Confronting Models of

Financial Frictions with the Data

V. V. Chari

University of Minnesota
and
Federal Reserve Bank of Minneapolis

Patrick Kehoe

University of Minnesota
and
Federal Reserve Bank of Minneapolis

Outline

- How important is access to financial markets for firms' investment decisions?

  - Not very

- Do small and large firms behave differently over the cycle?

  - No

- Were policy responses to crisis of 2008 grounded in data?

  - Not grounded in publicly available data

Importance of Financial Market Access

A Popular View of Business Cycles _____

- Disturbances to financial system key source of business cycles

    ○ Bank runs (Diamond-Dybvig)

    ○ Unexpected deflation with nominal debt (Irving Fisher)

    ○ Excessive risk-taking due to deposit insurance

A Popular View of Business Cycles _____

- Some shock hits

  - Sunspot (multiple equilibria, bank runs)

  - Unexpected deflation (Irving Fisher)

- Investment falls

- Aggregate output falls

Key Ingredients in Many Financial Friction Models _____

- Typical firm needs external funds to finance investment

- Agency costs induce wedge between internal and external funds

- Binding collateral constraints

- Fluctuations in wedge/constraint affect investment in a big way

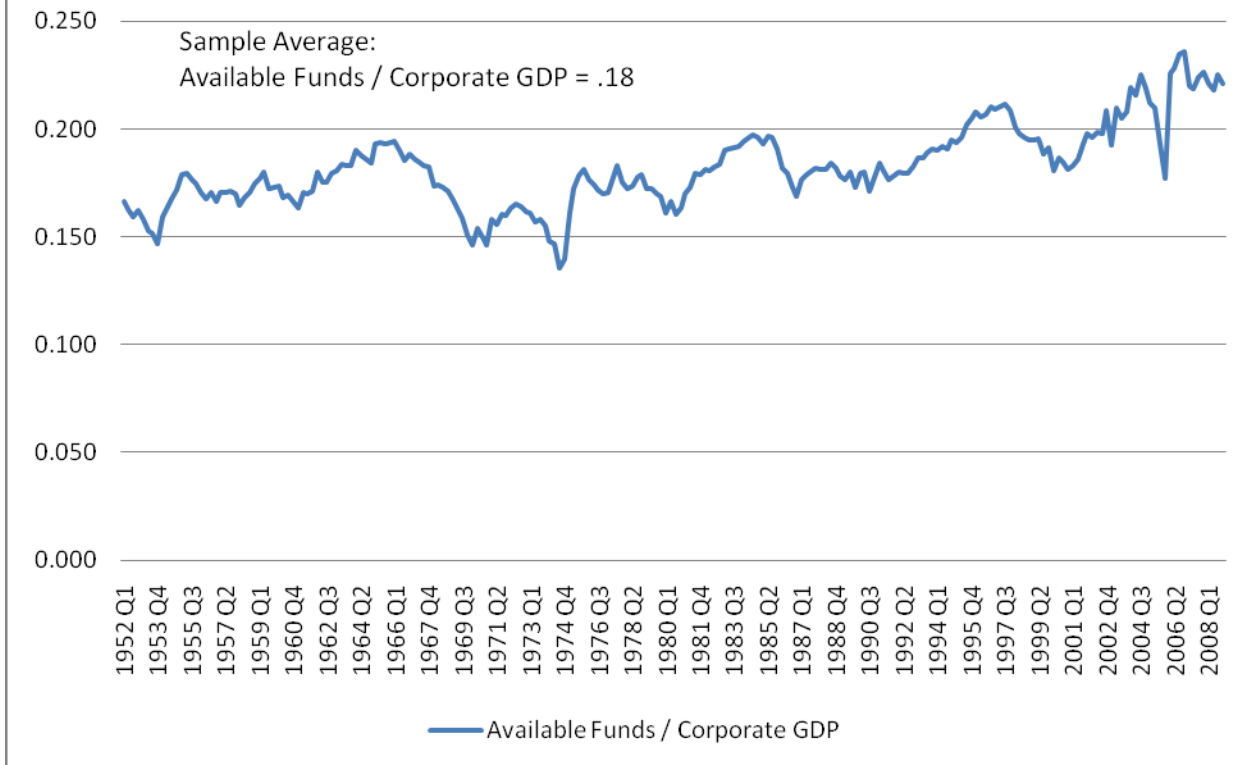## Does Typical Firm Use External Funds to Finance Investment?

- Use data from Flow of Funds for all nonfinancial corporations

- Available Funds (AF) = Revenues − Wages − Materials
  $$- \text{ Interest payments} - \text{Taxes}$$

- In Flow of Funds, AF = Internal funds + Dividends

  Alternatively, AF = Retained earnings + Dividends
  $$+ \text{ Depreciation}$$

- In Flow of Funds use Gross Investment for Capital expenditure

Does Typical Firm Use External Funds to Finance Investment?

- Available Funds − Dividends + Net new debt issue

                                     + Net new equity issue

      = Capital expenditure

- Suppose   Net new debt issue = 0

                    Net new equity issue = 0

- That is, firms lose access to financial markets

- Can they finance all investment internally?

