JOHNSON
Cornell University

NBA 5420: Investment and Portfolio Management

Class 11: Banking crises

Professor Matt Baron

April 27, 2016

Topics

- Bank balance sheets
- Bank runs
  - Central banks as “lenders of last resort”
- The “shadow banking system”
  - Collateralized lending
  - Money market mutual funds
- The 2007-08 financial crisis
- Macroeconomic & financial consequences of banking crises

Important readings

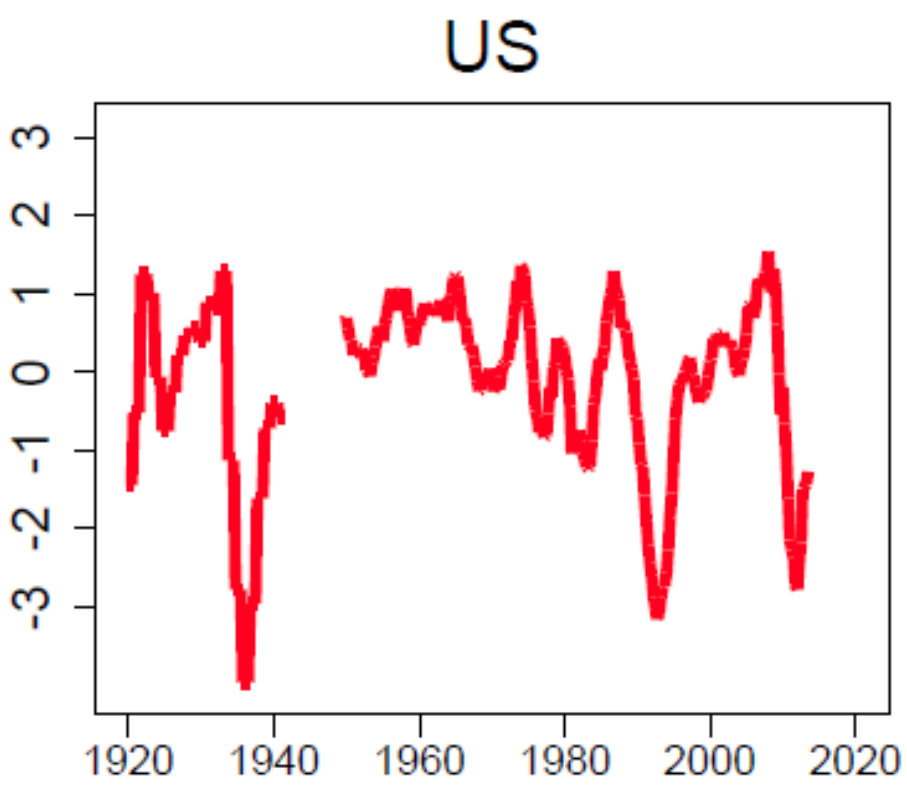
- Bernanke
  - "The Crisis as a Classic Panic"
- Delong
  - "The Great Depression from the Perspective of Today"
- Optional
  - Gorton: "Slapped in the Face by the Invisible Hand: Banking and the Panic of 2007"
  - Duffie: "The Failure Mechanics of Dealer Banks"

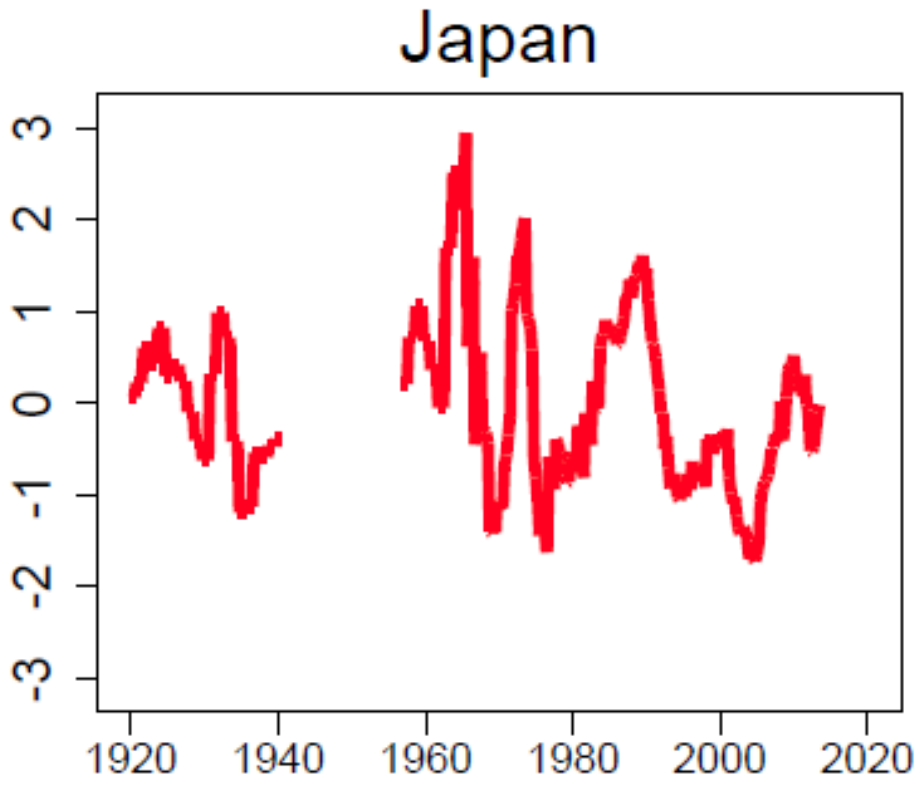
CAUSES AND CONSEQUENCES OF FINANCIAL CRISES

Causes of financial crises

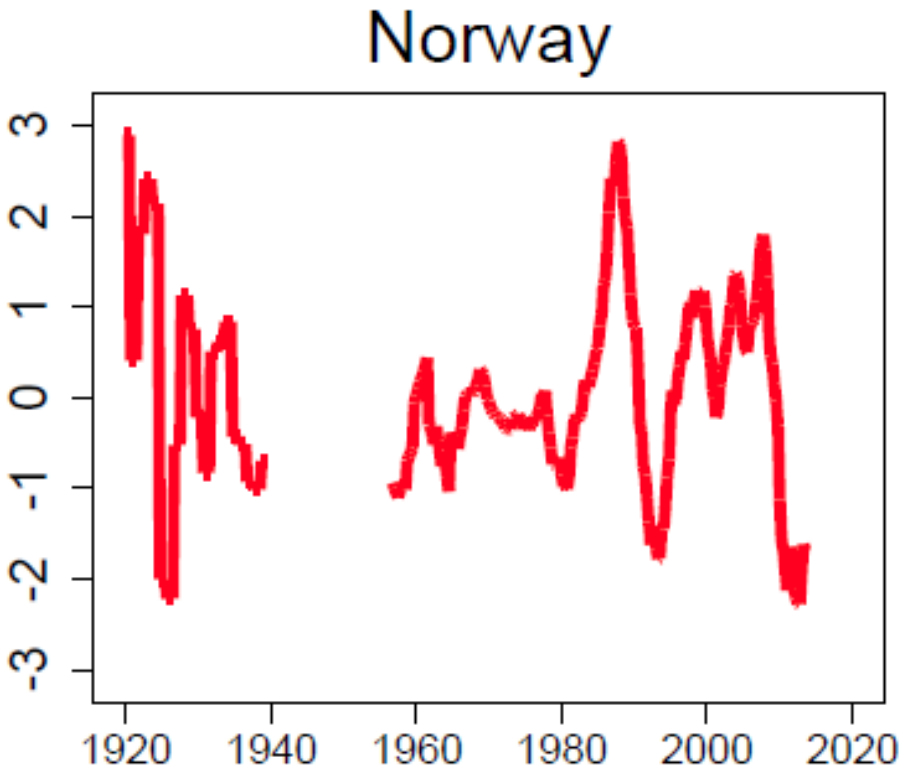
- Bank lending boom
- Other factors often (but not always) present
  - Real estate boom
  - Capital inflows

