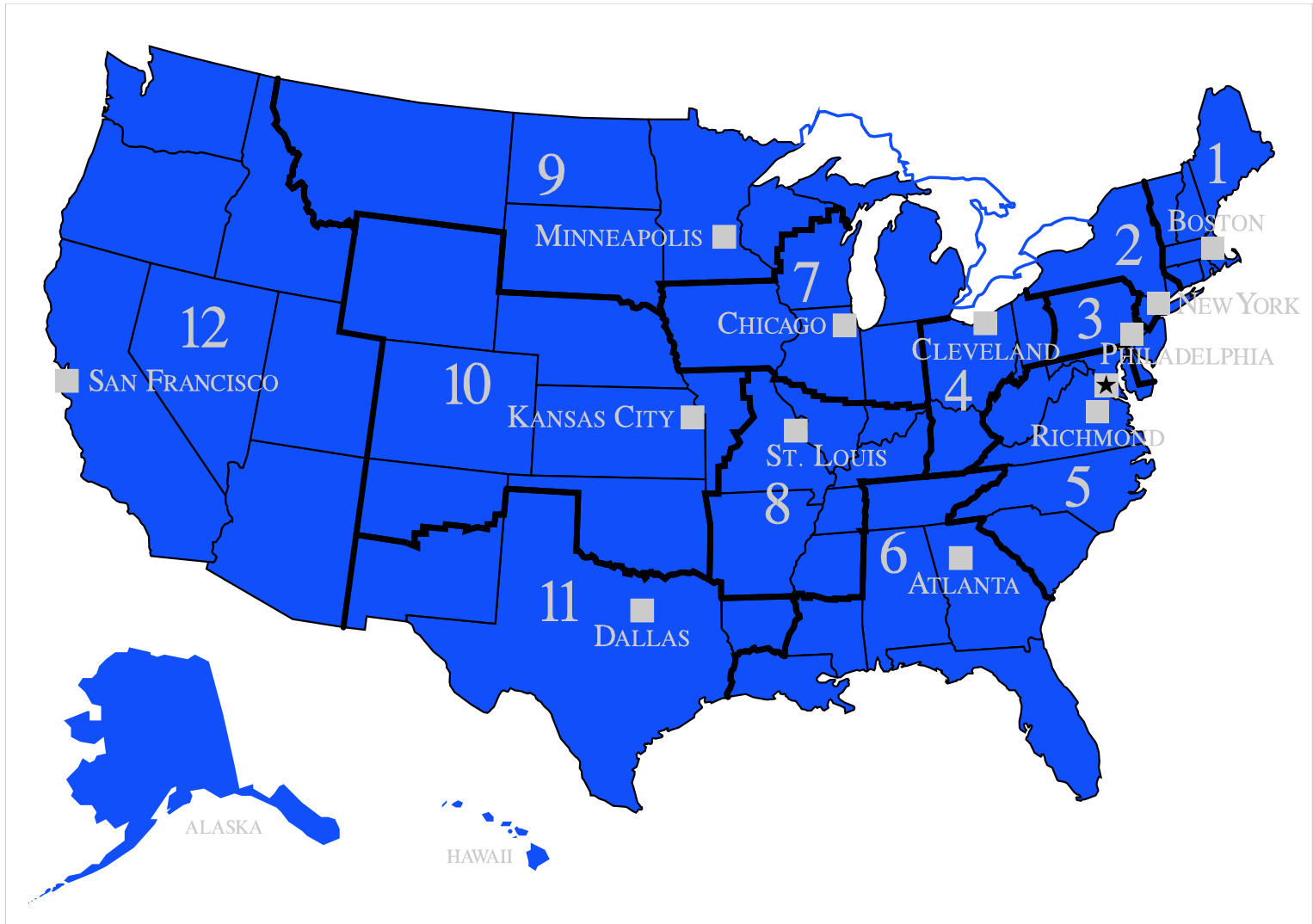
- Federal Reserve Board of Governors has 7 governors (one is chair and one is vice chair)
- Governors are nominated by the President and confirmed by Senate.
- Serve 14 year terms to minimize political pressure.

# Fed Governance

- There are 12 regional federal reserve banks
- Each bank has a president selected in a complicated system involving the Boards of the banks and also the Board of Governors.

# Regional Federal Reserve Districts

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# Federal Reserve Banks Board

- Board of 9 directors
  - 3 “A” directors: elected by member banks to represent banks
  - 3 “B” directors: elected by member banks but cannot be bankers
  - 3 “C” directors appointed by Board of Governors
- Board of directors elects a president is selected by the “B” and “C” directors with the approval of the Board of Governors

# Fed Governance

- Main monetary policy decisions are made by the Federal Open Market Committee (FOMC)
- The 7 governors vote along with 5 presidents on a rotating basis (NY Fed president always votes)
- By convention, chair of Board chairs FOMC; NY Fed president is vice-Chair.
- Note: an even number of votes promotes decision by consensus

# Fed history

- Discussed some Fed history earlier
- Started in a role of lender of last resort and evolved into macroeconomic stabilizing role
- General consensus is that two blunders
  - Great Depression
  - Rise of Inflation in 60s and 70s
- Bernanke speech on Milton Friedman's 90<sup>th</sup> birthday in 2002

“Regarding the Great Depression, You’re right, we did it. We’re very sorry. But thanks to you, we won’t do it again.”

# Fed Independence

- During WW2, Fed bought government bonds to keep borrowing costs down
- Led to inflation
- In 1951, Treasury-Fed accord gave Fed control of monetary policy (federal funds rate)
- In 1953, Fed adopted a “bills only” policy so that they were only affecting short rates (abandoned in 1961)
- Desk in New York had to follow FOMC directive
- Represents start of modern stabilization policy

# Fed Governance

- FOMC currently meets in 8 scheduled meetings per year to reconsider the stance of policy
- The FOMC also calls ad hoc meetings as warranted



# Accountability/Transparency

- Traditionally, the Fed and all central banks tended to be quite secretive about their actions and the motivations for those actions.
- Although the case was never compelling, it was claimed that secrecy was important to policy effectiveness.
- Gradually over the last 30 years, folks came to accept that this was nuts

# Accountability/Transparency

- First, economists came to understand that policy will be most effective if private sector agents understand the likely course of policy
- Second, from a good governance standpoint, even if one can justify insulation from short-run political pressure, accountability requires that the central bank clearly explain and justify its policies.

# Accountability/Transparency

- Thus, there has been a transparency revolution around the world in central banking.
- Still a work in progress: Central banks do lots of communicating, but still struggle to communicate effectively.

# Fed Communication

- Fed releases statement directly after each FOMC meeting.
- Chair gives press conference after all meetings.
- Extensive (yet somewhat opaque) minutes of FOMC meeting provided after a few weeks.
- Full transcripts after 5 years.

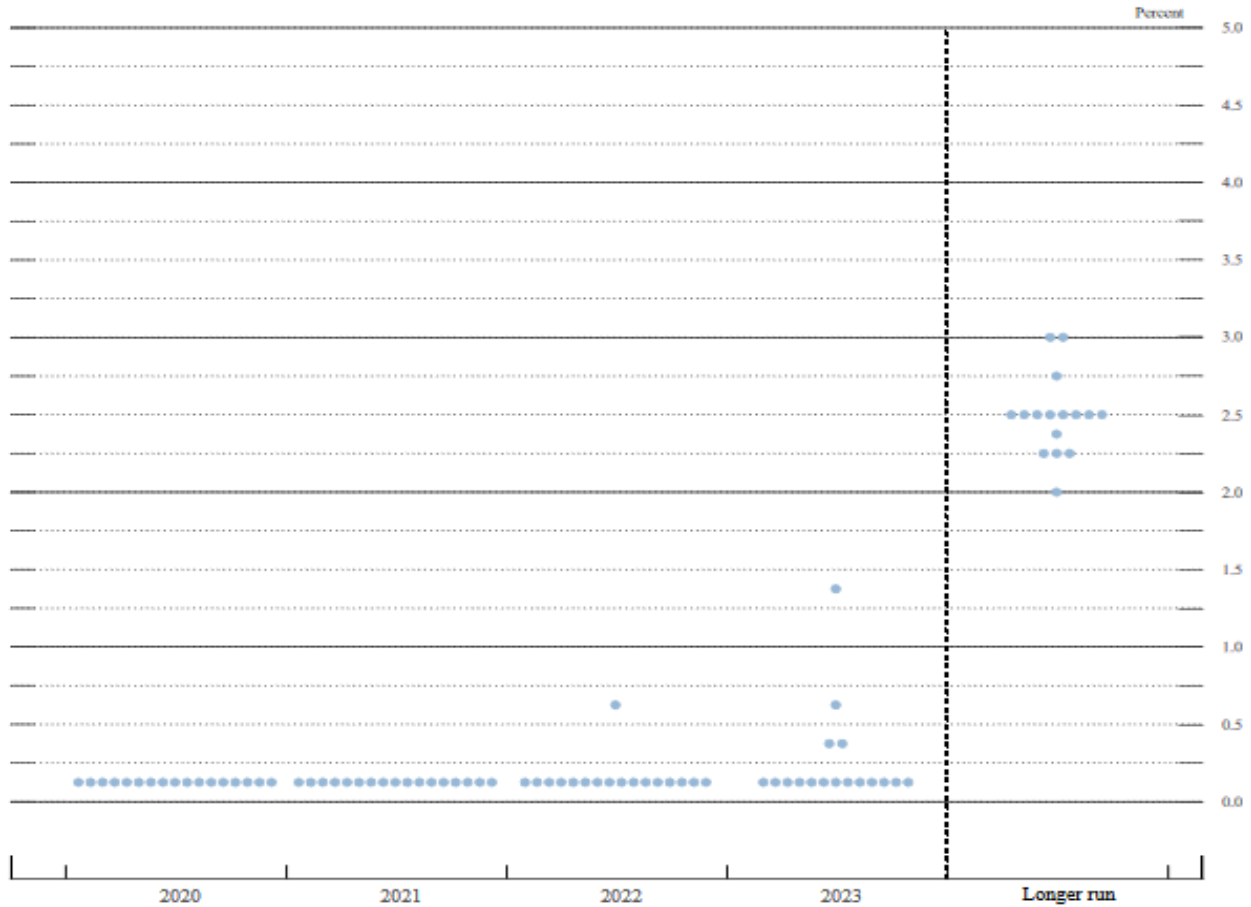
# Fed Communication

- Summary of Economic Projections (SEP) made four times a year that include forecasts of interest rates

# SEP

Variable	Median <sup>1</sup>				
	2020	2021	2022	2023	Longer run
Change in real GDP	-3.7	4.0	3.0	2.5	1.9
June projection	-6.5	5.0	3.5		1.8
Unemployment rate	7.6	5.5	4.6	4.0	4.1
June projection	9.3	6.5	5.5		4.1
PCE inflation	1.2	1.7	1.8	2.0	2.0
June projection	.8	1.6	1.7		2.0
Core PCE inflation <sup>4</sup>	1.5	1.7	1.8	2.0	
June projection	1.0	1.5	1.7		
Memo: Projected appropriate policy path					
Federal funds rate	.1	.1	.1	.1	2.5
June projection	.1	.1	.1		2.5

# SEP: Dot plot



# Accountability/Transparency

- Fed submits monetary policy report to Congress twice annually and Chair testifies about the report
- Fed policymakers regularly testify on other occasions.
- Fed officials give lots of other speeches.



# Fed asset purchases

- The Fed is only allowed to buy Treasuries and agency
- Pay for these with reserves

# Fed lending

- Fed can lend via discount window to depository institutions
  - Collateralized
- Section 13(3) of Federal Reserve Act allows lending to others in *unusual and exigent circumstances*
- Dodd-Frank act restricted this to require approval of Treasury secretary and that it must be broad-based

# Fed lending

- In financial crisis and in response to COVID, the Fed has lent money under 13(3) collateralized by commercial paper, corporate bonds etc.
- These are non recourse loans
- In effect, the Fed is buying these assets
- In response to COVID, Treasury took about the first 10 percent of losses

# Fed and other central banks

- That completes a summary of objectives, governance and accountability/transparency at the Fed
- Let us summarize some features of other CBs.

# Bank of England

- Founded in 1694 to finance war with France
- Bank of England is governed by a board known as the MPC (monetary policy committee).
- Gained independence in 1997
- Main objective is price stability with a secondary objective of supporting the government's economic policy.
- Thus, somewhere between single and dual mandate.
- Governor is Andrew Bailey

# ECB

- The European Central Bank (ECB) is the central bank of the euro area—the (currently) 19 nations that have adopted the euro as their currency.
- ECB formally founded in 1998, euro came into existence as a currency in 1999.
- Very young compared to the others and still undergoing change

# ECB

- The ECB set monetary policy in conjunction with and through the 19 national central banks (NCBs) of euro-area countries.
- Main decisions made by the Governing Council made up of the 6 members of the Executive Board and the 19 governors of NCBs
- 15 of the NCB governors have voting rights by rotation

# ECB

- The executive board has 6 members including the President (Christine Lagarde), vice president and 4 others.

(Lagarde is the rough equivalent of the  
Chair of Fed)



# ECB: Objective

- ECB is a single mandate central bank.
- Interprets its mandate as promoting inflation of less than, but close to, 2.

# ECB: transparency/accountability

- President (Lagarde) gives regular press conferences after meetings
- Monthly reports
- (but no information about votes is released)

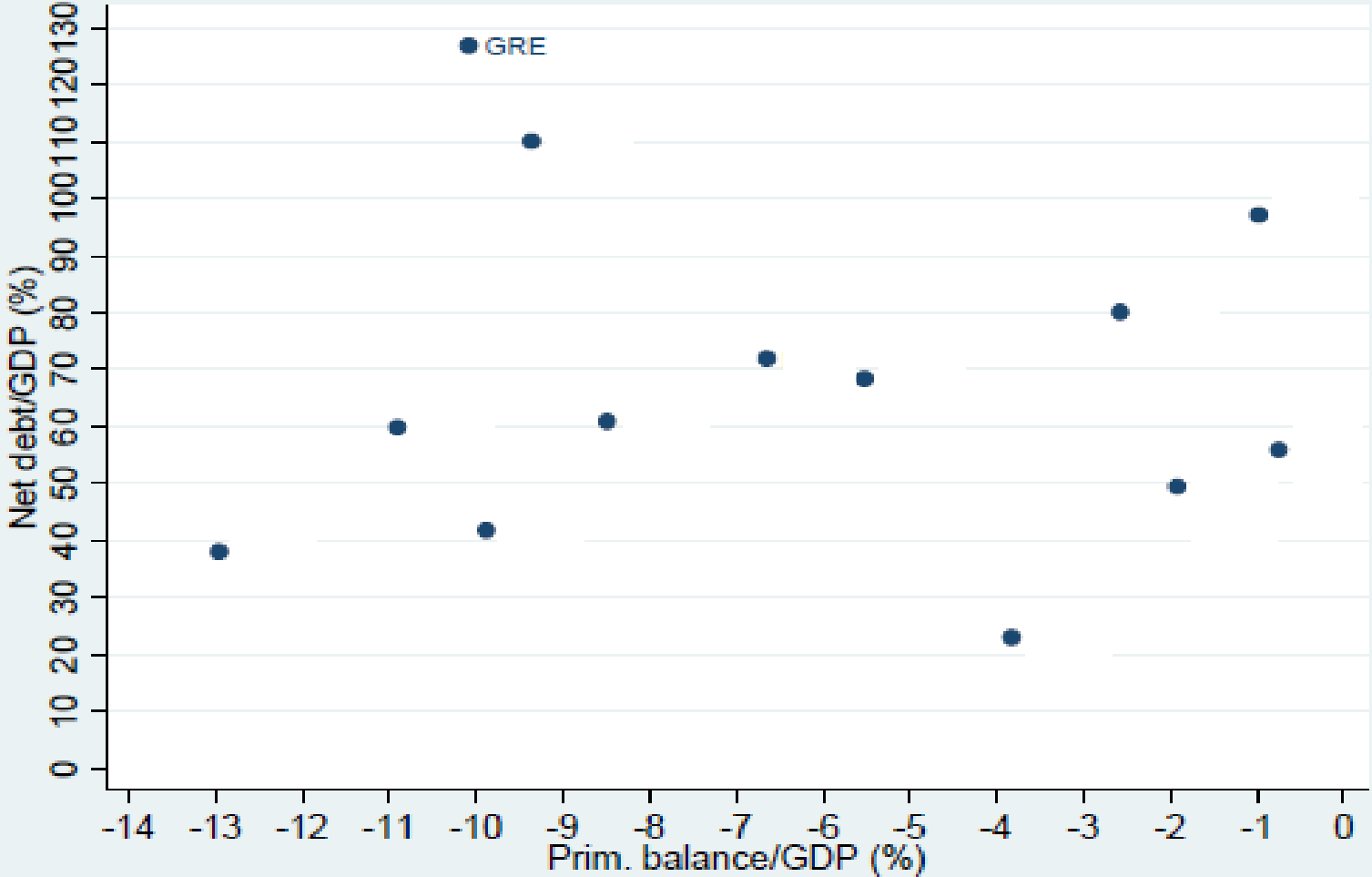
# ECB: unique challenges

- In most cases, the monetary policy authority is paired with a fiscal policy authority serving the same region.
- While there is a euro area wide monetary policy, fiscal policy still handled at the national level.
- This raises some challenges, especially recently as some euro-area countries have faced debt crises (e.g., Greece, Portugal, Ireland, and to a lesser extent Spain and Italy)

# ECB unique challenges

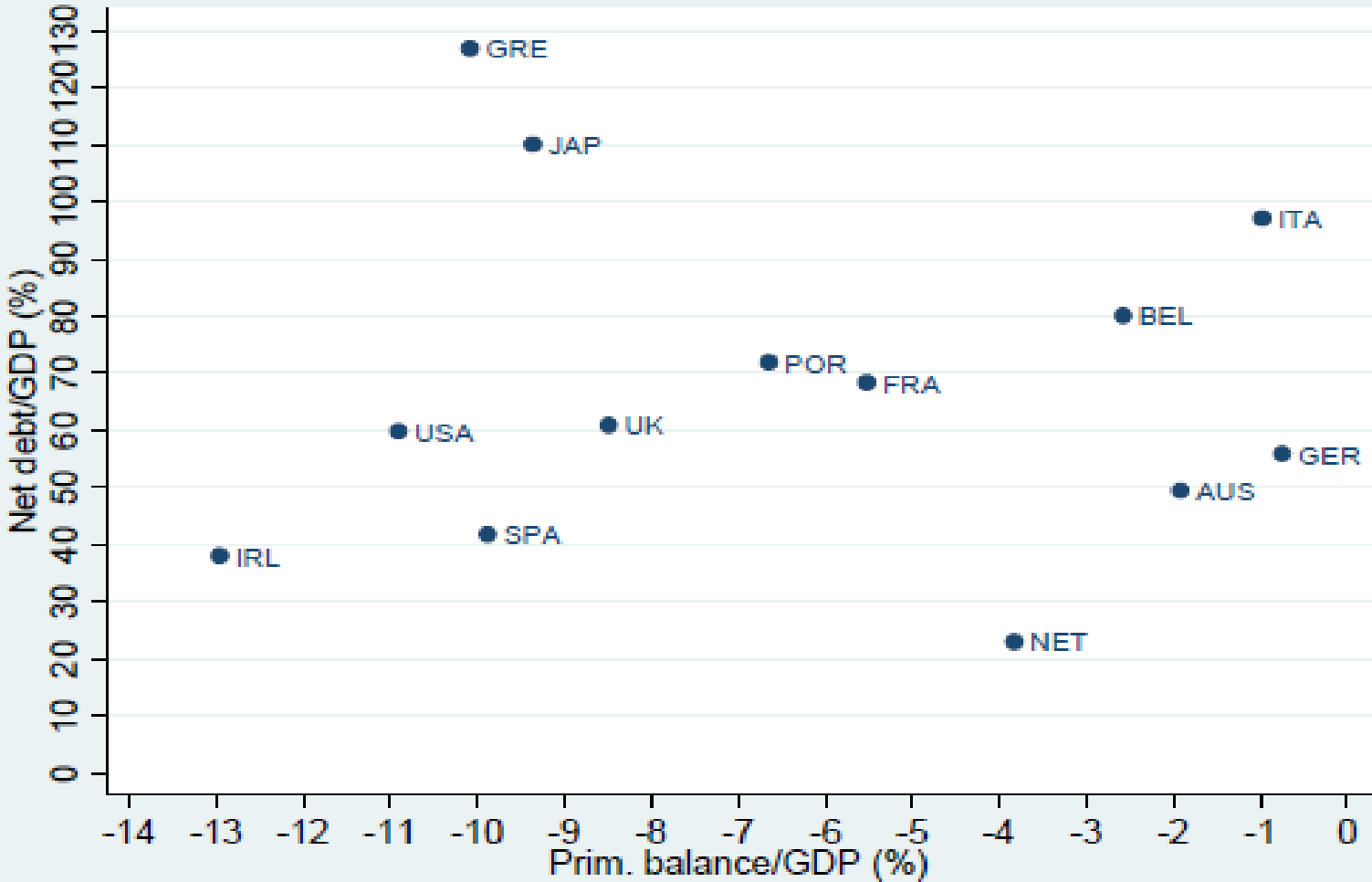
- Note: in many economies, fiscal and monetary policy sometimes work at cross purposes
- But this is still a bit less challenging than pairing one monetary policy with 18 fiscal policies
- And ECB can be caught in a vicious circle in which borrowing costs rise making a country insolvent

# Debt and Primary Balances: 2009



Source: WEO/Jeanne (2012)

# Debt and Primary Balances: 2009



Source: WEO/Jeanne (2012)

# Whatever it takes

- Euro zone had a debt crisis
- Nonetheless, in 2012, ECB announced program that it would buy bonds of countries where interest rates were rising in unlimited quantities
- Draghi gave speech on doing “whatever it takes”
- That stopped the crisis
  - And they never bought a bond!

# Challenges of European monetary union

- Diverging fiscal policy (moral hazard)
- Diverging productivity
- Lack of banking union
  
- Point 1 got all the attention in the design of the single currency



# Comparison with US as a monetary union

- Size of federal government gives a bigger shock absorber
- More labor mobility
- Banking union
- Federal government has not directly bailed out a state since 1790
  - Arkansas defaulted in 1933
  - 8 states defaulted in 1840s

# BOJ

- The policy board has 9 members including the Governor (Haruhiko Kuroda)
- Single mandate of price stability
- Now interpret as 2 percent inflation
- Have been very active in last few years in attempting to drive inflation up
  - Japan has been trapped in mild deflation since 1990s

# 2 percent inflation target

- International consensus
- Inflation is very similar across advanced economies
- A little above zero to give some buffer to cut rates
- Shift towards independence of central banks and numeric inflation targets starting with New Zealand in 1989
- Perhaps it's a historical accident that countries have picked 2, and perhaps it is too low
- But politically hard to change now

# Monetary policy in the US

- Fed has objectives of “stable prices” and “maximum sustainable employment”
- Interpreted as inflation around 2 percent and unemployment around NAIRU
- Potential output can be thought of as the level of output with unemployment at NAIRU

# General idea of monetary policy

- If unemployment too high/inflation too low, cut interest rates to stimulate AD and boost inflation
- If economy is overheating, do the converse
- Stabilization policy
- Neutral real rate is the rate that is neither stimulating nor slowing the economy

# What does monetary policy do?

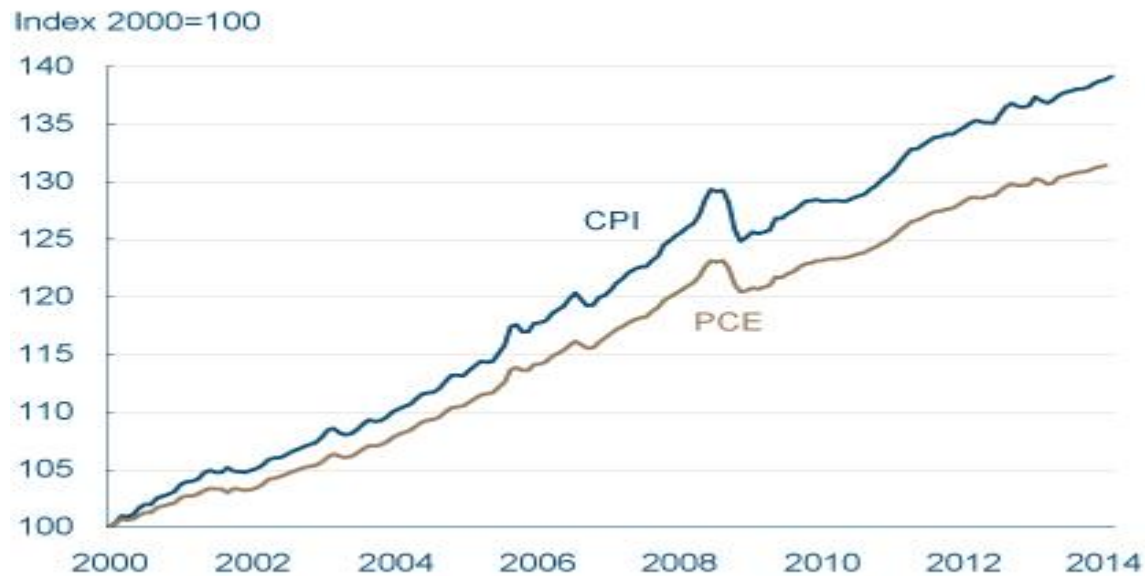
- Monetary policy aims to lower or boost aggregate demand to achieve CB objectives
- A cut in interest rates
  - Boosts consumption especially for large items financed with credit
  - Drives up investment (business and residential)
  - Drives up stock prices; hence C and I
  - Lowers exchange value of dollar and boosts net exports

# Measurement of inflation

- Not so easy
- For consumer prices, there is CPI and PCE
- CPI and PCE have different weights
  - CPI is based on survey of what households buy; PCE is based on survey of what businesses sell.
- PCE adjusts for substitution, CPI doesn't (as much)
- CPI excludes medical care paid by insurance; PCE does not

# Measurement of inflation

## CPI and PCE Levels



Source: FRED, Federal Reserve Bank of St. Louis.

From Haubrich (2014) PCE and CPI Inflation: What's the Difference?



# Measurement of inflation

- CPI is not revised (more or less) whereas PCE is heavily revised
- For this reason CPI is generally preferred for many official purposes
- But Fed views PCE as the better inflation measure
- CPI runs typically 30-40 basis points above PCE
- Fed target for inflation is 2 percent for PCE

# Measurement of inflation

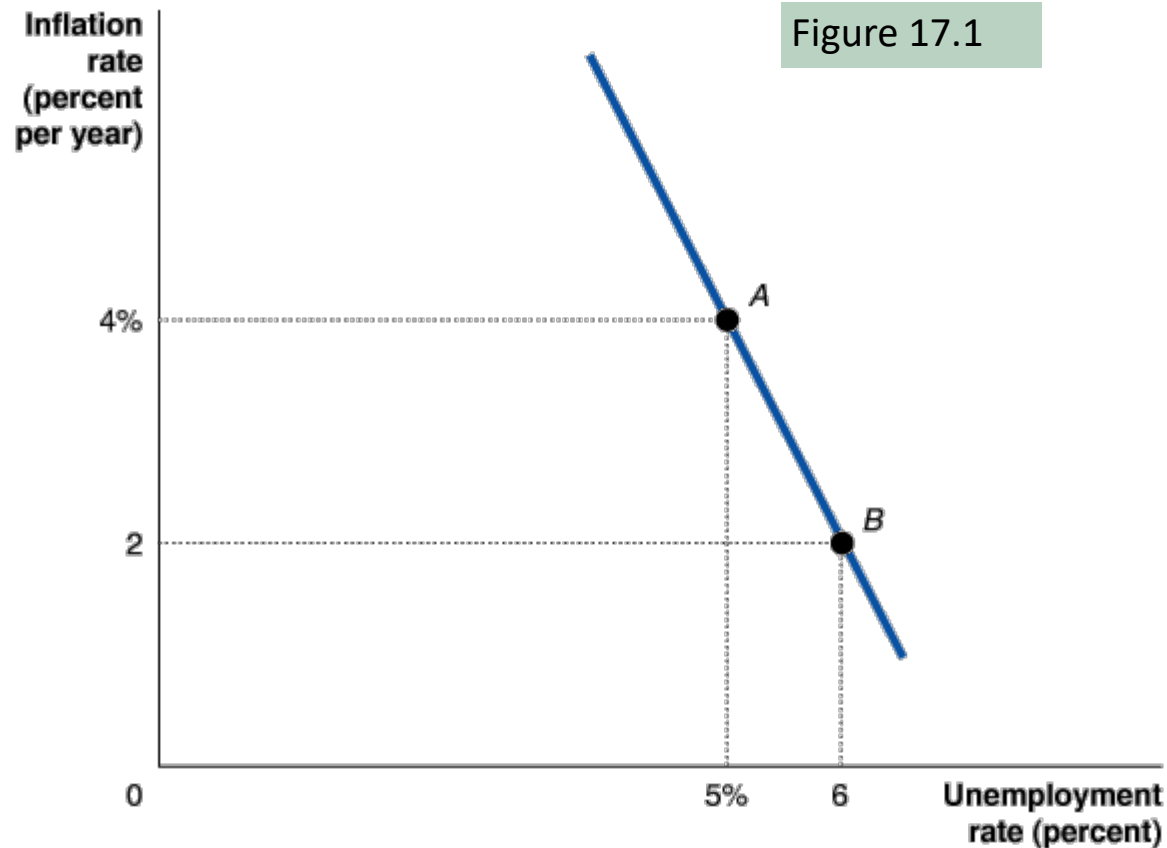
- Another issue is that food and energy prices are very volatile
- Core inflation is inflation excluding food and energy

# Unemployment and inflation

The two great macroeconomic problems that the Fed deals with (in the short run) are unemployment and inflation.

The *Phillips curve*, after economist A.W. Phillips.

Phillips curve: The short-run relationship between the unemployment rate and the inflation rate.



# Phillips curve

- Original Phillips curve was an inflation-unemployment tradeoff

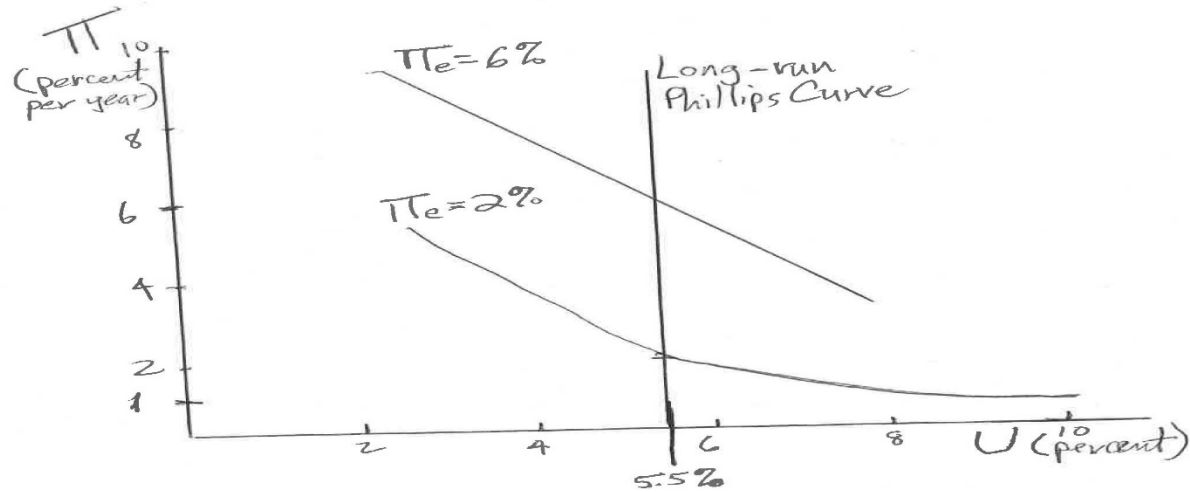
$$\pi = \alpha - \beta U$$

- Worked empirically in the 50s and 60s but not since
- Now use an “expectations augmented” Phillips curve

$$\pi = \pi^e - \beta(U - NAIRU)$$

- Controversial how useful it is, or at least  $\beta$  may be very small especially recently
- But still central to conduct of MP

The Zero Bound is a problem for disinflation and Phillips curves as well.