Available Funds and Capital Expenditures

Source: Flow of Funds and BEA

Sample Average:
Available Funds / Corporate GDP = .18

Available Funds / Corporate GDP

Data for U.S. Nonfinancial Corporations

Available Funds and Capital Expenditures

Source: Flow of Funds and BEA

Sample Average:
Available Funds / Corporate GDP = .18
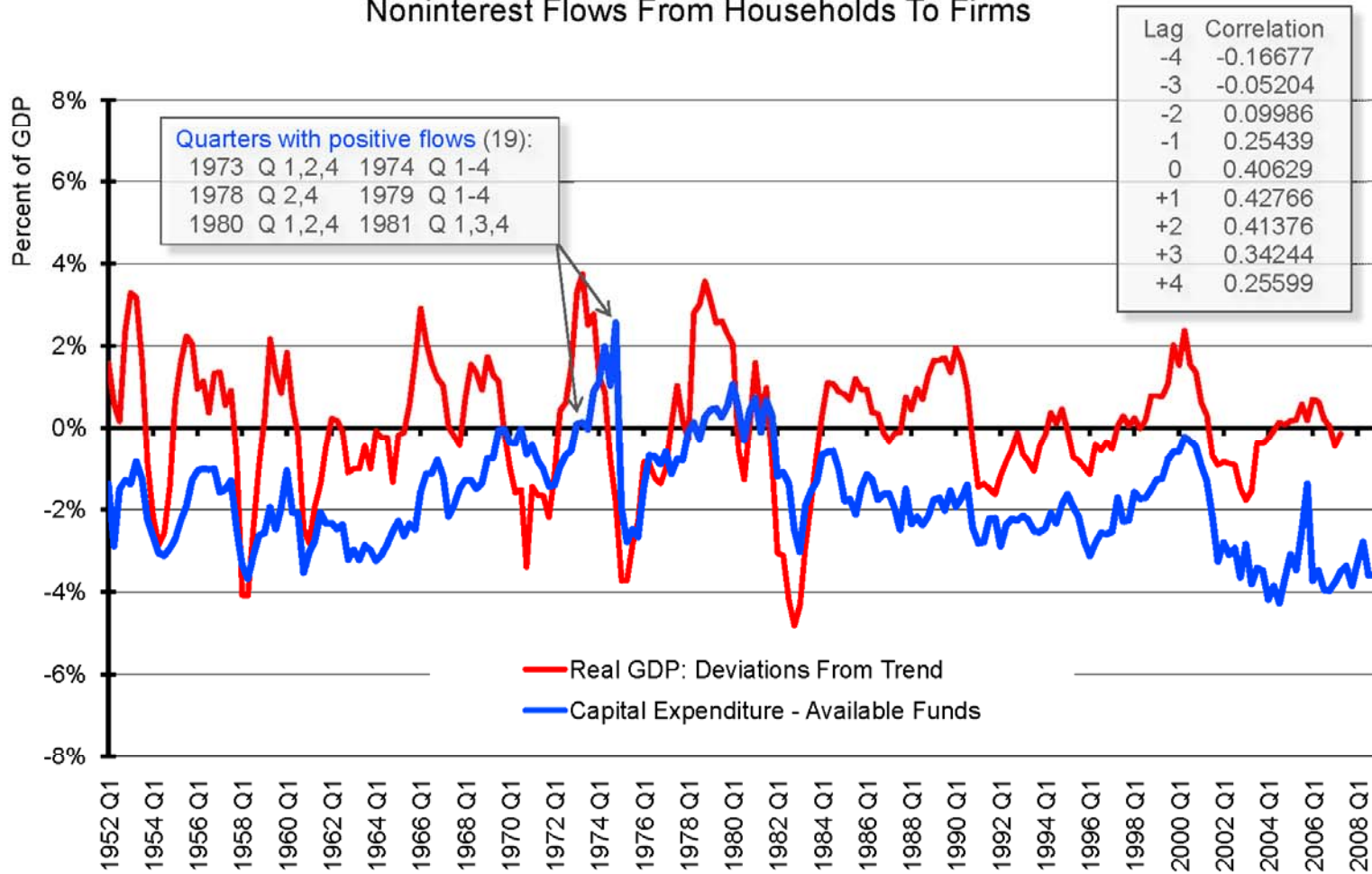Capital Expenditure / Corporate GDP = .15

——— Available Funds / Corporate GDP
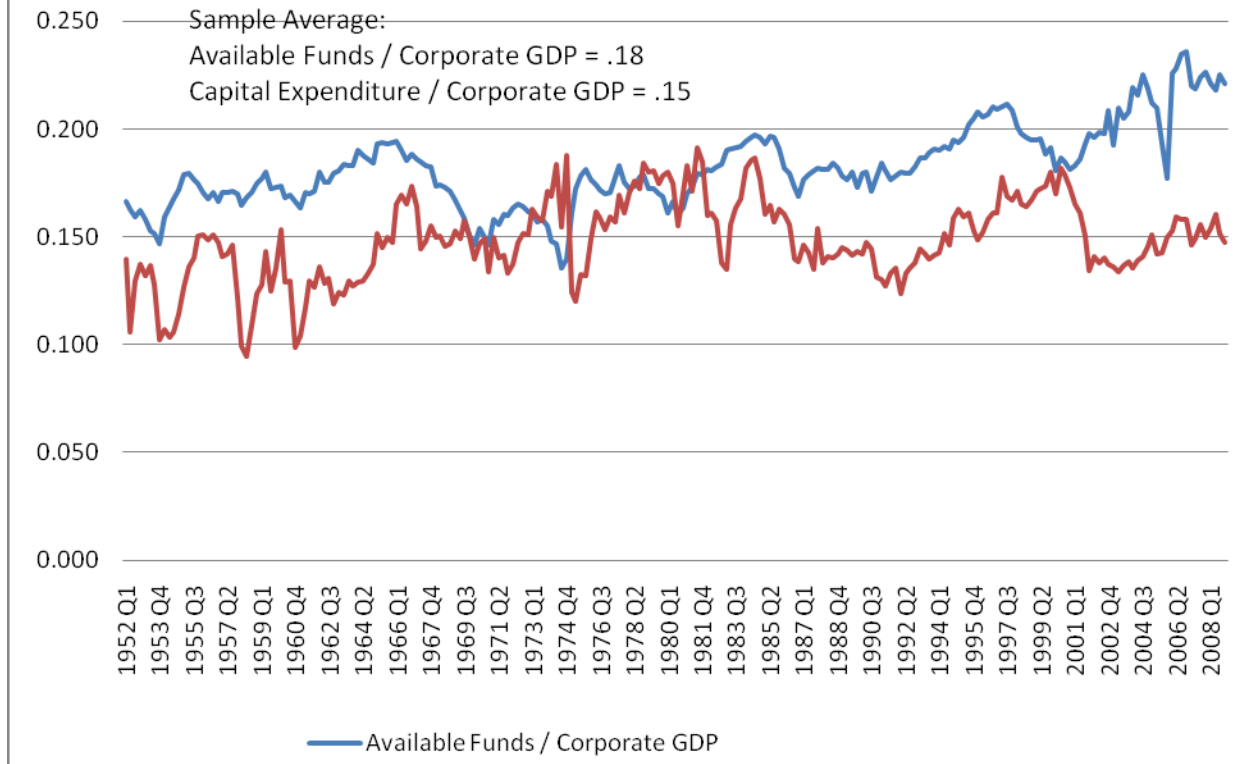
Data for U.S. Nonfinancial Corporations

Noninterest Flow from Households to Firms,

Source: Flow of Funds and BEA.