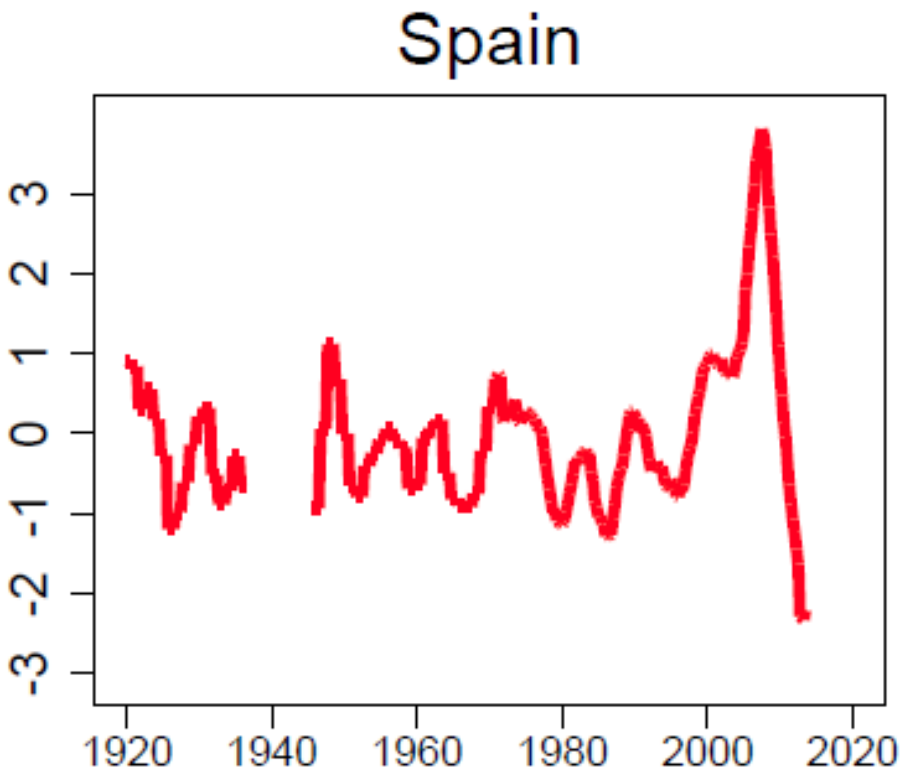
Bank lending / GDP





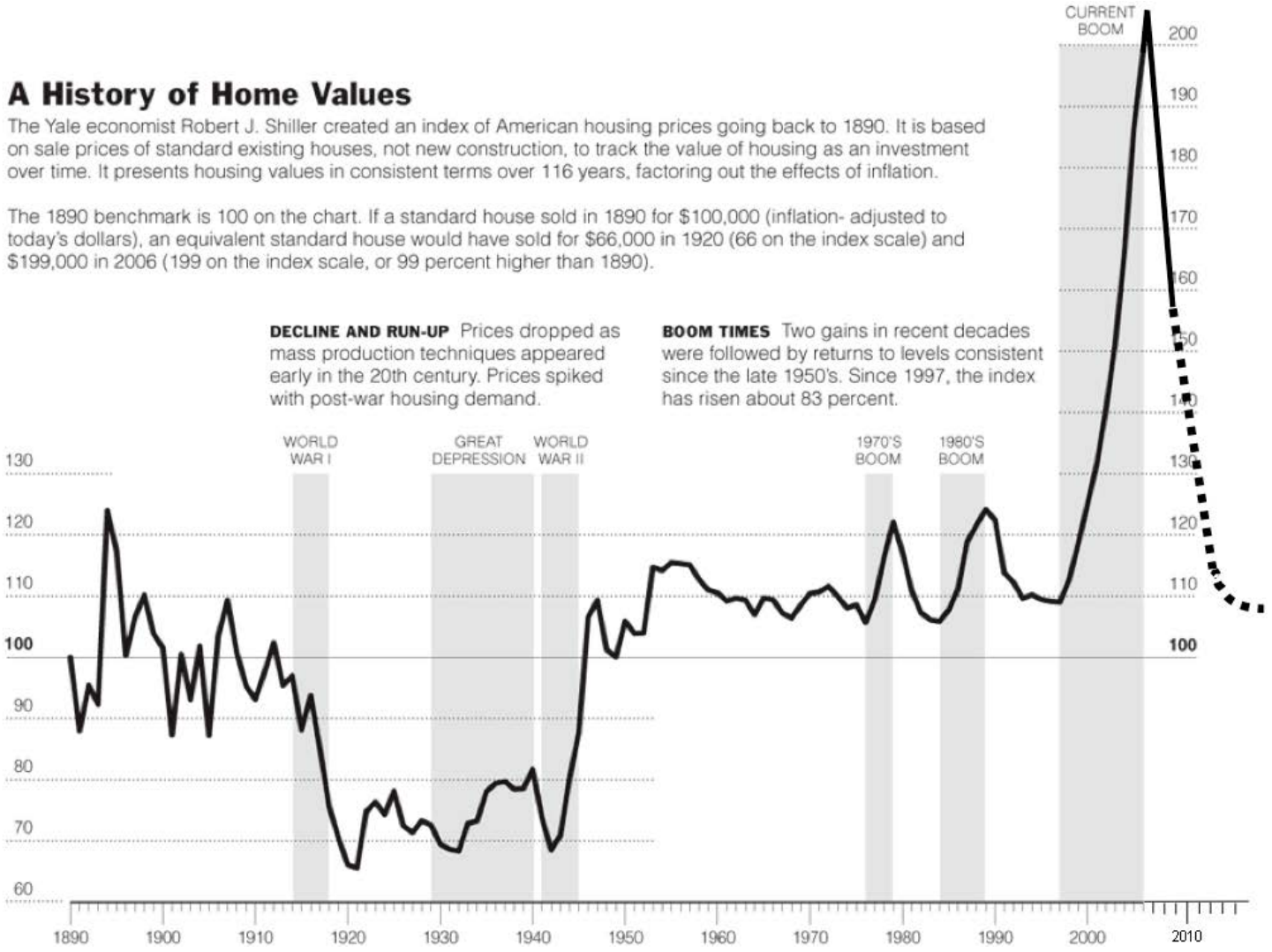
Bank lending / GDP



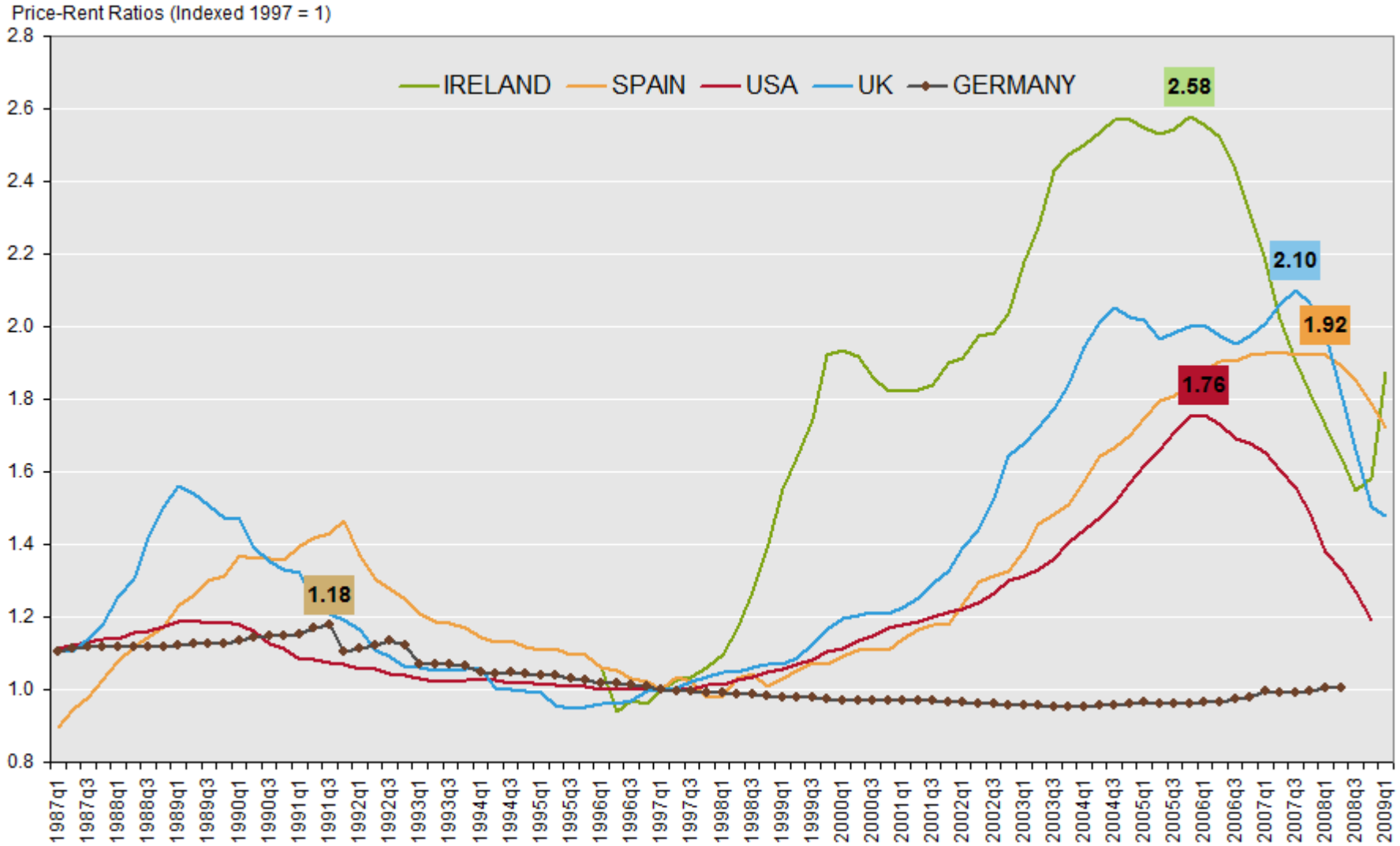


Large rise in (household debt / GDP)

A U.S. real estate bubble



… and a global bubble



Consequences of financial crises

1. Contraction in bank lending

2. Deep, persistent recessions
   - Avg. GDP decline = -9.6%, avg. time to recovery = 7.3 years
   - Avg. unemployment rise = 7 percentage points
   - Across 63 crises in adv. economies (Reinhart & Rogoff, 2009, 2014)

3. Decrease in asset prices
   - Stocks slump 55% and house prices decline 35%

4. Increase in government debt by 86%
   - Mostly due to decreased tax revenues
   - Not mainly due to bank recapitalization costs

5. Political extremism

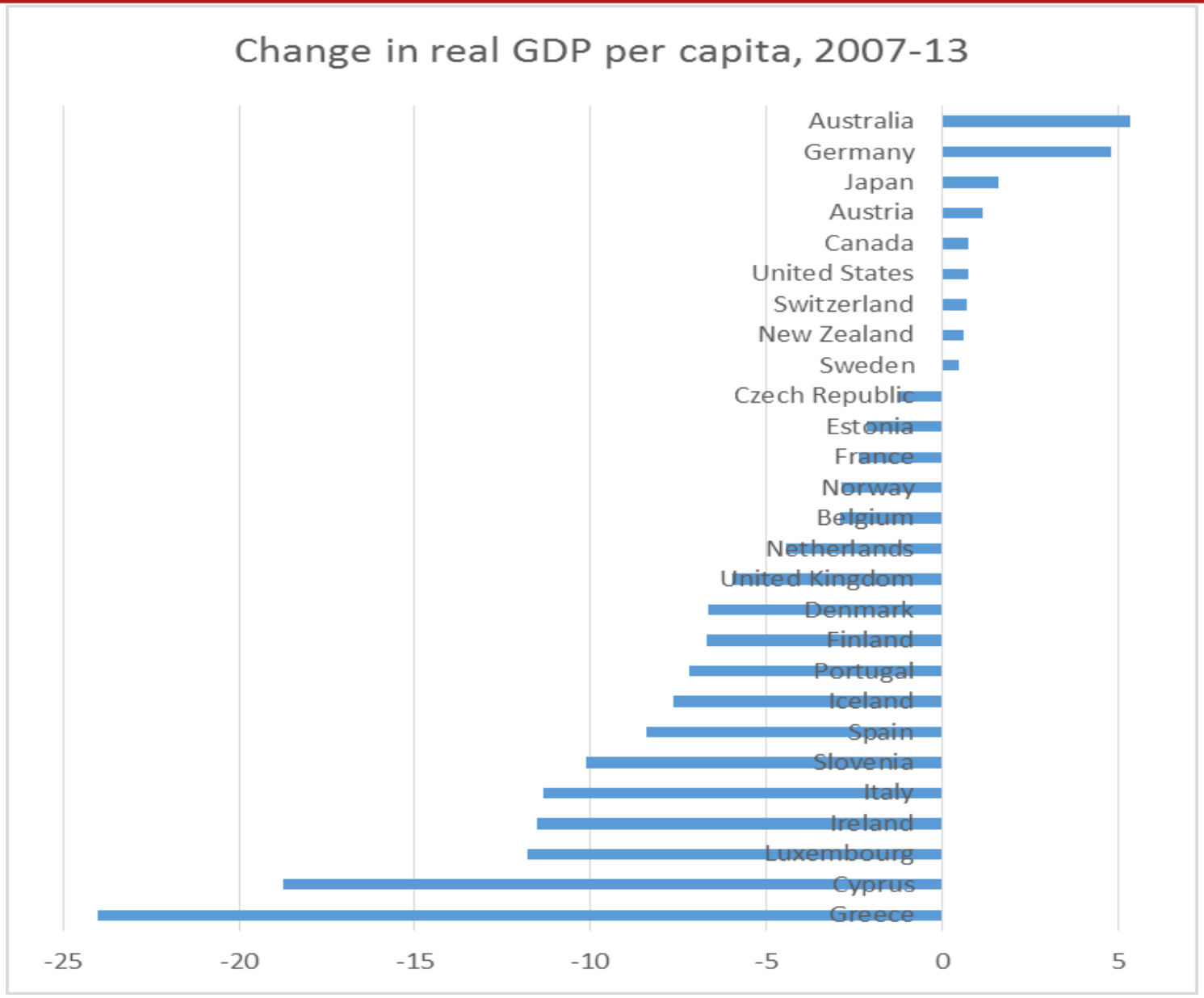
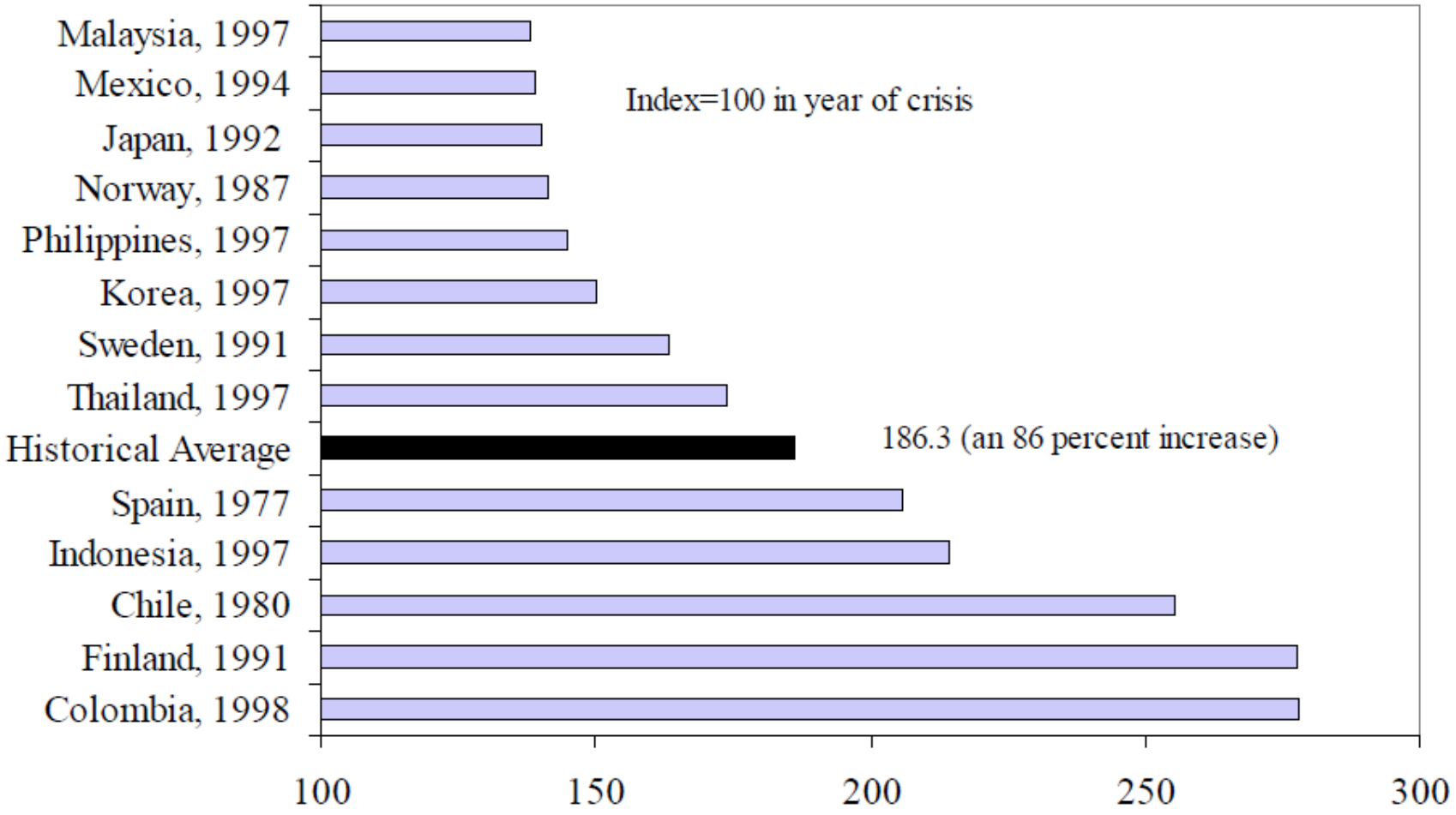