**JOBLESS RATES TO VERY HIGH LEVELS.  
BUT INFLATION DID NOT FALL BELOW  
ZERO: CONSIDER THE ITALIAN  
EXPERIENCE**

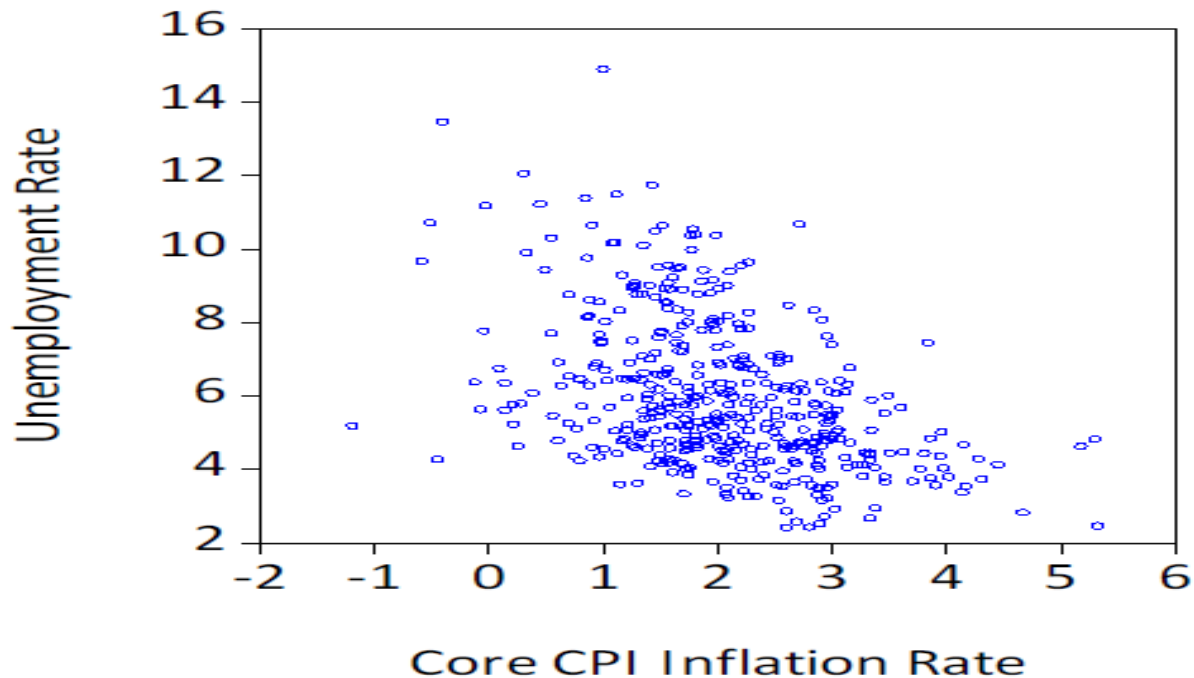
<b>Italy</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<b>jobless rate</b>	<b>6.8</b>	<b>8.3</b>	<b>8.2</b>	<b>9.5</b>	<b>11.4</b>	<b>12.4</b>	<b>12.3</b>
<b>hourly earnings*</b>	<b>4.0</b>	<b>2.8</b>	<b>1.7</b>	<b>1.4</b>	<b>1.7</b>	<b>1.4</b>	<b>1.1</b>
<b>*(YOY, percent change)</b>							

# PLOGS DON'T DELIVER DEFLATION!

- P            PERSISTANT
- L            LARGE
- O            OUTPUT
- G            GAPS
- PLOGS, LONG PERIODS OF VERY HIGH UNEMPLOYMENT, DON'T PUSH PRICE AND WAGE GAINS BELOW ZERO:
- THE ZERO BOUND SEEMS TO MATTER.

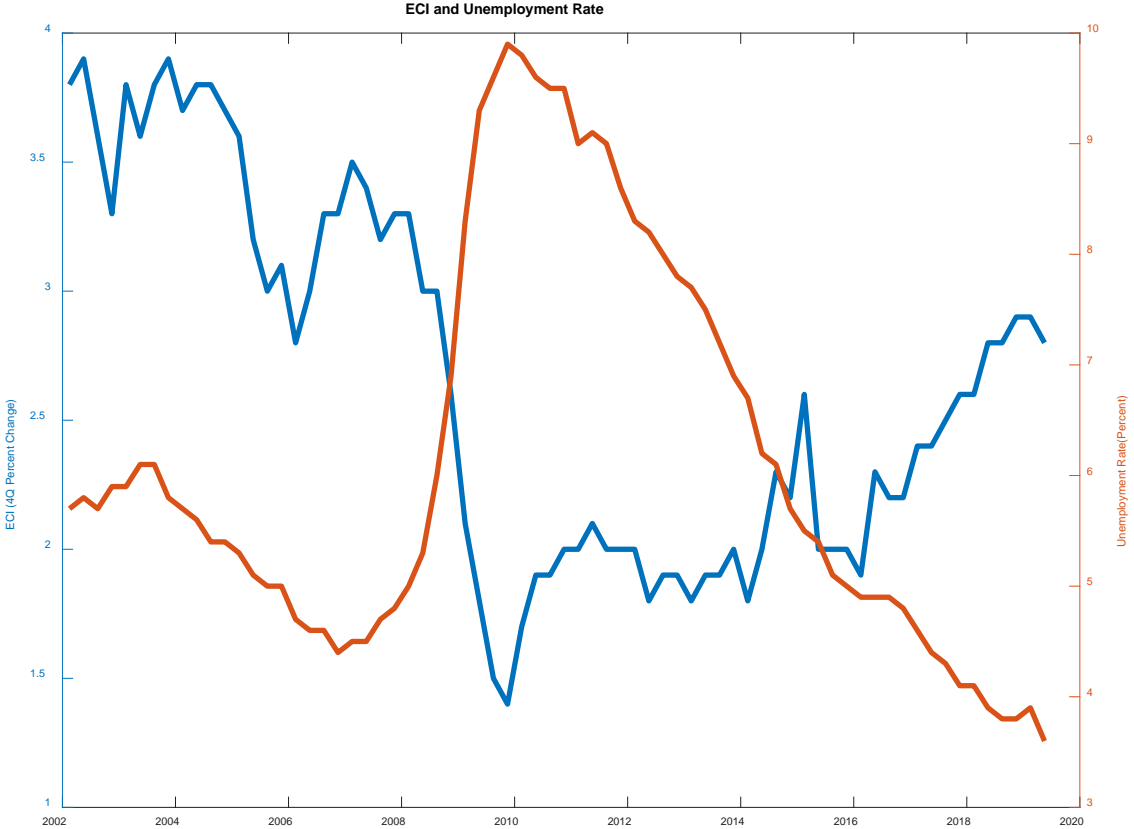
# Regional Phillips curves

- Recent trend to working with more disaggregate data
- Simple illustration is Detmeister and Babb (2017)
- Plot of unemployment against core inflation metropolitan areas, 1985-2016

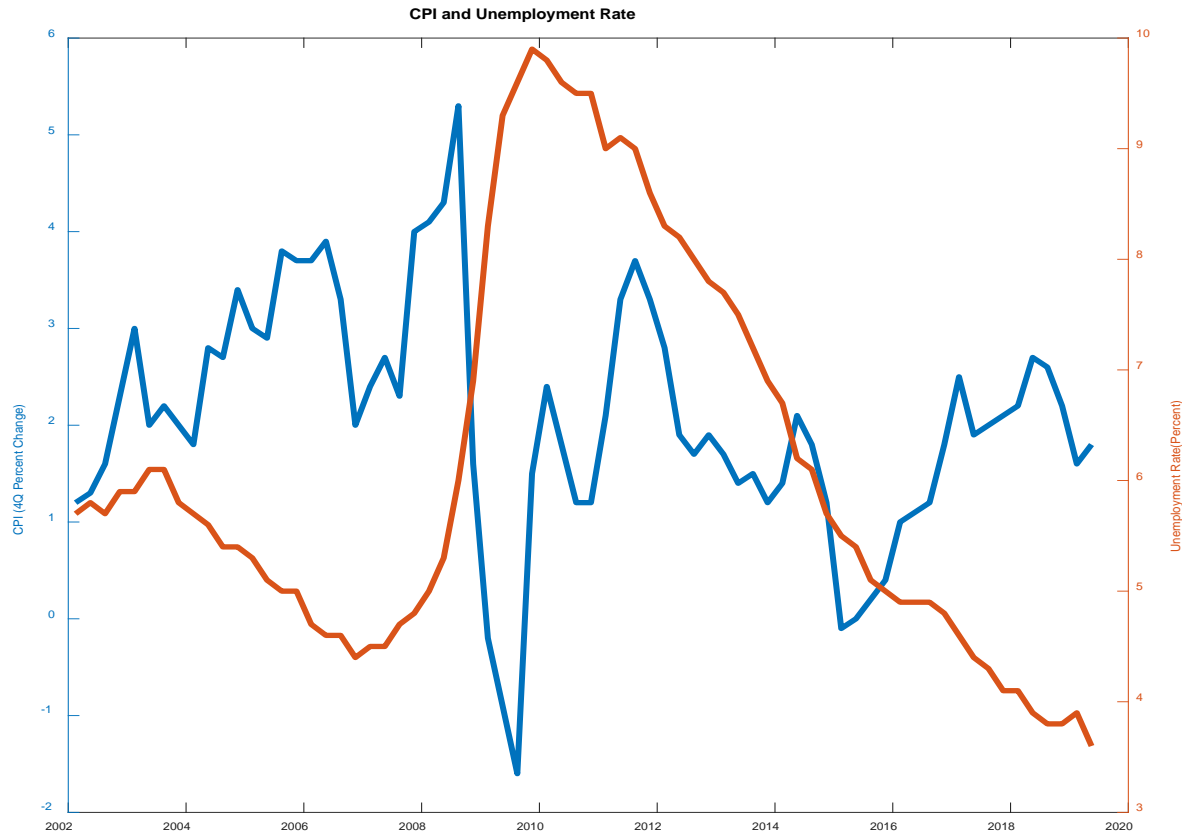




# ECI Phillips Curve: Relationship seems alive and well



# CPI Phillips Curve: Hard to See any relationship



# Has the Phillips curve flattened?

- Stronger evidence for Phillips curve in recent data in wage inflation than in price inflation
- Also, stronger evidence in services than in goods
- Possible answer: global competition (esp China) means that goods sellers can't pass on higher wage costs

# “Divine Coincidence”

- Phillips curve:

$$\pi_t = \pi_{t-1} + \alpha(U_t - U_t^*)$$

- If so, then keeping inflation stable is the same thing as keeping unemployment at NAIRU
- Dual mandate and single mandate will be equivalent

# Output gap and Okun's law

- Let  $y^*$  denote potential output. The output gap is

$$\text{Output gap} = \frac{y - y^*}{y^*}$$

- Okun's law (a version)

$$\text{Output gap} = -2(U - U^*)$$

# Taylor Rule

- Proposed by John Taylor

$$i_{ff} = 2 + \pi + 0.5(\pi - 2) + 0.5\text{Output Gap}$$

$$i_{ff} = 2 + \pi + 0.5(\pi - 2) - (U - NAIRU)$$

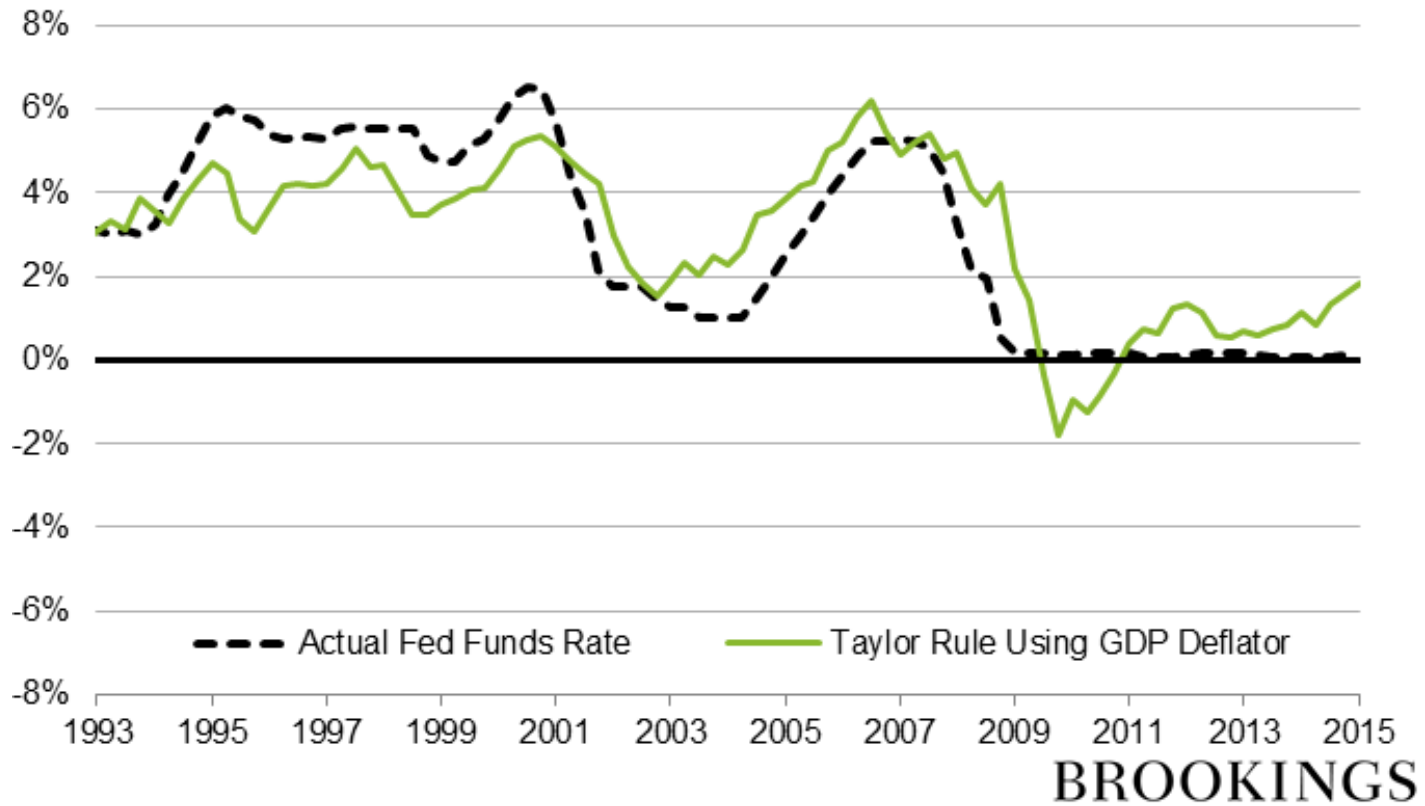
- Another version

$$i_{ff} = 2 + \pi + 0.5(\pi - 2) + \text{Output Gap}$$

$$i_{ff} = 2 + \pi + 0.5(\pi - 2) - 2(U - NAIRU)$$

# Taylor rule

Figure 1: The Original Taylor Rule, 1993-Present

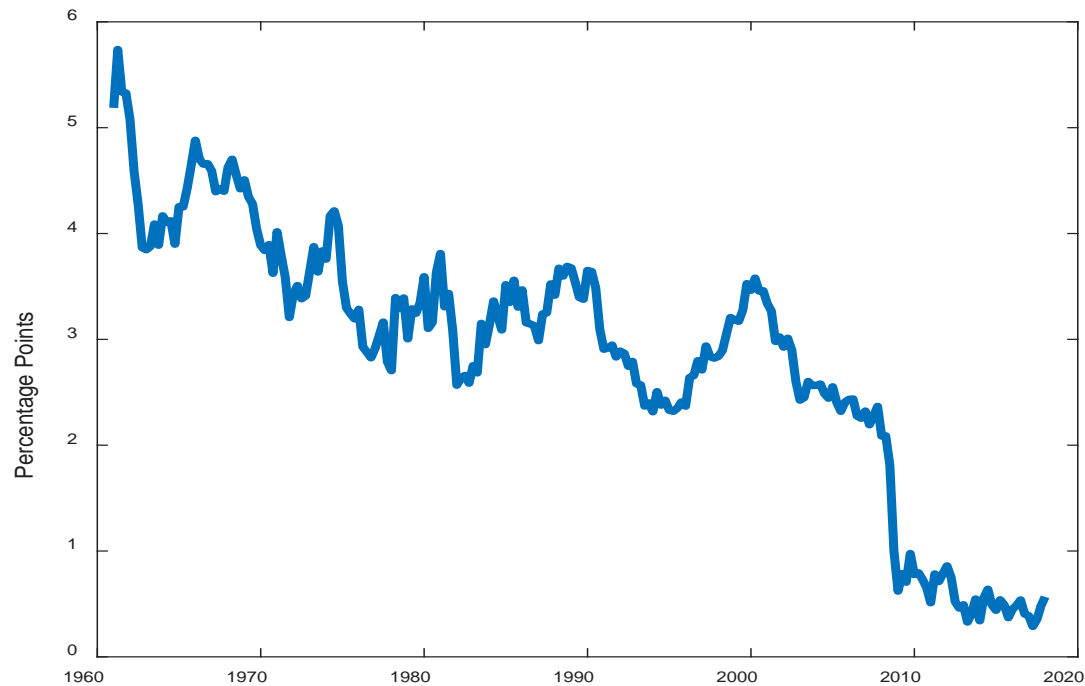


# Taylor rule

- Taylor rule assumes a neutral (or natural or Wicksellian) real rate of 2 percent
- With 2 percent inflation that would correspond to 4 percent nominal fed funds rate
- Neutral rate can be affected by fiscal policy, demographics, strength of the stock market etc.
- Most economists (and the Fed) think that neutral real rates are more like 1 percent today
- Even with this, fed funds rate is below neutral today



# Estimate of neutral real rate



Source: Holston, Laubach and Williams (2017)

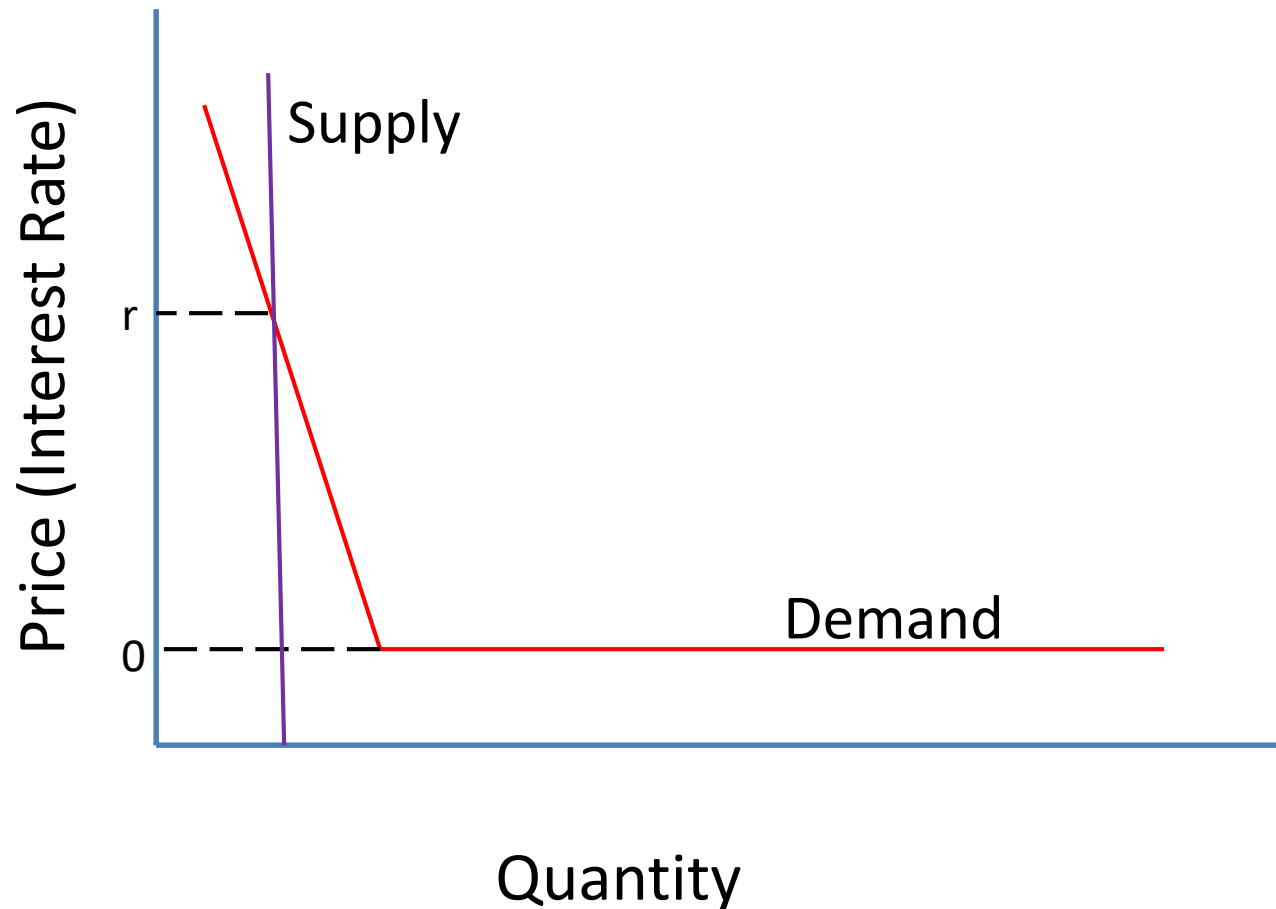
# Forward guidance

- Federal funds rate is a very special short term interest rate
- Fed sets a target for the federal funds rate but other rates are much more important
- Forward guidance means the Fed saying what it is going to do in statement, press conferences, projections...
- Greatly affects one or two-year interest rates

# Fed and Reserves: Old system

- Until 2008, Fed did not pay interest on reserves
- Banks had required reserves based on deposits
- Tried hard to minimize reserves
- NY Fed Desk would add or drain reserves to hit fed funds target
  - Permanent transactions
  - Repos or reverse repos

# Fed and Reserves: Old system



# Interest on reserves

- Zero interest on reserves was legislative constraint
- Fed didn't like it for financial stability and operational reasons
- It also limited the size of the balance sheet if the Fed were to control interest rates
- Finally in October 2008 Congress authorized interest on reserves

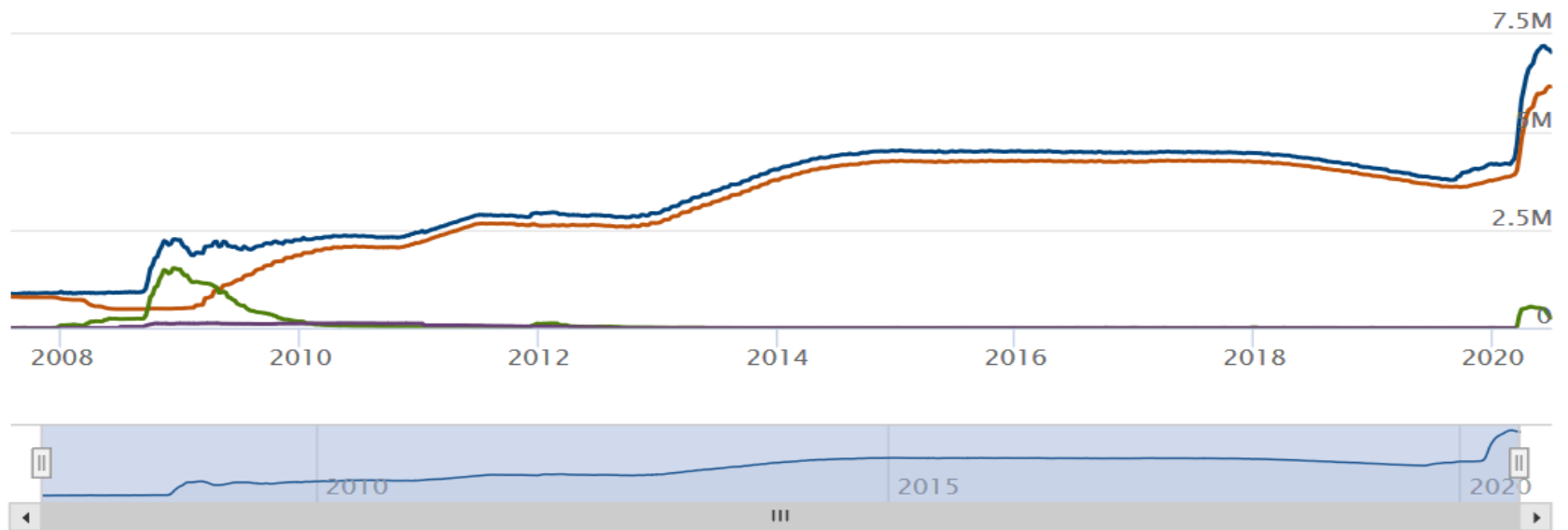
# The Zero Lower Bound

- From 2008 to 2015 and again since this spring, the federal funds rate was stuck at 0-25 basis points
- Rates can go negative, and has been implemented in other countries, but not in the US (except Tbills in the secondary market)
- Fed used other measures to boost the economy
  - Forward guidance
  - Large scale asset purchases

# LSAPs

- Fed bought longer term government bonds and agency mortgage backed securities
- Paid for these with reserves
- Aim was to drive down interest rates, including mortgages
- Di Maggio et al. (2016) argue that purchases of agency MBS track agency mortgage originations closely

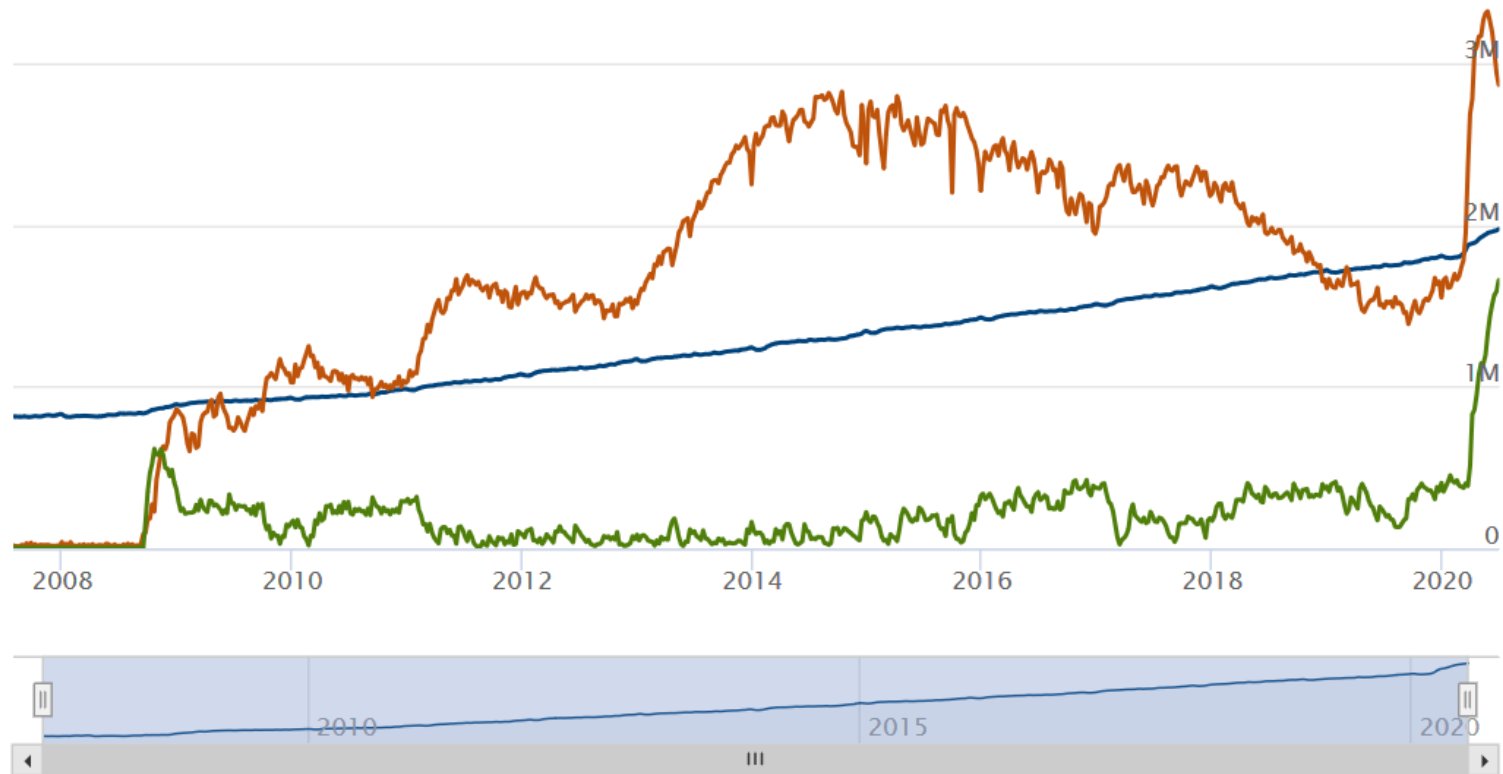
# Federal Reserve Assets



- Total Assets (In millions of dollars)
- Securities Held Outright (In millions of dollars)
- All Liquidity Facilities\* (In millions of dollars)
- Support for Specific Institutions\*\* (In millions of dollars)

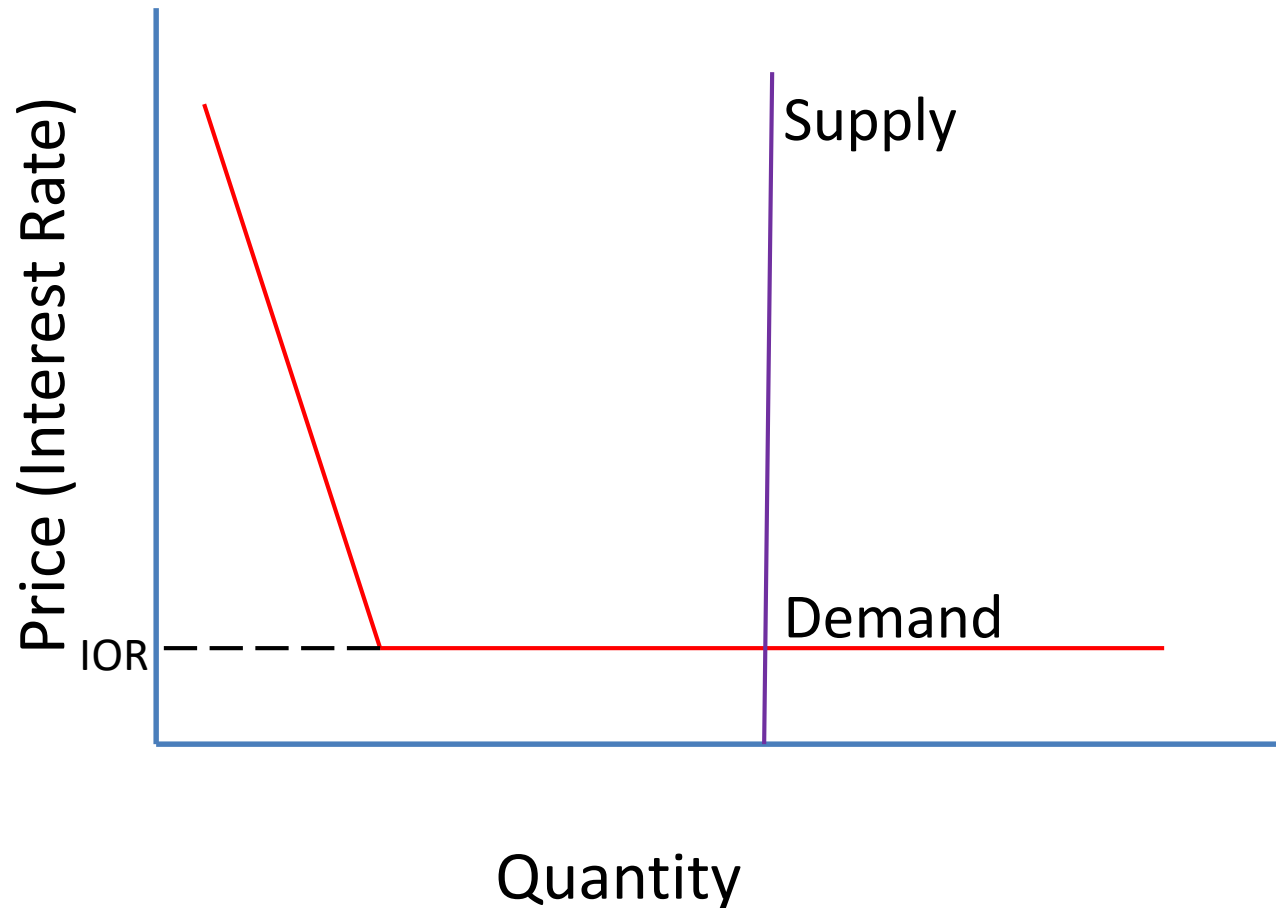


# Federal Reserve Liabilities



- Currency in Circulation (In millions of dollars)
- Deposits of Depository Institutions (In millions of dollars)
- Treasury Balance (In millions of dollars)