Sample Average:
(Capital Expenditure - Available Funds)/ Corporate GDP = -.03
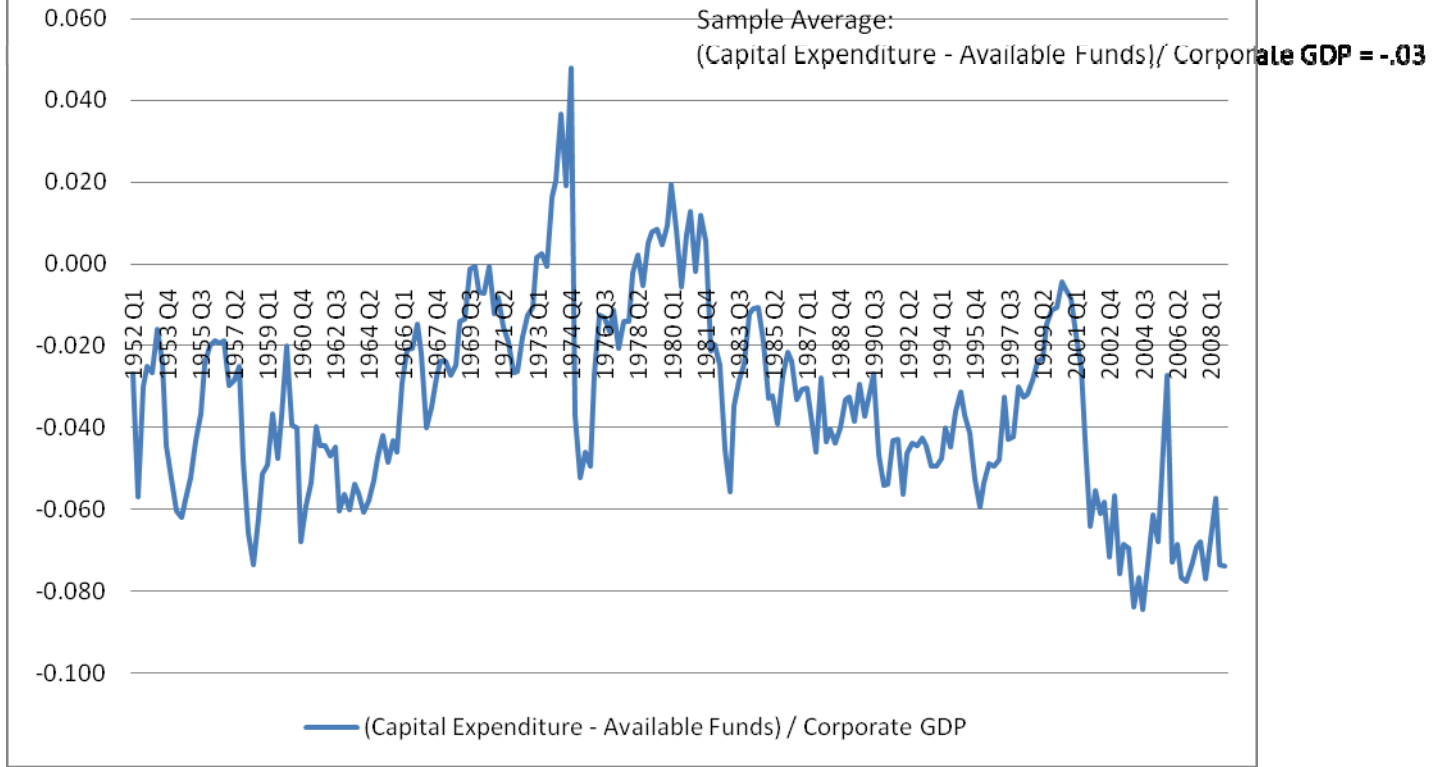
Noninterest Flows From Households To Firms

Lag	Correlation
-4	-0.16677
-3	-0.05204
-2	0.09986
-1	0.25439
0	0.40629
+1	0.42766
+2	0.41376
+3	0.34244
+4	0.25599

Quarters with positive flows (19):
1973 Q 1,2,4   1974 Q 1-4
1978 Q 2,4   1979 Q 1-4
1980 Q 1,2,4   1981 Q 1,3,4

Percent of GDP

— Real GDP: Deviations From Trend
— Capital Expenditure - Available Funds

Source: Federal Reserve Board, http://www.federalreserve.gov/releases/z1/

Does Typical Firm Use External Funds to Finance Investment?

- No, for aggregate of U.S. corporations

- Financial markets may play a big role in reallocating funds from cash-rich, project-poor firms to cash-poor, project-rich firms

- Use disaggregated data to analyze reallocation

Does Typical Firm Use External Funds to Finance Investment?

- Use data from Compustat

- Compute available funds for each firm, each time period

- AF_{it} = Available funds for firm i in period t

- I_{it} = Gross investment by firm i in period t

- How much would I_{it} fall if no firm can invest more than AF_{it}

Does Typical Firm Use External Funds to Finance Investment?

- Use of external funds to finance investment

$$\frac{1}{T}\sum_{t=1}^{T}\frac{\sum_{i}\left((I_{it}-AF_{it})\mid I_{it}>AF_{it}\right)}{\sum_{i}I_{it}}$$

- In data, financial market constraints = 16% of investment financed by external funds

- Interpretation: If firms had <u>no</u> access to financial markets, investment would have fallen by 16%