Change in real GDP per capita, 2007-13
Australia
Germany
Japan
Austria
Canada
United States
Switzerland
New Zealand
Sweden
Czech Republic
Estonia
France
Norway
Belgium
Netherlands
United Kingdom
Denmark
Finland
Portugal
Iceland
Spain
Slovenia
Italy
Ireland
Luxembourg
Cyprus
Greece
-25
-20
-15
-10
-5
0
5

TABLE 2—CUMULATIVE EFFECTS AFTER FINANCIAL CRISES

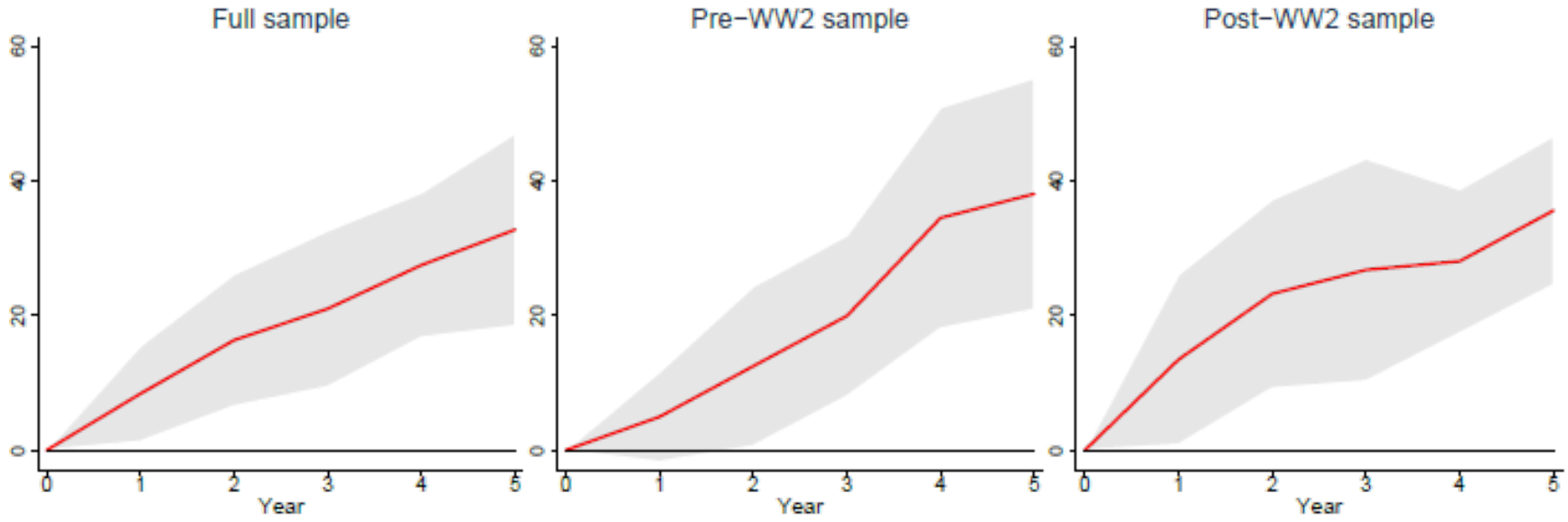
Cumulative log level effect, after years 0–5 of crisis, versus noncrisis trend, for:	Pre-World War II	Pre-World War II, excluding 1930s	Post-World War II
Log broad money	−0.139***	−0.103***	−0.077*
	(0.027)	(0.029)	(0.040)
Log narrow money	−0.083**	−0.098***	0.009
	(0.037)	(0.036)	(0.053)
Log bank loans	−0.248***	−0.220***	−0.144***
	(0.044)	(0.047)	(0.055)
Log bank assets	−0.156***	−0.144***	−0.258***
	(0.035)	(0.038)	(0.050)
Log real GDP	−0.041**	−0.018	−0.079***
	(0.020)	(0.020)	(0.018)
Log real investment	−0.190**	−0.115	−0.257***
	(0.091)	(0.089)	(0.049)
Log price level	−0.089***	−0.055***	0.007
	(0.025)	(0.026)	(0.029)

Note: Standard errors in parentheses.

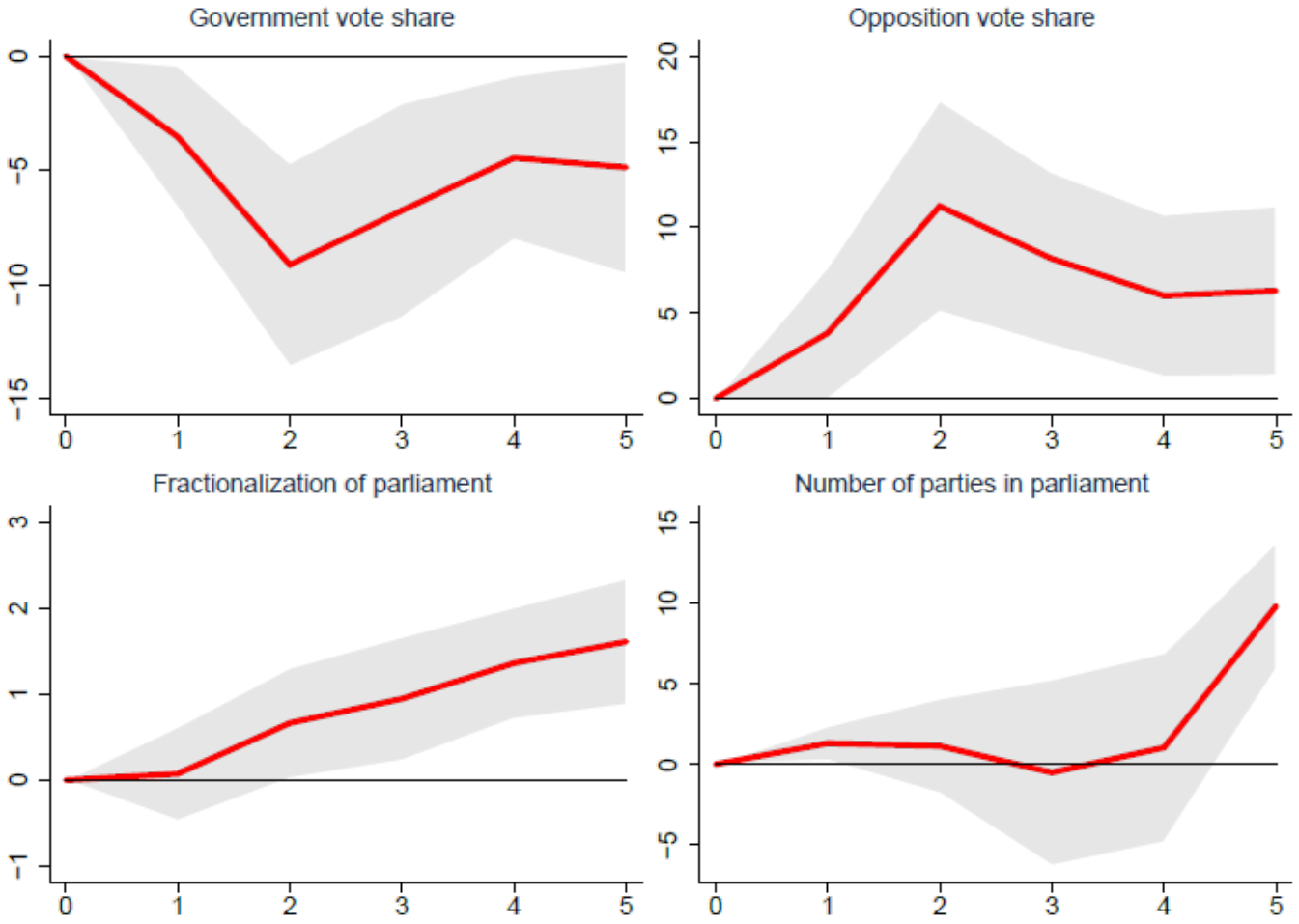
Cumulative increase in real public debt in the three years following the banking crisis