# Fed and Reserves: New system

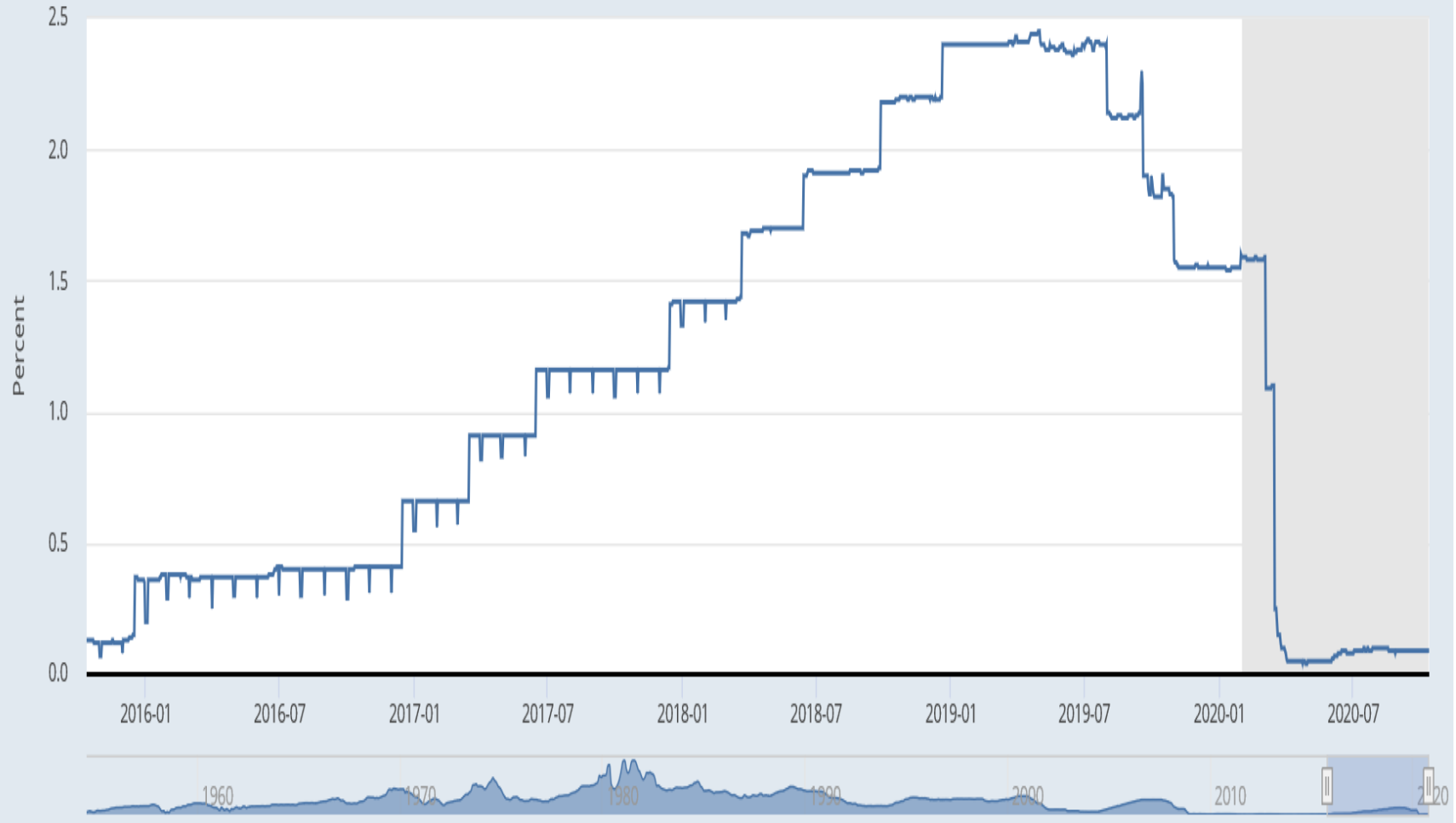


# Fed funds arbitrage

- GSEs cannot receive interest on reserves
- DI can receive interest on reserves
- GSEs lend reserves to banks
- What's the catch?
  - Regulation
  - FDIC Assessment for US banks
- Consequently it is foreign banks who do the fed funds arbitrage

# Window Dressing

FRED  Effective Federal Funds Rate



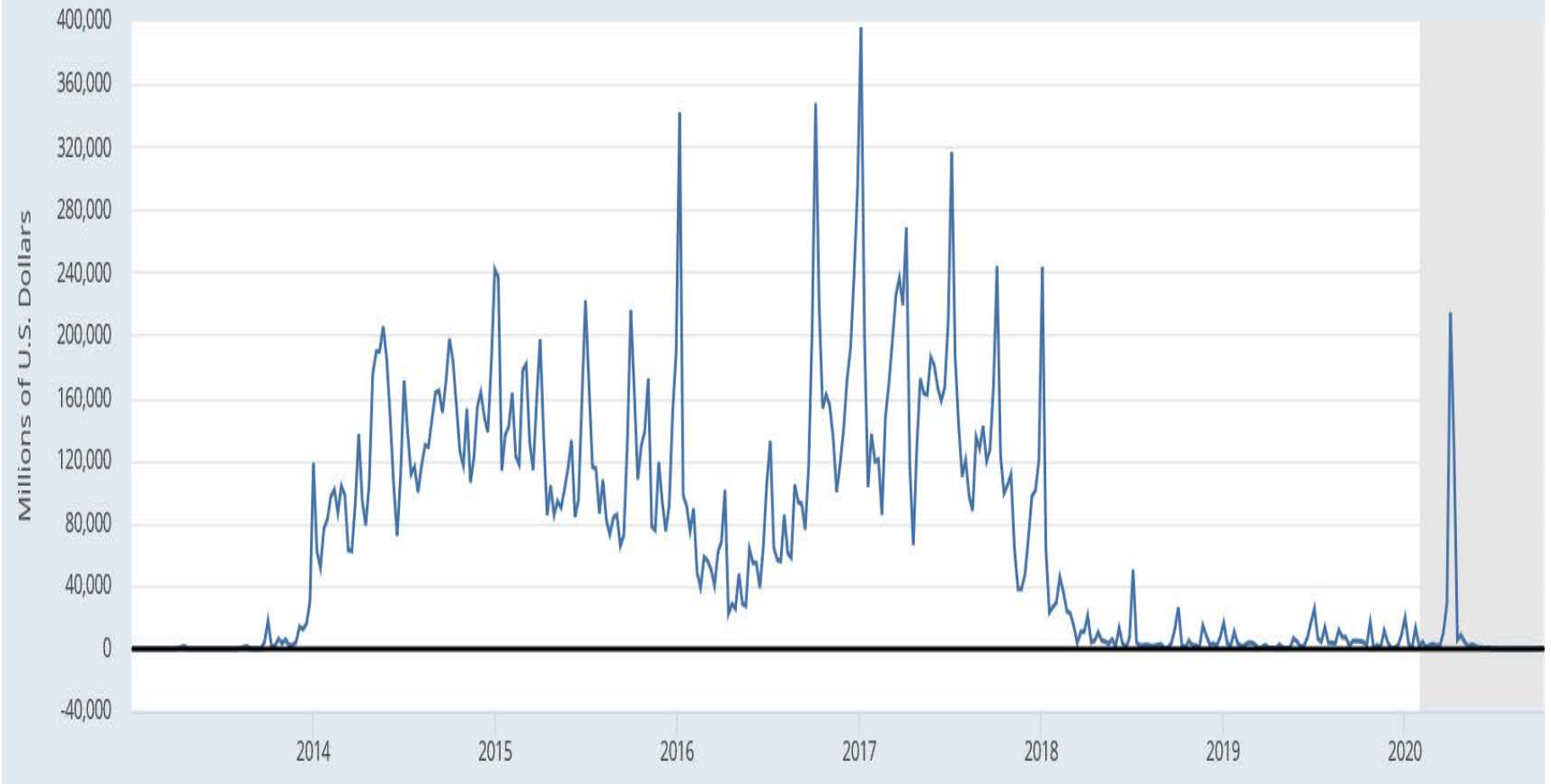
# Reverse Repos

- Broader problem is that the federal funds market is only a small part of short-term money markets
- Fed offers a “reverse repo” facility to money market mutual funds, GSEs and others
- Deposit cash with the Fed and receive collateral from the Fed
- Motivation: control short term interest rates

# Reverse Repos



— Liabilities and Capital: Liabilities: Reverse Repurchase Agreements: Others: Week Average



# Recessions

- Recessions are periods of economic contraction
- Typical rule of thumb is two quarters of falling GDP
- NBER provides “official” dates of recessions

# Last 5 recessions

Date	Cause
1980-1982	Volcker Disinflation (technically two recessions)
1990-1991	S&L crisis
2001	Dot Com Bubble
2007-2009	Housing Bubble
2020-	COVID



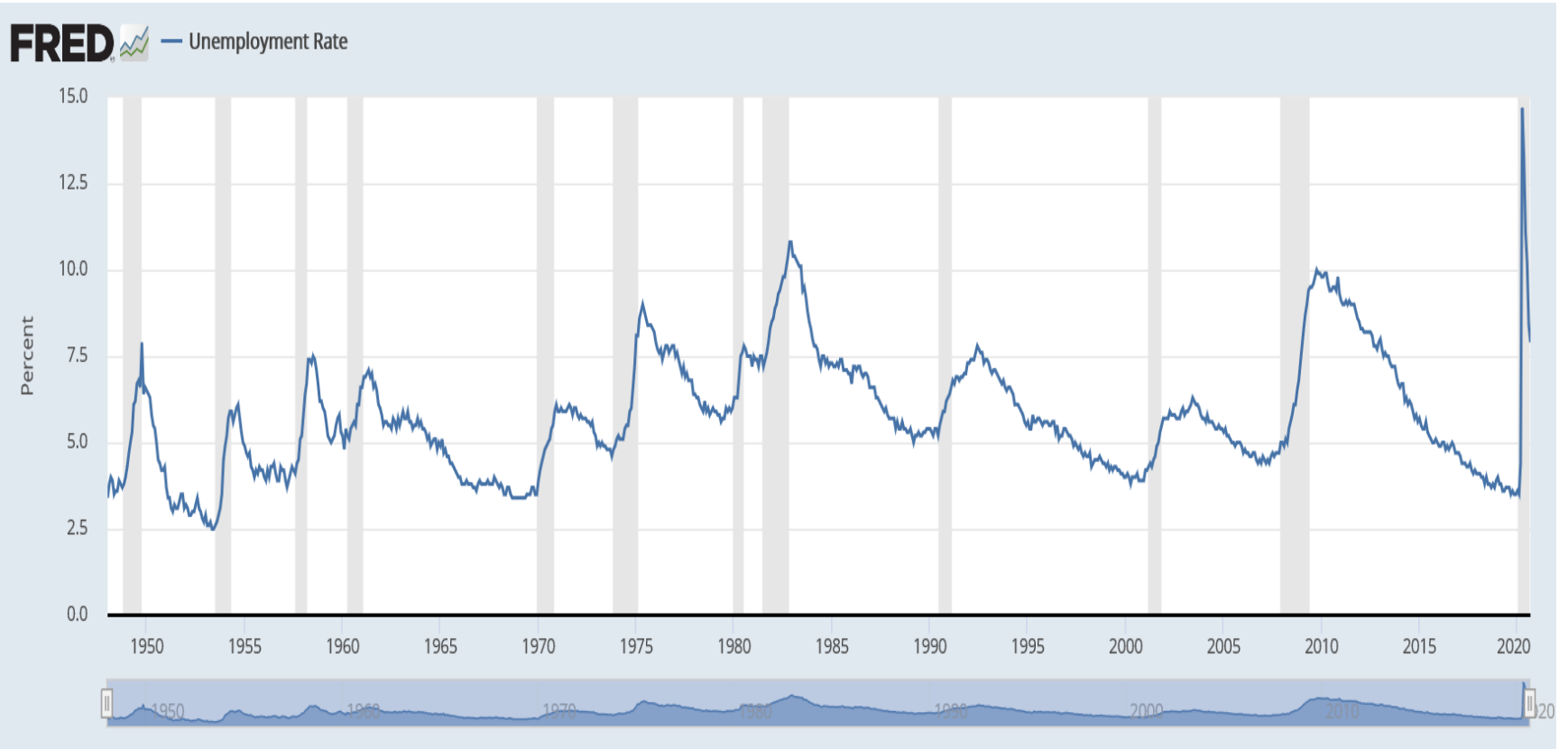
# Recent Recessions

- Last 3 recessions have all been followed by slow and “jobless” recoveries
- Part of the problem: firms and households had borrowed too much and wanted to delever
- State and local government having to cut spending hurt too

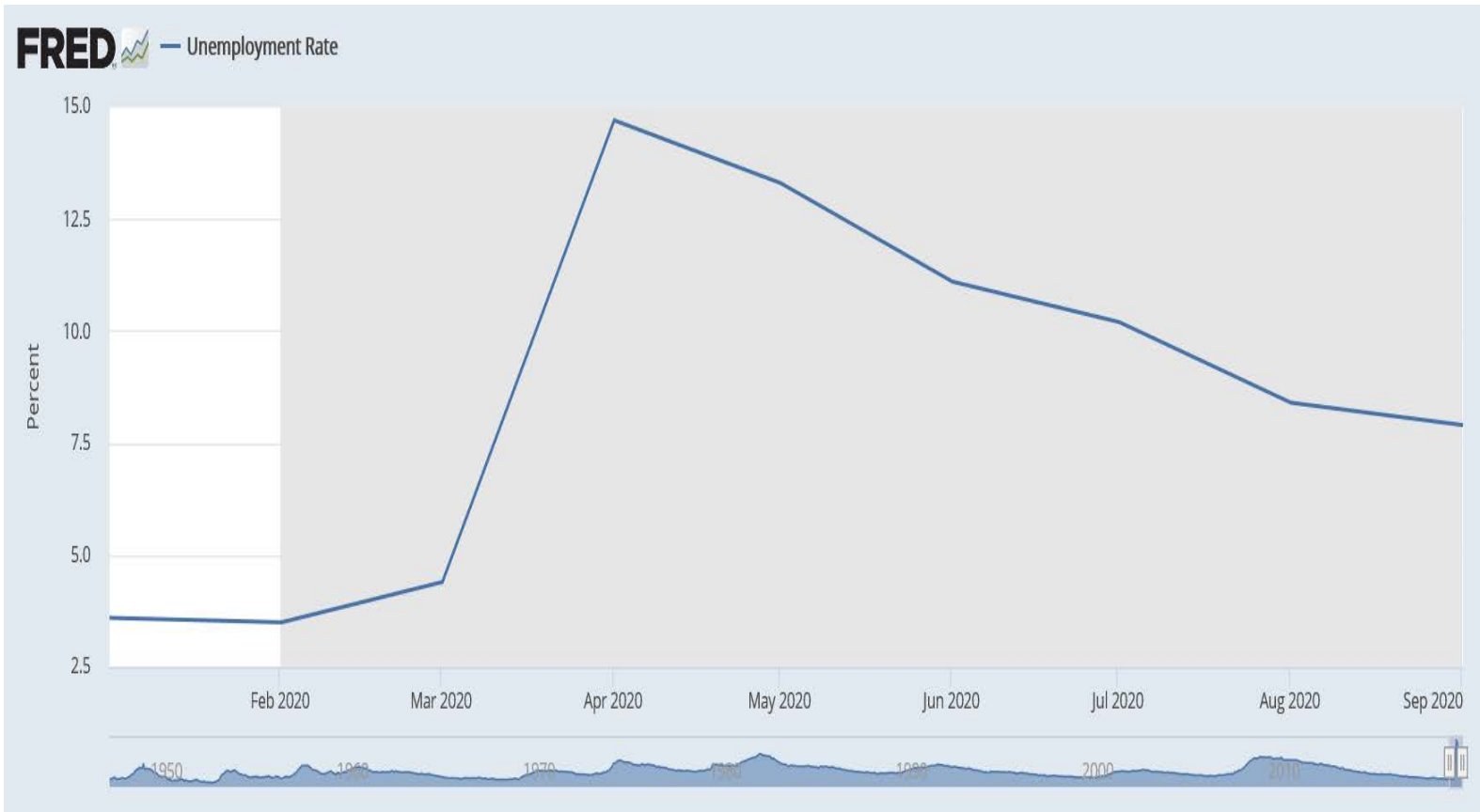
# COVID Recession

- Unlike any other recession
- Initial downturn extraordinarily severe with growth of -33 percent at an annualized rate
- “Swoosh” shaped recession
- Damage likely to be long lasting because small firms have failed and many people have lost their jobs, not just been laid off

# Unemployment rate



# Unemployment rate



# Current monetary policy

- Federal funds rate target is 0-0.25 percent
- Balance sheet is growing fast
- Interest on reserves: 0.1 percent
- Reverse repo rate: 0.0 percent
- Asset purchases
  - Treasuries and mortgage backed securities
- Lending facilities

# Section 13(3) again

- Fed has limited authority
- It can buy Treasuries and agency MBS
- It can lend to depository institutions with good collateral
- Section 13(3) says that it can lend to broad classes of other institutions in unusual and exigent circumstances

# COVID crisis

- 13(3) facilities.
  - Unprecedented in scope
  - State and local government, corporate bonds, bond ETFs
  - Main street lending program and Paycheck protection program (small firms)
  - Treasury takes first loss
  - But not stocks
- Forward guidance.
  - Say that there will be no liftoff until labor market is healed AND inflation is over 2 percent
- Unlimited Treasury and MBS purchases.
  - Motivation started as market functioning but morphed into macro support

# COVID crisis

- Fed encouraged banks to use capital and liquidity buffers
- Deferred payments and extended debt maturity would not incur a capital charge



# COVID crisis

- Unlike the 2008 financial crisis, COVID was not caused by foolish behavior of financial institutions
- Doesn't remove moral hazard problems, but makes them less central

# COVID crisis

- Lending programs haven't had big takeup

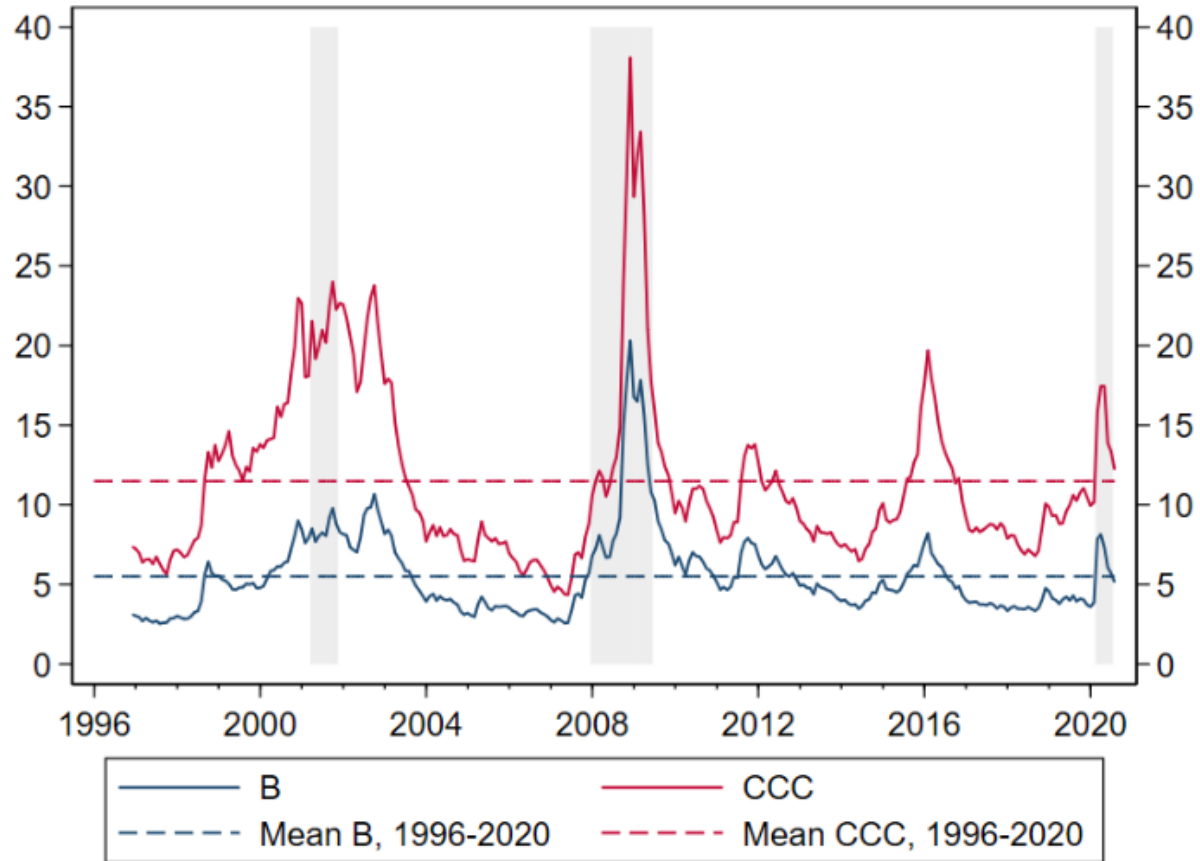
**Table 1. Capacity and Take-up for the U.S. Government's Business Credit Programs**

This table reports the lending capacity and take-up as of September 2, 2020 for the U.S. Government's business credit programs. Data are from the Federal Reserve's H.4.1 Release and the Small Business Administration.

Program	Total Capacity (\$ billion)	Utilization (\$ billion)
PMCCF and SMCCF	750	12.8
... of which is PMCCF		0.0
... of which is SMCCF		12.8
Main Street Loan Program	600	1.2
Paycheck Protection Program	659	525

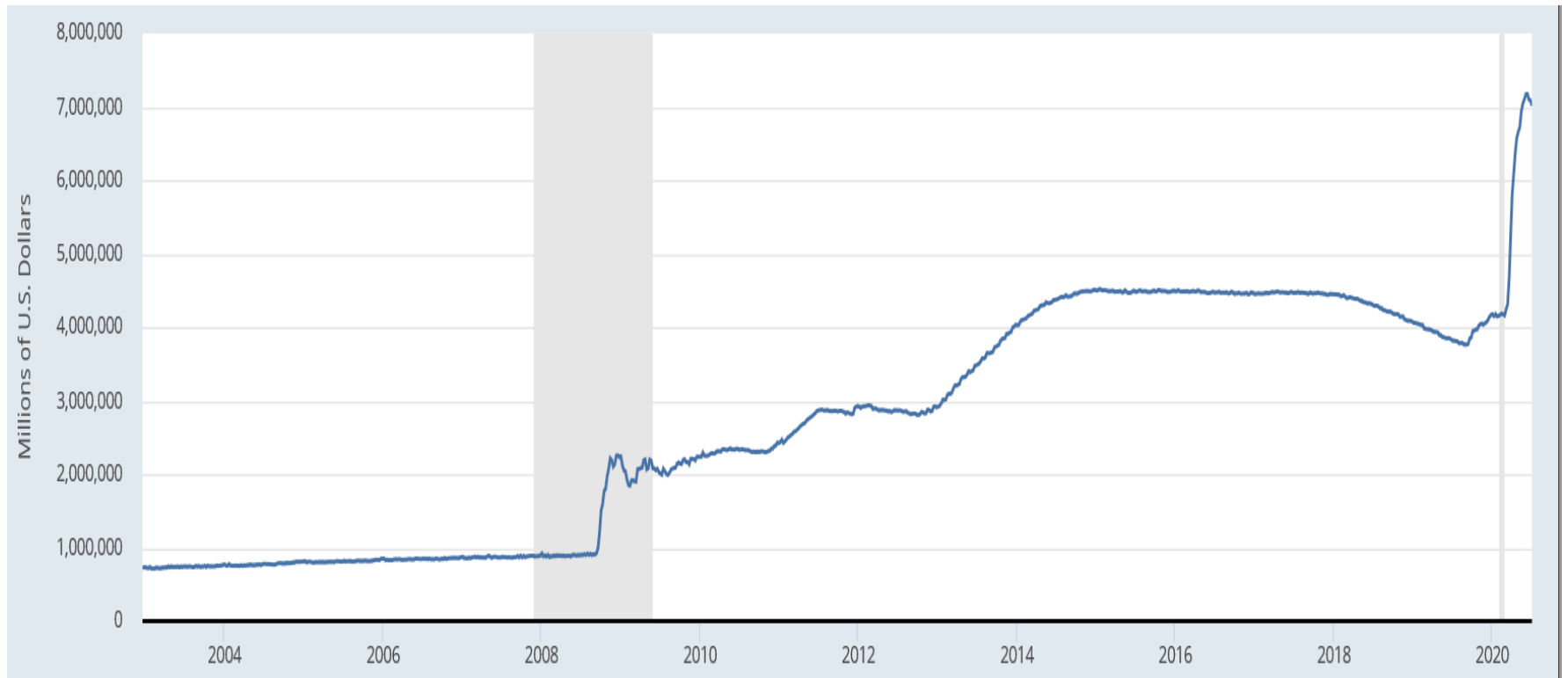
Source: Hansen et al. (2020; Brookings Papers on Economic Activity)

# Corporate spreads are not that high



Source: Liang (2020; Brookings Papers on Economic Activity)

# Federal Reserve Balance Sheet



Source: FRED

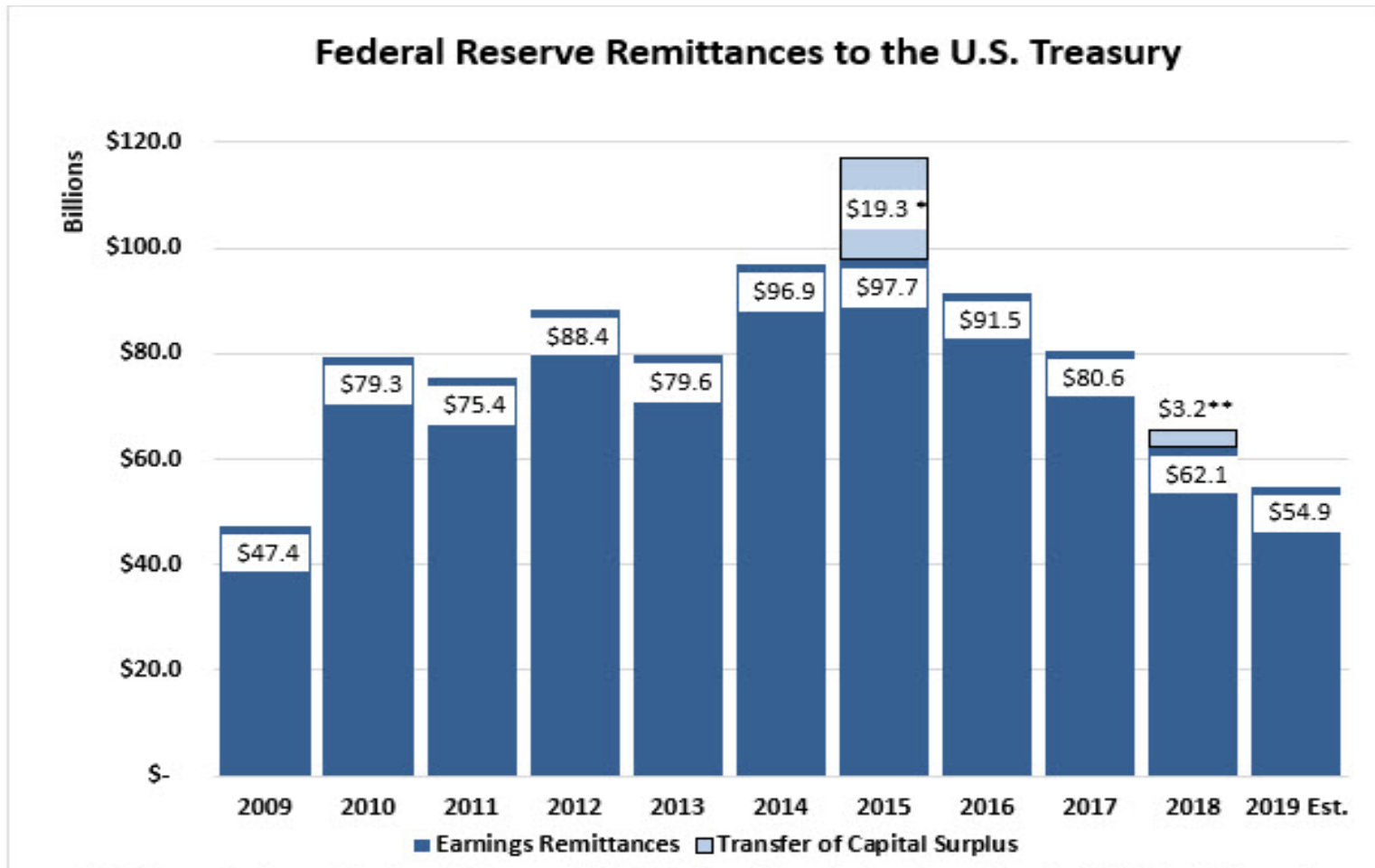
# Fed balance sheet: October 8 2020

Assets		Liabilities	
Treasuries	\$4.45t	Currency	\$2.03t
MBS	\$1.98t	Reserves	\$2.84t
Paycheck Protection	\$67b	Treasury Account	\$1.87t
Corporate Credit	\$45b		
Municipal Liquidity	\$17b		
Main Street Lending	\$39b		
etc		etc.	
TOTAL	\$7.1t		

# Fiscal policy

- Monetary policy cannot do much more
- There was already a large fiscal stimulus in spring
- Another may be coming
  - State and local government
  - Extensions of unemployment insurance
  - Aid to specific industries

# Seigniorage



# Modern Monetary Theory

- Conventional economic view is that inflation should be controlled by monetary policy
- Logic of separating interest rate policy from politics
- Mainstream idea: debt financed increase in spending where the debt is bought by the central bank can support economy in a recession and create inflation
- MMT: Keep interest rates and 0 and use fiscal policy to set inflation



# Negative interest rates

- An idea used in many other countries
- Hard to get interest rates below about -40 bps
- Some have gone as low as -75 bps
- Damage to financial system
- European Central Bank is trying funding for lending at negative rates

# Worries....Financial Stability

- Some would argue that stimulative policy causes risks to financial stability
- Banks are being encouraged to lend
- Stocks are already very expensive

# Fed Framework Review

- Fed recently finished a review of its framework
- Main changes
  - 2 percent inflation target is now average over a few years
  - Concerned about *shortfalls* of employment not *deviations* of employment
  - Broad measures of the labor market

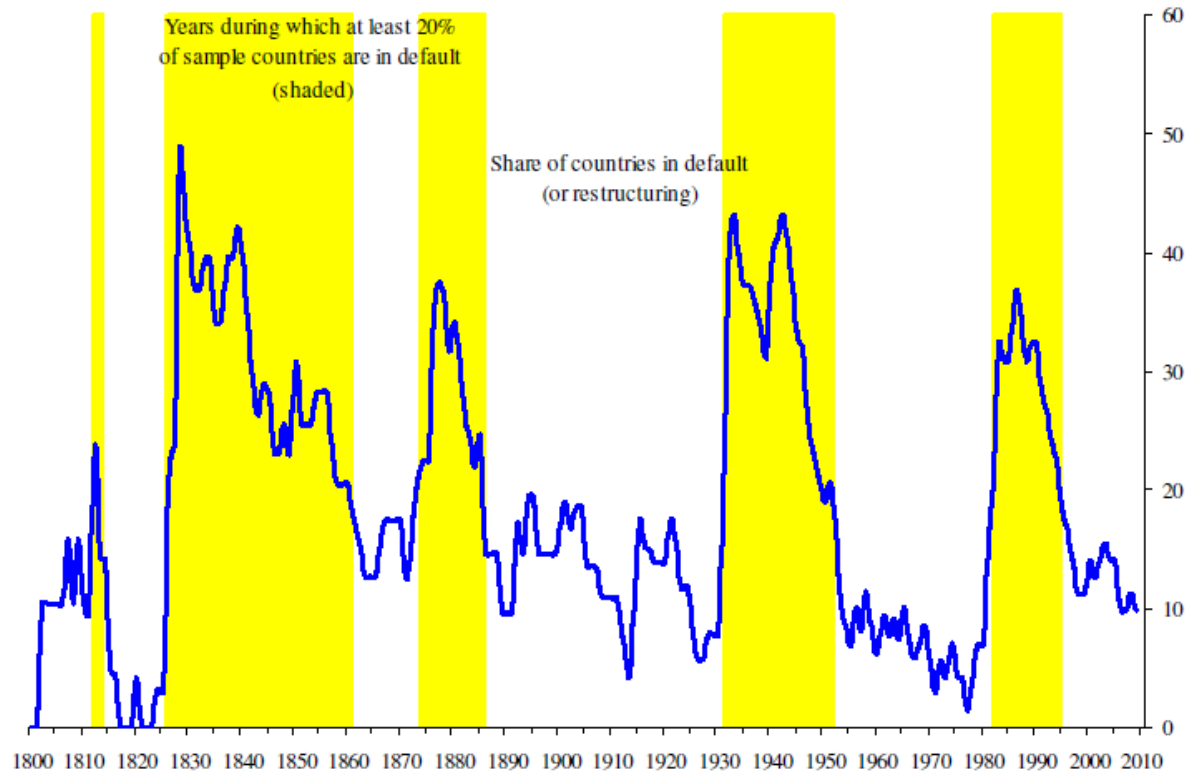
# Worries...Looking to CB for too much

- CBs can solve problems quickly but board is not elected
- CB lending and asset purchase programs can start to get close to “picking winners”
  - Traditionally like think of central banks as neutral as regards different industries
- Fed corporate credit program had broad terms and included tobacco
- ECB is buying “green bonds”

# Types of crises

- Currency crises
- Banking crises
  - Savings and Loan crisis
- Sovereign debt crises
- Financial crises generally have an element of at least one of these, often more than one
- Crises are “universal”...happen in all countries over all periods
- IMF often lends to countries in crisis

# Reinhart and Rogoff: “This time is different”



# Predicting Currency Crises

- Currency crisis is a sharp devaluation, mostly in developing countries
- Early warning indicators:
  - Current account deficit (>4 percent ?)
  - Budget deficit
  - Low reserves
  - Large capital inflows
  - High credit/GDP

# Emerging market crises

- Developing countries typically have to borrow in foreign currency (though this is changing)
- That makes them vulnerable to foreign currency appreciation
- Increases in US interest rates driving dollar up have been a trigger for many developing country crises
- “Original sin” is idea that developing countries must borrow in \$ which makes them more prone to crises which makes them need to borrow in \$.