- This is exceptionally extreme exercise

**Available Funds and Capital Expenditure Relative to Corporate GDP**

Source: COMPUSTAT and BEA

Sample Average: Capital Expenditure / Corporate GDP = .10

Capital Expenditure / Corporate GDP
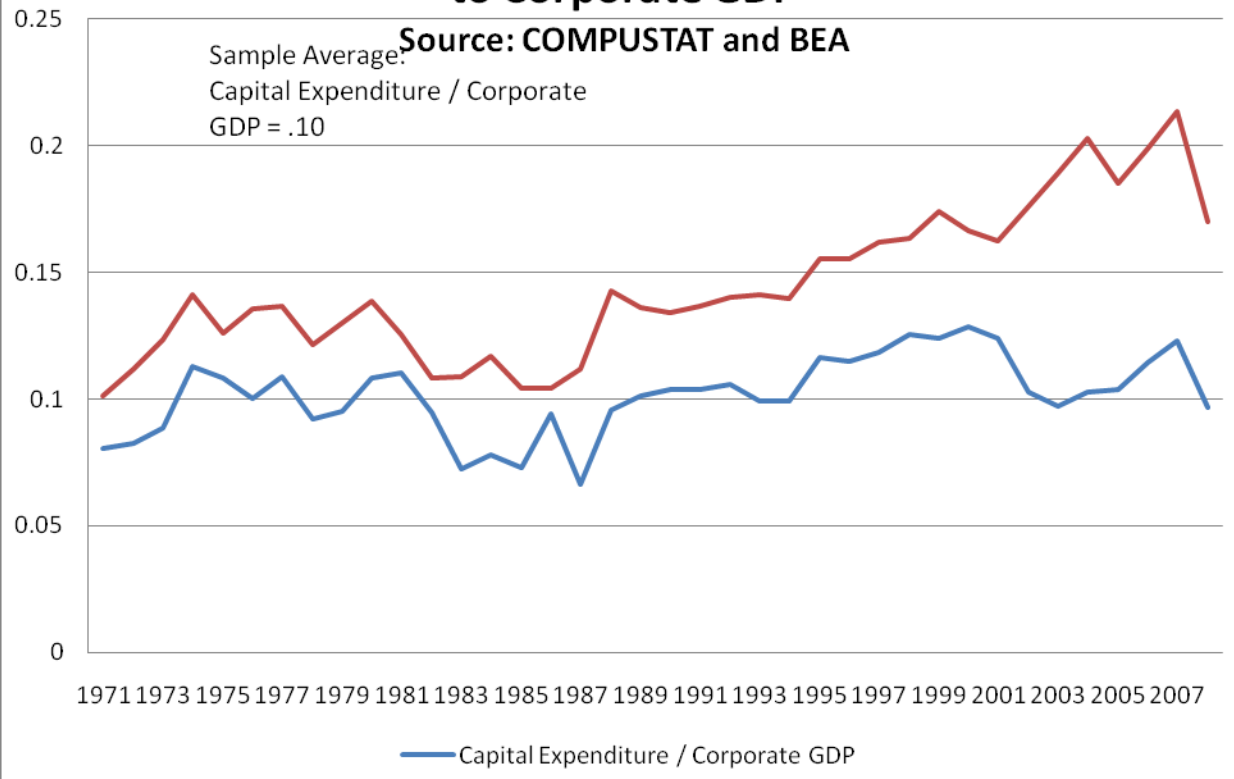
Available Funds and Capital Expenditure Relative to Corporate GDP, Firms Not Using External Funds
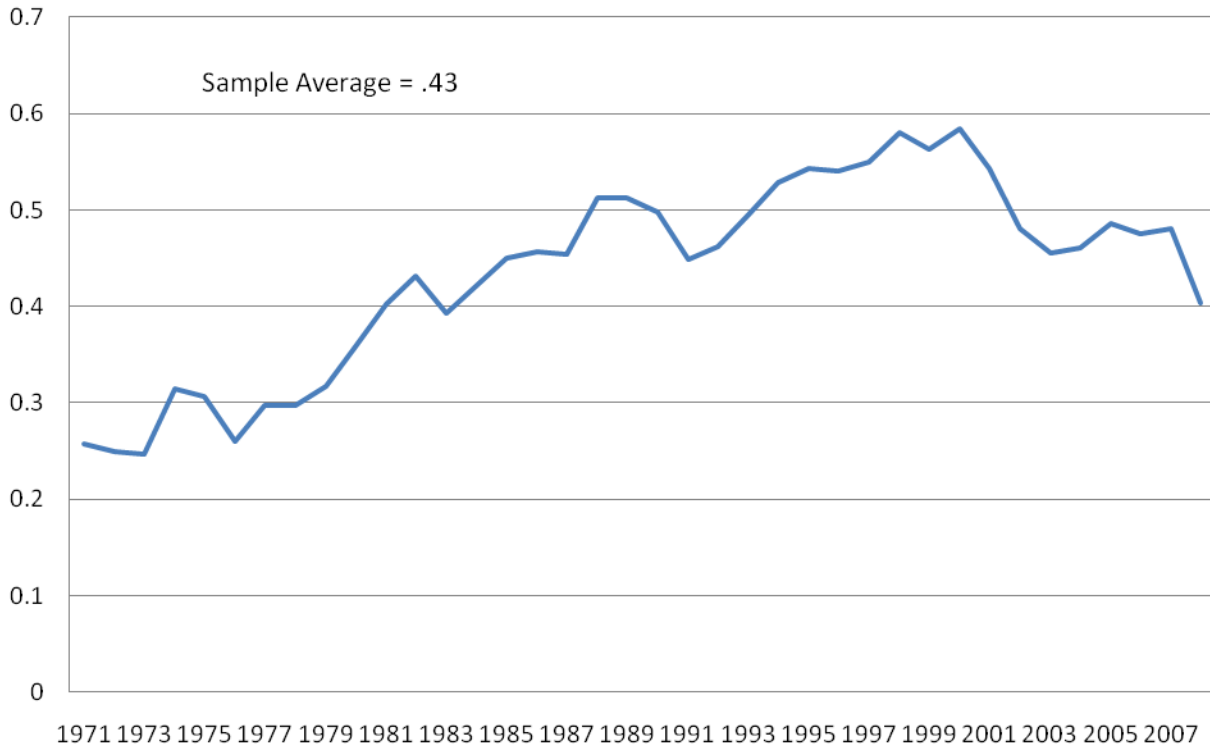
Source: COMPUSTAT and BEA

Sample Average:
Capital Expenditure / Corporate GDP = .07
Available Funds / Corporate GDP = .13