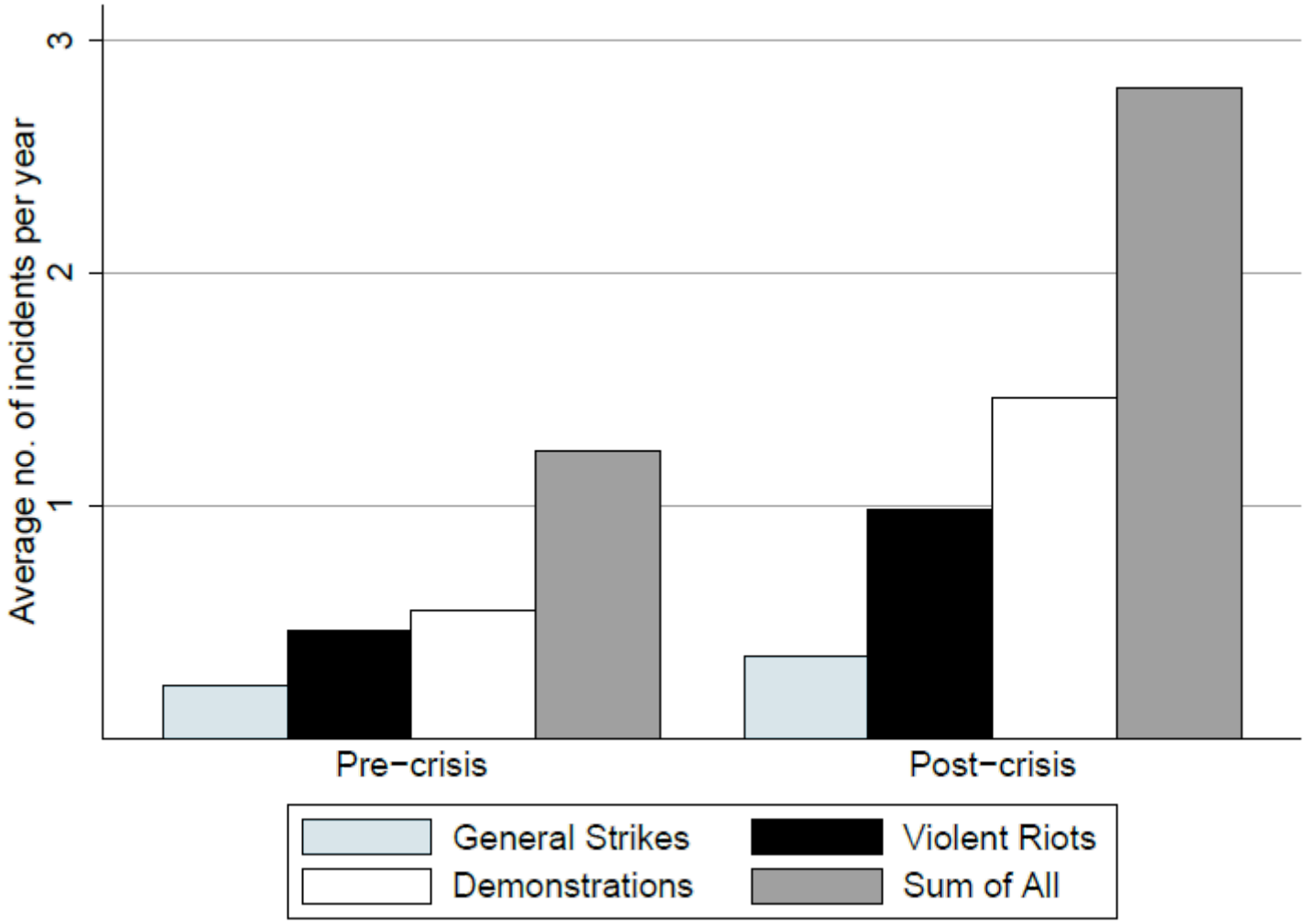
Increase in far-right vote after crises



Increasing polarization

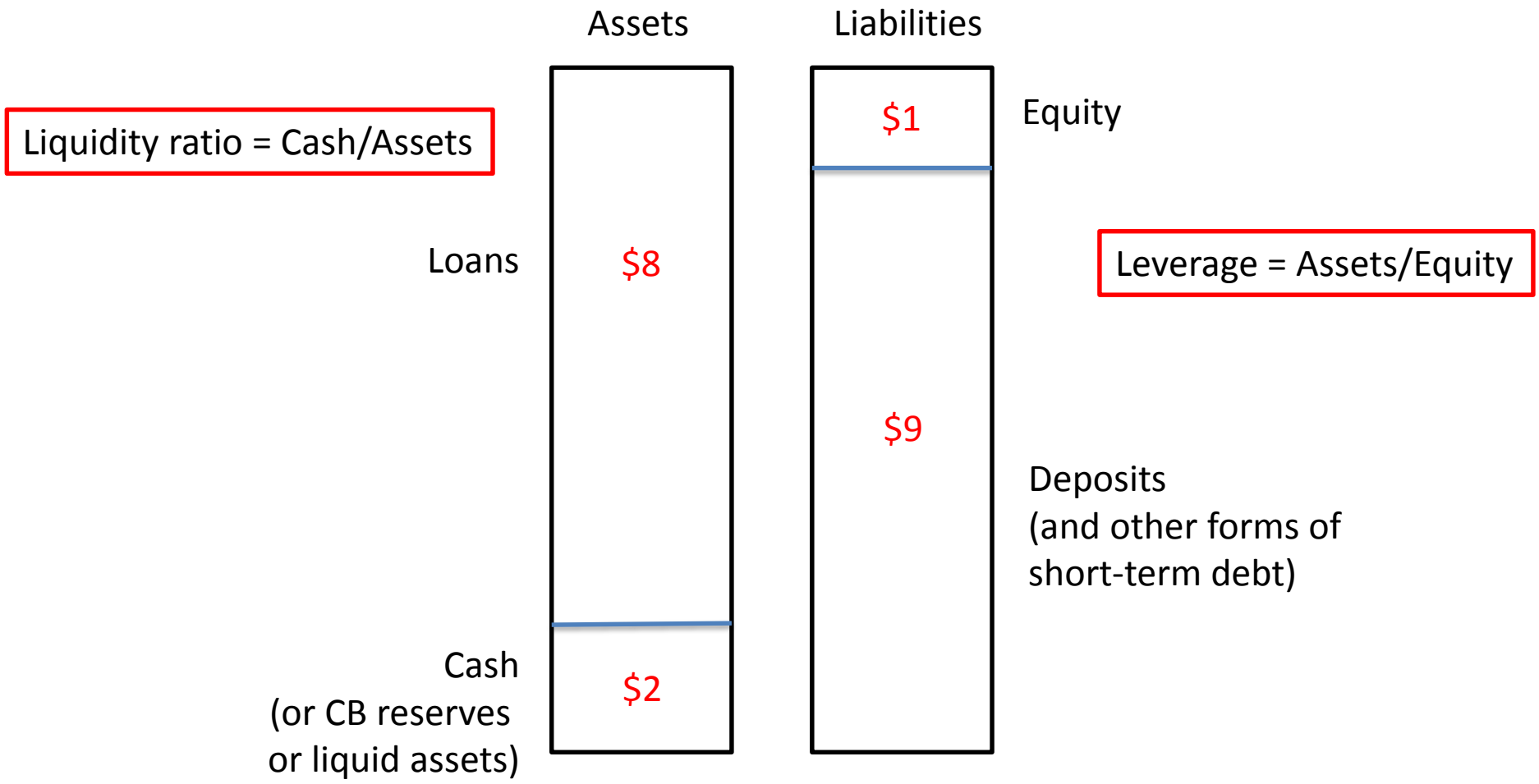


Political Unrest



BANK BALANCE SHEETS

A bank balance sheet



The need for banking regulation

- Suppose a bank is leveraged 20-to-1.
  - What's the return on equity (ROE) if the bank's assets return 1% (after paying interest to depositors)?
  - Suppose instead that 3% of its loans default (and become worthless). What is the shareholder loss?
  - What if instead 6% of its loans default?

- This suggests the importance of high regulatory capital requirements.

BANK RUNS


Dedicated to Thrift


northern rock

The Diamond-Dybvig Model

- Why do banks exist?

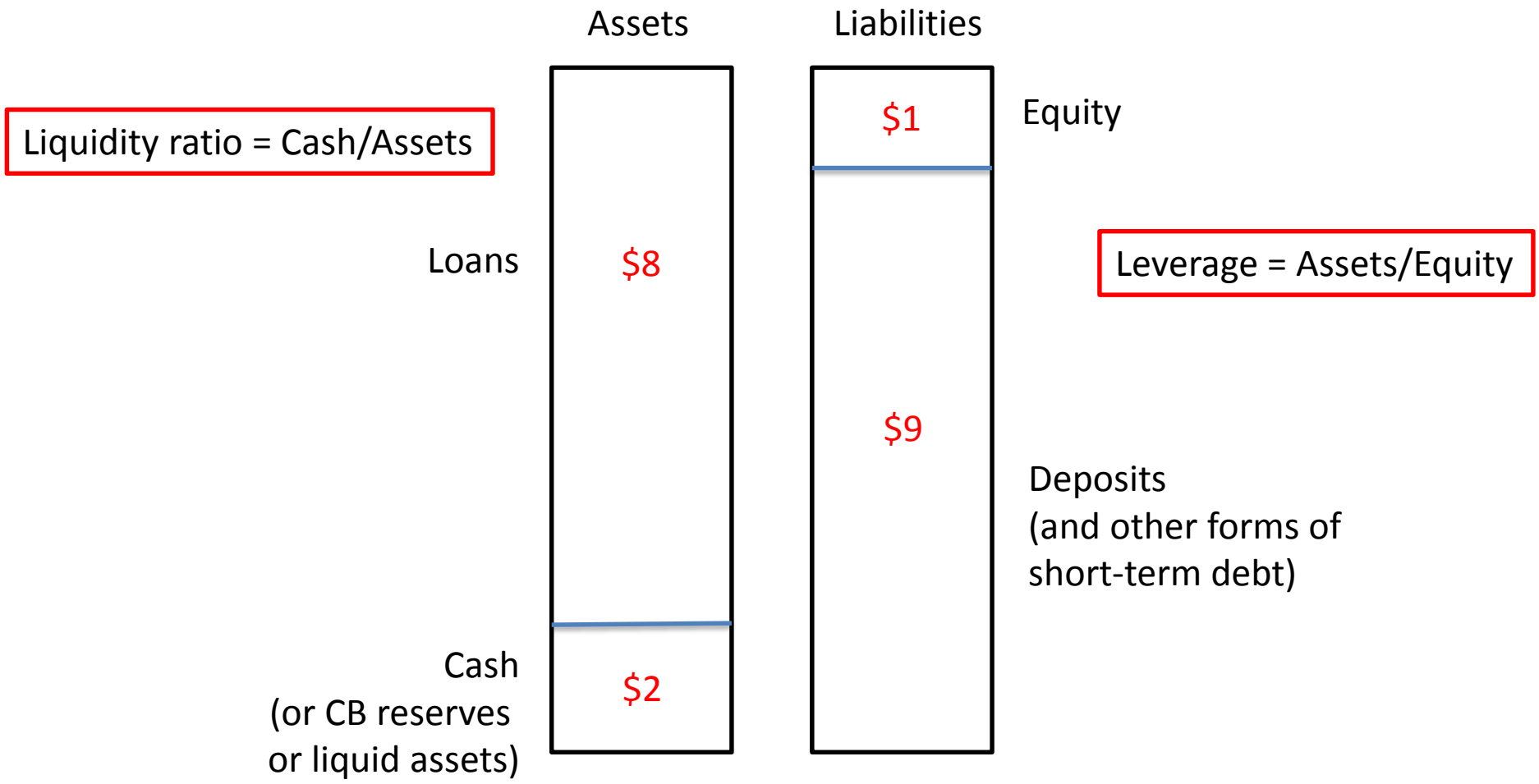
1. Bank provide screening and monitoring functions vis a vis borrowers
   - Banks as “delegated monitors” to determine creditworthiness of borrowers

2. Banks provide liquidity insurance to risk averse depositors
   - Demand deposits are vulnerability to runs when more than the “expected” fraction of depositors withdraw

The Diamond-Dybvig Model

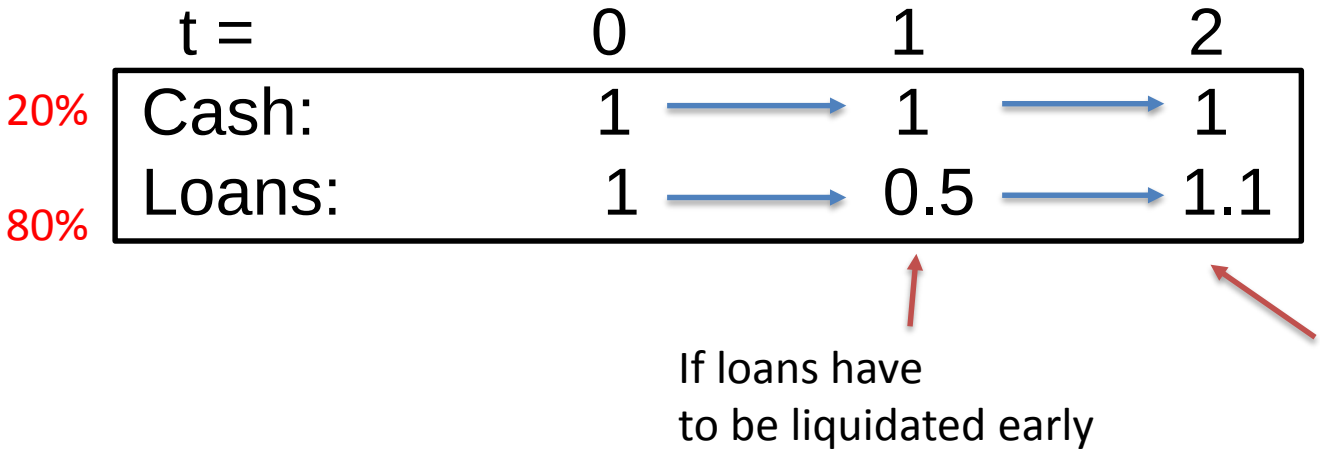
- Banks issue liquid liabilities (demand deposits)
  - Which depositors can withdraw at any time
- But invest mainly in illiquid assets
  - Which are costly to liquidate prematurely
- This allows banks to provide liquidity insurance to depositors but also creates maturity mismatch
  - Which exposes them to **runs**