# Sovereign defaults

- Cost is reputational/access to capital markets
- Sovereign defaults are much more common with foreign currency debt than local currency debt
- Local currency debt ratings are typically higher than foreign currency
- Foreign currency defaults: Argentina, Greece....
- Example of local currency default: Russia (1998)
- No rich country has defaulted in local fiat currency that I know of
- Also loans to IMF are effectively top of the pecking order

# Latin American Crisis of the 1980s

- Rising US interest rates and appreciating dollar
- Argentina, Brazil, Mexico borrowed in dollars
- Borrowing costs unsustainable, and exacerbated by global recession
- Led to default

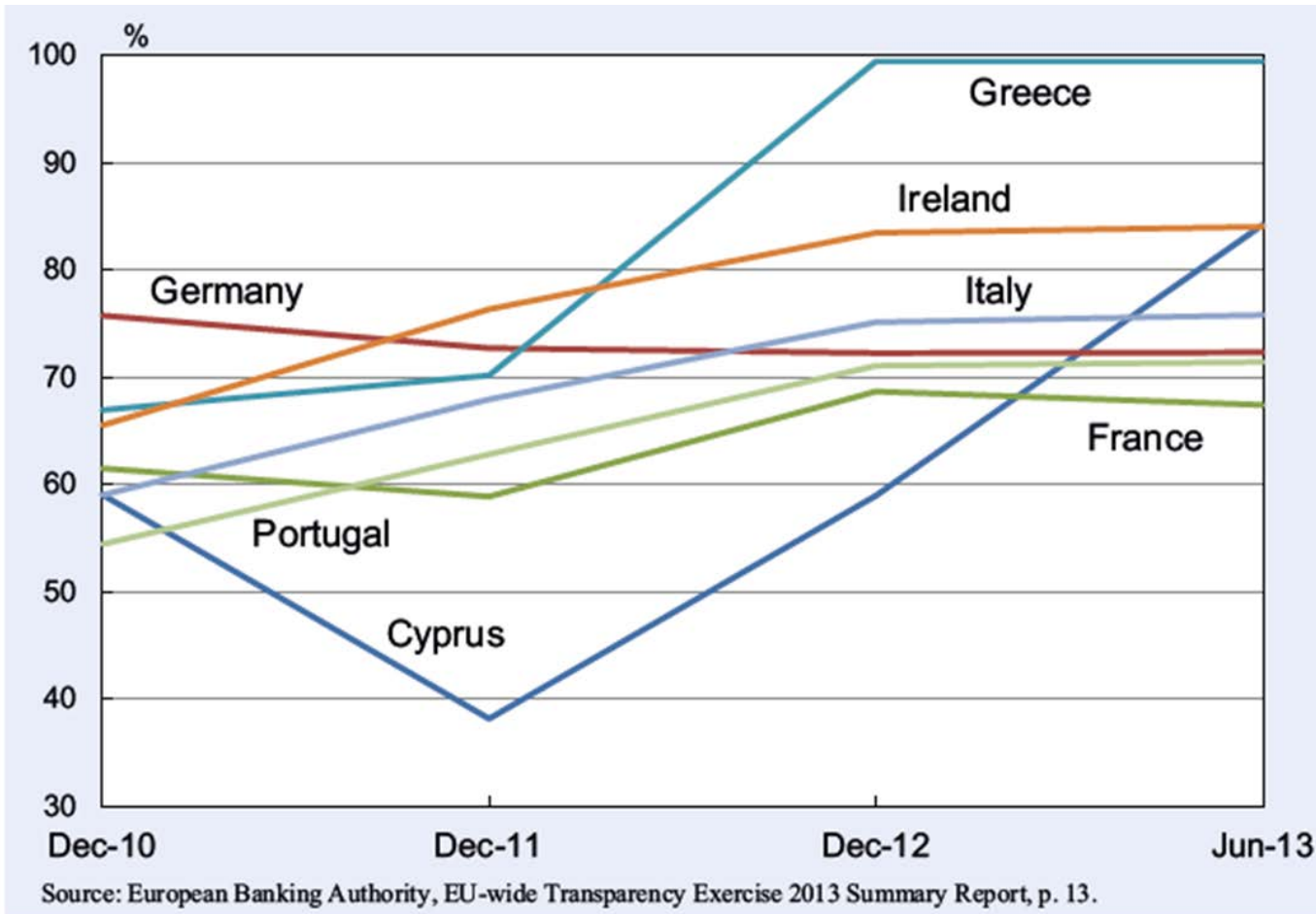
# Tequila crisis

- Low interest rates in the US led to search for higher yielding assets abroad
- Mexico had a big current account deficit
- After rates went up in 1994, capital flowed out of emerging markets.
- Mexican peso fell sharply
- Led to collapse of Mexican banks

# European debt crisis

- Southern Europe economically weak and low productivity growth
- Greece defaulted
- Spreads on sovereign debt of Italy, Spain, Portugal and Ireland shot up
- “Doom loop” between banks and sovereign debt

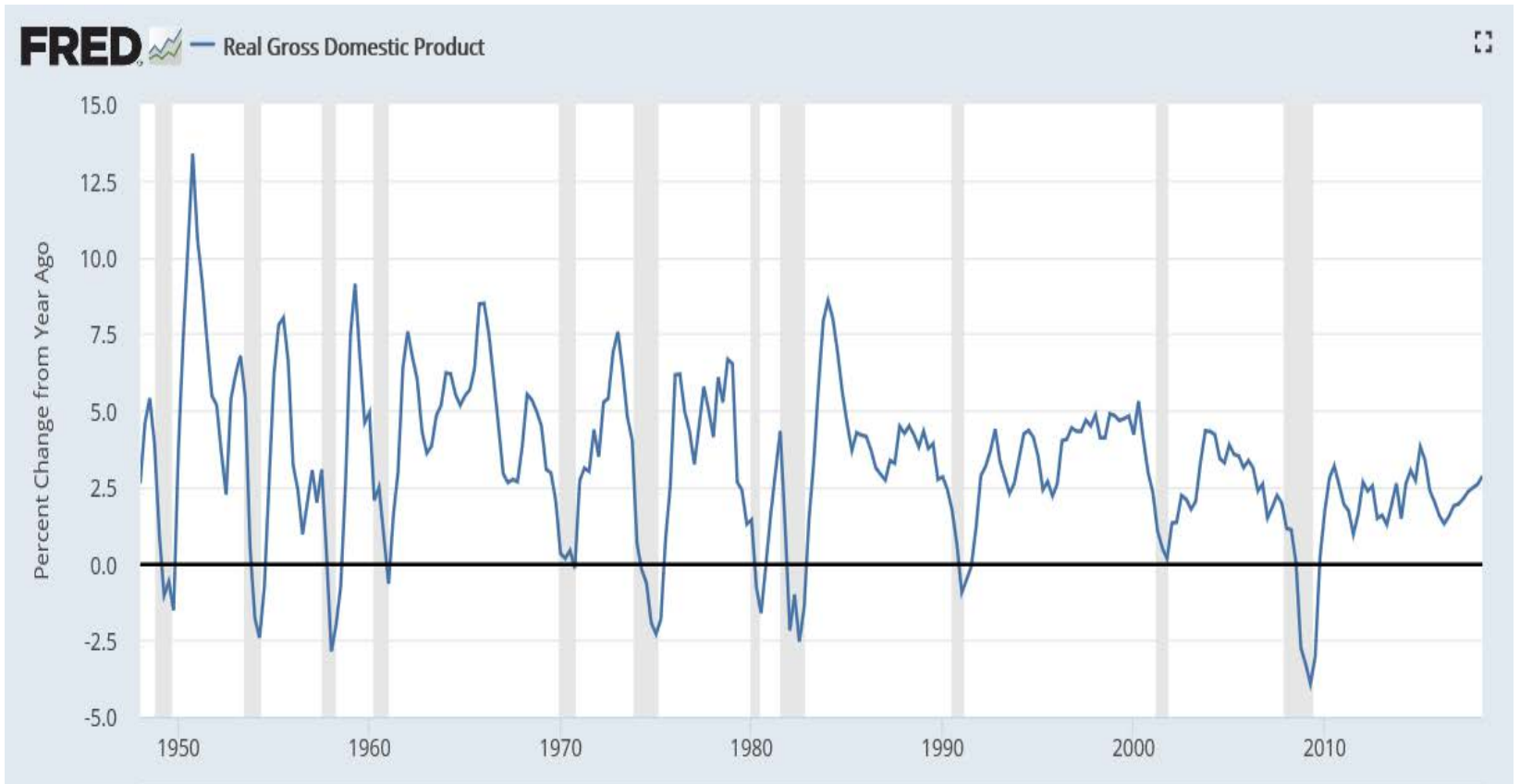
# European debt crisis: share of debt held by domestic banks



# Financial Crisis of 2008

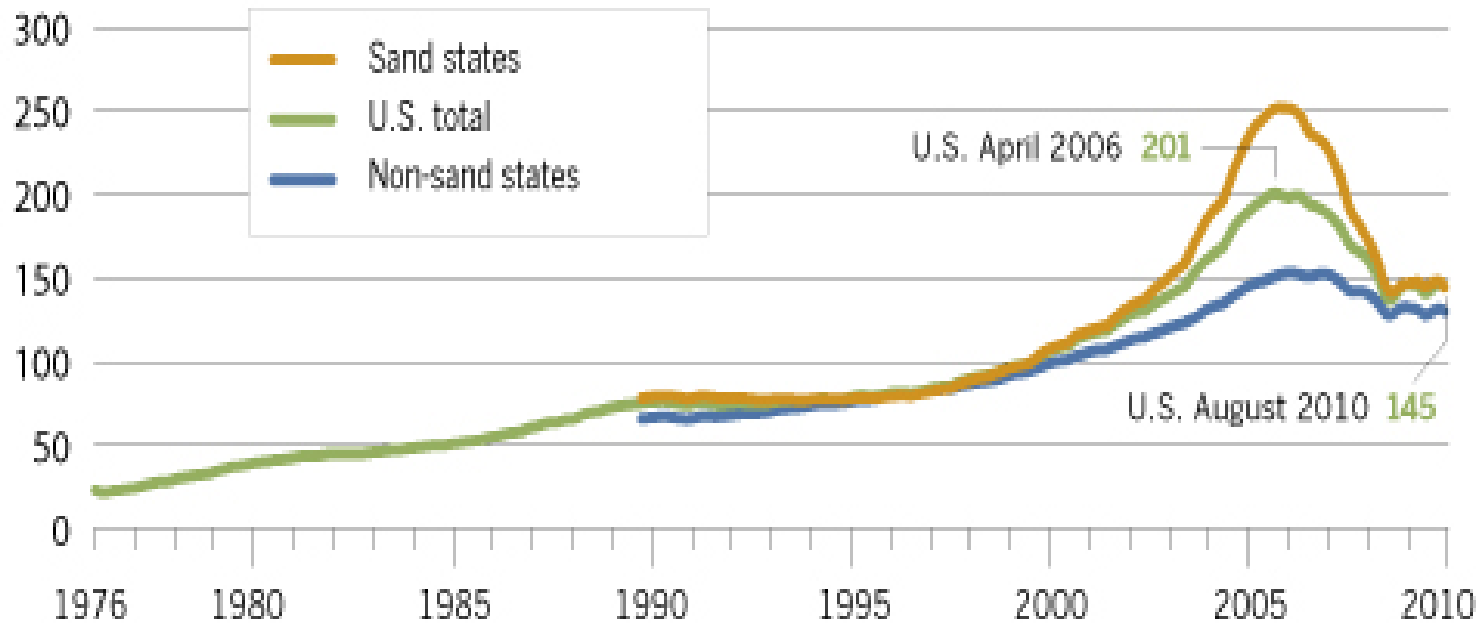
- Some antecedents of the Crisis:
  - “The Great Moderation”: a time in which the U.S. had a stable economy with low interest rates and a tame business cycle with only mild recessions
  - Historic boom in housing market
  - Build up of leverage. In 2004, SEC removed a rule limiting leverage of the biggest investment banks to 15.
  - LTCM and the “Greenspan put”
  - Agency problems and lax regulation
  - Changes in housing finance and the banking industry

# Great moderation



# US Home Prices

INDEX VALUE: JANUARY 2000 = 100



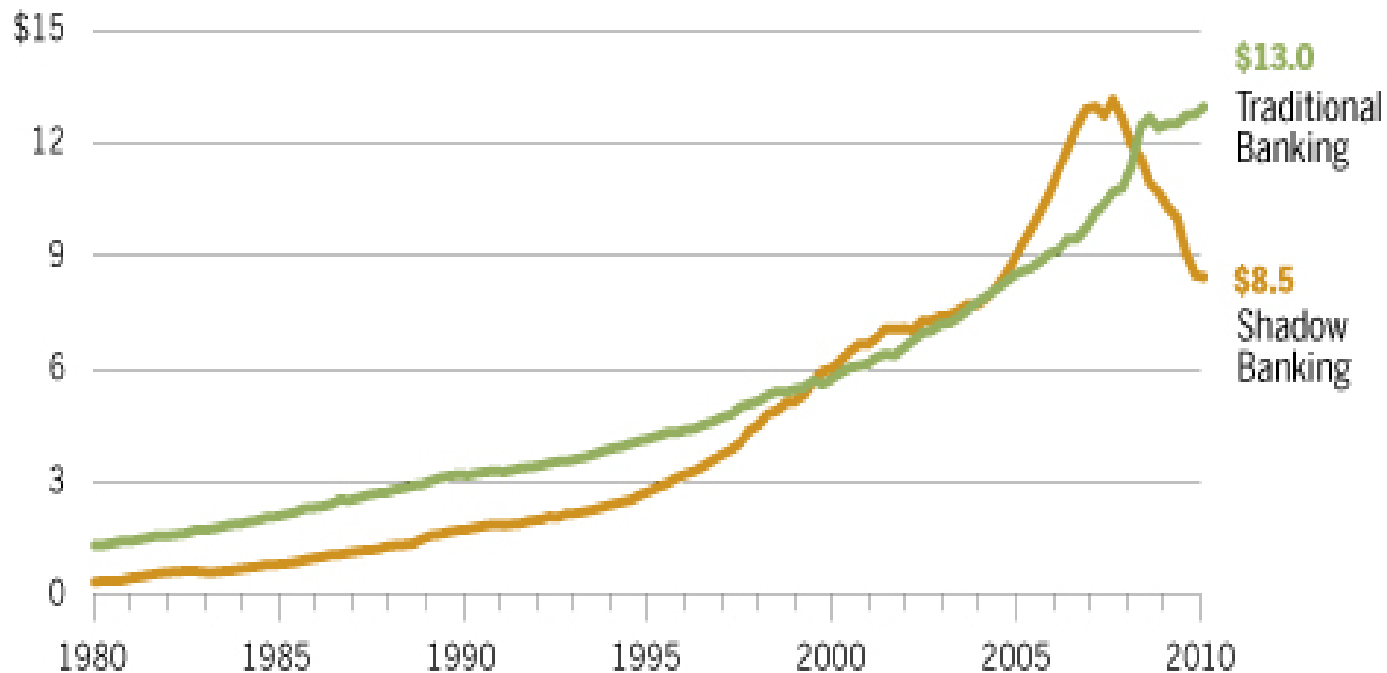
NOTE: Sand states are Arizona, California, Florida, and Nevada.

SOURCE: CoreLogic and U.S. Census Bureau: 2007 American Community Survey, FCIC calculations



# Traditional and shadow banking systems

IN TRILLIONS OF DOLLARS



NOTE: Shadow banking funding includes commercial paper and other short-term borrowing (bankers acceptances), repo, net securities loaned, liabilities of asset-backed securities issuers, and money market mutual fund assets.

SOURCE: Federal Reserve Flow of Funds Report

# Leverage of banks

- Until 1999 Glass-Steagall Act separated
  - Commercial banks (depository institutions)
  - Investment banks
- Separation ended by Gramm Leach Bliley Act
- In 2008 typical leverage ratios were
  - Commercial banks: 10 to 1
  - Investment banks: 30 to 1

# Universal Bank Activities

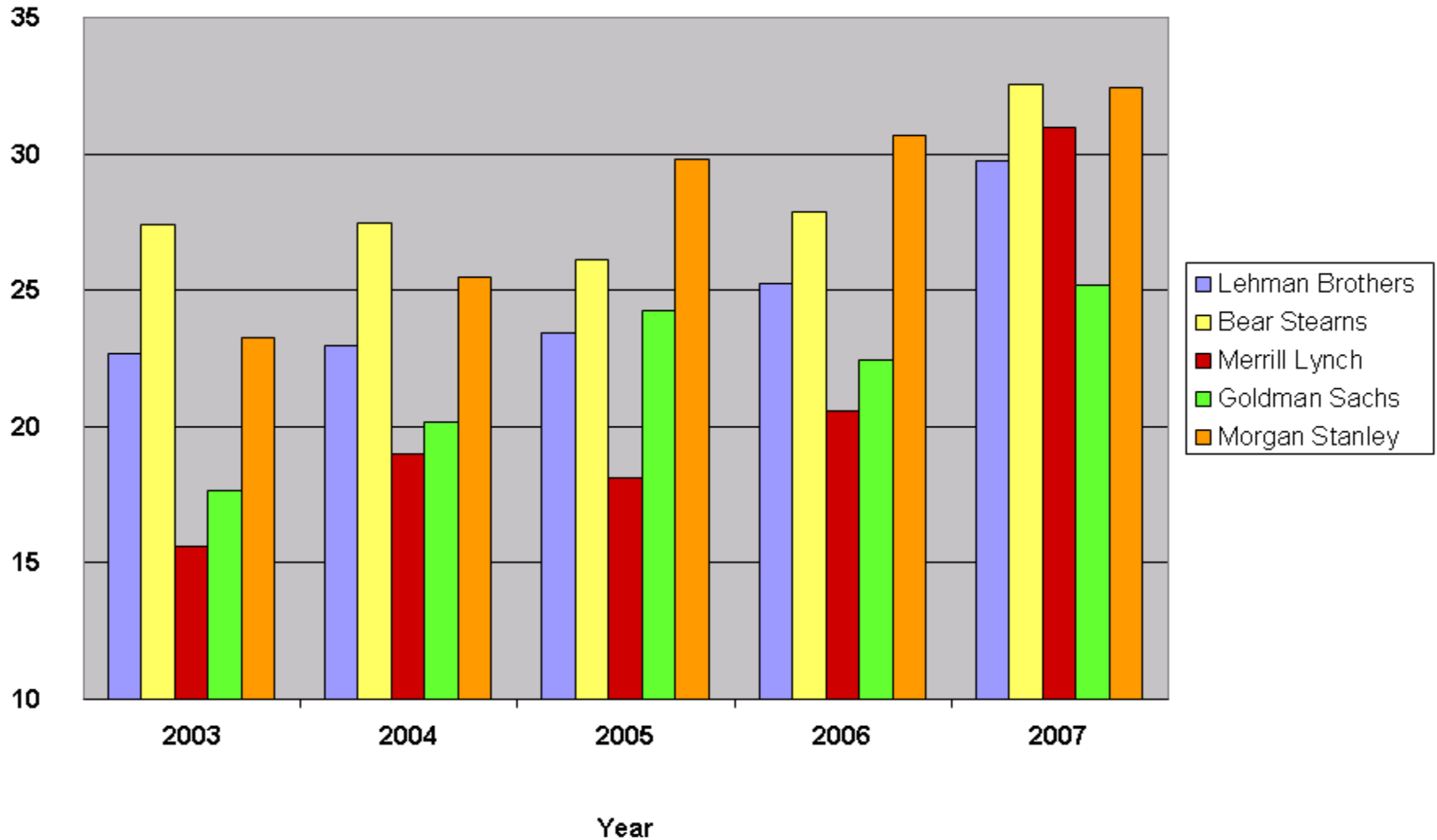
## Investment Banking

- Underwrite new stock and bond issues
- Sell newly issued securities to public in the primary market
- Investors trade previously issued securities among themselves in the secondary markets

## Commercial Banking

- Take deposits and make loans

# Leverage of major Investment banks



# Mortgage Derivatives

- Collateralized debt obligations (CDOs)
  - Mortgage pool divided into slices or tranches to concentrate default risk
  - Senior tranches: Lower risk, highest rating
  - Junior tranches: High risk, low or junk rating

# Correlation and Mortgage Derivatives

- The extent of correlation among defaults affects the riskiness of different tranches in a CMO (CDO).
- With low correlation, senior tranches really are risk free
- With perfect correlation, tranching accomplishes nothing
- Correlation was underestimated.

# Correlation and CDOs Example

- Consider a CDO made up of three zero-coupon bonds, each with a face value of \$100. Each bond has a default probability of 10 percent, and there is no recovery following default. The most senior tranche of this bond has a face value of \$100.
  - (a) If defaults on the bonds are independent of each other, what is the default probability for the most senior tranche of the CDO?
  - (b) If defaults are perfectly correlated (i.e. either all bonds default or none do), what is the default probability for the most senior tranche of the CDO?

# Mortgage Derivatives

- Problems:
  - Underwriting standards were grossly inadequate
  - Ratings were wrong. Risk was much higher than anticipated, even for the senior tranches
  - Principal-agent problems
  - Correlations were higher than expected

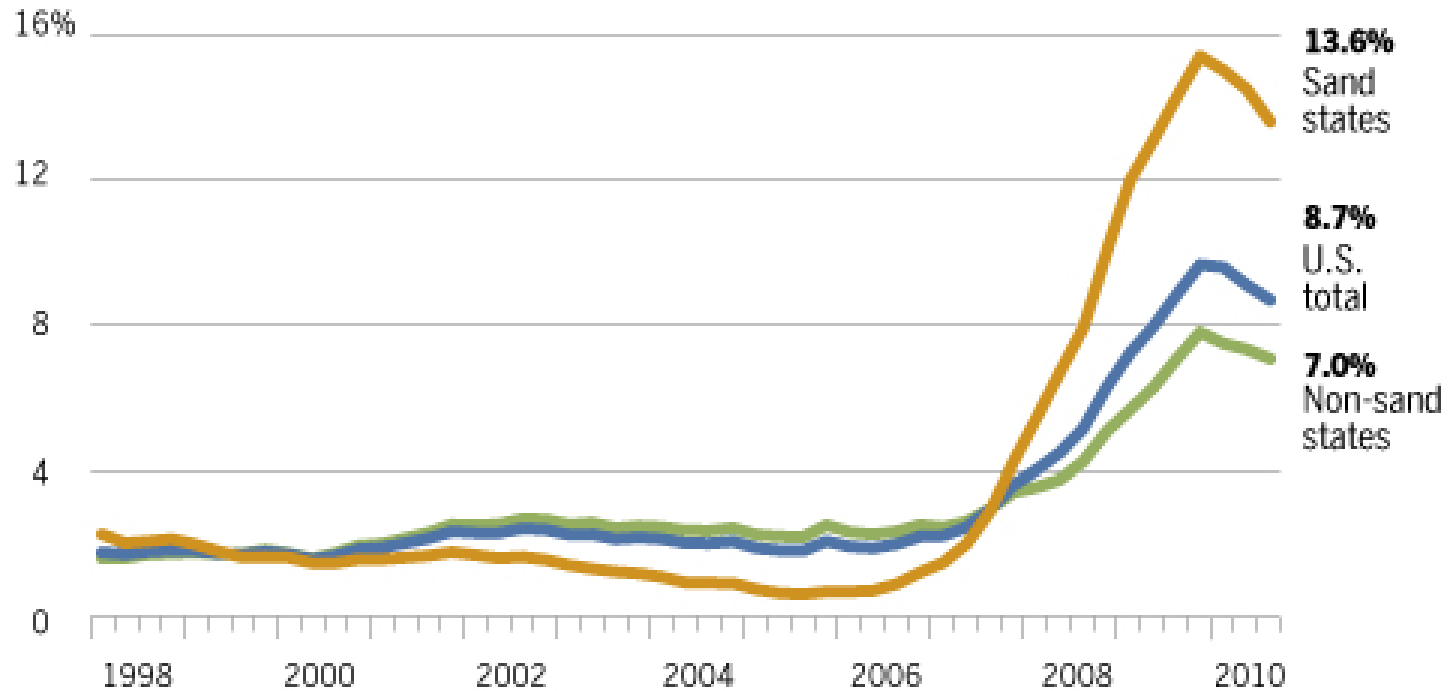


# Why was Credit Risk Underestimated?

- No one expected the entire housing market to collapse all at once
- Geographic diversification did not reduce risk as much as anticipated
- Agency problems with originators and rating agencies

# Mortgage Delinquencies by Region

IN PERCENT, BY REGION

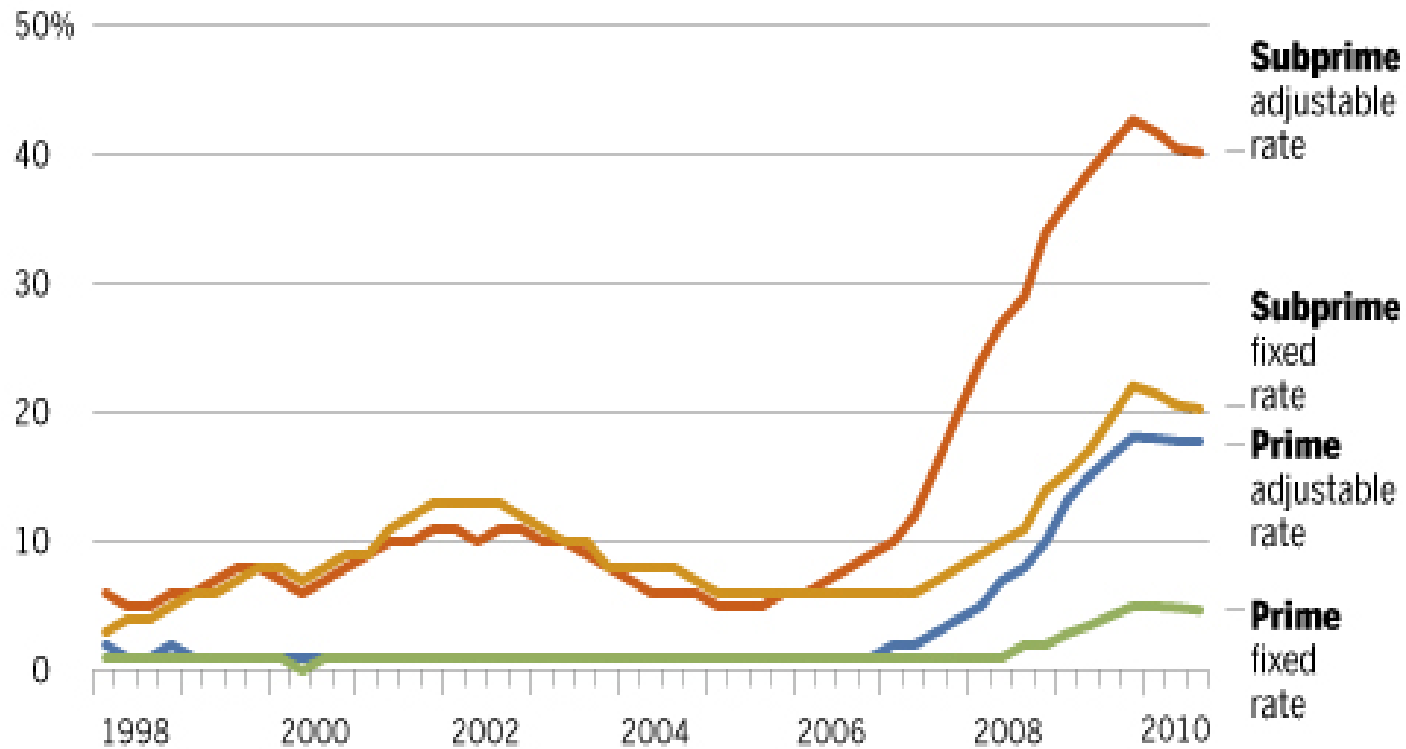


NOTE: Serious delinquencies include mortgages 90 days or more past due and those in foreclosure.

SOURCE: Mortgage Bankers Association National Delinquency Survey

# Mortgage Delinquencies by Loan Type

IN PERCENT, BY TYPE



NOTE: Serious delinquencies include mortgages 90 days or more past due and those in foreclosure.

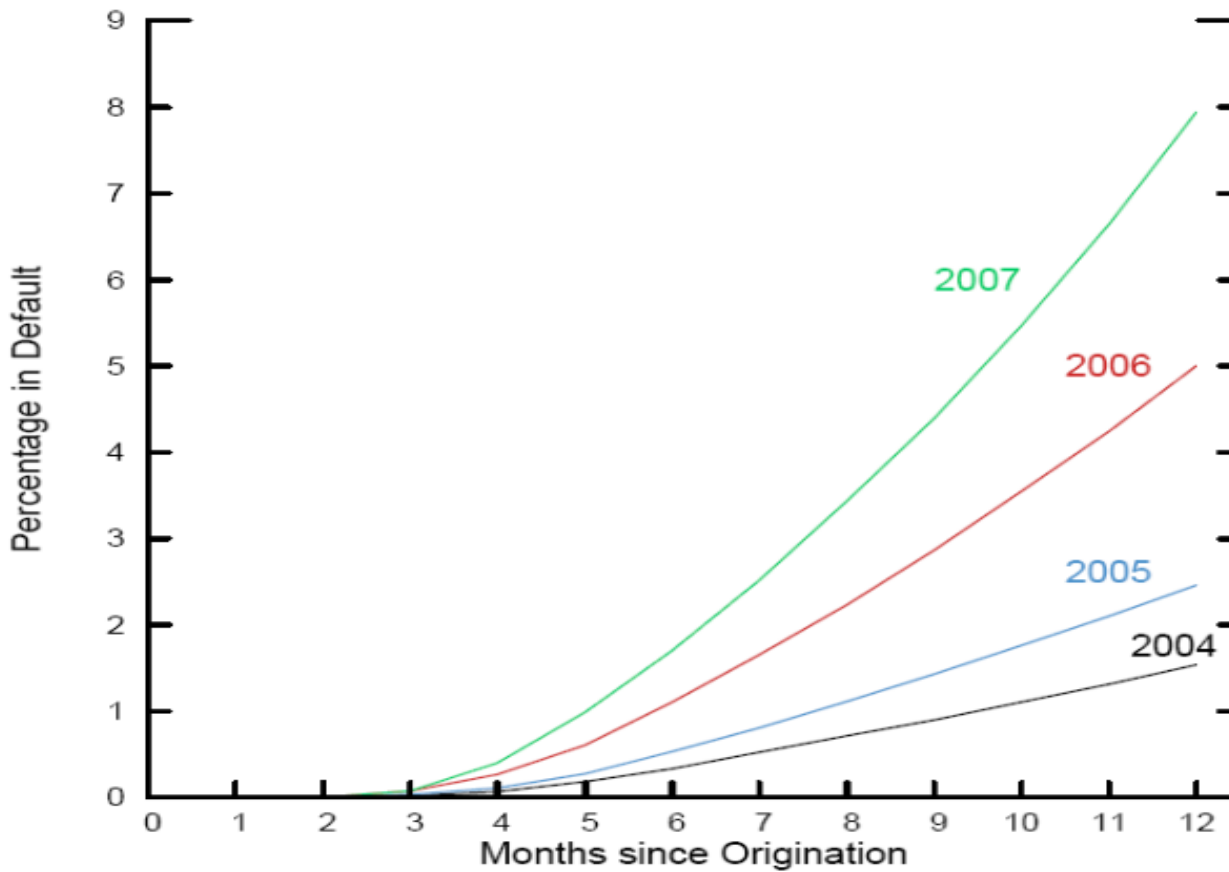
SOURCE: Mortgage Bankers Association National Delinquency Survey

# Adjustable rate mortgages

- Was common to have mortgages with a low rate for the first 3 years and then a floating rate
- If house prices are rising fast, then homeowner can borrow more than they can afford in the long run and sell the house when the rate resets

# Early Payment Defaults on Subprime Loans

## Early Payment Defaults on Subprime Loans



Source: Mayer, Pence and Sherlund (2009)

# How the MBS machine got so crazy

- In 2005, demand for equity tranches started to slow
- But demand for senior tranches was still strong
- Price of senior tranches was high; equity tranches became cheap
- Hedge funds began to **short** senior tranches and go **long** equity tranches (Magnetar)
- Created further demand for equity tranches

# CDOs of CDO

- Equity tranches of CDOs were in turn repackaged into CDOs
- Senior tranches of these were rated AAA

# Credit Default Swaps

- Operate as insurance on a bond, or mortgage backed security or CDO
- More details later
- By 2007, about \$50 trillion of notional underlying
- Was an unregulated market
- Companies that sold credit protection, including AIG, faced catastrophic losses



# The Shoe Drops

- 2000-2006: Sharp increase in housing prices caused many investors to believe that continually rising home prices would bail out poorly performing loans
- 2004: Interest rates began rising
- 2006: Home prices peaked

# The Shoe Drops

- 2007: Housing defaults and losses on mortgage-backed securities surged
- 2007: Bear Stearns announces trouble at its subprime mortgage-related hedge funds

# The Shoe Drops

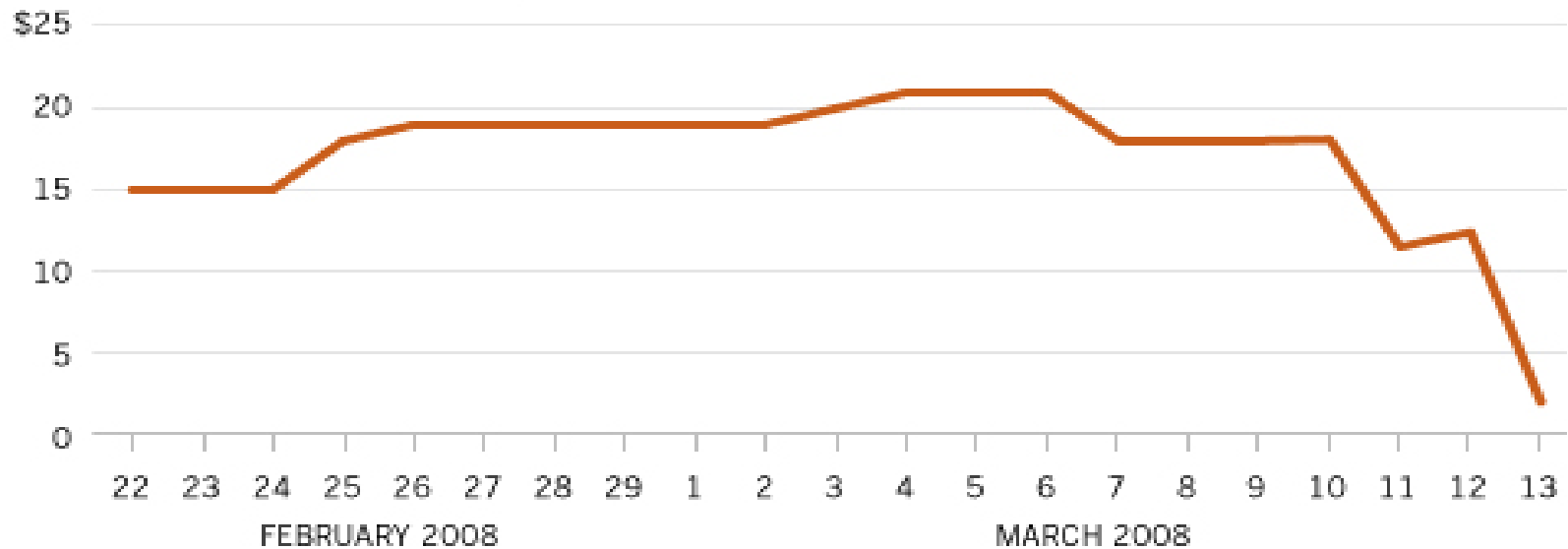
- March 2008: Bear Stearns taken over by JP Morgan with financing provided by the Fed
- September 2008: Fannie Mae and Freddie Mac taken into conservatorship
- September 2008: Lehman Brothers files for bankruptcy
- Money market mutual funds break down
- Commercial paper cannot be sold
- Merrill Lynch taken over by Bank of America
- AIG receives emergency funding
- TARP