Legend: Capital Expenditure / Corporate GDP, Available Funds / Corporate GDP
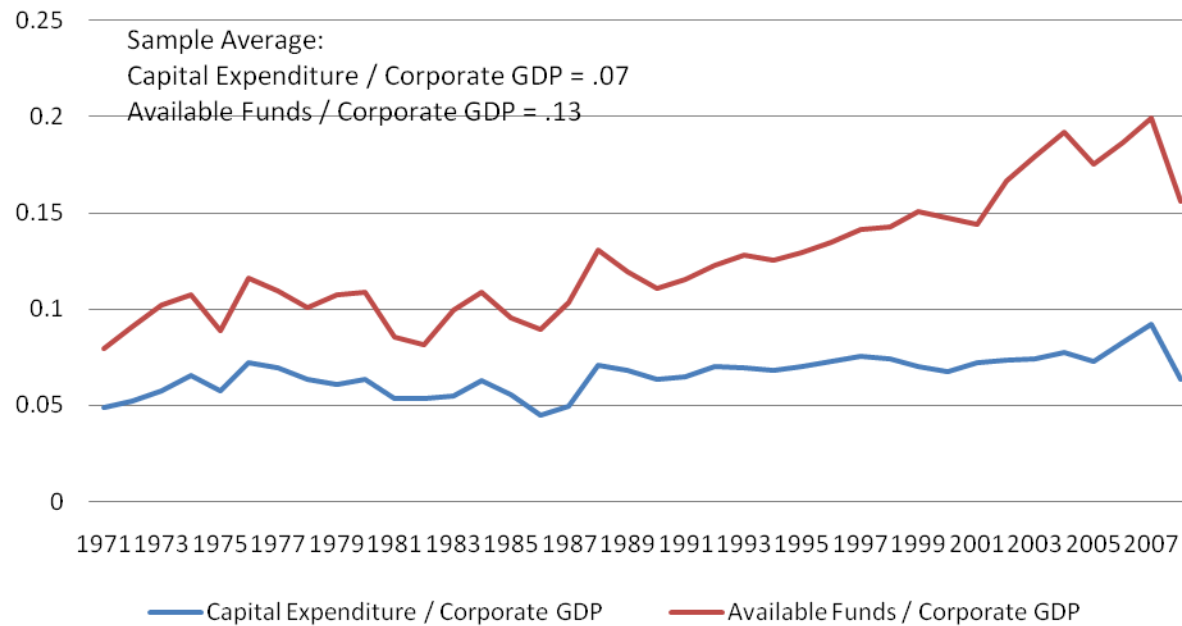
Available Funds and Capital Expenditure Relative to Corporate GDP, Firms Using External Funds
Source: COMPUSTAT and BEA

Sample Average:
Capital Expenditure / Corporate GDP = .036
Available Funds / Corporate GDP = .019
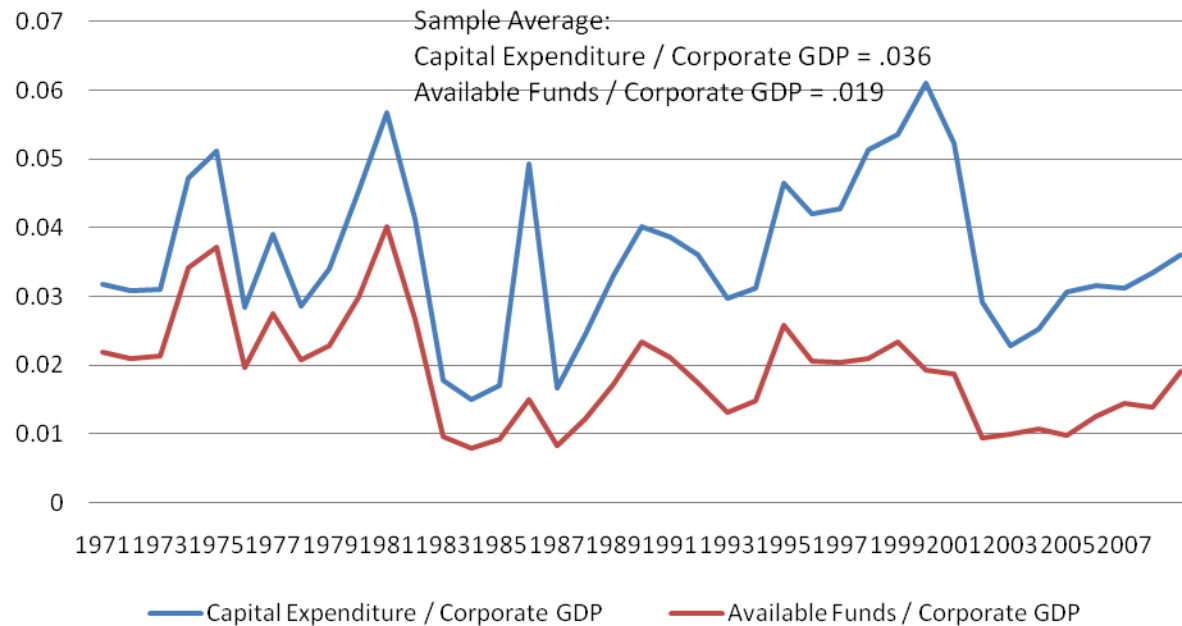
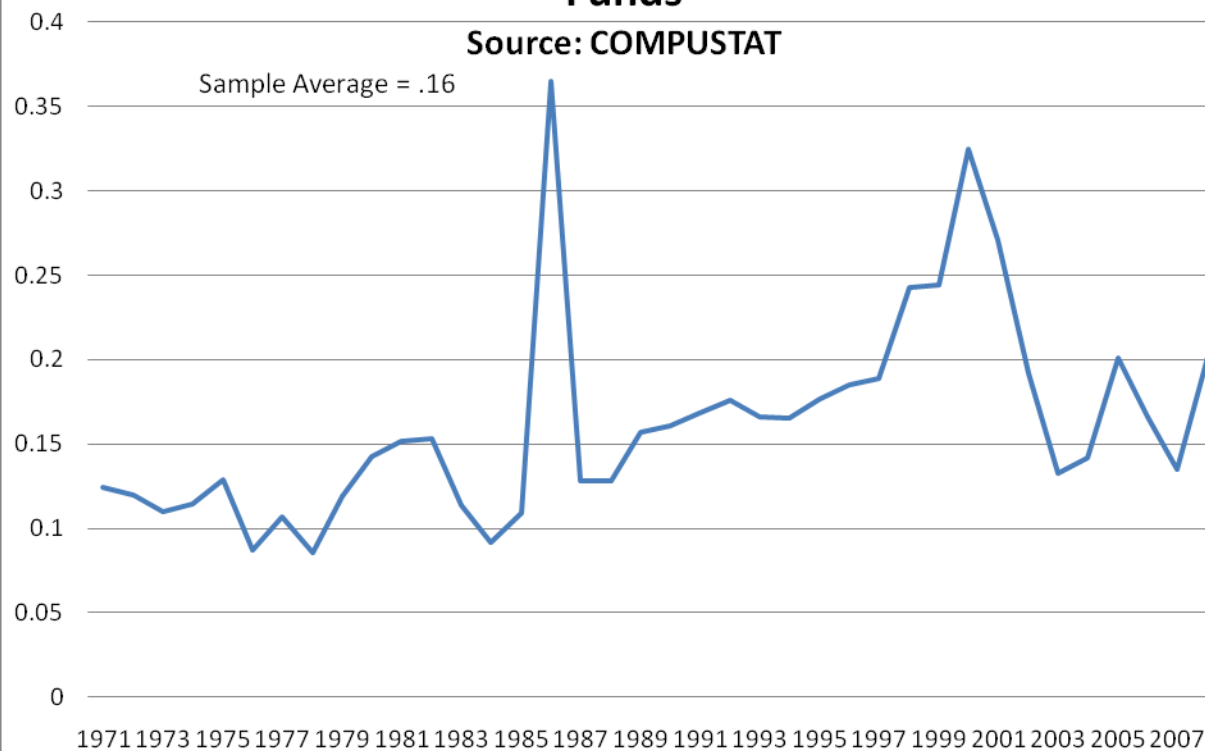**Fraction of Firms Using External Funds**
Source: COMPUSTAT