A bank balance sheet

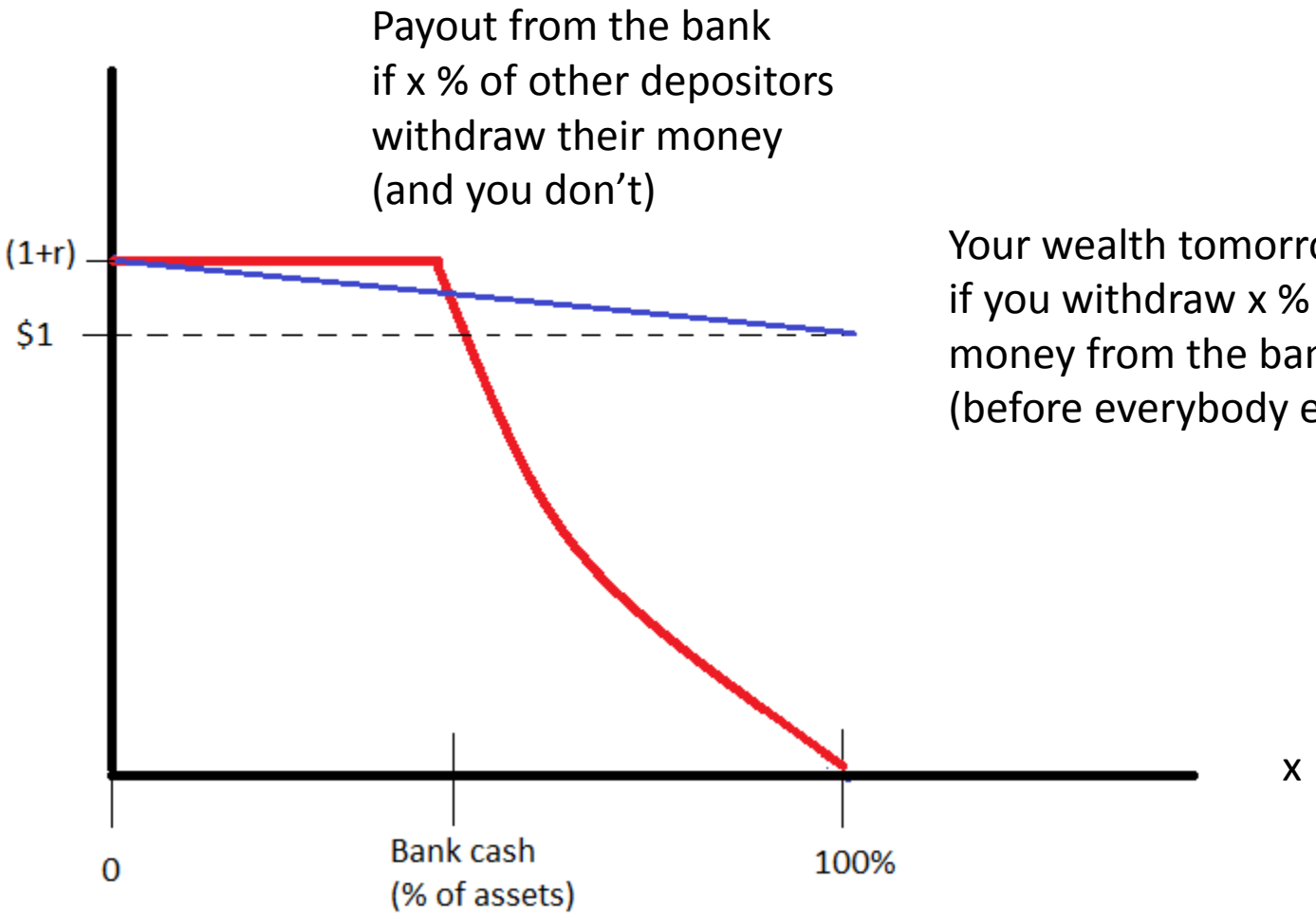


The basic model

- Three dates t = 0, 1, 2
- A fraction of random size *L* are exposed to early withdrawal shocks
- Banks invest their deposits as follows:



The Diamond-Dybvig Model

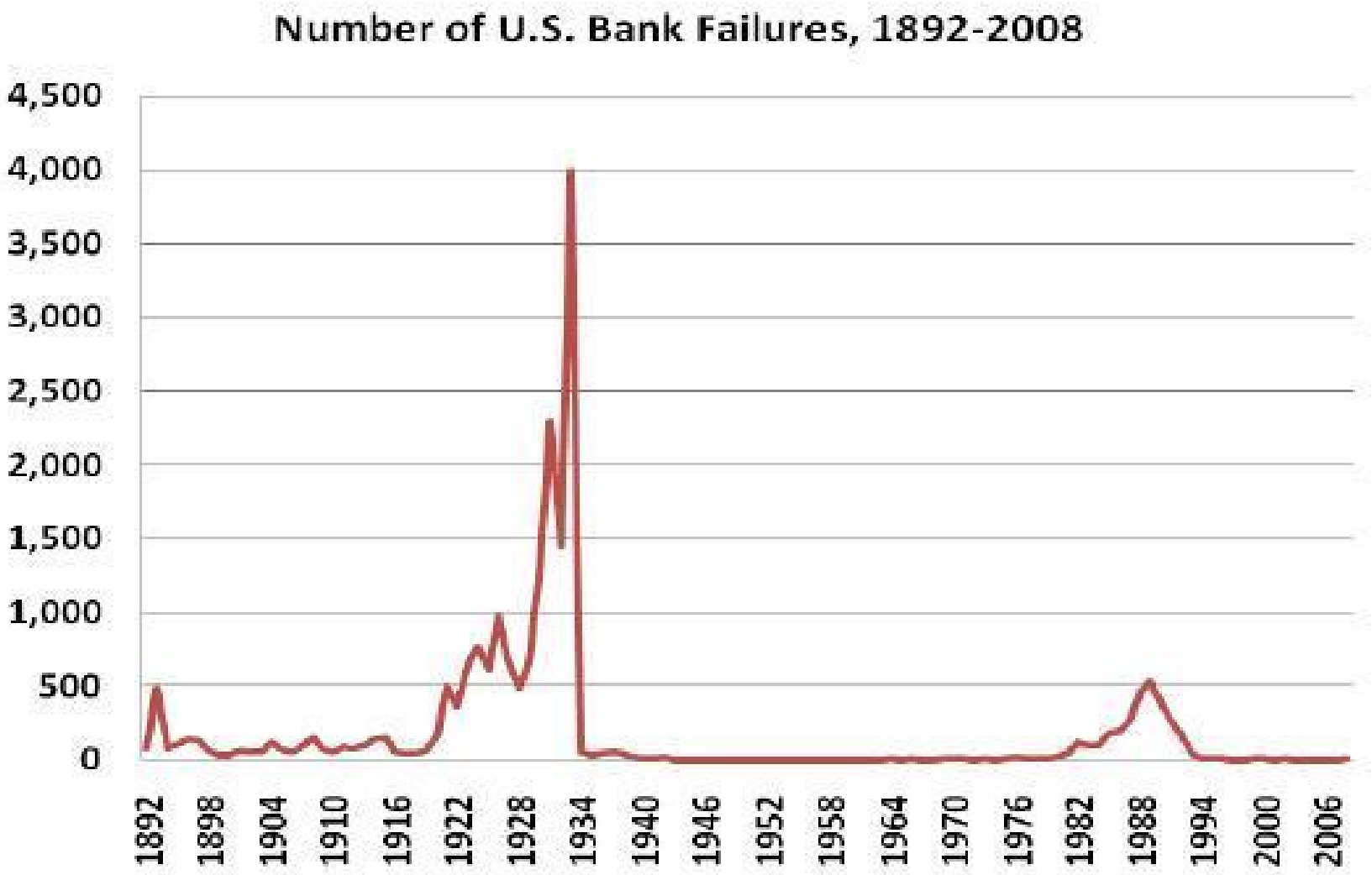


Two equilibria

1. All depositors keep their money at the bank, and everyone earns 10% interest

2. All depositors withdraw early (“a bank run”) and they take a loss on their initial deposit

- Ways to prevent bank runs:
  - Deposit insurance
  - CB acting as “lender of last resort”


Number of U.S. Bank Failures, 1892-2008
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1892
1898
1904
1910
1916
1922
1928
1934
1940
1946
1952
1958
1964
1970
1976
1982
1988
1994
2000
2006

“SHADOW BANKING” ALSO PRONE TO RUNS

Shadow banking system

- More recently, non-bank entities operate as banks, in the sense of taking short-term funding ("wholesale funding") and lending long-term (usually by holding securities)
  - e.g., investment banks, structured investment vehicles (SIV), levered hedge funds, other finance companies (credit cards & auto loans)

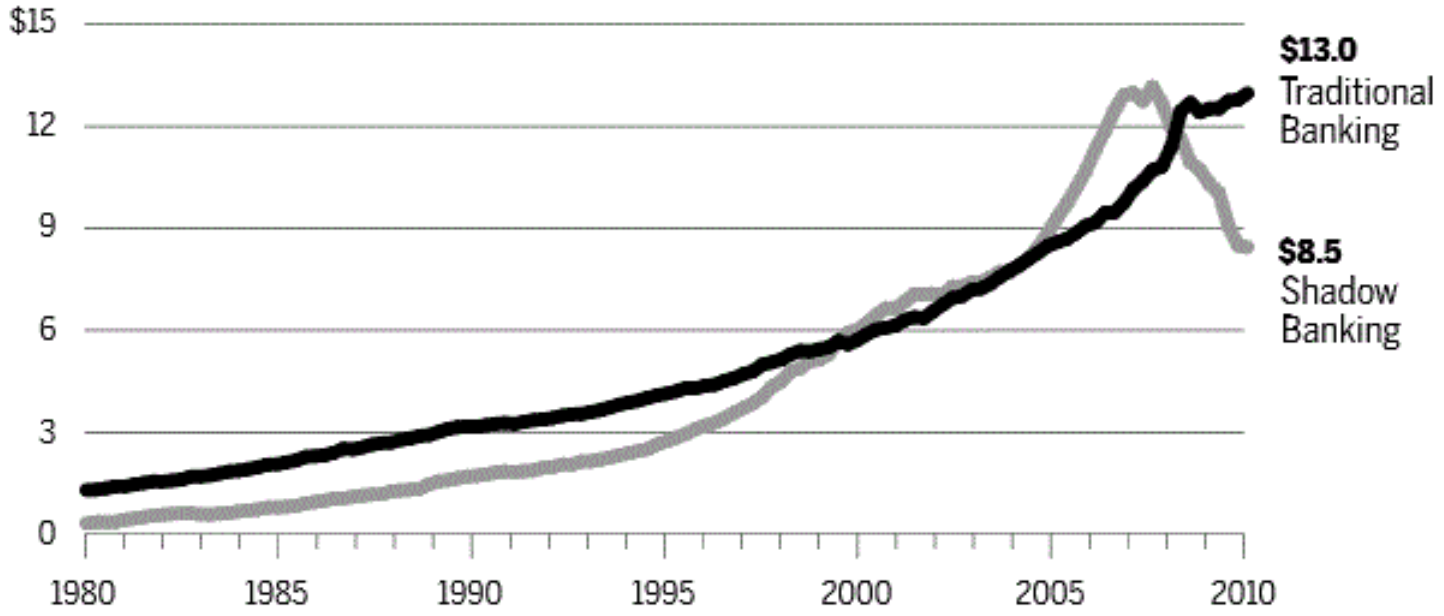
- They effect "maturity transformation"
  - Like banks, mainly earn profits on the spread between their funding costs (at the short-term rate) and their lending (at the long-term rate)

- Problem:
  - These firms are not regulated like banks
  - Do not have deposit insurance or "lender of last resort"
  - Subject to runs

Traditional and Shadow Banking Systems

The funding available through the shadow banking system grew sharply in the 2000s, exceeding the traditional banking system in the years before the crisis.