# Run on Bear Stearns

## Bear Stearns Liquidity

*In the four days before Bear Stearns collapsed, the company's liquidity dropped by \$16 billion.*

IN BILLIONS OF DOLLARS, DAILY



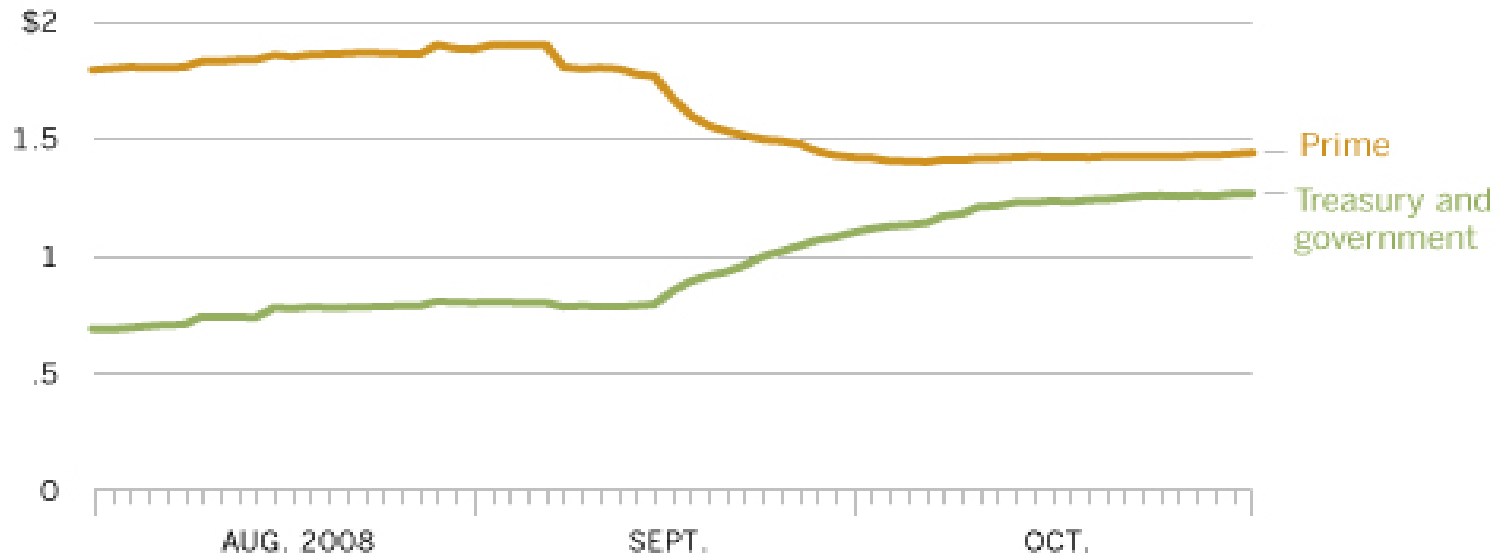
SOURCE: Securities and Exchange Commission

# Run on Prime MMMFs

## Investments in Money Market Funds

*In a flight to safety, investors shifted from prime money market funds to money market funds investing in Treasury and agency securities.*

IN TRILLIONS OF DOLLARS, DAILY

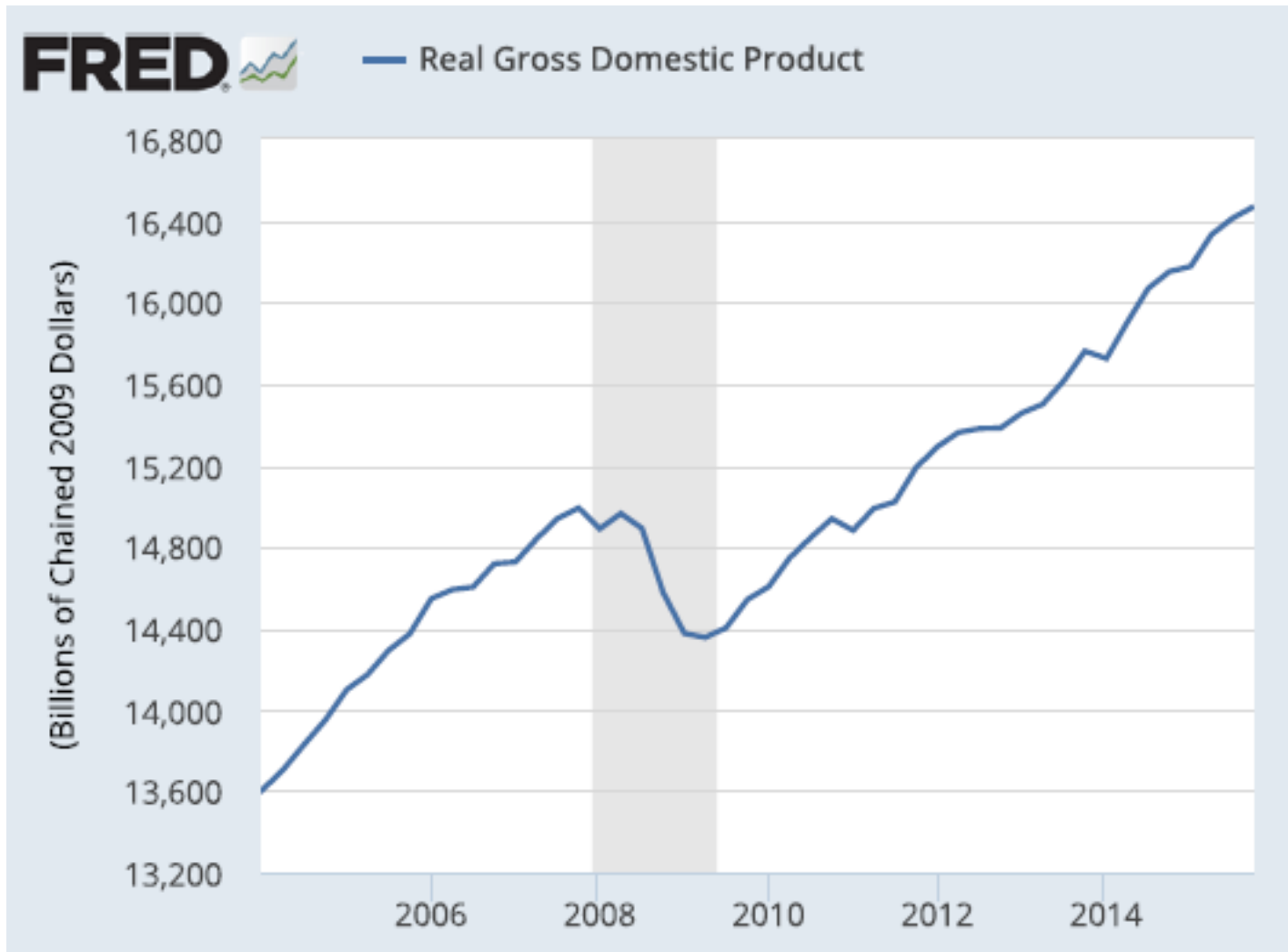


SOURCE: Crane Data

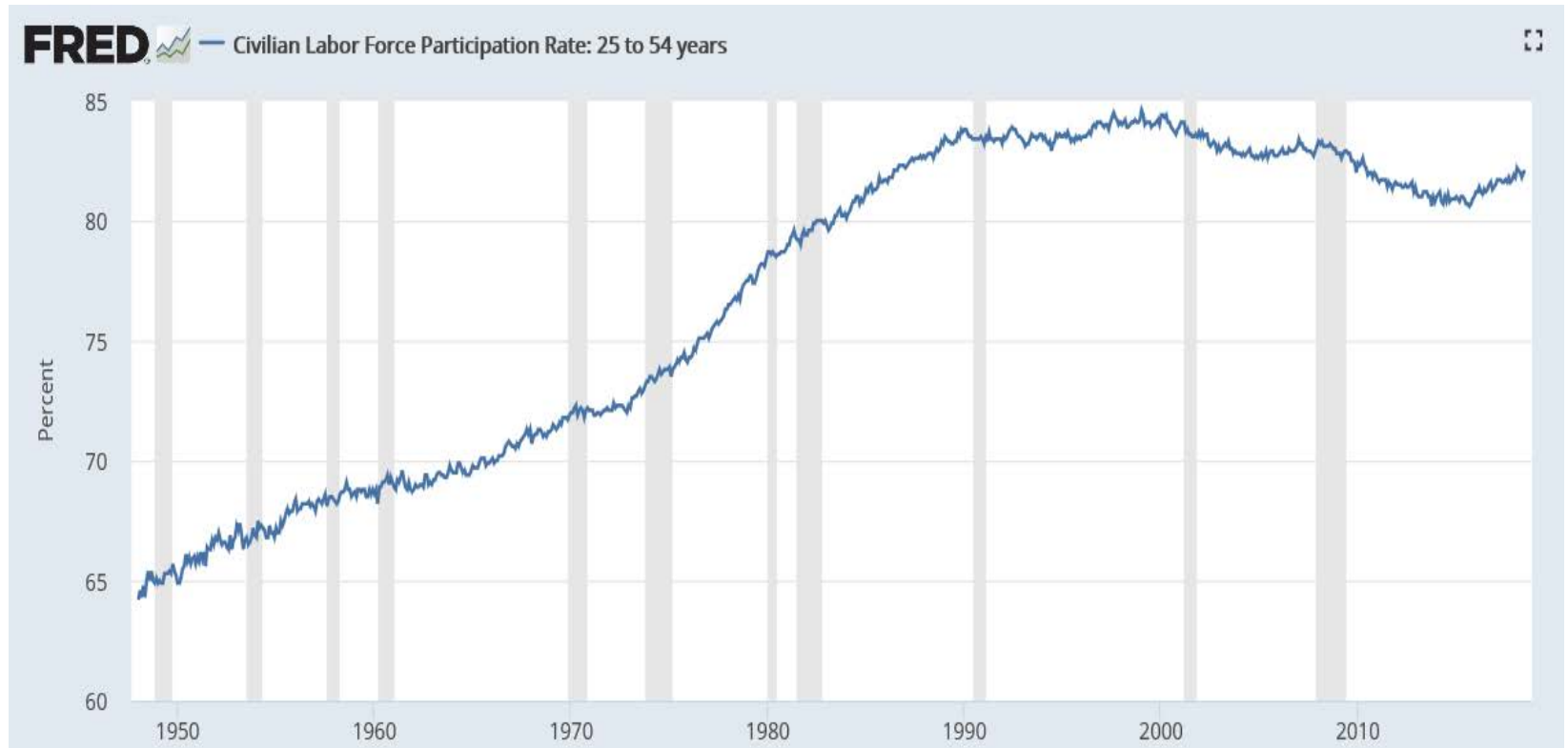
# Damage done by Great Recession

- Severe recessions can affect productive capacity of the economy
- Firms invest less in R&D, so productivity grows more slowly
- Workers drop out of the labor force

# Sudden stop

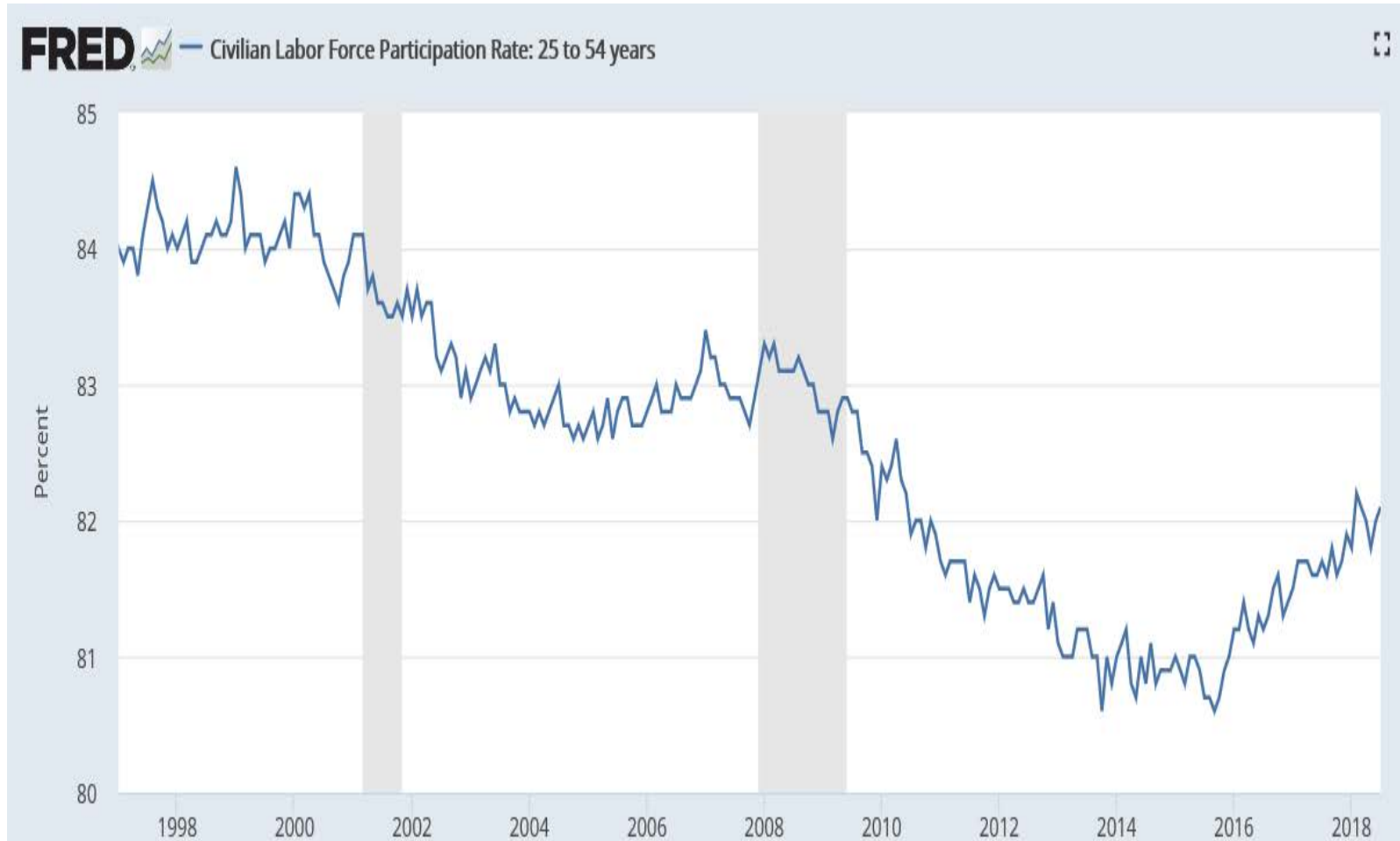


# Labor force participation rate 25-54



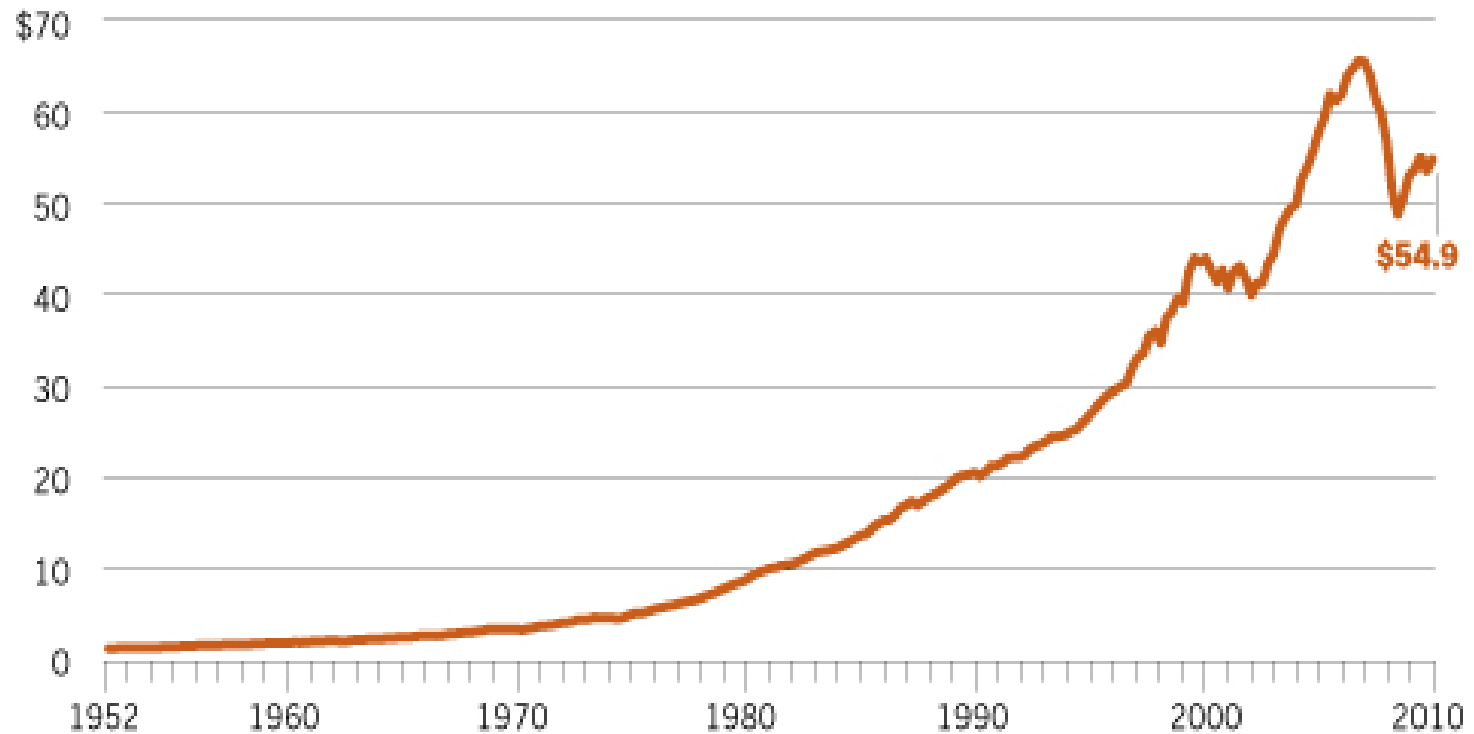


# Labor force participation rate 25-54



# Household net worth

IN TRILLIONS OF DOLLARS



NOTE: Net worth is assets minus liabilities for U.S. households.

SOURCE: Federal Reserve Flow of Funds Report

# Aftermath of financial crises

## A long, hard slog

Peak-to-trough changes in severe financial crises\*

	Cumulative change, %	Duration, years
House prices	-36	5.0
Equity prices	-56	3.4
Unemployment <sup>†</sup>	7.0	4.8
GDP per person	-9.3	1.9

Percentage of years spent in banking crises

	Advanced economies	Emerging economies
Since 1800 or independence	7.2	8.3
Since 1945 or independence	7.0	10.8

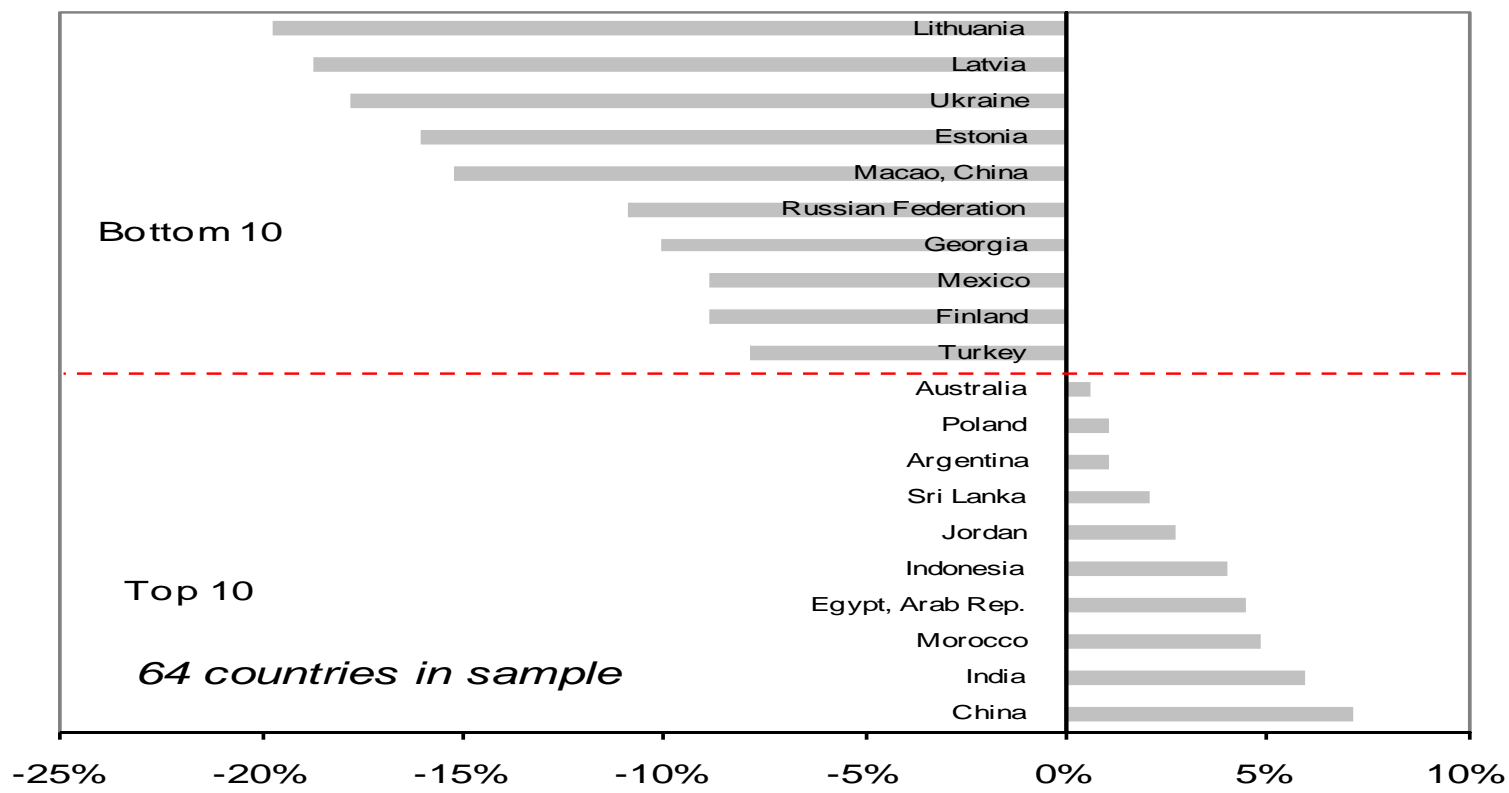
\*Argentina (2001), Colombia (1998), Hong Kong (1997), Indonesia (1997), Korea (1997), Malaysia (1997), Philippines (1997), Thailand (1997), Japan (1992), Finland (1991), Sweden (1991), Norway (1987), Spain (1977), US (1929)

<sup>†</sup>Excludes Japan †Percentage points, trough to peak

Source: Reinhart and Rogoff, *The Aftermath of Financial Crises*, 2009

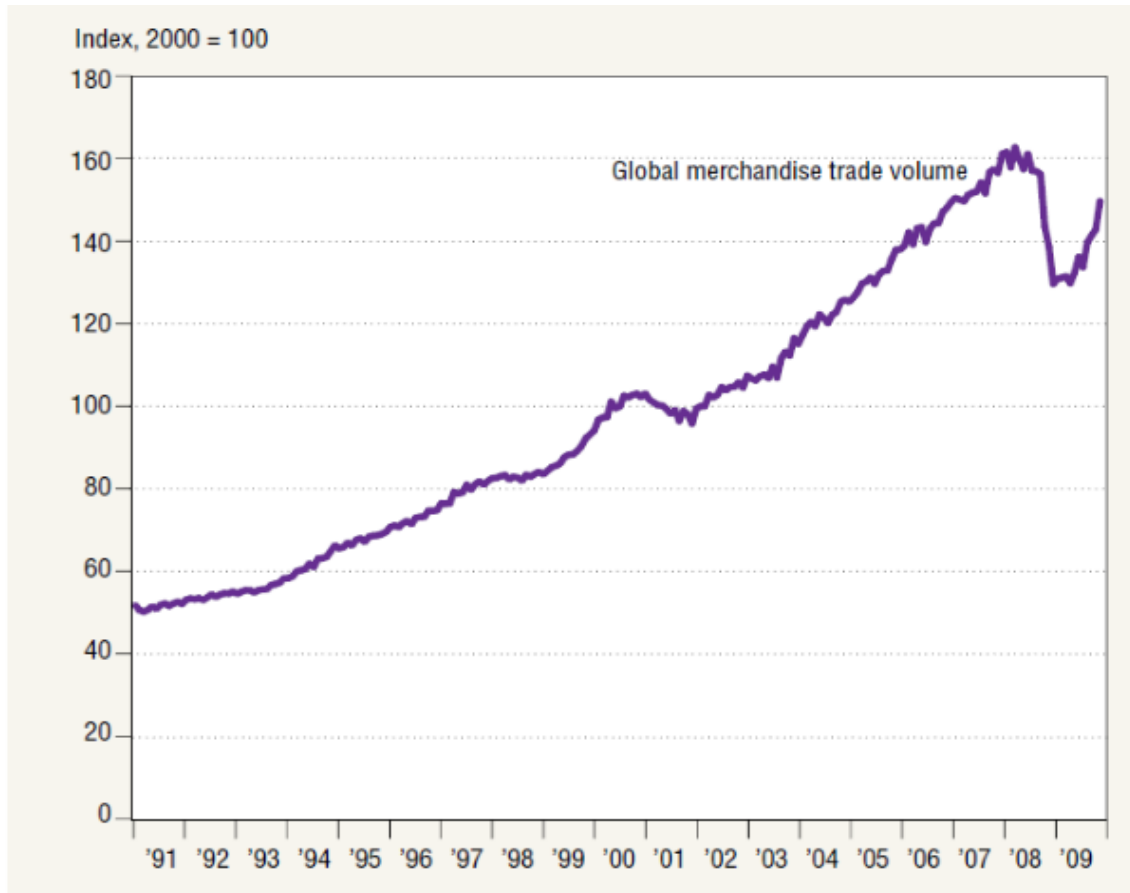
# International spillovers

GDP Change, Q2 2008 to Q2 2009



Source: Frankel and Saravelos (2010)

# Global trade



Source: Federal Reserve of Dallas

# Policy responses to the crisis

- Fed bought commercial paper under 13(3) authority
- Federal funds rate set to zero
- Forward guidance
- Fiscal stimulus
- Large scale asset purchases
- Financial reform (e.g. Dodd-Frank)

# Moral Hazard concerns

- Bail out in financial crises may encourage risk taking
- Concern is often central to response to crises

# Some elements of Financial Reform

- Forcing banks to hold more equity
- **C**Ontingent **C**Onvertible bonds and preferred shares
- Special treatment for **S**ystemically **I**mportant **F**inancial **I**nstitutions
- Changes to money market mutual funds
- Require for creators of risky MBS to have “skin in game”
- Pressure to trade derivatives on exchanges not OTC
- Volcker Rule



# CoCo Bonds

- Bonds that convert to shares when the bank is in trouble
- Triggers:
  - Share price falls below a threshold
  - Tier 1 capital ratio falls below a threshold
- Point is to recapitalize bank when it gets in difficulty without requiring a bailout
- Popular in Europe
- Don't know of a case of a CoCo bond being triggered, although Banco Popular was sold to Santander for 1 euro wiping out the CoCo bonds

# Systemically Important Financial Institutions

- Dodd Frank designated SIFIs that were to have regulation to make failure less likely and more manageable
- Originally any BHC with more than \$50b in assets
- Plus any institution designated by FSOC
- Subject to regulation by the Federal Reserve Board
- Tighter capital and liquidity requirements
- Stress tests and must get permission to pay dividends and buy back stock
- FDIC has “orderly liquidation authority” for SIFIs...yet to be tested

# Supplementary Leverage Ratio

- Standard capital ratio is Capital/Assets, with assets being risk-weighted
- SLR is intended as an additional “backstop”

$$SLR = \frac{\text{Tier 1 Capital}}{\text{Total Leverage Exposure}}$$

- Denominator includes off-balance-sheet items
- Basel 3 requires this to be 3 percent for large banks
- US has gone further in requiring a 5 percent SLR for the largest banks

# Liquidity Coverage Ratio

- LCR is high quality liquid assets (cash, Treasuries) divided by 30 day net outflows in a stress scenario
- Basel 3 requires this to be at least 100 percent
- Currently enforced in the US

# Net Stable Funding Ratio

- Net stable funding ratio requires banks to be funded from stable sources
  - “Stable” includes long term loans
  - Also retail deposits
- Another part of Basel 3
- Implemented in US

# Regulatory rollback

- Regulations have been weakened in 2018 and 2019
  - SIFI threshold has been raised to \$100 bn and \$250 bn
  - Met Life successfully appealed against SIFI designation
  - Regulators eased the Volcker rule
- Rules eased again in response to COVID
- Regulatory framework remains much tighter than before the crisis
- Bank leverage (and profitability) is down

# Hyman Minsky and financial instability hypothesis

- 1. New idea
- 2. Normal (hedge) borrowing
  - Cashflow covers P&I
- 3. Speculative borrowing
  - Cashflow covers interest; need to rollover
- 4. Bubble (Ponzi)
  - Financing based on expectations of future appreciation
  - New financial instruments
- 5. Bubble bursts (Minsky moment)
- 6. Deleveraging and recession



# Financial instability hypothesis

- In this story, stability is what encourages too much borrowing....stability is destabilizing
- According to Minsky: "the financial system swings between robustness and fragility and these swings are an integral part of the process that generates business cycles"
- His solutions
  - Keynesian fiscal policy to mitigate the effects of downturns
  - Tight regulation



# Ponzi scheme

- Named after Charles Ponzi, who launched paid early investors returns from later investors after WW1.
- Spent 12 years in jail.

# Extrapolative Expectations

- Malmendier and Nagel (2011) find that stock market participation can be explained by average returns in own lifetime.
- Gallup survey of expected stock returns for the next 12 months tracks actual stock returns over the last 12 months

# Derivatives

- Consider three kinds of derivatives
  - Futures
  - Options
  - Swaps
- Can be used for hedging or speculating
- Derivative contracts mostly regulated by CFTC

# Futures and Forwards

- Forward - an agreement calling for a future delivery of an asset at an agreed-upon price
- Futures - similar to forward
- How futures are different from forwards: futures are
  - Standardized and traded on exchanges
  - Secondary trading - liquidity
  - Clearinghouse warrants performance

# Key Terms for Futures Contracts

- Futures price - agreed-upon price at maturity
- Long position - agree to purchase
- Short position - agree to sell
- Profits on positions at maturity

Long = spot minus original futures price

Short = original futures price minus spot

# Sample of Future Contracts

<b>Foreign Currencies</b>	<b>Agricultural</b>	<b>Metals and Energy</b>	<b>Interest Rate Futures</b>	<b>Equity Indexes</b>
Euro	Soybean	Copper	Eurodollars	S&P 500
Pound	Corn	Gold	Federal Funds	Nasdaq
Yen	Coffee	Oil	Treasury Bonds	FTSE Index

# Trading Mechanics

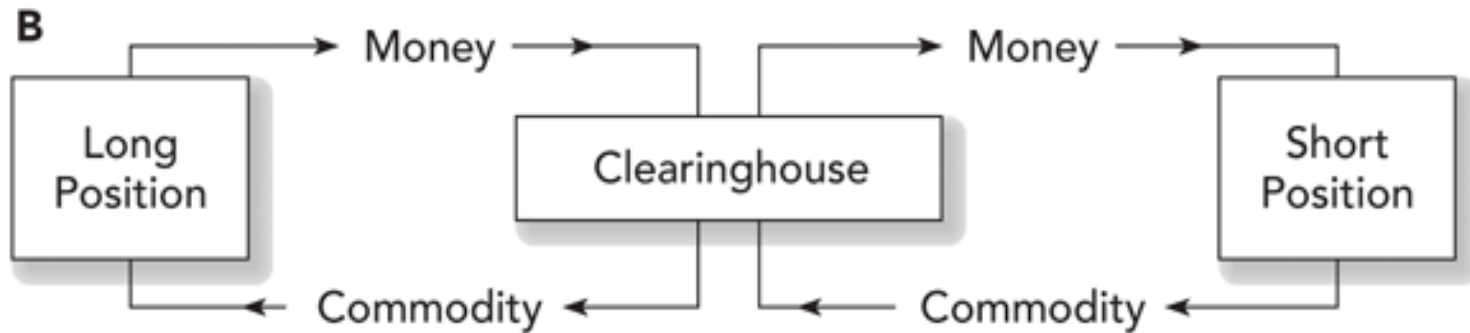
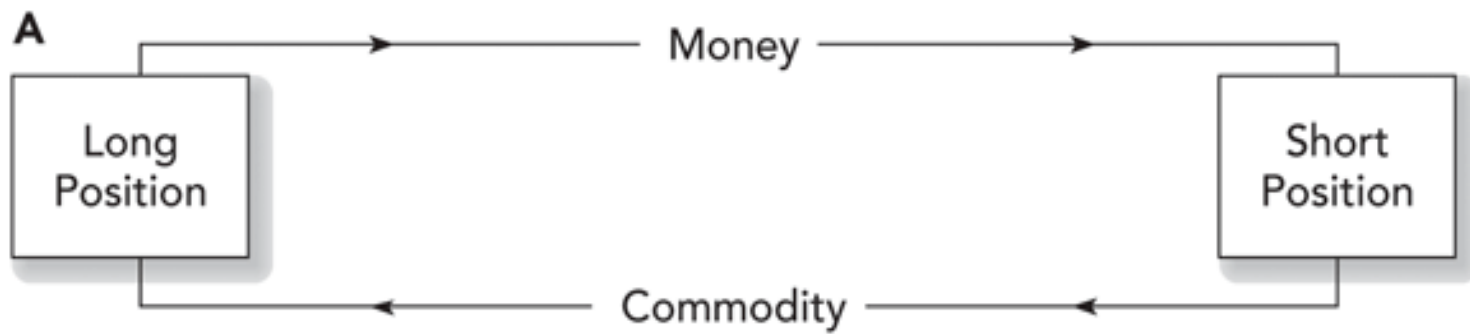
- Clearinghouse - acts as a party to all buyers and sellers
  - Obligated to deliver or supply delivery
- Closing out positions
  - Reversing the trade
  - Take or make delivery
  - Most trades are reversed and do not involve actual delivery

# Trading Mechanics

- Electronic trading has mostly displaced floor trading.
- CBOT and CME merged in 2007 to form CME Group.
- The exchange acts as a clearing house and counterparty to both sides of the trade.
- The net position of the clearing house is zero.