Sample Average = .43

Fraction of Investment Financed by External Funds

Source: COMPUSTAT
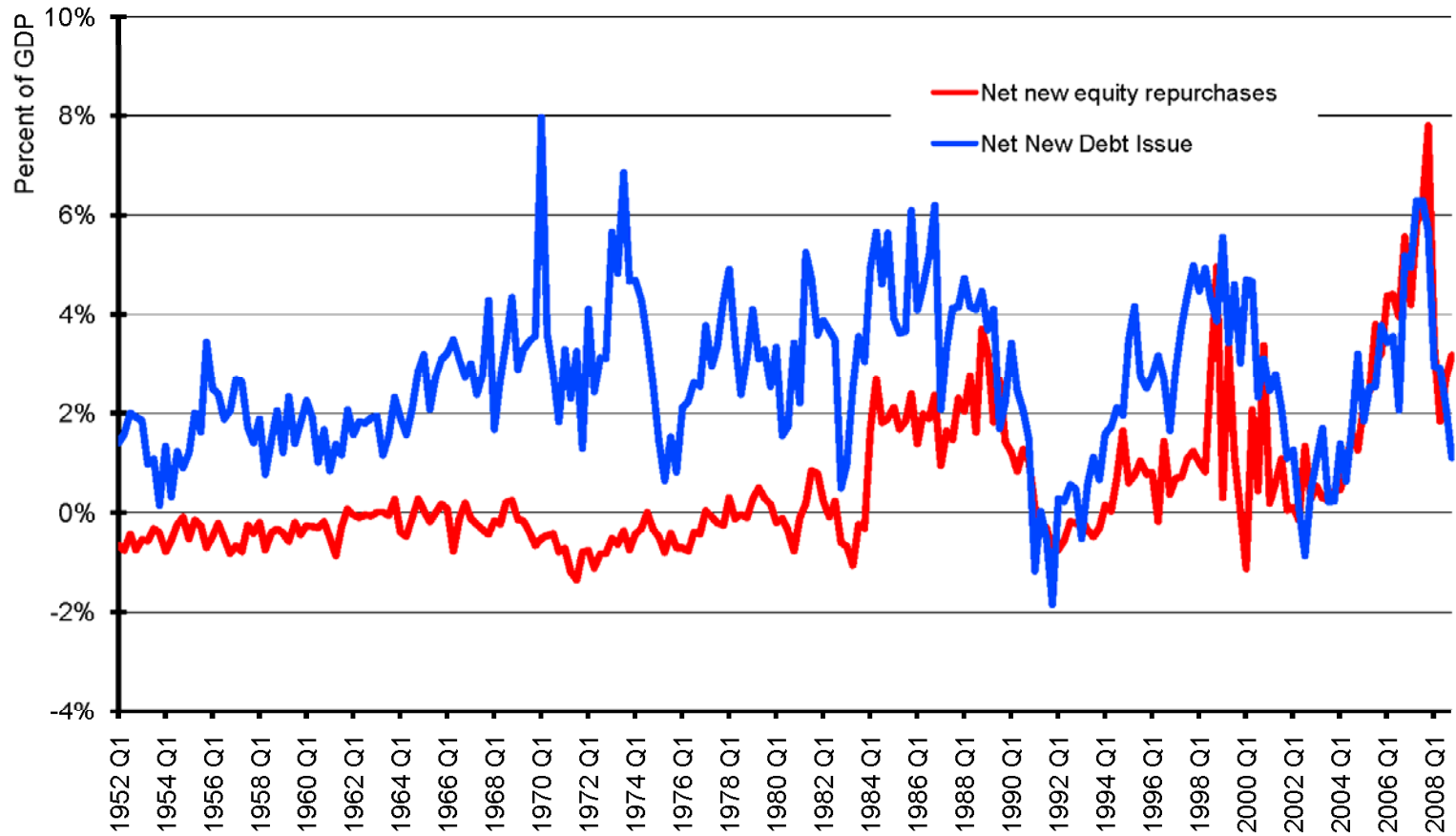
Sample Average = .16

Why Do Firms Issue Debt?