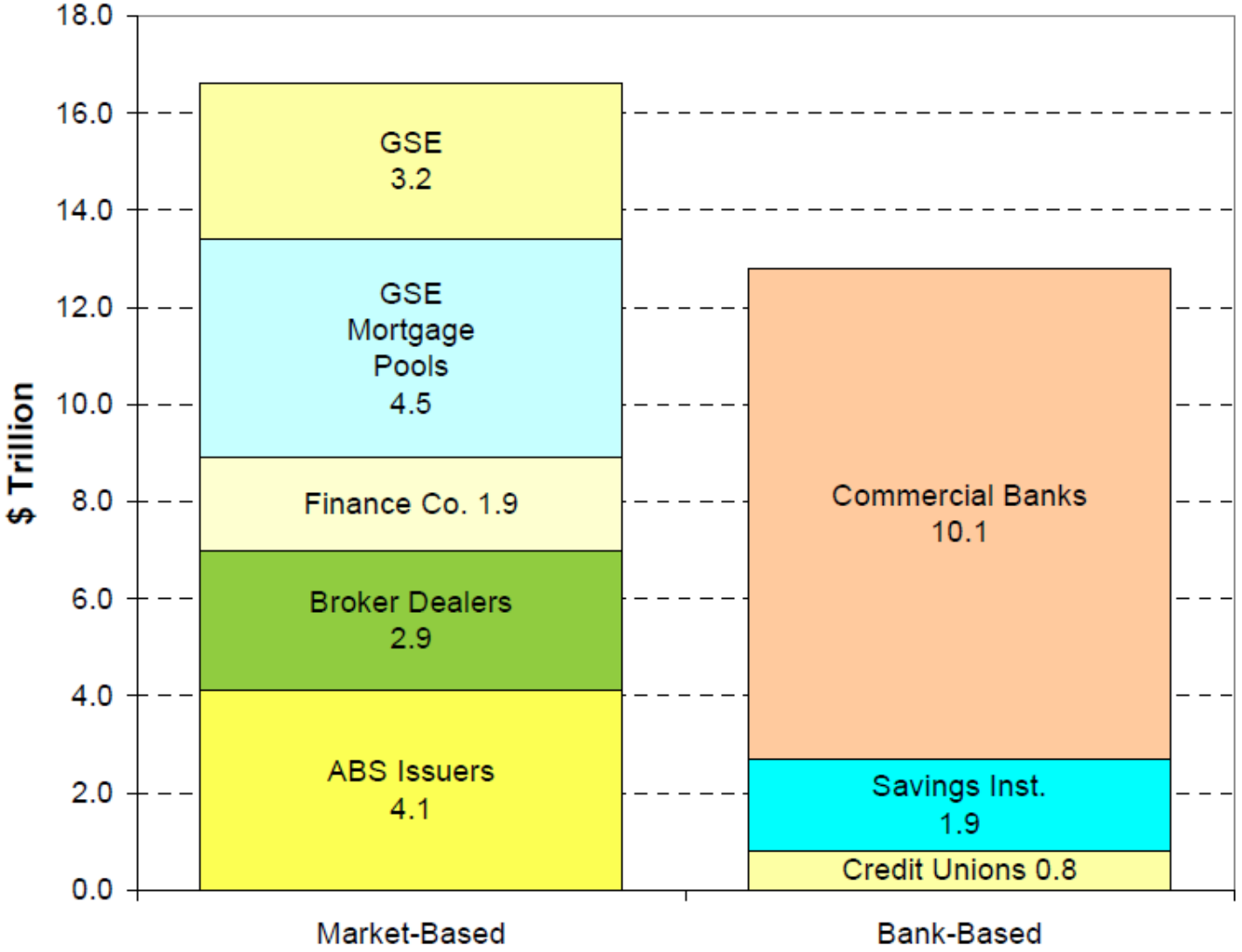
IN TRILLIONS OF DOLLARS



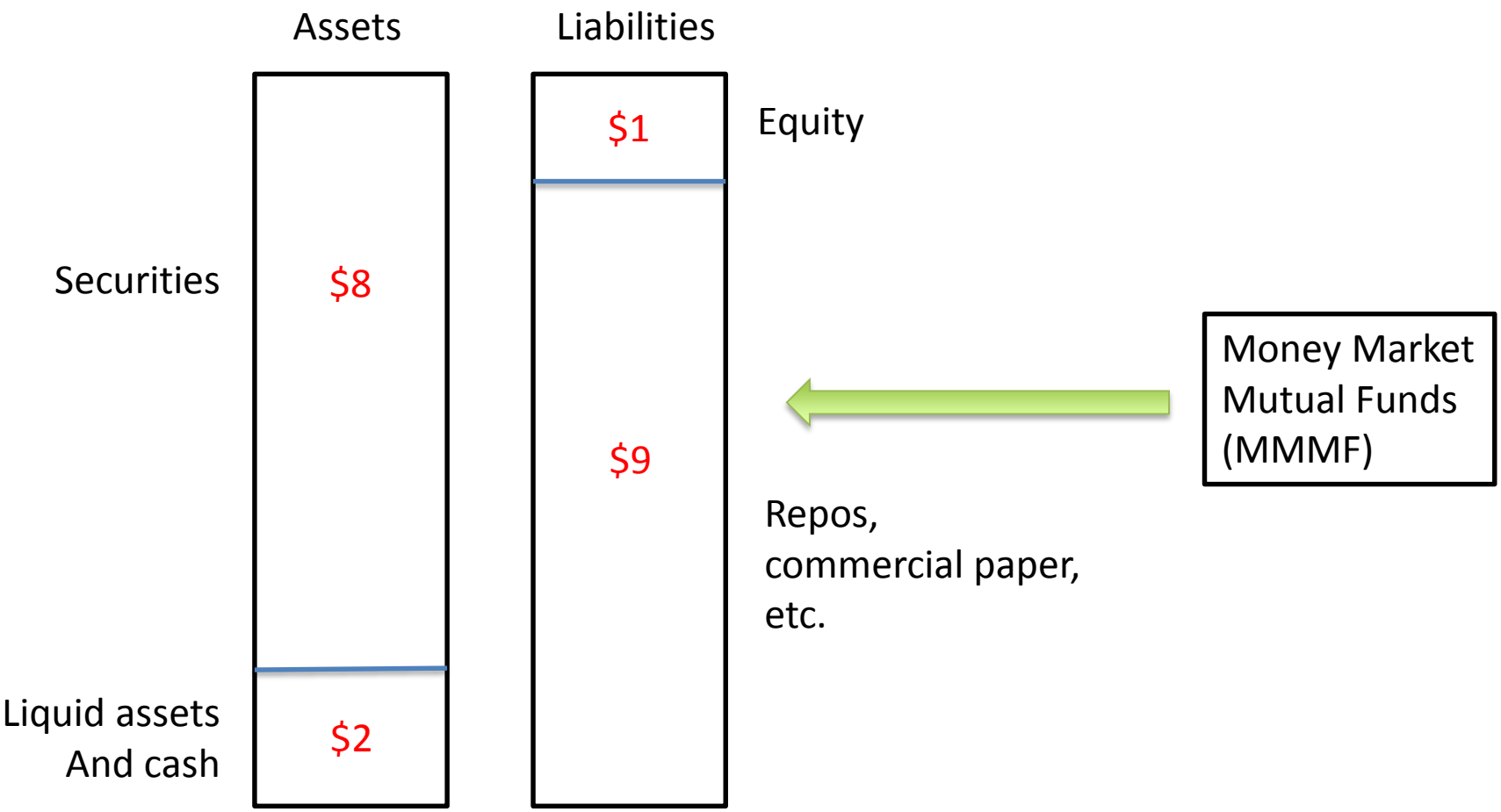
NOTE: Shadow banking funding includes commercial paper and other short-term borrowing (bankers acceptances), repo, net securities loaned, liabilities of asset-backed securities issuers, and money market mutual fund assets.

SOURCE: Federal Reserve Flow of Funds Report

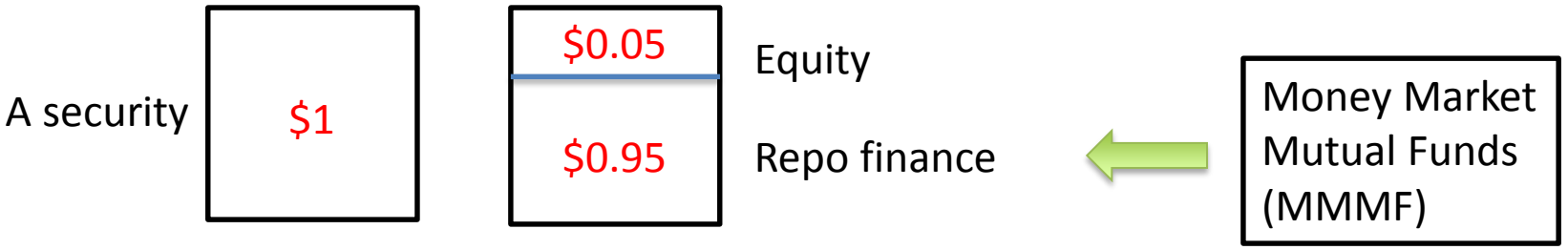
Figure 1. Total Assets at 2007Q2 (Source: US Flow of Funds, Federal Reserve)



An investment bank



Collateralized lending



- Creditors give the broker-dealer $0.95, which is used to purchase a $1 asset
  - The security is pledged as collateral
    - Formally, the creditor takes possession of the asset, with the bank repurchasing it the next day (in effect, repaying the loan)
  - That way, the credit has a 5 cent margin of error called a “haircut”

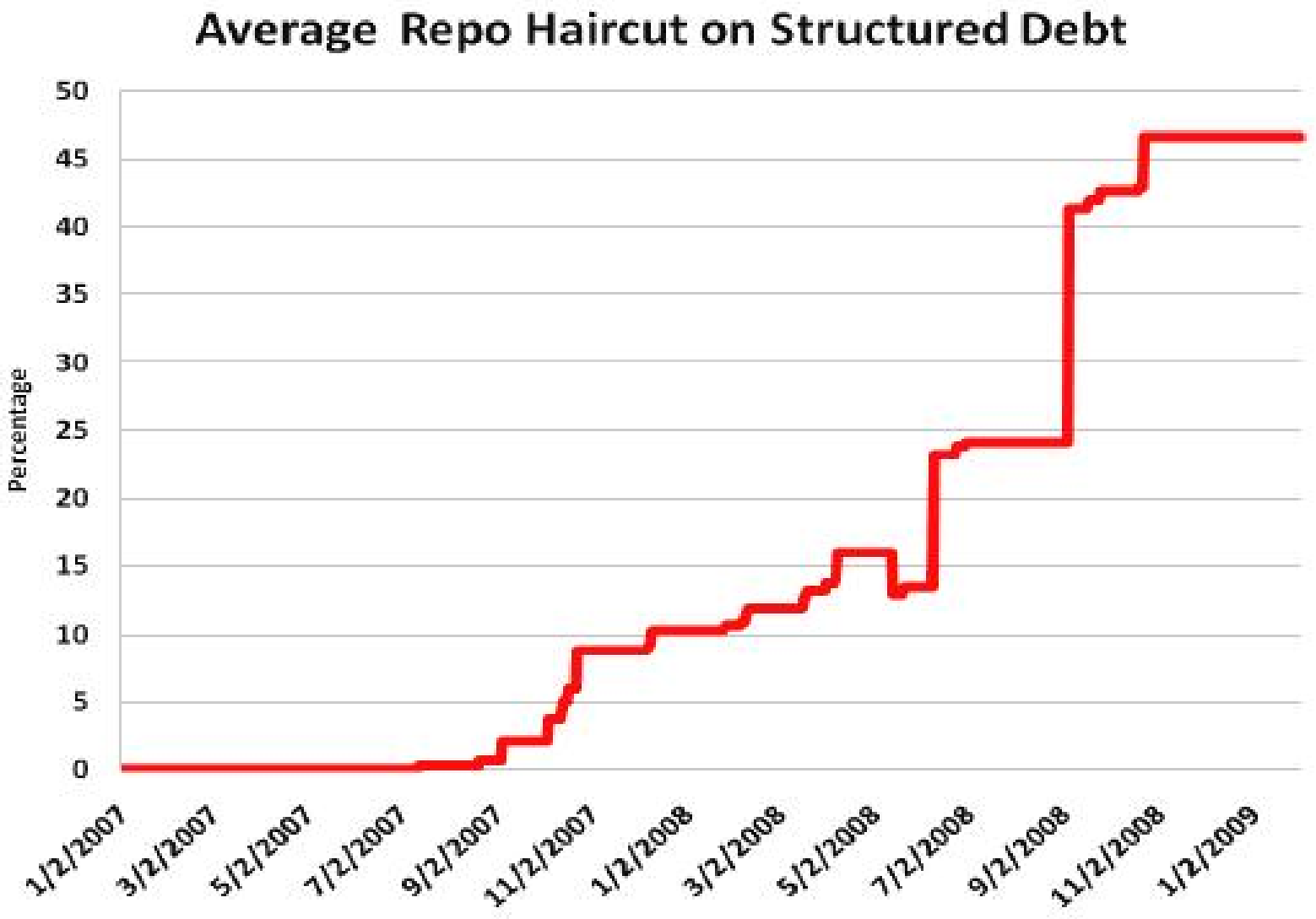

Average Repo Haircut on Structured Debt
Percentage
50
45
40
35
30
25
20
15
10
5
0
1/2/2007
3/2/2007
5/2/2007
7/2/2007
9/2/2007
11/2/2007
1/2/2008
3/2/2008
5/2/2008
7/2/2008
9/2/2008
11/2/2008
1/2/2009

Table 7. Haircuts on Repo Agreements (percent)
(Source: IMF Global Financial Stability Report, April 2008)

Securities	April-07	August-08
U.S. treasuries	0.25	3
Investment-grade bonds	0–3	8–12
High-yield bonds	10–15	25–40
Equities	15	20
Senior leveraged loans	10–12	15–20
Mezzanine leveraged loans	18–25	35+
Prime MBS	2–4	10–20
ABS	3–5	50–60

Collateralized Debt Obligations

Collateralized debt obligations (CDOs) are structured financial instruments that purchase and pool financial assets such as the riskier tranches of various mortgage-backed securities.