# Panel A, Trading without a Clearinghouse. Panel B, Trading with a Clearinghouse



# Trading Mechanics

- Open interest is the number of contracts outstanding.
- If you are currently long, you simply instruct your broker to enter the short side of a contract to close out your position.
- Most futures contracts are closed out by reversing trades.
- Only 1-3% of contracts result in actual delivery of the underlying commodity.

# Margin and Trading Arrangements

Initial Margin - funds deposited to provide capital to absorb losses

Marking to Market - each day the profits or losses from the new futures price are reflected in the account

# Margin and Trading Arrangements Continued

Convergence of Price - as maturity approaches the spot and futures price converge

Delivery - Actual commodity of a certain grade with a delivery location or for some contracts cash settlement

Cash Settlement – some contracts are settled in cash rather than delivery of the underlying assets

# Futures curve

- Consider the plot of futures price against delivery date
- Curve starts at spot price
- Downward slope: normal backwardation
- Upward slope: contango

# Oil prices

- Supply and demand
- Supply: Political instability, new discoveries, collusion among producers
- Demand: Economic growth, environmental concerns
- Supply more inelastic in the short run than the long run

# Breakeven and shutdown prices

- Breakeven price is the price that a producer needs to earn a profit on drilling a well
  - For shale producers \$35 - \$55 or more
- Shutdown price is the price where you want to stop pumping even after you have paid the fixed cost of drilling the well
  - Much lower

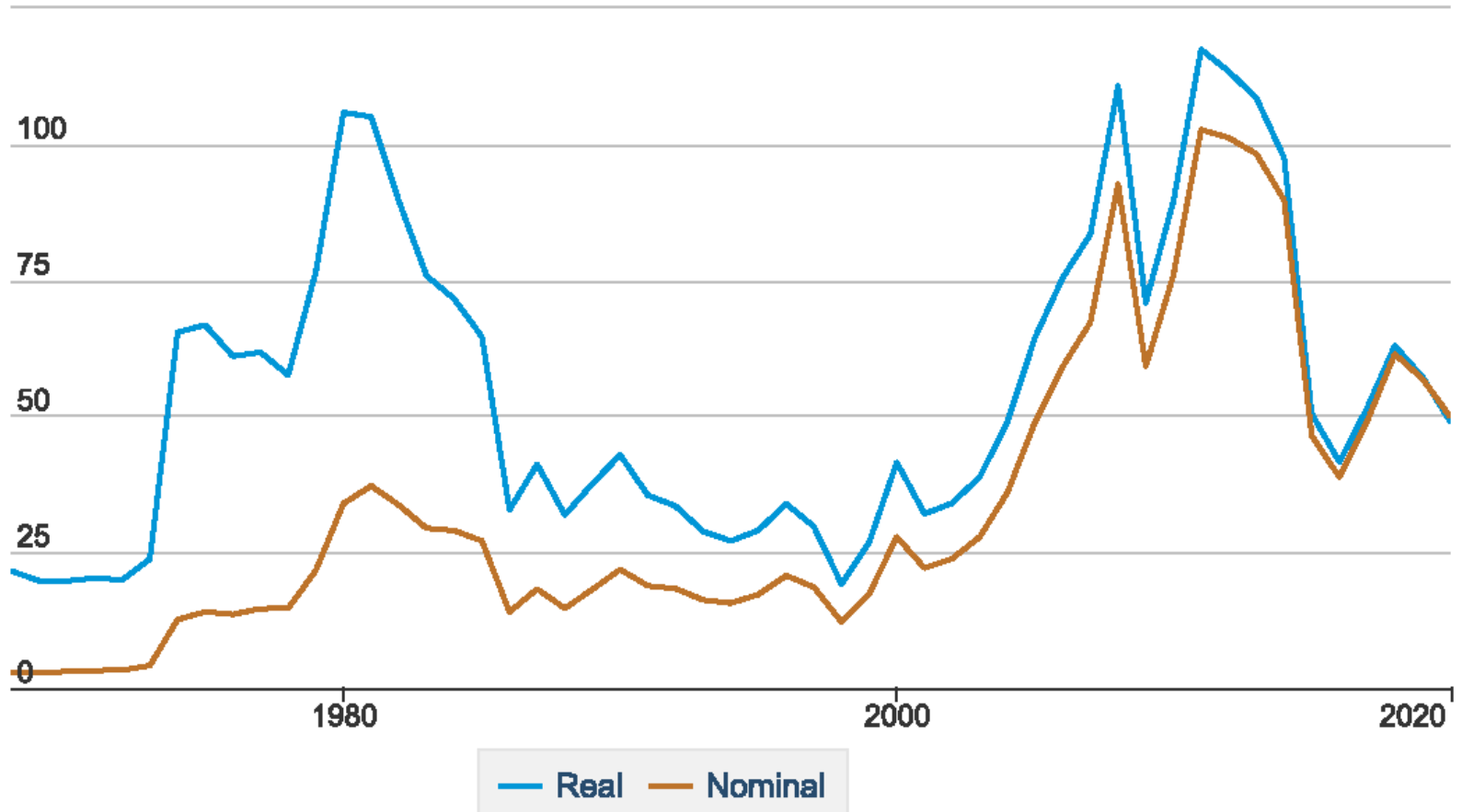
# History of oil prices

- Oil extraction goes back to 19<sup>th</sup> century
- Standard oil was an impetus for antitrust
- US was big oil producer in mid 20<sup>th</sup> century
- Texas railroad commission stabilized prices
- Starting in 1960s other countries became big oil producers and developed a cartel (OPEC)
- 1973 and 1979 were two spikes in oil prices
- Oil futures markets go back to 1970s



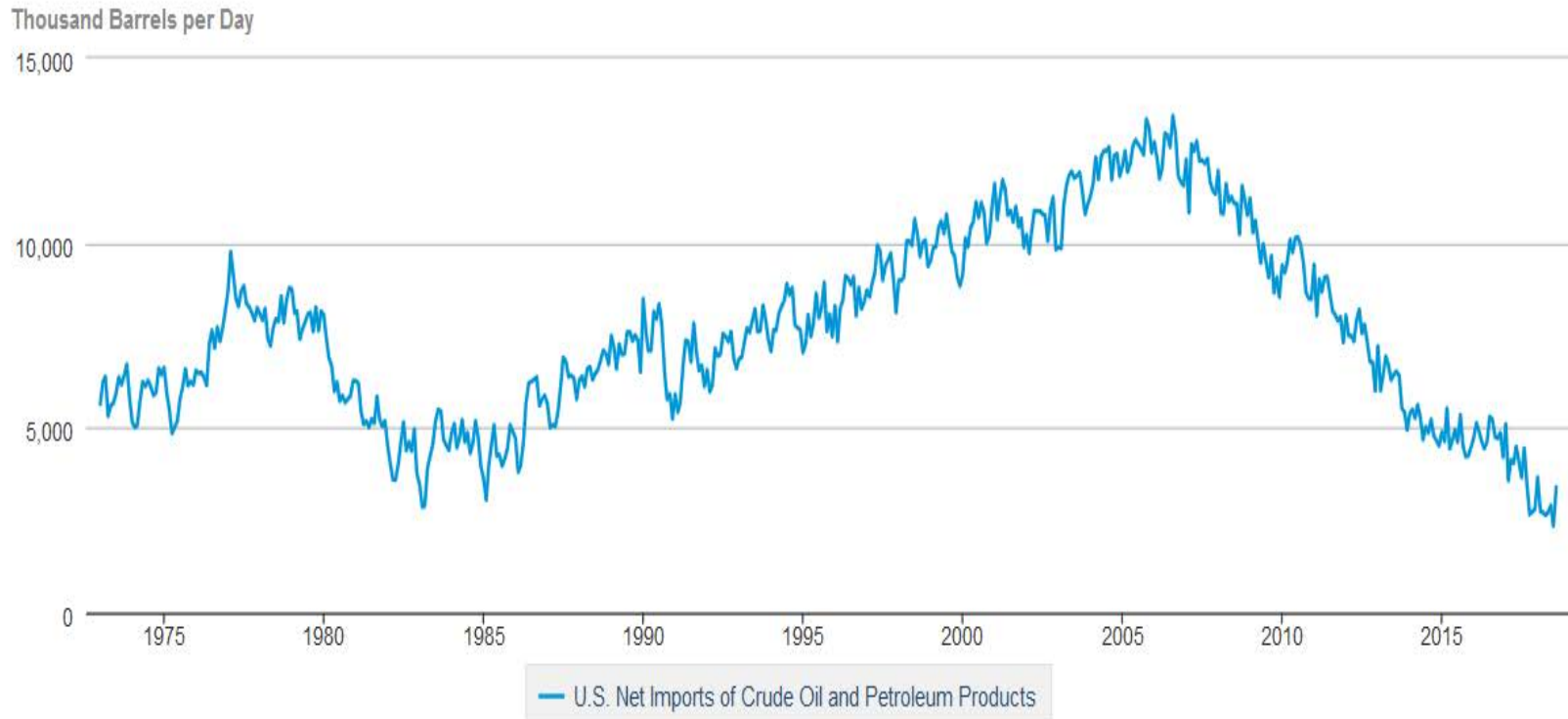
# History of oil prices

Values



Source: U.S. Energy Information Administration

# U.S. Net Imports of Crude Oil

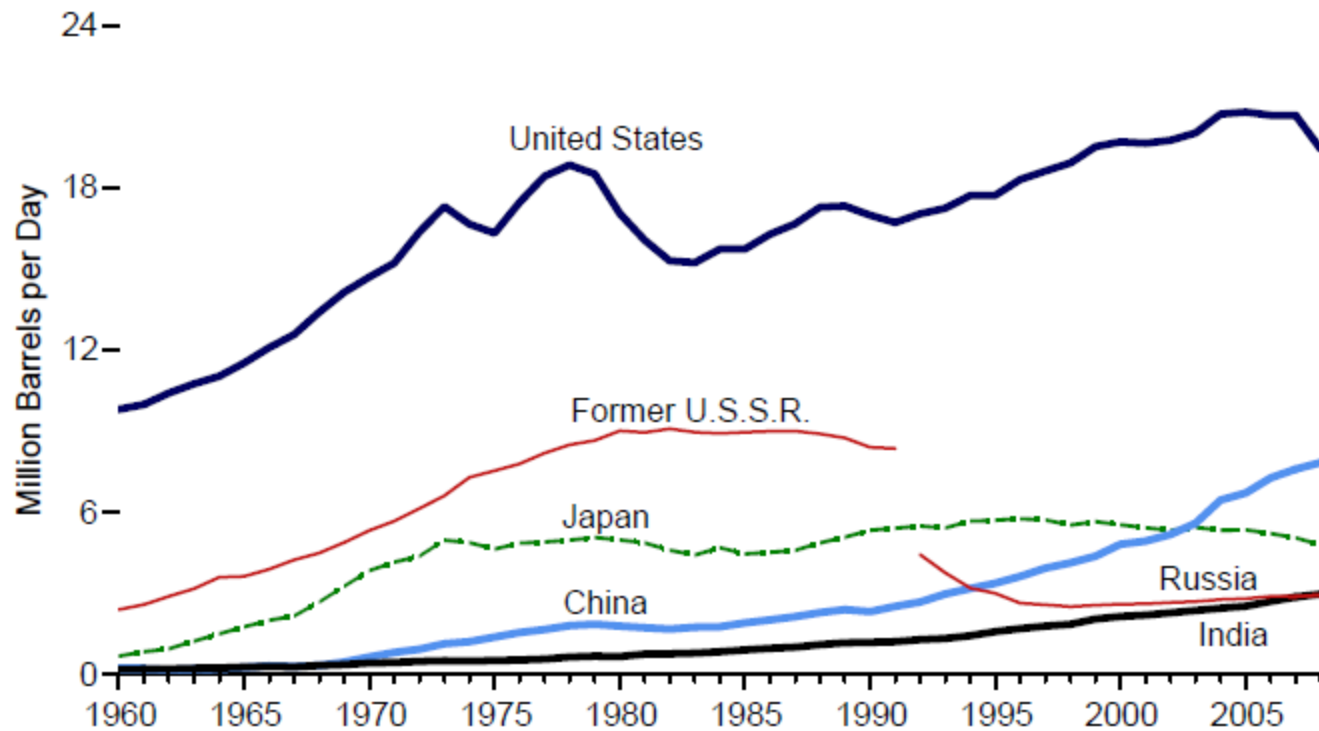


# Long term oil price outlook

- Depends heavily on speed of transition to renewables
- “Environmental Kuznets curve” hypothesis
  - Income growth first leads to more oil demand
  - Then further income growth reduces oil demand
  - “Peak oil demand” may come in next decade or two
  - COVID may have hastened that change

# Oil consumption

**World Petroleum Consumption**  
Top Consuming Countries, 1960-2008



Source: <http://www.eia.gov/totalenergy/data/annual/archive/038409.pdf>

# Stock index futures

- Leading example of a cash settled futures
- They are based on 250 times the S&P 500 index
- Example: I go long one contract at 2,800. At maturity the index is 2,700. I pay:

$$(2,800-2,700)*250=25,000$$

- Stock index futures have favorable tax treatment

# Spot Futures Parity

Spot-futures parity theorem - two ways to acquire an asset for some date in the future

- Purchase it now and store it: assume this is free
- Take a long position in futures
- These two strategies must be equivalent

$$F = S(1 + r_f)^T - D$$

# Example

- S&P 500 fund that has a current value equal to the index of \$2,500
- Assume dividends of \$25 will be paid on the index at the end of the year
- Interest rate is 5%
- If I borrow to buy the stock today, my cost in one year is  $\$2,500 * 1.05 - \$25 = \$2,550$
- Therefore the futures price should be \$2,550

# Index arbitrage

- For futures on an index, futures price should be close to cash price
- Index arbitrage is strategy to profit from deviations
- All done by program traders



# Spot futures parity

- With positive interest rates and no storage costs, futures price should lie above spot
- And further above the longer ahead delivery

# Basis

- Basis= Cash Price- Futures Price
- Basis risk is the risk that a hedge will not work because the basis changes

# Interest Rate Futures

- Two main interest rate futures
  - Treasury bond
  - Eurodollar

# Treasury bond futures

- Physically settled
- Basket of acceptable securities
- Short side gets to pick any of the securities in the acceptable basket to deliver
- Cheapest to deliver is one that is usually delivered

# Eurodollar Futures

- The Eurodollar futures contract is the most widely traded short-term interest rate futures.
- It is based upon a 90-day \$1 million Eurodollar time deposit.
- It is settled in cash.
- Contracts mature in March, June, Sep, December
- At expiration, the settlement price is 100-LIBOR
- At expiration if the settlement price is  $S$  and the futures price is  $F$ , then the short side pays the long side  $\$2,500*(S-F)$  per contract.

# Eurodollar Futures Example

- In February you **short** a March Eurodollar futures contract. The quoted futures price at the time you enter into the contract is 98.86.
- Q. If the 90-day LIBOR rate at the end of March turns out to be 2.14% p.a., what is the payoff on your futures contract?
- A. Settlement price: 97.86. So you receive a payoff of  $\$2,500 * (98.86 - 97.86) = \$2,500$ .

# Hedging with a Eurodollar Futures Contract

- Suppose a firm knows that it must borrow \$1million for three months in the future.
- **Short** a Eurodollar futures contract.
- Suppose the current futures rate is 97.86. This implies a LIBOR rate of 2.14%.
- Now consider three scenarios:

<b>Borrowing Rate</b>	<b>2.14</b>	<b>3.14</b>	<b>1.14</b>
Eurodollar Payoff	0	\$2,500	-\$2,500
Borrowing Cost	\$5,350	\$7,850	\$2,850
Total Expense	\$5,350	\$5,350	\$5,350

# Hunt brothers

- Example of market cornering
- In the early 1980s, accumulated huge amount of silver and long position on silver futures
- Demanded physical delivery
- Commodity exchanges changed rules causing price of silver to fall
- Futures exchanges and regulators remain concerned about short squeezes



# Option Terminology

- Buy - Long
- Sell - Short
- Call
- Put
- Key Elements
  - Exercise or Strike Price
  - Premium or Price
  - Maturity or Expiration

# Market and Exercise Price Relationships

In the Money - exercise of the option would be profitable

Call: market price > exercise price

Put: exercise price > market price

Out of the Money - exercise of the option would not be profitable

Call: market price < exercise price

Put: exercise price < market price

At the Money - exercise price and asset price are equal

# American vs. European Options

American - the option can be exercised at any time before expiration or maturity

European - the option can only be exercised on the expiration or maturity date

Bermudan – the option can be exercised at fixed dates up to the expiration or maturity date.

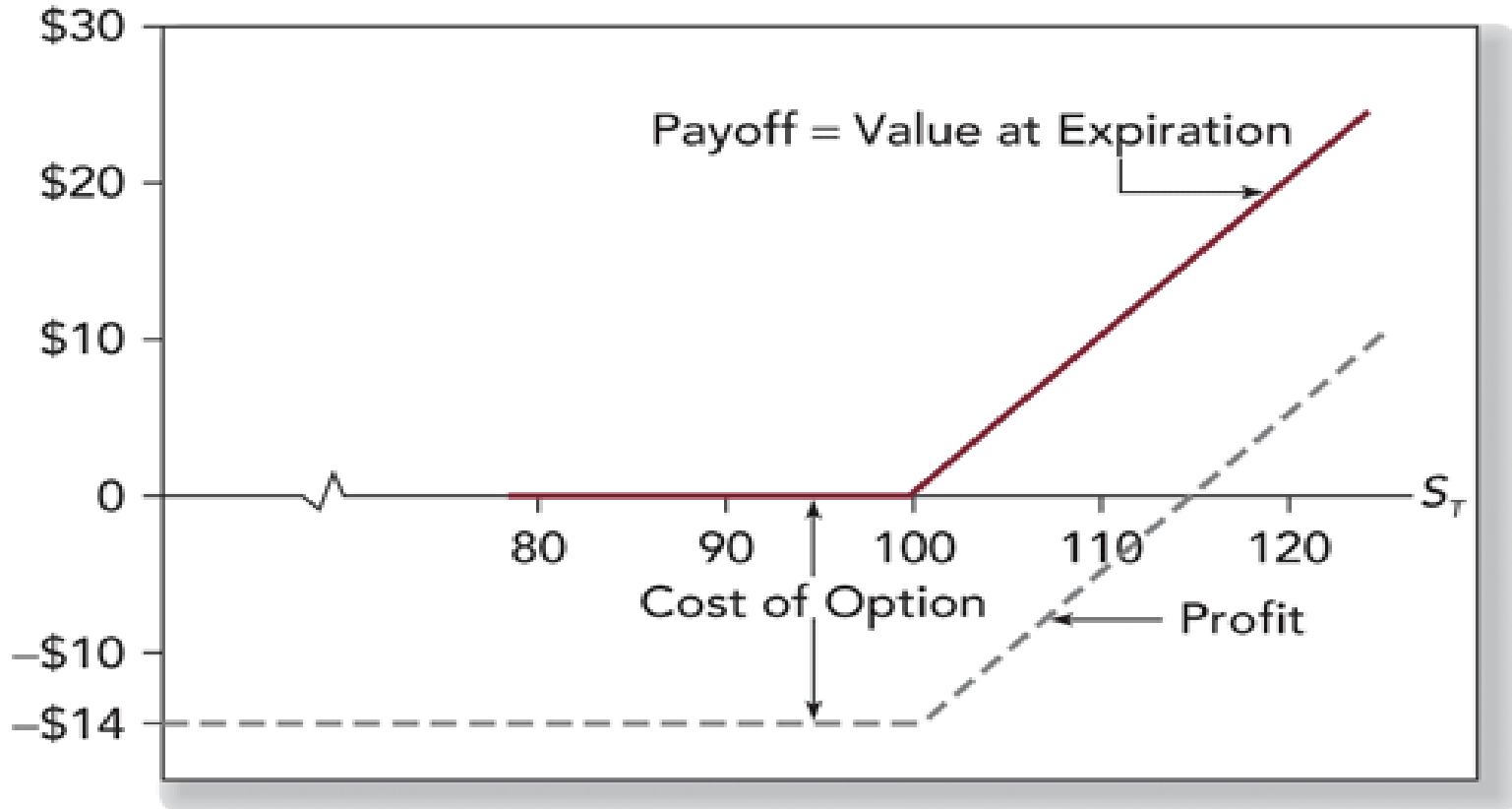
# Options maturity

- Most stock options are short maturity
- LEAPS (long term equity anticipation securities) are longer-dated, exchange traded options

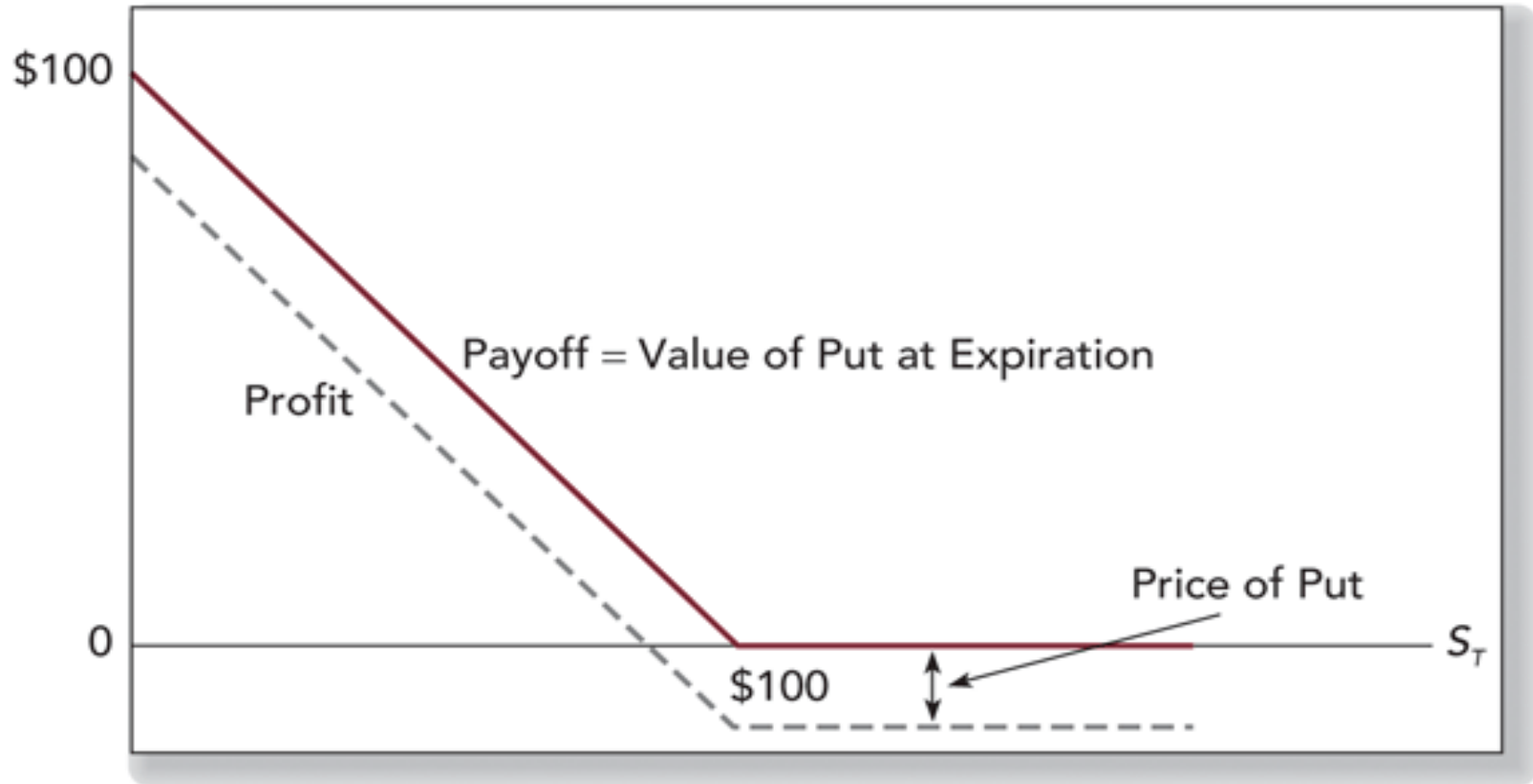
# Different Types of Options

- Stock Options
- Stock Index Options
- Futures Options
- Foreign Currency Options
- Interest Rate Options

# Payoff and Profit to Call Option at Expiration



# Payoff and Profit to Put Option at Expiration



# Option Strategies

Straddle (Same Exercise Price)

Long Call and Long Put

Spreads - A combination of two or more call options or put options on the same asset with differing exercise prices or times to expiration.

Vertical or money spread:

Same maturity

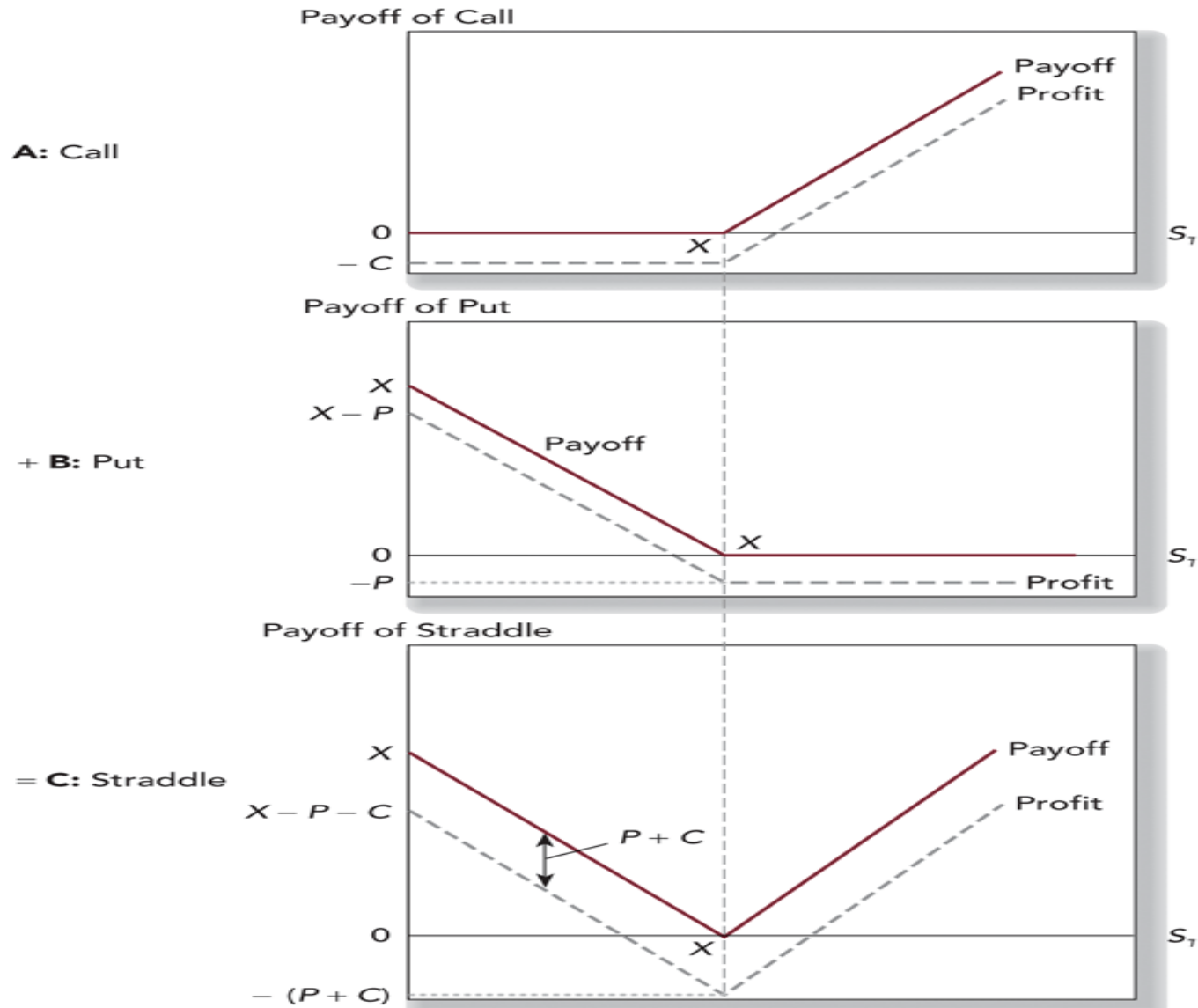
Different exercise price

Horizontal or time spread:

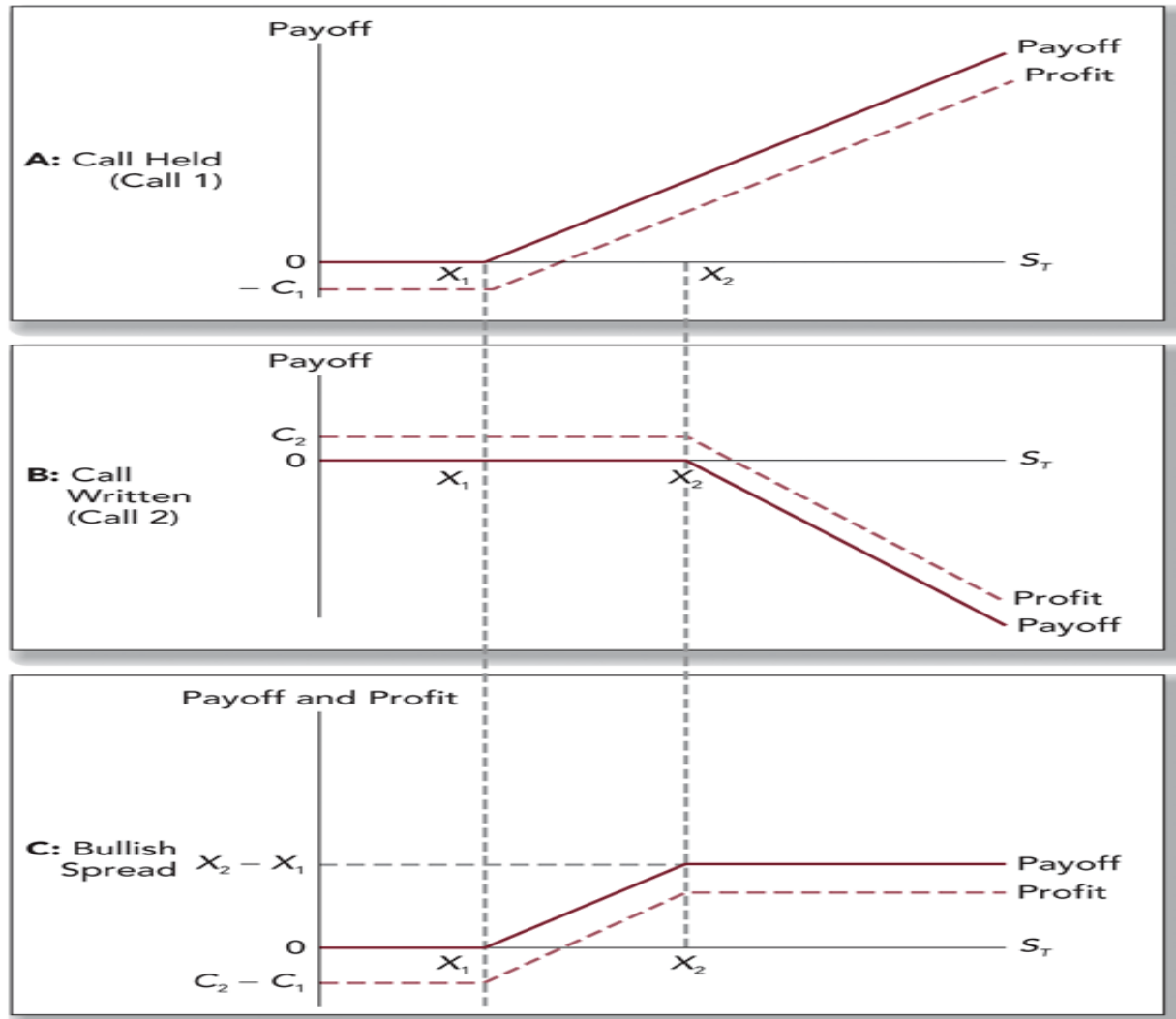
Different maturity dates



# Value of a Straddle at Expiration



# Value of a Bullish Spread Position at Expiration



# Stock warrants

- A stock warrant is issued by a company
- Gives the holder the right, but not the obligation, to buy shares that will be issued by the company at an agreed price
- Like a call option except
  - Issued by the company, not another investor
  - New stocks are created if the warrant is exercised
  - Warrants are often very long-term, unlike equities
- Warrants are sold by firms as a way of raising capital
- Give an investor the upside of the company at a lower cost than buying the share