- At least in recent past, to buy back shares
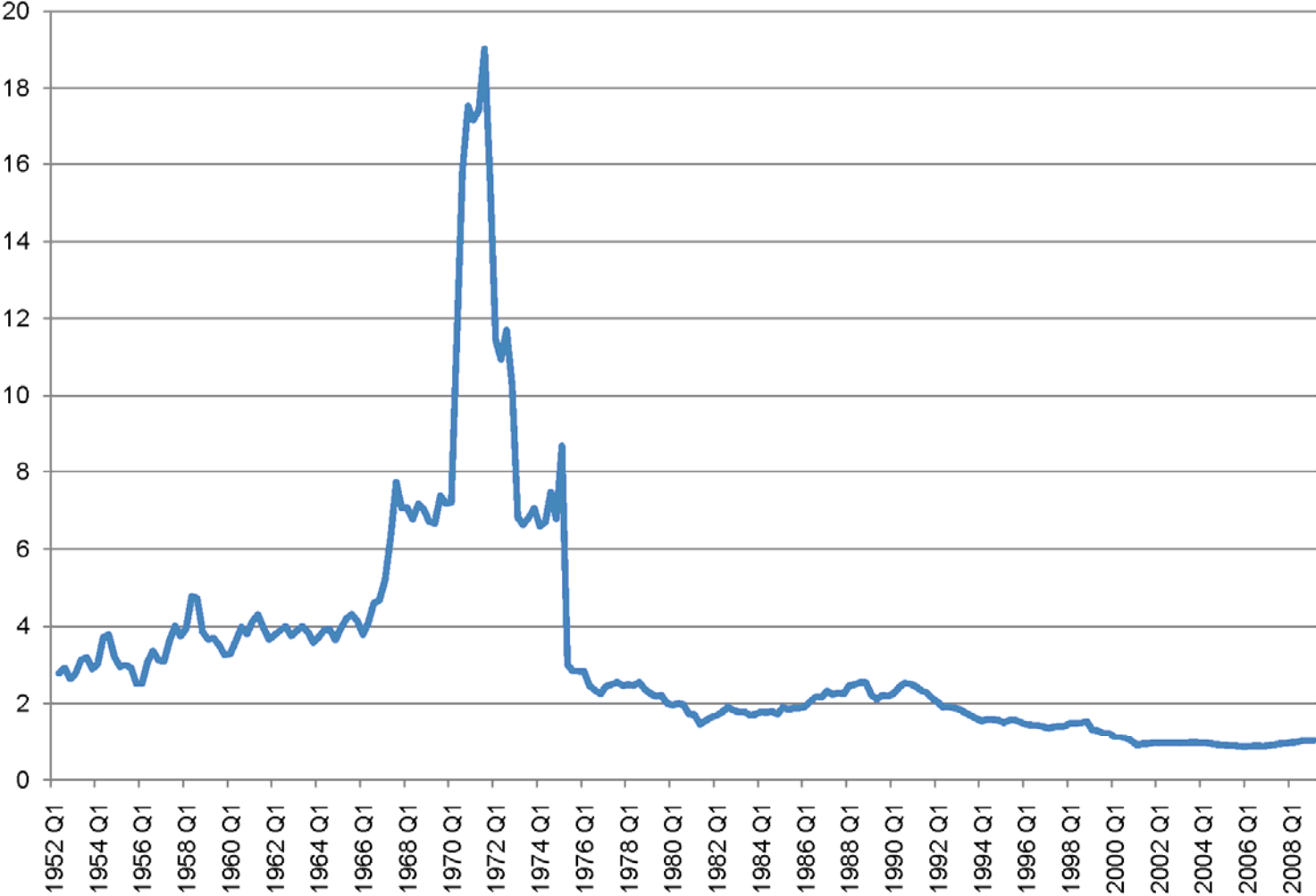
New Debt, Net Repurchases of Equity, and Dividends

Source: Federal Reserve Board, http://www.federalreserve.gov/releases/z1/

Have Firms Increased Leverage? _____
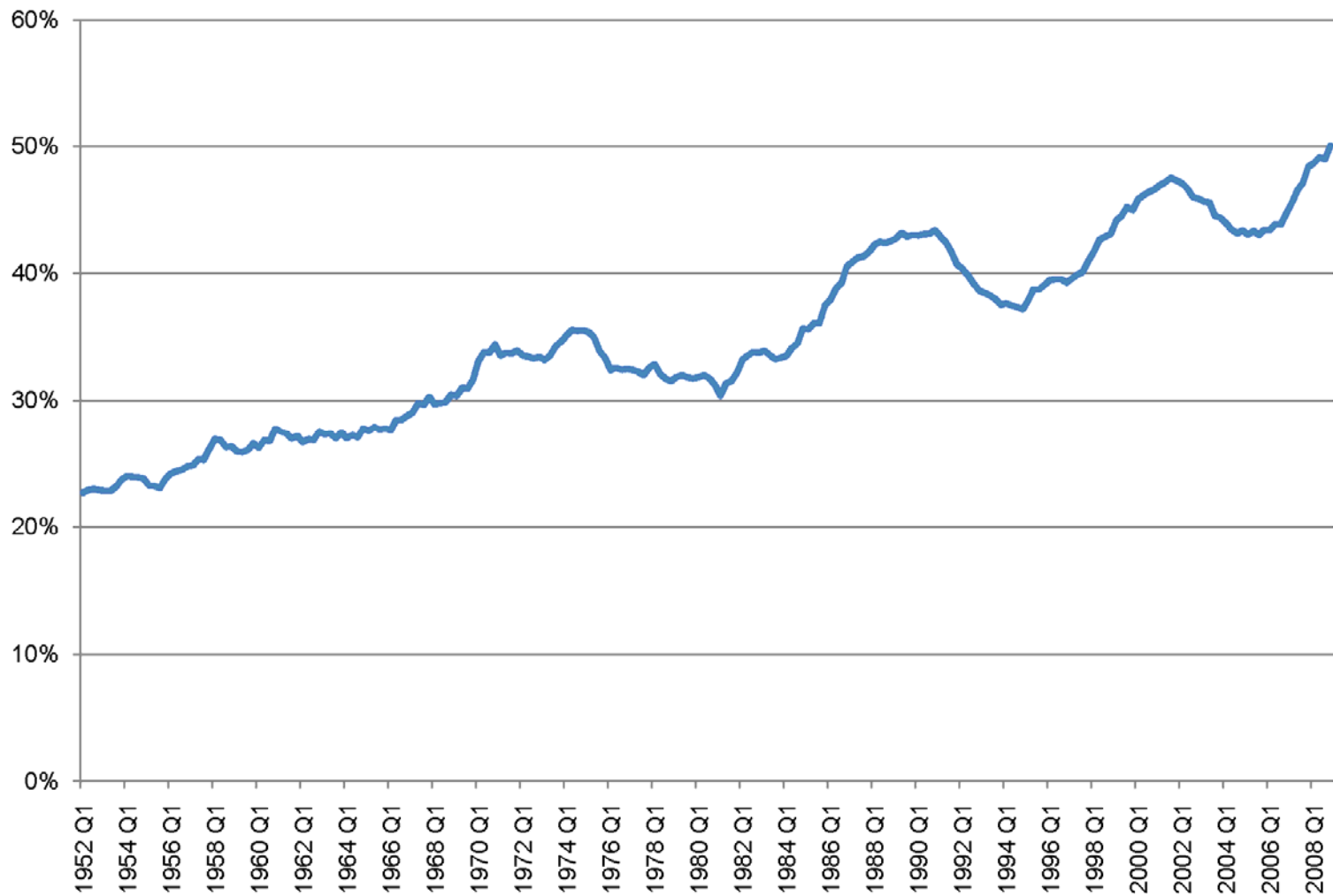
- No and Yes

Debt To Equity Ratio

Data are for U.S. Nonfinancial Corporations

Debt / Nominal GDP

Data are for U.S. Nonfinancial Corporations

Consistency of Findings with Growth Model _____

- In steady state of growth model

  $$c + x = wl + rk$$

- $x = \delta k, \ \ r = \rho + \delta$

- So, $c = wl + \rho k$

- So, $c > wl$

Consistency of Findings with Growth Model _____

- Consider decentralization in which investment done by firms

- Here, funds flow from firms to households in steady state

- If you want to keep debt/equity ratio constant, must keep issuing debt in growing economy