1. Purchase

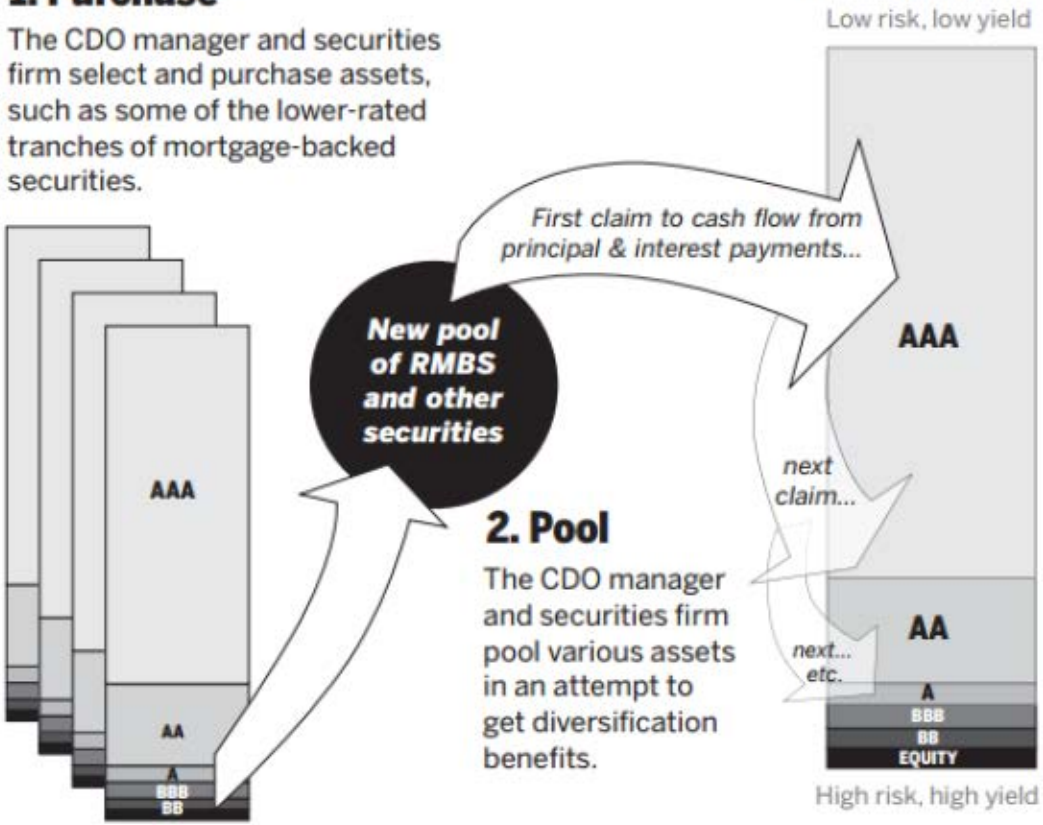
The CDO manager and securities firm select and purchase assets, such as some of the lower-rated tranches of mortgage-backed securities.

2. Pool

The CDO manager and securities firm pool various assets in an attempt to get diversification benefits.

3. CDO tranches

Similar to mortgage-backed securities, the CDO issues securities in tranches that vary based on their place in the cash flow waterfall.



Leverage ratios

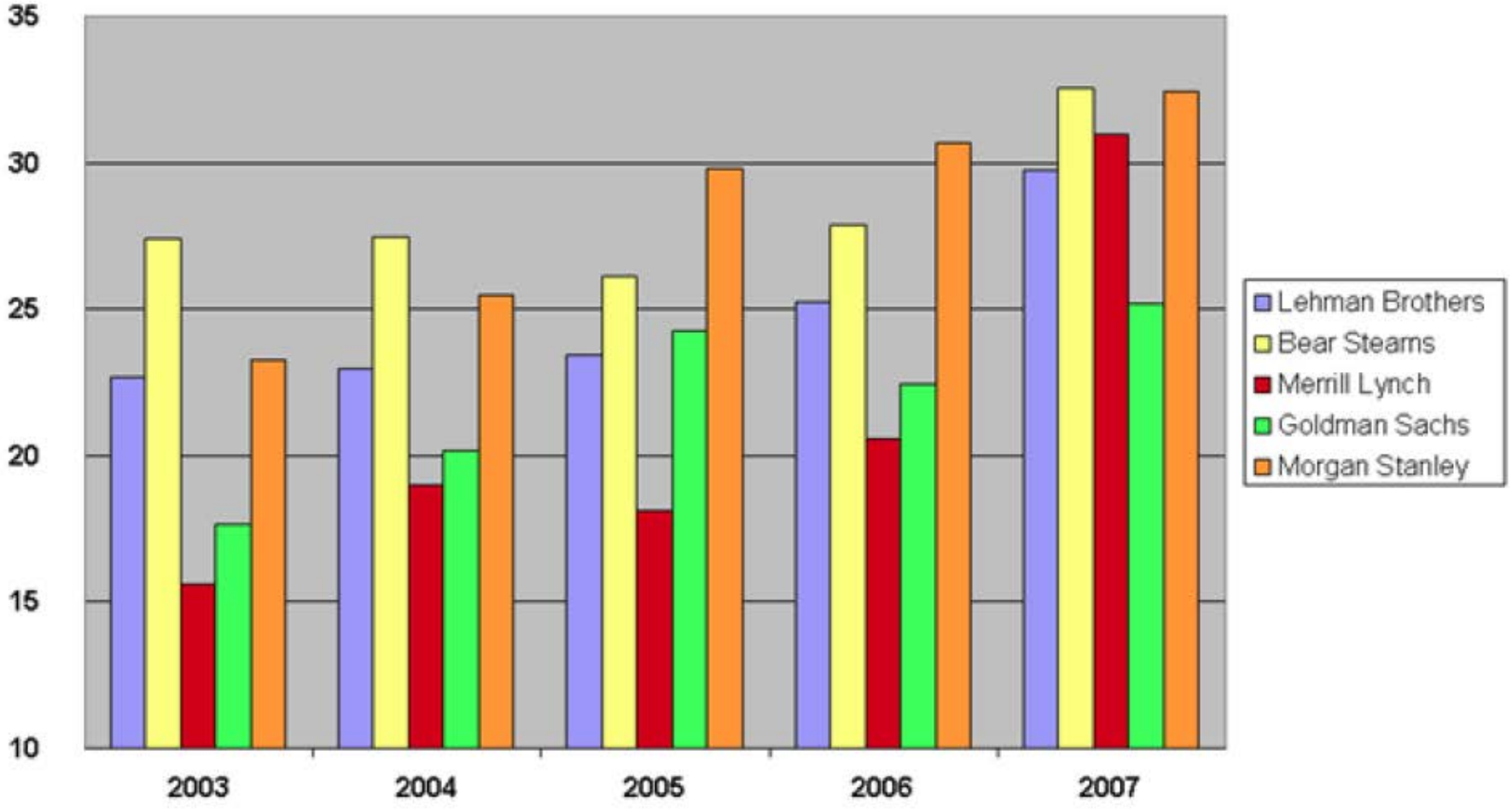
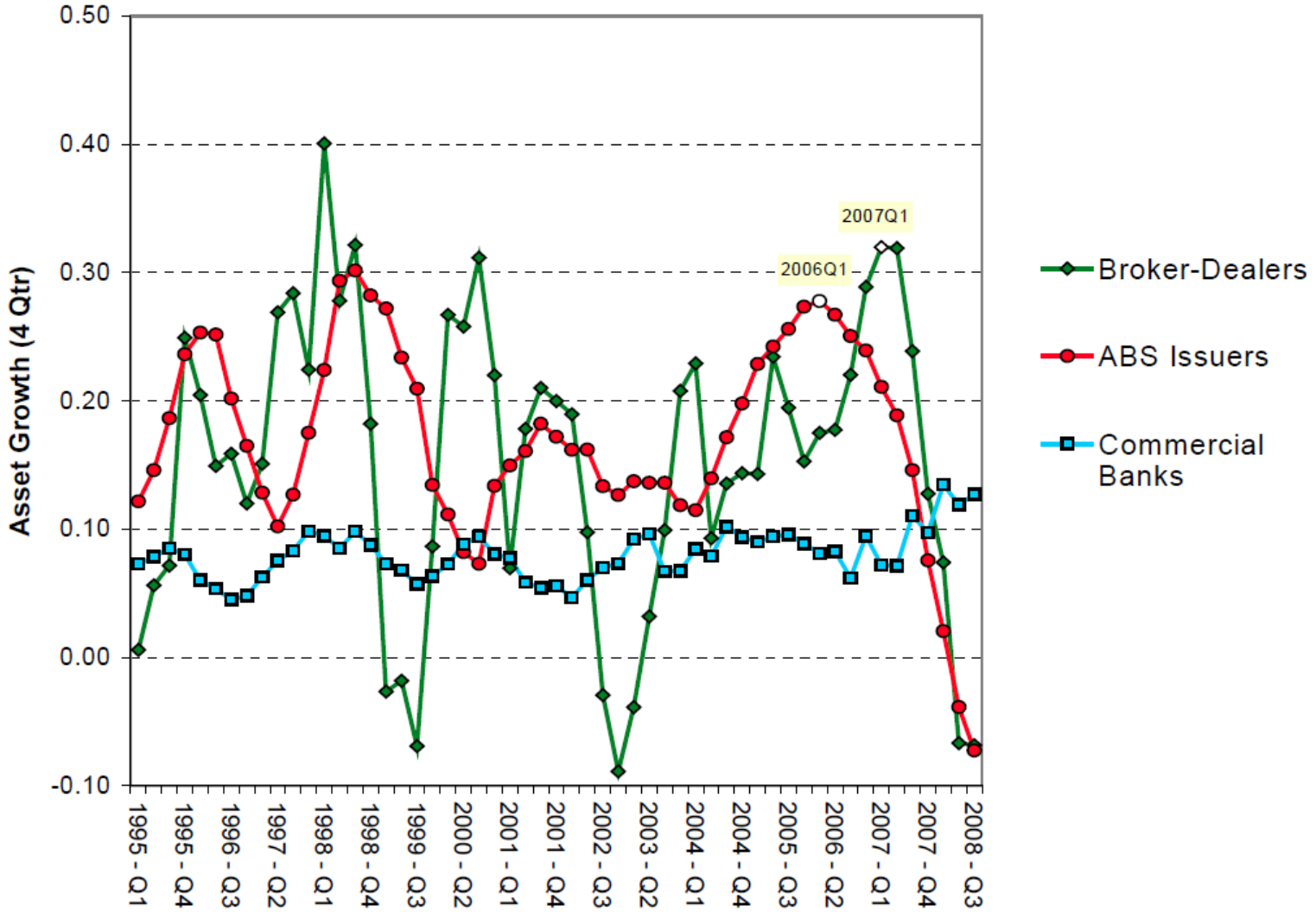
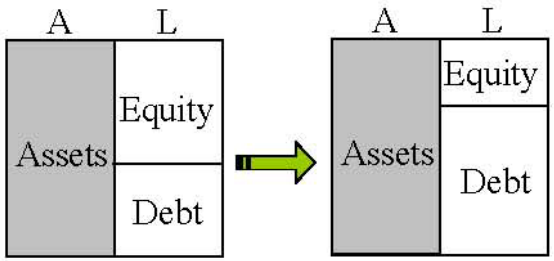


Figure 5. Annual Growth Rates of Assets
(Source: US Flow of Funds, Federal Reserve)

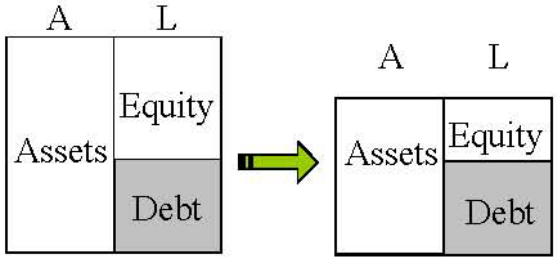


Three modes of leveraging up

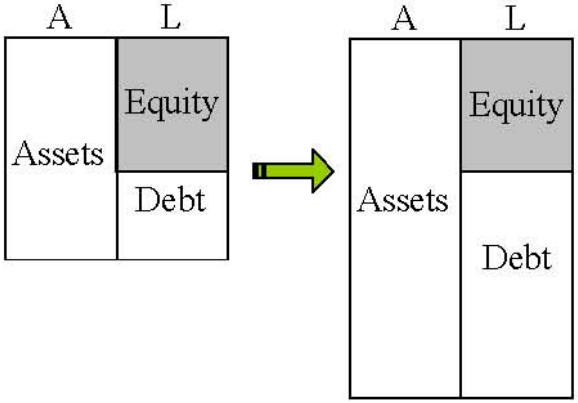
Mode 1: Increased leverage resulting from equity buyback