# Swaps

- Interest rate swap
- Credit default swaps

# Interest rate swap

- Agreement between two parties to exchange a fixed rate a notional underlying principal for a floating rate
- For example:
  - Pay LIBOR times \$100 million
  - Receive fixed rate times \$100 million
  - Only net amount changes hands

# Interest rate swap: example

- Suppose that the 3 month LIBOR rate is 4% and the fixed rate is 7%
- Party paying fixed gives the counterparty  
 $0.25 * (7% * \$100 \text{ million} - 4% * \$100 \text{ million}) = \$750,000$

# Uses of Interest Rate Swaps

- Converting liabilities or assets from fixed to floating
- Banks have short-term liabilities and long-term assets
  - Banks generally pay fixed, receive floating
- Betting on interest rate movements
- Managerial or investor myopia

# Example of Interest Rate Swap

- Companies X and Y have been offered the following rates per annum on a \$20 million 5-year loan:

	Fixed	Floating
Company X	12%	LIBOR+0.1%
Company Y	13.4%	LIBOR+0.6%

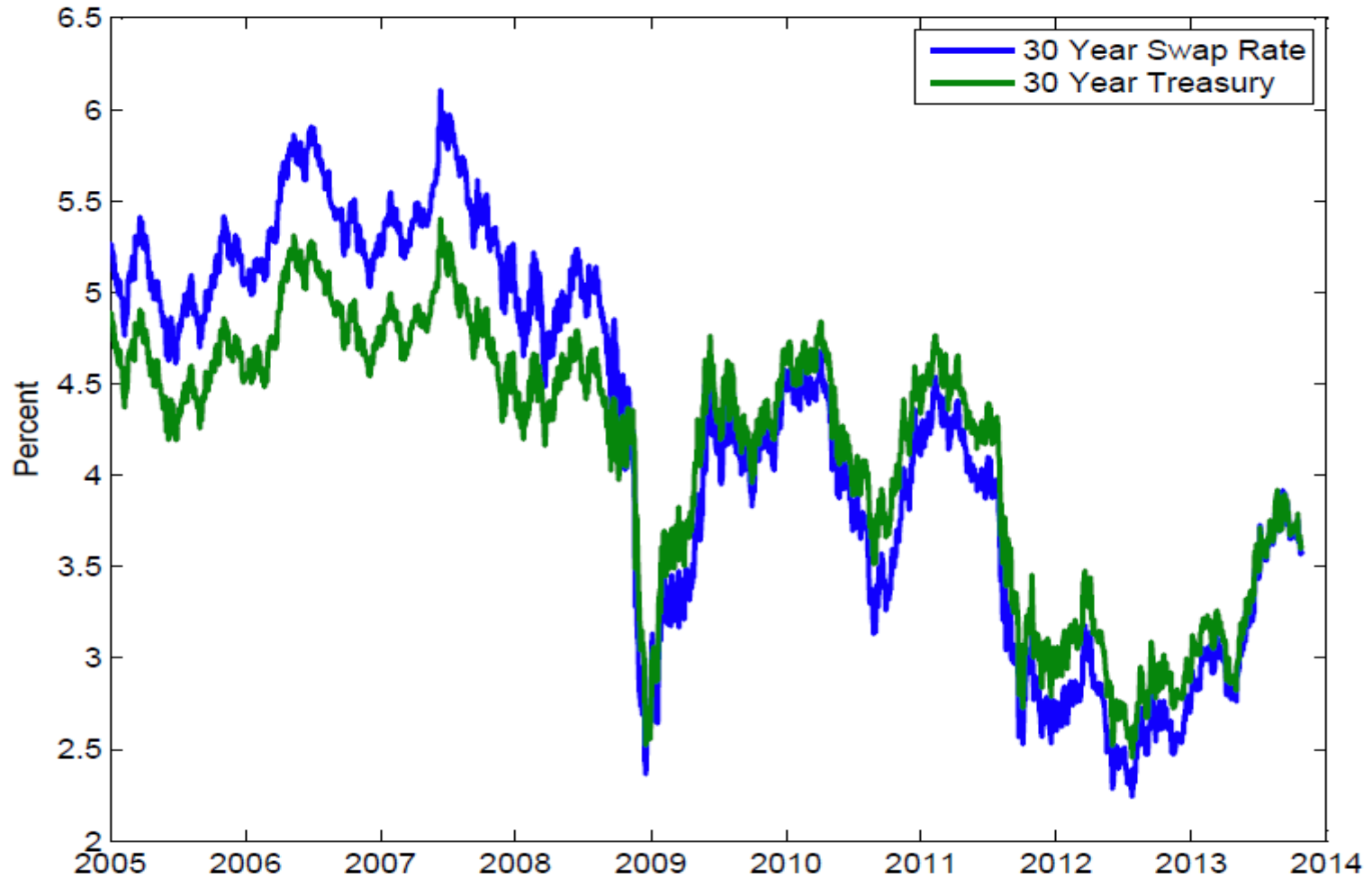
- Company X wants a floating rate loan
- Company Y wants a fixed rate loan
- Swap dealer charges 10 bp spread



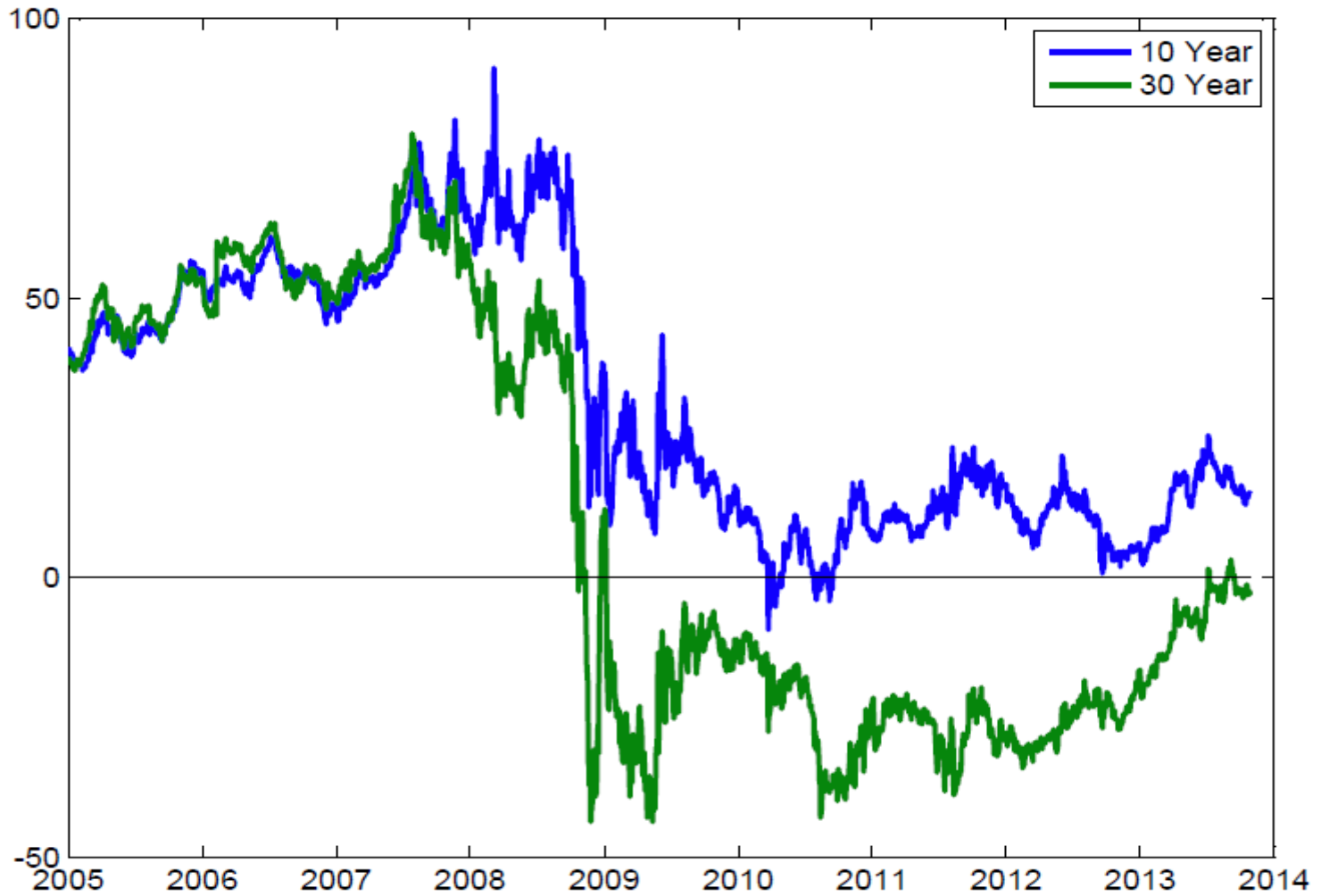
# Example of Interest Rate Swap

- Company X borrows at 12%
- Enters swap to pay LIBOR and get 12.3%
- Effectively X pays LIBOR - 0.3%
  
- Company Y borrows at LIBOR + 0.6%
- Enters swap to receive LIBOR and pay 12.4%
- Effectively Y pays 13%

# Treasury and Swap Rates



# Swap Spreads



# Swap Bond Arbitrage

- If swap rate is above bond rate
  - Short the bond
  - Invest the proceeds in floating
  - Receive fixed in a swap contract
- Limitation is default risk
- If swap rate is below bond rate
  - Borrow at the floating rate
  - Pay fixed
  - Go long the bond
- Why isn't this being done (more)?

# Overnight Index Swaps (OIS)

- Newer kind of swap contract, usually for a short tenor (1 month, 3 months...)
- One side agrees to pay a fixed rate on a notional underlying principal at the end of the contract
- The other side pays whatever the average fed funds rate had been over the life of the contract
- Only the net changes hands
- Bet on short rates with minimal default risk
- LIBOR-OIS spread is a measure of health of banking system



# Interest Rate Caps

- Buyer of a cap pays a premium
- In exchange, receives  $\max(0, i - k)$  percent of a notional underlying where  $i$  is LIBOR and  $k$  is a strike
- For example, if the strike is 2.5%, the notional underlying is \$1,000,000 and LIBOR is 3%, then receive

$$0.25 * (0.03 - 0.025) * 1,000,000 = 1,250$$

- Useful for hedging the issuance of a floating rate loan

# Interest rate floors

- Are the converse
- Buyer of a floor pays a premium
- In exchange, receives  $\max(0, k - i)$  percent of notional underlying
- Useful for hedging purchase of a floating rate asset



# Interest rate collar

- Way of keeping the interest expense within a certain range
- Buy an interest rate cap at  $C\%$ .
- Sell an interest rate floor at  $F < C\%$
- Effectively keeps interest expense between  $F$  and  $C$

# Swaption

- A swaption gives holder the right but not the obligation to enter into an interest rate swap at a future date
- OTC market
- Can be American, European or Bermudan

# Credit Default Swaps

- Payment on a CDS is tied to the financial status of a **reference bond**
- The buyer of credit protection pays a fixed rate
- If there is a credit event, the issuer of the protection has to buy the bond at par value
  - Settlement can be *physical* or *cash*
- Credit events include bankruptcy, failure to pay or restructuring

# Credit Default Swaps: Example

- Investor buys protection for \$10 million of Risky Bank Debt
- CDS spread is 30 bps
- Each year, buyer of protection pays seller of protection \$30,000
- On default, the seller pays the buyer \$10 million less the *recovery* value of the defaulted bonds

# CDS Bond Arbitrage

- In theory

Corporate Bond + CDS Protection = Risk-free Bond

Corporate Bond Spread = CDS Rate

# Basket CDS and CDS Index

- Basket CDS has a set of reference obligations, not just 1
- First-to-default basket CDS will trigger payment and conclusion of the swap after 1 default
- Similarly for k-to-default basketed CDS
- CDS index is effectively a bundle of single name CDS contracts
- Dow Jones North American Investment Grade Index references 125 Investment Grade corporations

# Sovereign CDS

- Generally pay off in a currency other than that of the issuer
- e.g. US Treasury CDS pay off in Euro
- European CDS pay off in Dollars
- But you can get Italian CDS contracts in Euro as well as in Dollar
- Can go long Italian CDS in dollars and short Italian CDS in euros---quanto CDS
  - Taking a bet on the currency in the event of default

# Use of CDS

- Protection against default of bond
- More liquid way to bet that default is likely/unlikely than investing in the underlying bond



# Problems with CDS

- Definition of default can be manipulated
  - ISDA is arbiter of default
- Seller of credit protection may not be able to pay
  - Some collateral
- Actual size of market might exceed bonds that exist
  - Motivates cash settlement

# Potential Abuse of CDS

- Codere is a Spanish company
- Blackstone offered to refinance some of its debt in exchange for Codere making an interest payment a few days late
- Blackstone also bought CDS protection on Codere
- Missed interest payment ensured a payout
- A lot can go wrong with this kind of strategy
  - Blackstone had to lend money to a shaky company
  - You only get the difference between face value and market value of debt as payoff

# Potential Abuse of CDS 2

- Hovnanian was a US construction firm: junk rated but not near bankruptcy
- Blackstone offered to buy newly issued 22Y bond at 5% in exchange for making an interest payment a few days late
- Traded far below face value
- Blackstone also bought CDS protection
- When CDS was triggered the bonds were to be bought back at face value
- Blackstone eventually backed down

# Credit linked notes

- A credit linked note is a security that promises coupon and fixed repayment as long as a reference entity does not default
- If the reference entity does default, holder gets recovery on the default
- Example:
  - Bank issues 5 year credit linked note paying 6 percent coupon, but referencing debt of XYZ company
  - If XYZ defaults in the next 5 years, and recovery is 40 percent, then bank is only obligated to pay back 40 percent of the CLN
  - Useful to bank passing on credit risk

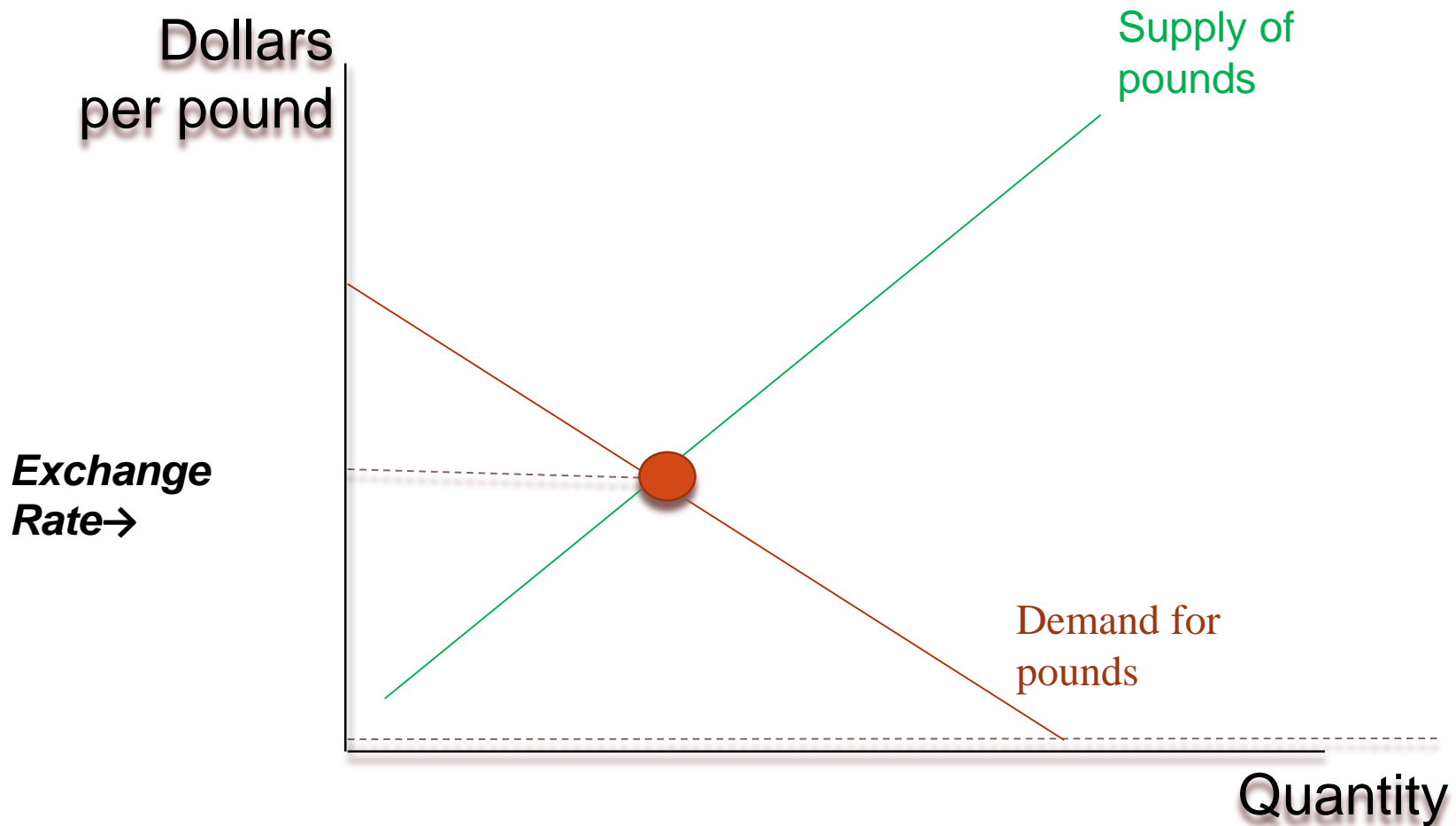
# Foreign Exchange

- 1 Unit of currency A = X units of currency B
- Quoting conventions differ by currency pair
- Euro-Dollar: 1 Euro = X Dollars
- Dollar- Yen: 1 Dollar = X Yen
- Enormous liquid market
- Spot market is the market for immediate (t+2) delivery
- An *appreciation* of a nation's currency will make foreign goods cheaper.
- A *depreciation* of a nation's currency will make foreign goods more expensive.

# Foreign exchange systems

- Floating exchange rates
- Fixed exchange rates
  - Bretton woods
- Managed float
- Adjustable peg
- Currency board is a promise to convert local currency into foreign currency
  - Only foolproof if you 100% back local currency with reserves
  - Hong Kong operates a currency board
- Dollarization is even more extreme fixed exchange rate
  - Ecuador uses US dollar
  - No seignorage revenue
- Single currency (euro zone, EC Dollar)

# Determinants of exchange rate in Short Run



# Changes in the Exchange Rate

- Factors that cause a currency to *depreciate*:
  - a rapid growth of income (*relative to trading partners*) that stimulates imports relative to exports
  - a higher rate of inflation than one's trading partners
  - a reduction in domestic real interest rates (*relative to rates abroad*)
  - a reduction in the attractiveness of the domestic investment environment that leads to an outflow of capital



# Uncovered interest parity

- Suppose I borrow dollars today, invest it in a foreign currency and plan to buy it back tomorrow.
- Profit will be

$$\frac{S_t (1 + R_t)^T}{S_{t+T}} - (1 + R_t^*)^T$$

- Note: Exchange rate defined as \$ per unit foreign currency

# Uncovered interest parity

- Uncovered interest parity says that

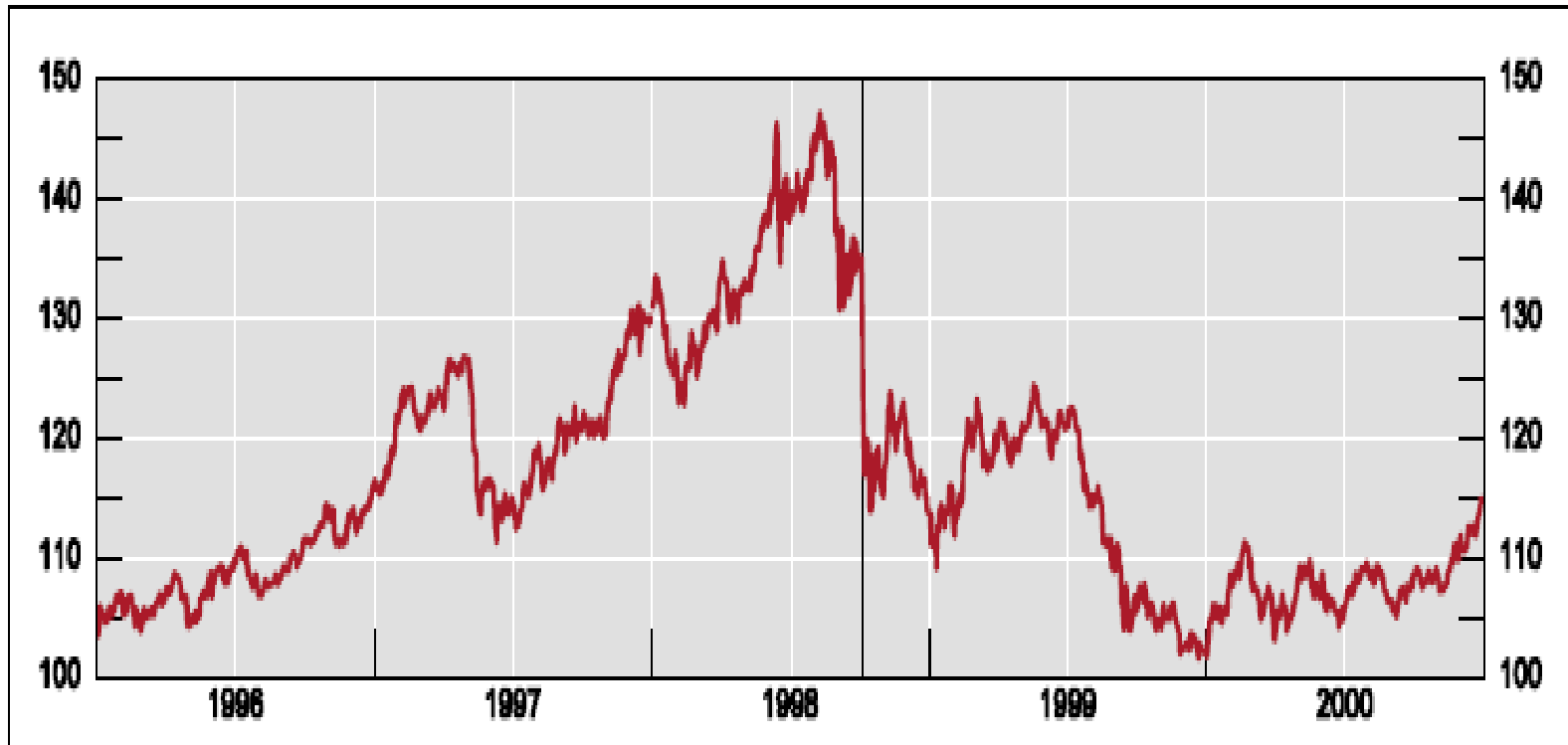
$$E_t (S_{t+T})(1 + R_t^*)^T = S_t (1 + R_t)^T$$

- For example, if exchange rate today is AUD 1=\$0.80
- One year interest rate is 0.25 percent in US
- One year interest rate is 4.25 percent in Australia
- Expected exchange rate in one year is AUD=\$0.769
- Currency with the higher interest rate is expected to depreciate

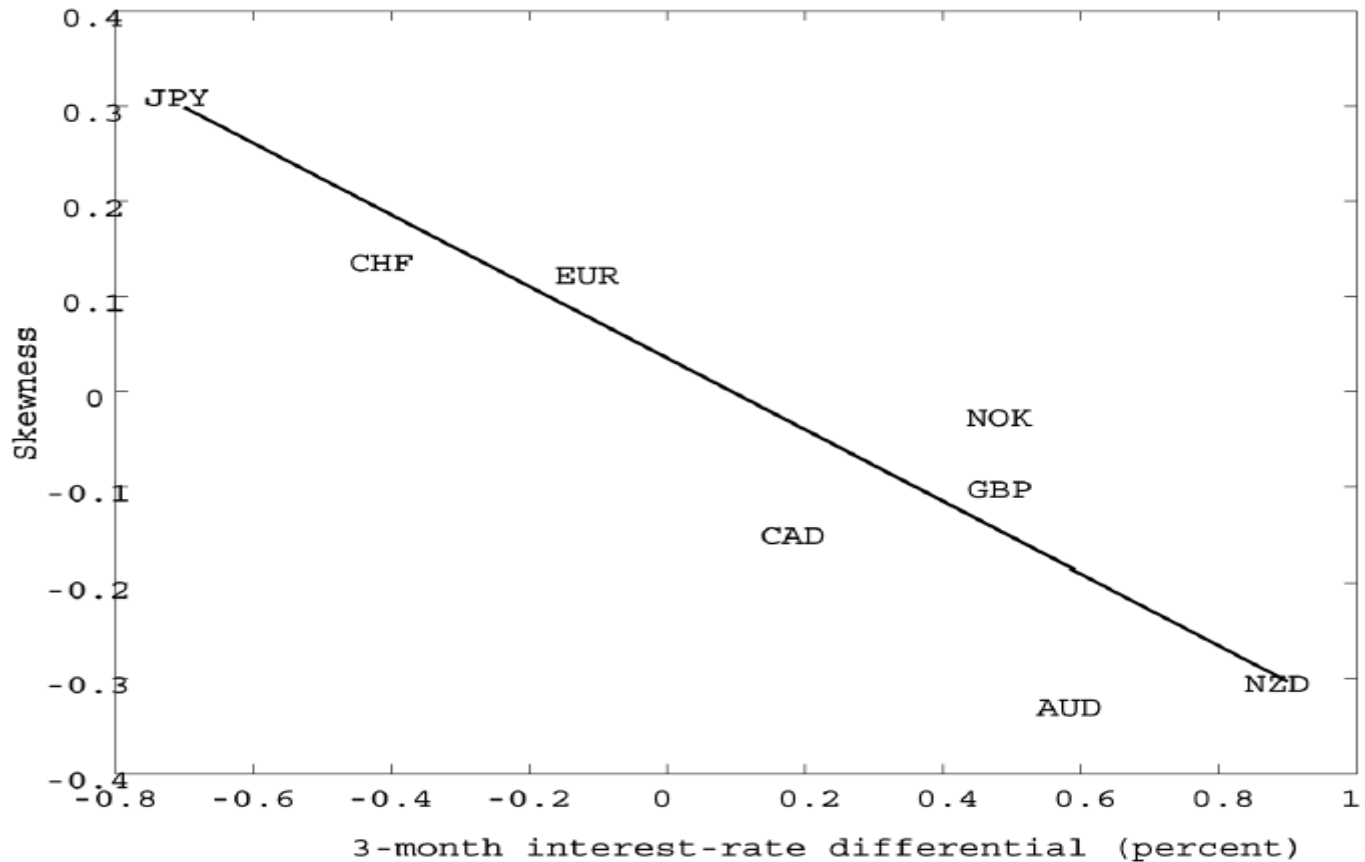
# Uncovered interest parity Empirical Evidence

- Evidence goes *against* uncovered interest parity
- If anything, the currency with the *higher* interest rate tends to *appreciate*
- Motivates the “carry trade”
  - Borrow in currency with low interest rate (*funding* currency)
  - Convert to the high interest currency and invest
  - Do NOT hedge the exchange rate risk
  - Convert back
- From 1990 till crisis, yen was the natural funding currency
  - From 2008 till 2015 dollar also a natural funding currency

# AUD-JPY



# Skewness and interest differentials



# Purchasing Power Parity

- Idea that goods should cost the same, once you adjust for exchange rate

$$P_D = eP_F$$

- Exchange rate again defined as \$ per unit foreign currency
- May be a reasonable approximation over the very long run
- Big Mac index is an illustration of failure of PPP

# Big Mac Index (Data: July 2018)

Country	Price (in US Dollars)
Switzerland	6.57
Sweden	5.83
US	5.51
:	
Ukraine	1.91
Egypt	1.75

# Purchasing Power Parity

- Typically we are comparing price indices in countries, not a single good
- Then at two times  $t_1$  and  $t_2$

$$\frac{CPI_{D,t_2}}{CPI_{D,t_1}} = \frac{e_{t_2}}{e_{t_1}} \frac{CPI_{F,t_2}}{CPI_{F,t_1}}$$



# Real exchange rate

- Real exchange rate is the relative cost of goods in two countries in one currency

$$\text{Real Exchange Rate} = e * \frac{P_f}{P_d}$$

- Real exchange rate determines whether good is cheaper domestically or from abroad

# Balassa-Samuelson Effect

- Richer countries have higher dollar price levels
- Two components of price level: tradeable and nontradeable
- Price level for tradeable goods is equalized
- But productivity is higher in the tradeable sector in the rich country

# Balassa-Samuelson Effect: Example

- Two goods: one traded, one non-traded.
- Number produced per worker per hour

	Traded	Nontraded
Rich Country	50	5
Poor Country	10	5

- Price of traded good is \$1
- Wages. Rich country- \$50; Poor country - \$10.
- Price of nontraded good. Rich country - \$10; Poor country - \$2.

# Exchange Rate Systems

- Advantages of Fixed Exchange Rates
  - Makes trade and investment easier
  - Constraint on policymakers
- Advantages of Floating Exchange Rates
  - Can respond to shocks

# Trilemma

- Trilemma is principle that a country can have any two of:
  - Fixed exchange rate
  - Independent monetary policy
  - Absence of capital restrictions
- Broadly, 3 alternatives:
  - Fixed exchange rate, independent monetary policy, capital controls
    - Bretton Woods system
  - Fixed exchange rate, no capital controls, follow foreign monetary policy
    - Denmark
  - Floating exchange rate, independent monetary policy, no capital controls
    - Canada

# Balance of Payments

- ***Balance of payments:*** accounts that summarize the transactions of a country's citizens, businesses, and governments with foreigners
- Any transaction that creates a demand for foreign currency (*and a supply of the domestic currency*) in the FX market is recorded as a debit item.

***Example:*** Imports

- Transactions that create a supply of foreign currency (*and demand for the domestic currency*) on the FX market are recorded as a credit item.

***Example:*** Exports

# Balance of Payments

- Under a *pure flexible rate system*, the foreign exchange market will bring the quantity demanded and the quantity supplied into balance, and as a result, it will also bring the total debits into balance with the total credits.

# Balance of Payments

- ***Current account transactions:***  
all payments (*and gifts*) related to the purchase or sale of goods and services and income flows during the current period
- Four categories of ***current account*** transactions:
  - Merchandise trade  
(*import and export of goods*)
  - Service trade  
(*import and export of services*)
  - Income from investments
  - Unilateral transfers  
(*gifts to and from foreigners*)



# Balance of Payments

- ***Capital account transactions:***  
transactions that involve changes in the ownership of real and financial assets
- The ***capital account*** includes both
  - direct investments by foreigners in the U.S. and by Americans abroad, and,
  - loans to and from foreigners.
- Under a pure flexible-rate system, official reserve transactions are zero; therefore:
  - a current-account deficit implies a capital-account surplus.
  - a current-account surplus implies a capital-account deficit.