Mode 2: Increased leverage resulting from fall in asset value



Mode 3: Increase borrowing to fund asset growth



Broker-dealer leverage

Figure 6. Leverage Growth and Asset Growth of US Investment Banks
(Source SEC; Adrian and Shin (2007))

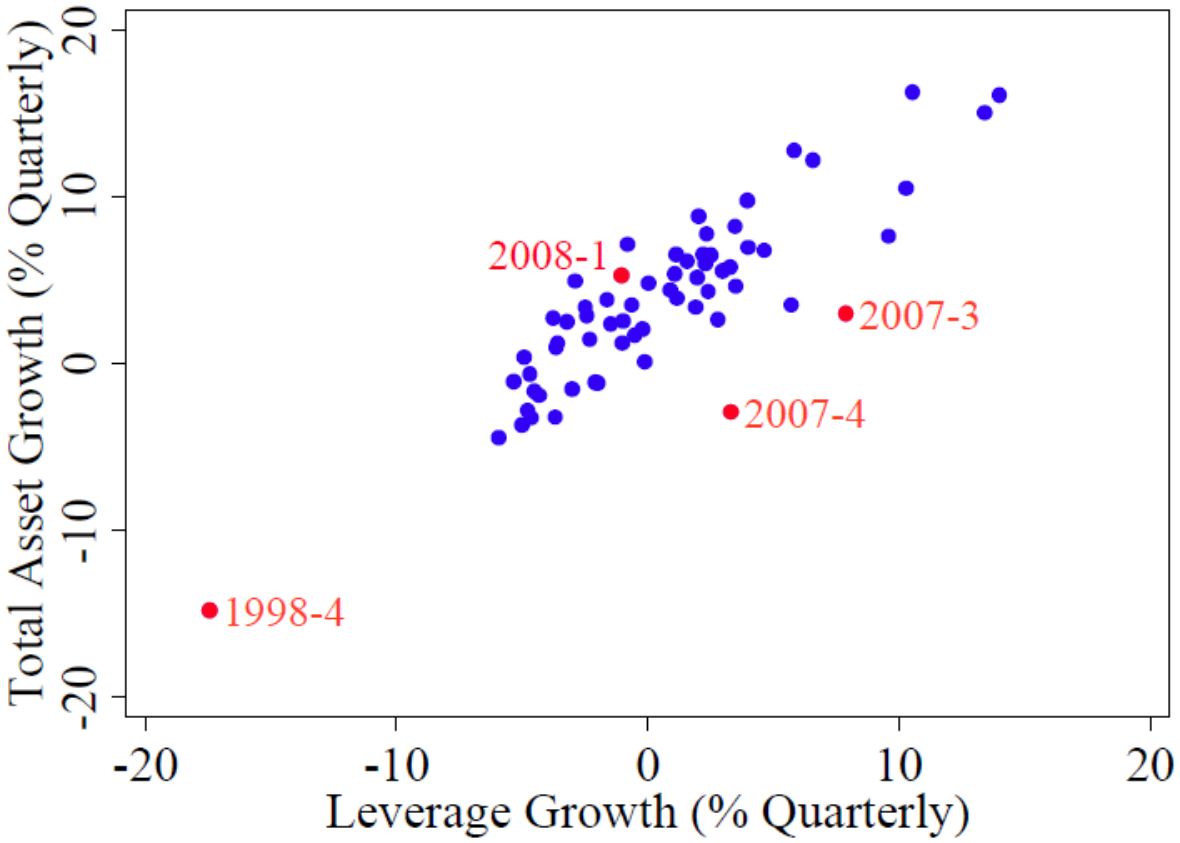
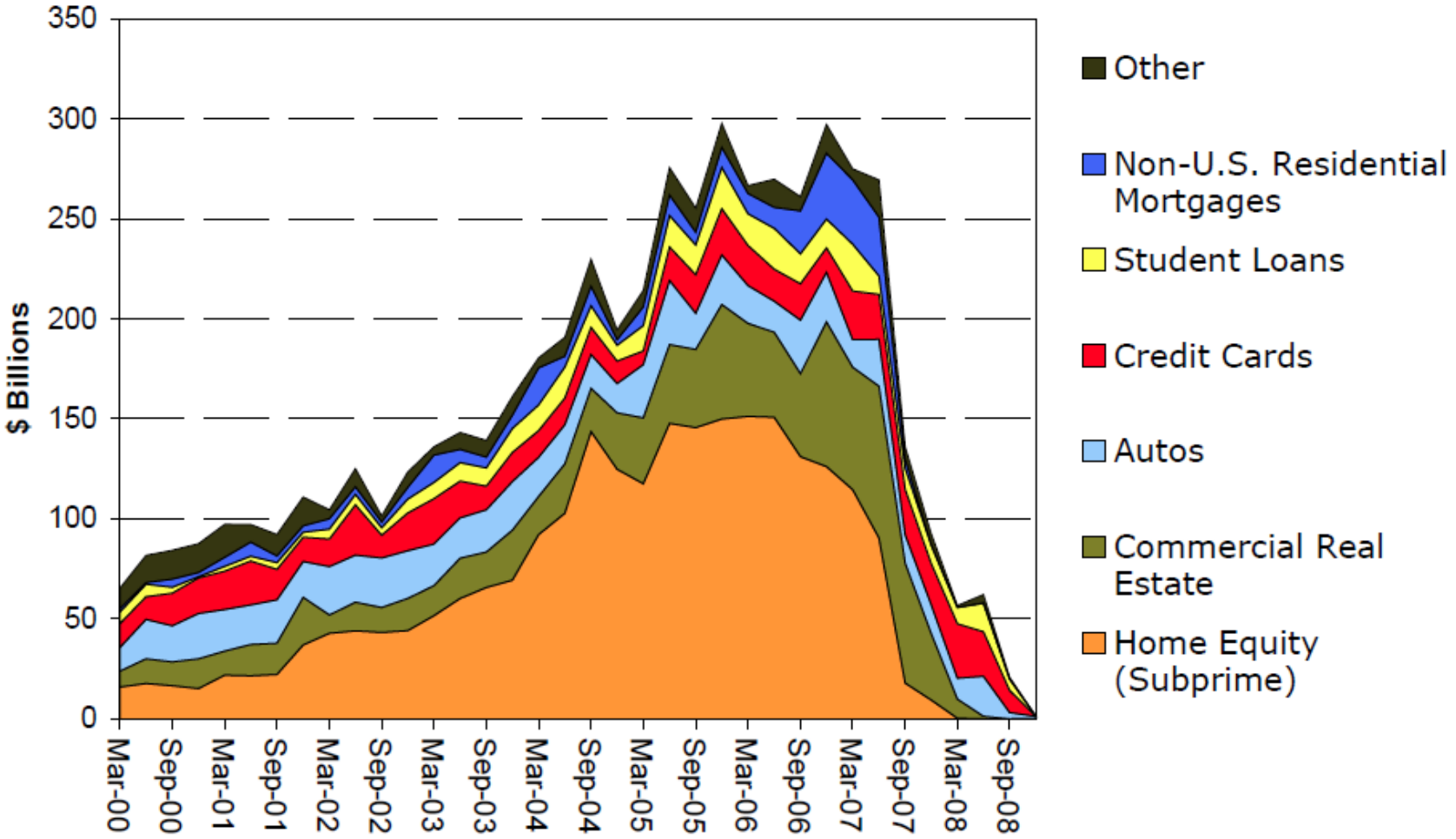


Figure 4. New Issuance of Asset Backed Securities in Previous Three Months (Source: JP Morgan Chase)



Outstanding ABCP

THE 2007-08 FINANCIAL CRISIS

Run up to the crisis

- Housing bubble (over-lending)
  - **Initial cause**
- Over-leveraged banks neglected risks and held bad assets
  - **Amplification**

Timeline of the crisis

- The first tremors: 2007
  - Early 2007: Credit spreads widen
  - Summer 2007: Bear Stearns & BNP Paribas investment funds holding sub-prime mortgages run into major problem
  - August 2007: quantitative hedge funds suffer huge loses in one week
  - Fall 2007: Pressure for banks to recognize off-balance sheet assets and write-down bad debt. Bank stocks plunge.

Timeline of the crisis

- 2008: A “soft landing”…
  - March 2008: Bear Stearns suddenly fails, taken over by JP Morgan with loan guarantees by the NY Fed
  - Summer 2008: Losses at Fannie and Freddie rise, forcing its take-over by the government
  - Oil prices rise rapidly, mortgage delinquencies rise, and banks take huge losses …
  - But fiscal stimulus (in Feb 2008) and monetary easing lead many to believe that the Fed can engineer a “soft landing”
- … turns into a full-blown panic
  - Lehman fails on Monday, September 15

"The crisis takes a much longer time coming than you think, and then it happens much faster than you would have thought."

– Rudi Dornbusch (MIT economist)

Timeline of the crisis

- After Lehman: the dominoes start to fall
  - Banks can't raise funding. ABCP markets grind to a halt. Interbank lending markets freeze up.
  - Merrill Lynch immediately sells itself to BoA, and Goldman and Morgan Stanley convert into bank holding companies, bringing themselves under the Fed's umbrella.
  - Major nonfinancial corporations can't get funding as commercial paper markets grind to a halt and credit lines are cut.
    - Major cash squeeze on Wall Street and Main Street.
  - Fed becomes the essentially only lender left and implements major intervention in short-term funding markets, keeping the economy on life support

Timeline of the crisis

- Other problems emerge
  - More bank runs: Wachovia and Washington Mutual (big commercial banks / mortgage lenders) fail in late September
    - FDIC takes them over and sells them to Wells Fargo & JP Morgan
  - Money market mutual funds (MMMF) suffer losses. Investors panic and withdraw their cash. Runs on the MMMF.
  - Banks had insured against mortgage losses with credit-default swaps, and so AIG (an insurance company) was suddenly on the hook (i.e. had to produce collateral) for ~$100 billion it did not have.
    - If the banks didn't get payments, which they were counting on, they too would have failed.
    - Treasury and Fed have to bail out AIG (80% equity stake + loans, about $180 billion in total)
  - Other countries' banking systems go haywire. Especially Iceland's, which has a spectacular collapse
  - Stock markets fluctuate ±15% per day.

Timeline of the crisis

- A bailout is arranged
  - TARP, Fall 2008: Congress authorizes ~$700 billion for equity injections into the banking sector.
    - Equity injections are better than buying toxic assets, why?
    - Paulson tells all banks that they have no choice but to accept.
    - Only about half of that money was actually used
  - AIG and automakers get saved too. Why?
  - Over the next two years banks slowly recapitalize through their earnings – how does this work?

Timeline of the crisis

- Overall, how much of the money got paid back (with interest and capital gains)?
  - Govt made big profit off the stock ownership in the banks. Essentially, only GM lost money. Broke even with AIG.
  - Govt came out marginally ahead
    - Got back $444 billion [$378 in principal] on $423 billion cash dispersed
  - Though took on extraordinary risk, & maybe also just got lucky
- Should the government have used more money to help underwater home owners?
  - Mortgage modifications and refinancing
  - Govt only spent about $8 billion on this

Macroeconomic consequences of financial crises

The traditional views:

1. Contraction in the money supply
   - For example, after the Great Depression
   - Because of mistakes at the Fed + the Gold Standard
   - Milton Friedman & Anna Schwartz (1963)

2. Contraction in bank lending
   - Ben Bernanke (1983), Kashyap and Stein (2000)

"As everyone here knows, in their *Monetary History,* Friedman and Schwartz made the case that the economic collapse of 1929-33 was the product of the nation's monetary mechanism gone wrong…

"Let me end my talk by abusing slightly my status as an official representative of the Federal Reserve. I would like to say to Milton and Anna: Regarding the Great Depression. *You're right, we did it. We're very sorry. But thanks to you, we won't do it again.*"

– Ben Bernanke, 2002
On Milton Friedman's Ninetieth Birthday

Macroeconomic consequences of financial crises

- Mian and Sufi's work
  - Whose balance sheets matter?
    - Maybe not banks' balance sheet
    - Households (in post-2008 U.S.)
    - Corporate (in 1990s Japan)
  - Help explains why recession lasts so long, even after the financial sector regains health