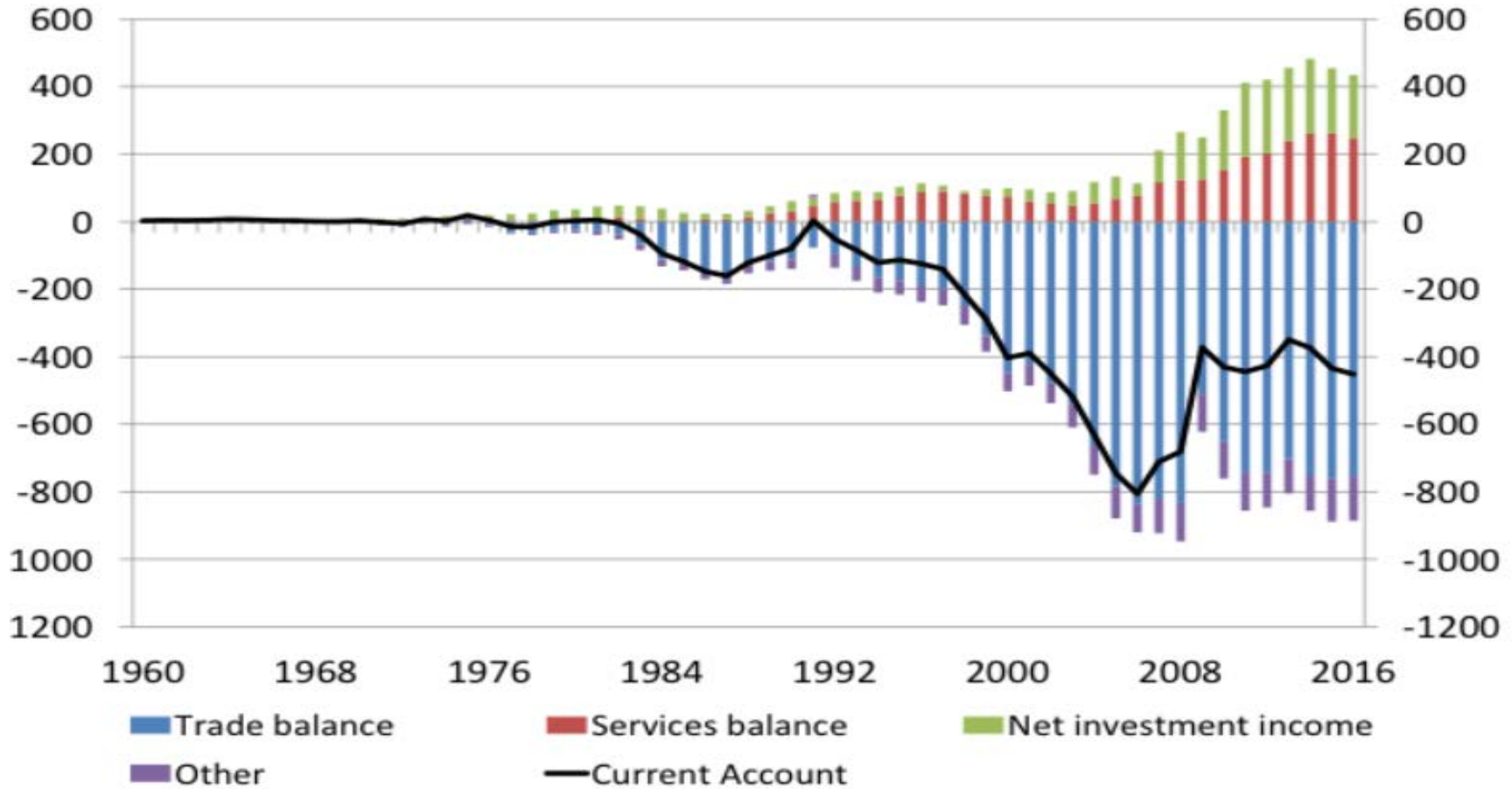
# Are Trade Deficits Bad?

- With flexible exchange rates, an inflow of capital implies a *trade* (current account) *deficit*; an outflow of capital implies a *trade* (current account) *surplus*.
- While the term “deficit” generally has negative connotations, this is not necessarily true for a trade deficit.
  - If a nation’s investment environment is attractive, it is likely to result in a net inflow of capital, which will tend to cause a trade deficit.
  - Similarly, rapid economic growth will tend to stimulate imports, which is likely to result in a trade deficit.

# Trade Deficits: Points to Ponder

- Although they often cause trade (*and current account*) deficits, both rapid growth and a healthy investment environment are signs of a strong economy, not a weak one.
- A trade deficit (*or surplus*) is an aggregate that reflects the voluntary choices of individuals and businesses.
- In contrast with a budget deficit, no legal entity is responsible for the trade deficit.
- The trade deficits of the U.S since 1980 were largely the result of rapid growth and a favorable investment climate.

# US current account and its composition



Source: Boonstra (2017)

# Composition of US external assets/liabilities

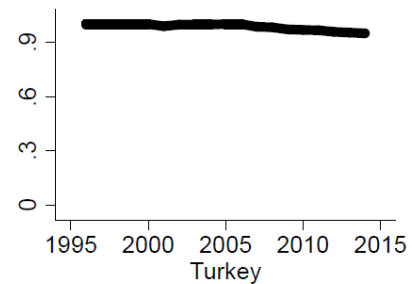
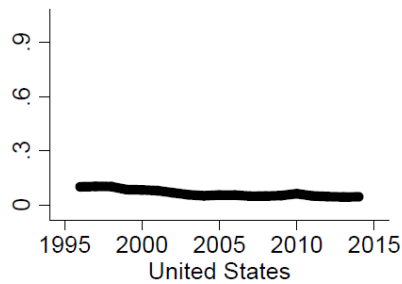
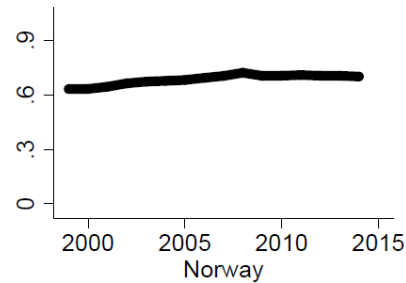
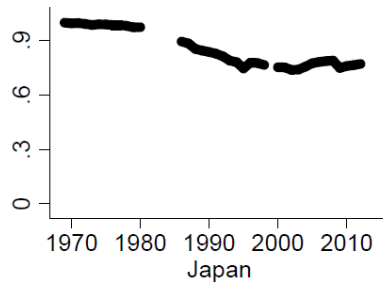
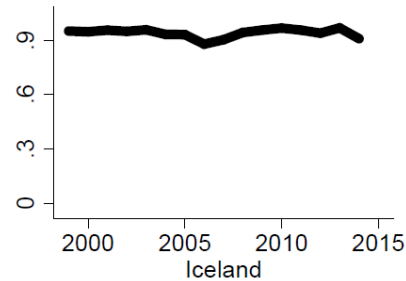
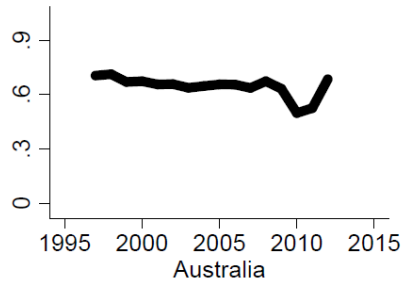


Source: Boonstra (2017)

# Dollar as Reserve currency

- 2/3rds of government foreign exchange reserves are in dollars
- 88% of foreign exchange trades are between the dollar and another currency
- Many countries invoice their imports in dollars, even when they are not trading with the US
  - True for developed and developing countries
  - Oil is always traded in dollars

# Share of imports invoiced in foreign currency (Gopinath (2015))



# Dollar as Reserve currency

- Nearly all \$-denominated transaction are effectively subject to US jurisdiction
- Gives US great leverage
- US has higher return on assets held overseas than foreigners get on assets held in US
- China is trying to develop its own international payment system



# Changing magnitude of global flows

- Mean absolute value of current account/GDP in 15 countries (Schularick 2012).

Years	Abs(Current Account)/GDP in %
1870-1889	4.0
1890-1913	3.7
1927-1931	2.7
1932-1939	1.5
1947-1959	2.0
1960-1973	1.3
1974-1989	2.2
1989-2000	2.6
2001-2008	4.5
2009-2012	4.3

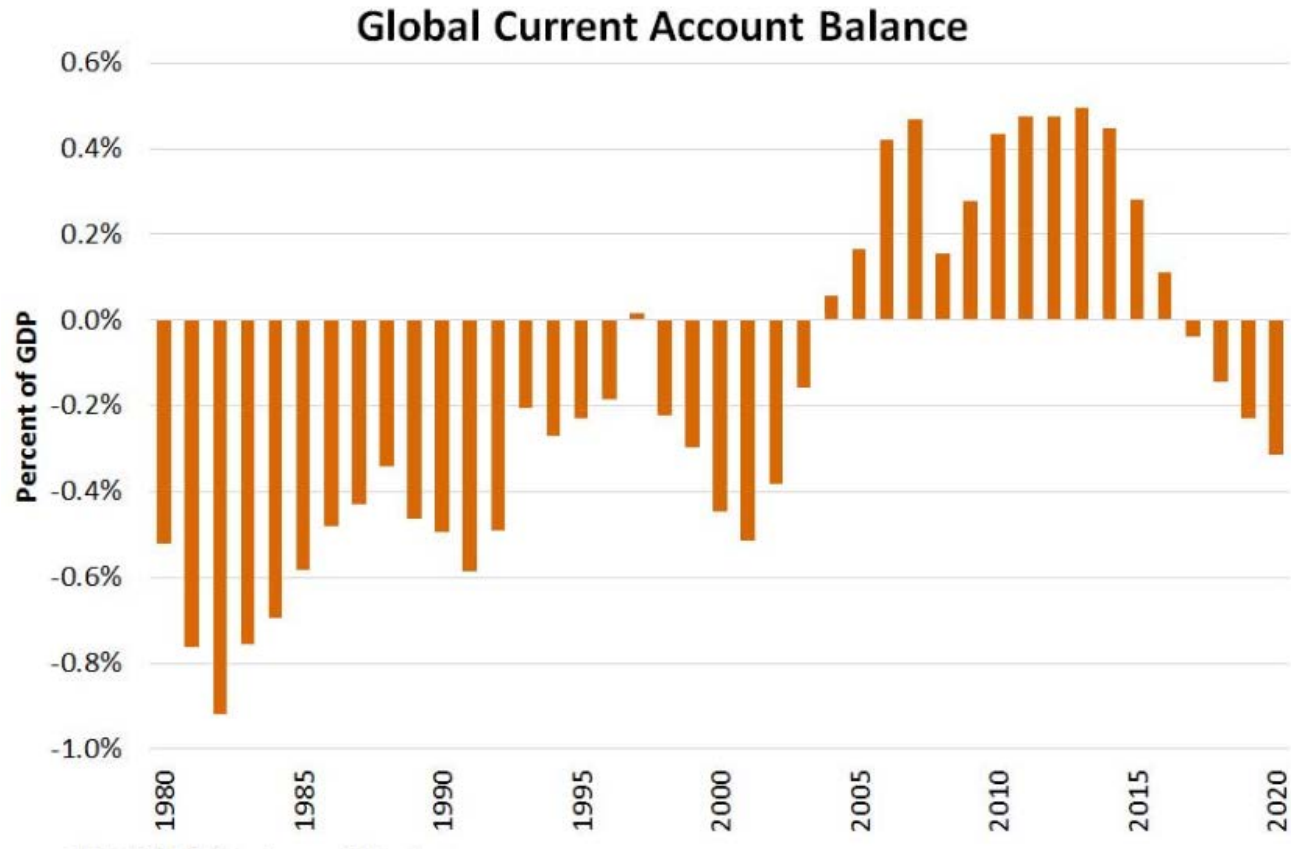
# Direction of Capital Flows

- Before WW1, capital flows were from rich to poor
  - Standard case for capital mobility
- Recent capital flows are from poor to rich
  - Development strategy of China
  - Countries building up foreign exchange reserves
  - Goes back to Asian financial crisis of 1998

# Types of international capital flows

- Bank Loans
- Portfolio Investment (Bonds, Equities)
  - Short term (“hot money”)
- Foreign Direct Investment
  - Longer term
  - Foreign ownership can be politically contentious

# Global current account balance



Source: Santacreu (2016)

# Foreign Currency Futures and Forward Rates

- Currency futures are an agreement to buy a foreign currency at a point in the future
  - Currency forwards are more common
- Covered Interest Parity

$$S_t (1 + R_t)^T = F_t (1 + R_t^*)^T$$

where

$S_t$  : Exchange Rate (US\$/Foreign Currency)

$F_t$  : Forward Exchange Rate

$R_t$  : \$ Interest Rate

$R_t^*$  : Foreign Interest Rate

# Covered Interest Parity Example 1

- Suppose that the exchange rate today is 1 Euro=\$1.10
- Interest rate is 2% in the US
- Interest rate is -0.25% in the euro zone
- Covered interest parity says that the one year forward rate must satisfy

$$1.1 * 1.02 = F_t * 0.9975$$

- The forward rate is 1 Euro=\$1.125

# Covered Interest Parity Example 1

- In the example on the last slide, suppose instead that the forward rate was 1 Euro=\$1.14.

- What could I do?

Borrow \$1, Convert it to Euro.

Receive: Euro 0.9009.

Invest it at -0.25% interest. In one year I have Euro 0.9068.

Convert this back to dollars to receive \$1.034

Pay off the loan for \$1.02

Profit of 1.4 cents

## Covered Interest Parity Example 2

- Suppose that the spot exchange rate in 2005 was \$1=100 Yen.
- Interest rate was 0 in Japan
- One year forward rate was \$1=95 Yen.
- Q. What must US\$ interest rate have been?

Spot: 1 Yen=\$0.01. Forward 1 Yen=\$0.0105

$$0.01 * (1 + R_t) = 0.0105$$

- US interest rate is 5 percent.



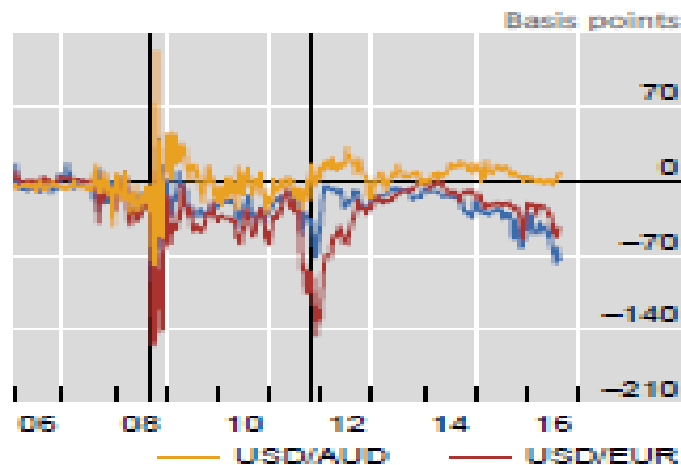
# Foreign currency swaps

- A swap is a combination of a spot and forward rate
- Party A buys dollars for euros today
- Agrees to sell the dollars back in the future at a rate agreed today
- Covered interest parity says that the difference in the exchange rates should be determined by relative interest rates
- Makes up a lot of FX trading

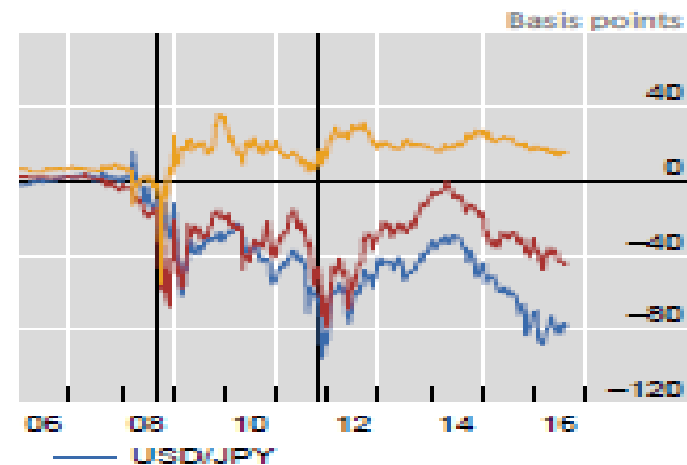
# Covered Interest Parity

- A violation of covered interest parity is an arbitrage opportunity
- Violations used to be rare and small
- Since 2008, there have been violations
- Banks need to use swaps market to borrow dollars
  - Cross-currency basis: negative means more expensive to borrow dollars via swaps than to do so directly

Three-month basis



Three-year basis



# Central bank foreign currency swaps

- Fed developed facilities with other major central banks in 2008 which are still there and were reactivated in COVID crisis
- ECB asks for dollars from Fed in exchange for euros
- ECB pays interest and fee on the dollars and lends them on to European banks without taking a profit
- Fed pays no interest on the euros that it has received
- After the term, the money is returned
- ECB is responsible for returning funds even if European banks default

# Central bank foreign currency swaps

- Why did the Fed do this?
  - Fed makes a profit
  - Alternative is that European banks would have to sell their US assets quickly which is bad for the US.

# Hedging with Foreign Currency Futures

- A firm's profits go down by \$200,000 for every 5 cent rise in the pound/dollar exchange rate
- Each pound contract calls for the delivery of 62,500 pounds
- Q. How should this firm hedge exchange rate risk?
- A. Enters a long position on pound futures
  - 1 contract goes up  $0.05 * 62,500$  when the pound appreciates by 5 cents
  - The firm needs  $200,000 / (0.05 * 62,500) = 64$  contracts

# Pension Funds

- Defined benefit
  - The plan promises certain payments during retirement
- Defined contribution
  - The plan requires employer and or worker to make certain contributions. These are invested, often at the discretion of the worker. Pay out is simply determined by the investment outcome.
- Defined benefit used to predominate, but now are becoming rarer
- Pensions are heavily tax favored

# Problem with defined benefit

- Company has only weak incentives to put away enough reserves to pay future benefits
- Investing for future retirement benefits cuts earnings and ROE
- When obligations become due, firm will have to declare bankruptcy if cannot pay, but that's a long way off

# Market discipline

- Workers are like unsecured creditors
  - Firm goes bust; no pension
- But how many workers really understand this?
- And what could they do if they did?
- Instead various laws have evolved requiring firms to set aside money (likely inadequate)



# Pension Benefit Guaranty Corporation

- Provides some insurance against default
- Applies only to DB plans
- Covered by premia on issuers of DB plans
- Has been used e.g. in airline bankruptcies
- But relies on some DB plans being able to pay premia plus an implicit government guarantee
- Doesn't apply to state and local government

# ERISA

- Congressional Act in 1974
- Establishes funding standards for contributions to DB plans
- Establishes minimum vesting standards (e.g. 100% after 10 years)
- Created the PBGC
- Doesn't apply to state and local government

# Pension plans: measuring funding

- Compare the assets with the present value of liabilities
- Key question is discount rate
- Funding gap is  $(\text{Liabilities} - \text{Assets}) / \text{Liabilities}$
- Higher is discount rate, smaller is funding gap
- ERISA requires plans to use IRS interest rates based on corporate bond yields
  - Shortfalls generally have to be addressed

# Pension plans: measuring funding

- State and local government can use their own “expected returns” to discount liabilities
- Assumed returns around 7 percent are common
- Even with this, there was a 34% funding gap in 2016

# Insurance

- Other large institutional investor
- Life insurance
  - Term
  - Permanent....by construction having a savings component
  - Annuities
- Health Insurance
- Property and casualty
- Monoline (financial guarantees for ABS and munis)

# AMBAC

- Case study of monoline insurer
- Insured some of the WPSS bonds
- Went bankrupt in the crisis
- Since emerged from bankruptcy

# Insurance Regulation

- Insurance regulation is largely at the state level
- National Association of Insurance Commissioners
  - State regulators
  - Establishes guidelines but doesn't have regulatory authority
- State insurance guaranty associations pay claims up to a limit (approx. \$300,000 per person) in insurer failure
- Insurance failure is rarer than bank failure
  - No run on an insurer
  - Insurers less leveraged

# Why do insurers fail?

- Too many illiquid assets
- Investment in risky assets
- Rapid growth and expanding into noncore activities



# Stock versus mutual insurance companies

- Stock insurance company is owned by shareholders, as with any other corporation
- Mutual company is owned by the policyholders
- Most large insurers used to be mutual companies, but there has been a trend to demutualization

# Risks faced by large investors

- Key risk for DB pension funds, life insurers, annuities is interest rate risk
  - Long term liabilities and hurt by low rates
  - “Reaching for yield” behavior
- Property and casualty worry more about natural disasters
  - Reinsurance and catastrophe bonds

# Asset management company (AMC)

- An AMC manages and invests in portfolios of securities
- Typical activities:
  - Sponsoring ETFs
  - Owns private equity
  - Mutual funds
  - Hedge funds
- Blackrock is world's largest AMC (c. \$7 trillion assets under management).

# Blackrock and Blackstone

- Easy to get confused between two large asset management companies
- Blackrock was a part of Blackstone that became an independent company in the 1990s
- Blackrock: low fees, large scale, passive investing (eg ETFs)
- Blackstone: focus on private equity
- Blackrock is now much bigger

# Hedge Funds vs. Mutual Funds

## **Hedge Fund**

- Transparency: Limited Liability Partnerships that provide only minimal disclosure of strategy and portfolio composition
- No more than 100 “sophisticated”, wealthy investors
- Large investors

## **Mutual Fund**

- Transparency: Regulations require public disclosure of strategy and portfolio composition
- Number of investors is not limited
- Small investments can be made

# Hedge Funds vs. Mutual Funds

## **Hedge Fund**

- Compensation structure:  
Typically charge a management fee of 1-2% of assets and an incentive fee of 20% of profits

## **Mutual Fund**

- Compensation structure:  
Fees are usually a fixed percentage of assets, typically 0.5% to 1.5%

# Net Asset Value

- Net Asset Value  $\frac{\text{Market Value of Portfolio-Liabilities}}{\text{Number of Shares}}$

# Types of mutual funds

- Managed Investment Companies
  - Open-End
    - Fund issues new shares when investors buy in and redeems shares when investors cash out
    - Priced at Net Asset Value (NAV) (except some MMMF)
  - Closed-End
    - No change in shares outstanding; old investors cash out by selling to new investors
    - Priced at premium or discount to NAV



# Types of mutual funds

- Open vs. closed
  - Closed end funds can trade far away from NAV
- ETF (effectively trade at NAV)
  
- Load versus no-load mutual funds
  
- Rising popularity of passive investment strategies (index funds, or ETFs)

# Passive management

- Most fund managers underperform broad stock market indices
- Corollary of efficient markets
- Massive inflows into passive management
- Blackrock, State Street and Vanguard are the big 3 passive management firms
- There are some worries, though probably overblown
  - Who will monitor managers if investment is all through passive funds?

# Hedge Fund Strategies

- Directional
- Non-directional
  - Exploit temporary misalignments in relative valuation across sectors
  - Buy one type of security and sell another
  - Strives to be market neutral

# Regulation FD (“Fair Disclosure”)

- Since 2000, firms cannot provide information to analysts without making it public
- This reduced the information advantage of hedge funds

# Black Swans and Hedge Fund Performance

- Nassim Taleb:
  - Many hedge funds rack up fame through strategies that make money most of the time, but expose investors to rare but extreme losses
  - “Fake alpha”
- Examples:
  - The October 1987 crash
  - Long Term Capital Management

# Fake Alpha

- Stylized example
  - Suppose set up a fund investing in S&P500 and selling earthquake insurance
  - Every year that there isn't an earthquake, I beat the index
  - For a long time, I look like a genius
- But it is fake alpha
- Hedge funds have opaque strategies, so it is easier to create fake alpha than with a mutual fund

# Survivor bias

- Survivor bias is a big problem with measuring returns
- We don't look at returns of closed funds
- Problem exists for mutual funds
- But especially for hedge funds

# Hedge fund structure

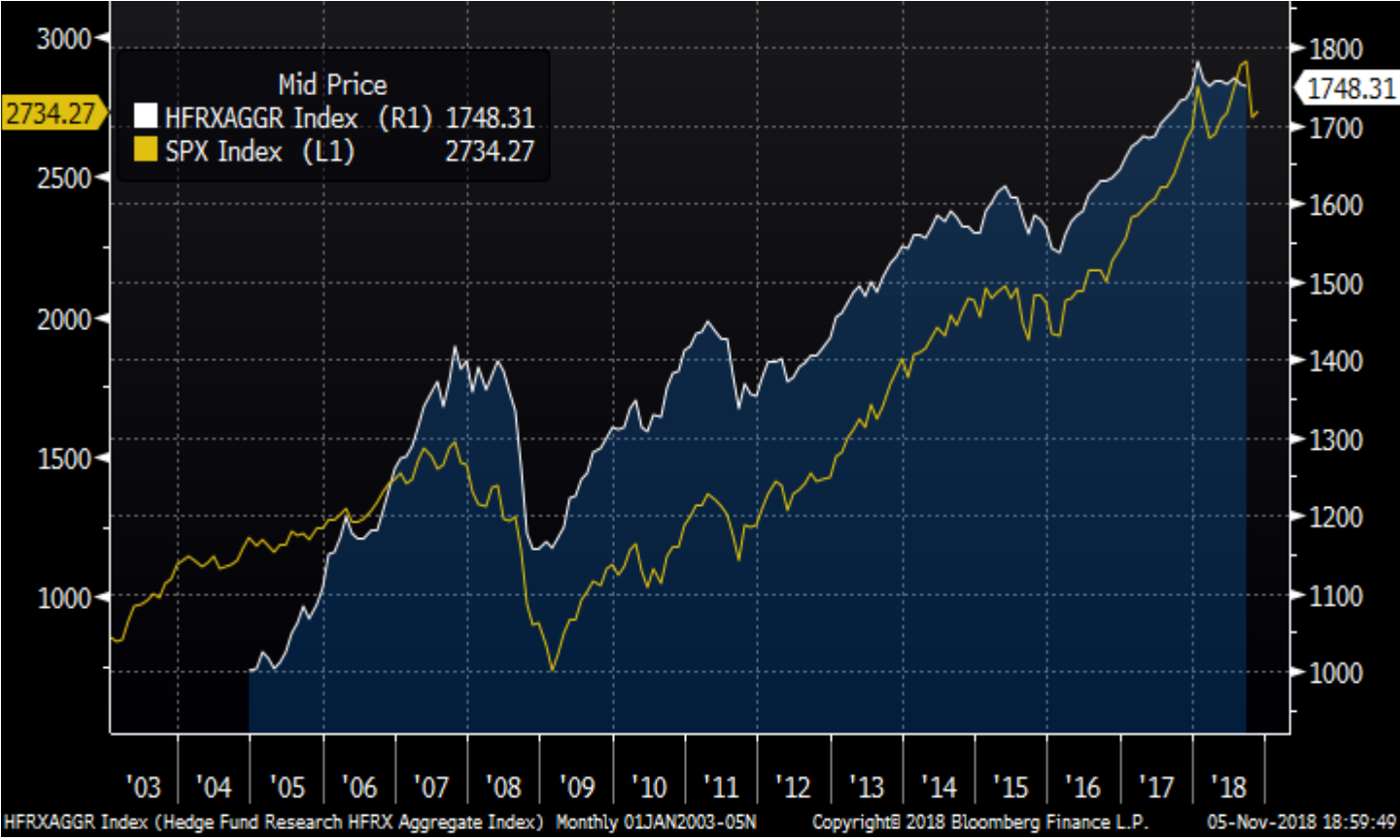
- “General partner” manages fund, collects fees and usually has some share in the fund
- “Limited partners” are regular shareholders. Just put up the money and have limited liability
- Prime broker lends money and securities to hedge fund and executes trades
  - Investment banks provide prime brokerage services



# Buffett Challenge

- In 2007, Warren Buffett made a \$1million bet that his S&P500 index fund would beat a basket of hedge funds over the next 10 years
- Protégé Partners accepted the bet
- Average returns S&P 500: 7.1%
- Average returns hedge fund: 2.2%

# The pattern...



# Sovereign Wealth Funds

- Run by governments that have accumulated large surpluses, usually because of oil/commodity boom
- Total about \$8 trillion
- Norway is the biggest
  - Larger part is global which does not invest in Norway
- Gulf states have large sovereign wealth funds (Kuwait, Saudi Arabia)
- Separate from foreign exchange reserves

# ARAMCO

- Saudi Arabia has a state run oil company ARAMCO
- Long standing plan to list on stock exchanges and sell some of the shares---funds going to SWF
- Diversification away from oil
- Exchanges require disclosure of information about the company
- IPO went ahead in 2019 but listed only on the Saudi stock exchange
- ARAMCO reports more profits than any other company in the world

# Private equity firms

- Carlyle, Blackstone are examples of firms that specialize in private equity
- Buys underperforming public firms and takes them private
- Generally uses a lot of leverage
- Private equity firms run private equity funds

# Private equity funds

- Also funds open only to small numbers of investors with same structure
- Buys underperforming public firms and takes them private
- Managers of the fund control the business
- Take over many funds at the same time
- Require long term commitment

# Venture capital

- New enterprises can be funded by a seed/angel investor
- Either equity or convertible debt in a startup
- Small investments with high risk of failure and huge potential returns
- Many startups need funds in excess of what can be raised from loans and angel investors---venture capital funds

# Venture capital

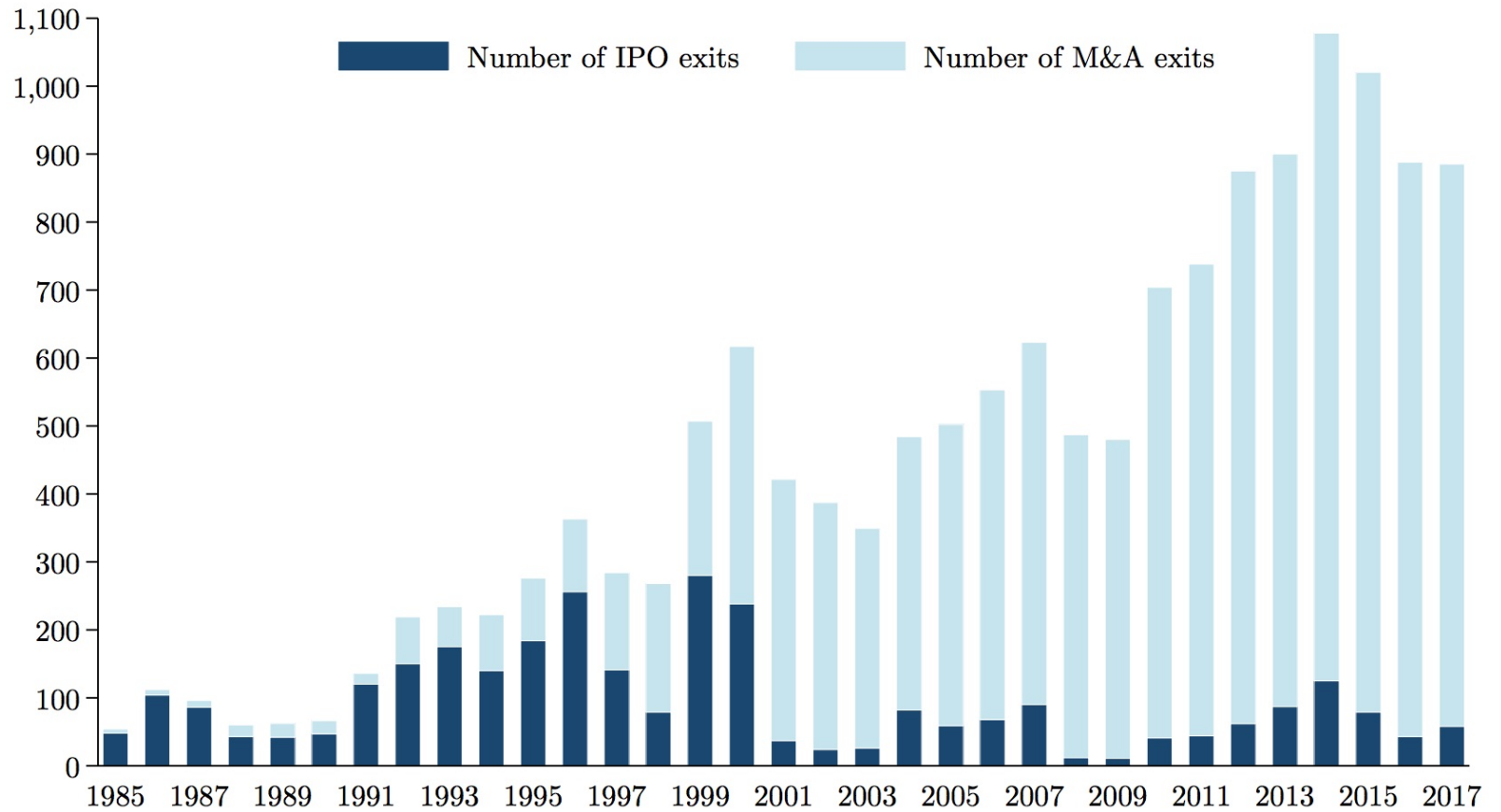
- Many startups need funds in excess of what can be raised from loans and angel investors---venture capital
- Also equity/convertible debt
- Venture capital uses staged financing
- As time goes by risk is lower
- VC keeps substantial control of the company
- A lot of capital in search of a few really good ideas



# Venture capital funds

- Like hedge funds, must limit to 100 sophisticated investors
- Same structure
- Invest in new IT and biotech firms
- Much smaller than hedge fund sector
- Specialize in a particular industry
- VC funds require long term (e.g. 10 year) commitments
- Exit strategy is either IPO or being bought out by another firm
- Private equity is now a common exit strategy

# Venture capital exits by year



# Venture capital exits by year

- Trend towards buyouts is part of increasing industry consolidation in the tech sector
- Advantages
  - Enormous economies of scale
  - Tech companies may be natural monopolies
- Disadvantages
  - Lack of competition
  - Perhaps less incentive to innovate
  - Political power?
- Antitrust enforcement is tricky because hard to argue that big tech is driving prices up

# Green finance

- Investments aimed at generating environmental benefits
  - Renewable energy
  - Walkable cities
  - Public transport
  - Forestry
- Includes green bonds, green banks, green private equity funds and green venture capital funds
- Bank credit is still the main way in which environmental projects get financed

# Green finance

- Somewhat different from older “socially responsible” investing
- ESG may be a role for active management
- “Greenwashing”: claiming environmental benefits that are limited for PR purposes

# Green bonds

- Issued by corporations (e.g. Apple), sovereign governments, World Bank, municipalities.
- Massachusetts issued a green bond to acquire conservation rates on coastal habitats.
- Problem: environmental benefits are public goods and hard to scale up green bonds if they are giving investors lower returns
- Green bond issuance has both grown very fast and is still very small (raised \$270 bn last year: 4% of bond issuance).

# Transition bonds

- Polluters can raise money to shift away from fossil fuels
- Payments tied to their success in doing this
- Enel (Italian electricity firm) issued debt where the payments are tied to the share of renewables in generation

# Ways in which public sector can encourage green bonds

- Tax advantages
  - Clean Renewable Energy Bonds provided federal tax credits in lieu of interest (not being issued any more)
- European Central Bank choosing to buy green bonds
- Bank regulators can reward lending to green projects (common in Europe)
- Government or a foundation can provide subsidies
- Having indices of green bonds can promote liquidity
- Arguably, needs tax subsidies or carbon pricing to really expand beyond a niche market