Can Signaling Models of Dividends Solve the Problem? _____

- No

- Private information about aggregate shocks hard to swallow

The Behavior of Small and Large Firms over the Business Cycle

Credit Market View

- Credit market frictions central in propagating the cycle

- Theory

    ○ Kiyotaki-Moore, Bernanke-Gertler, Cooley-Marimon-Quadrini and dozens more

- Evidence:

    ○ Small firms more sensitive to cycle: Gertler-Gilchrist, Sharpe

    ○ Balance sheet effects: Fazzari, Hubbard, Peterson

    ○ Inventories: Kashyap, Lamont and Stein

Credit Market Frictions View

- "Long standing tradition in macroeconomics beginning with Fisher and Keynes that gives a central role to credit markets conditions in the propagation of aggregate fluctuations" (Bernanke, Gertler and Gilchrist, 1999)

- "Although the underlying theories [of credit market frictions] are diverse, a common prediction is that **differences in cyclical behavior should emerge across firms depending on their respective access to capital markets**" (Gertler, Gilchrist, 1994)

- Kockerlakota's (2000) survey of theory: Credit constraints are mechanisms for turning small shocks into large, persistent movements in aggregate income

Our Question

Do small firms decline more than large ones in downturns?

Idea: small firms have less access to capital markets than large firms

Outline _____

- Postwar Data

  ○ Manufacturing (QFR)

    – Start with Gertler-Gilchrist (RR dates)
    – Contrast with Business Cycle dates

- Great Depression Data

  ○ Census data

- Theory

  ○ Help interpret results

Most Influential Evidence: Gertler-Gilchrist _____

- QFR data on sales, loans, inventories by asset size

- Size is a good measure of financial markets access

- Small firms hurt more by monetary contractions (RR dates)

    ○ Small firms sales and inventories fall more than large

    ○ Small firms debt rises less than large

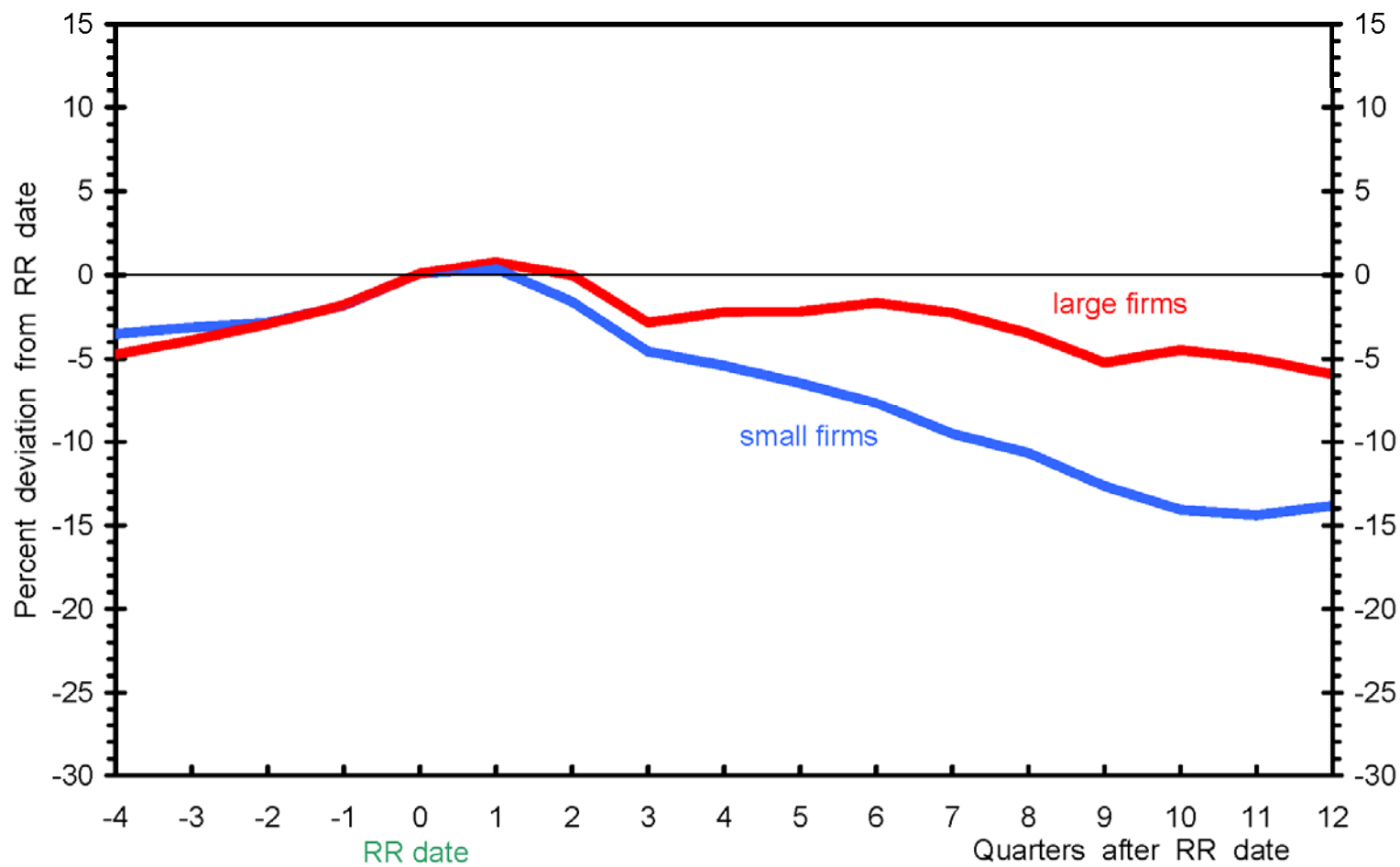# Quarterly Financial Reports for Manufacturing Corp _____

- Data

  - Sales, inventories, loans by eight size classes of nominal assets

- Advantages

  - Quarterly, long (1958–2006)
  - All firms in manufacturing

- Limitations

  - Repeated cross-section
  - Use size as proxy for access to financial markets

Example of Data from QFR

Sales, Inventories, and Loans by Asset Size, 1986:4

	Asset size							
	< 5m	5 10m	10 25m	25 50m	50 100m	100 250m	250 1000m	> 1000m
Sales	57,319	20,821	30,149	22,785	21,412	34,504	67,175	310,291
Inv	23,377	10,900	17,374	13,221	12,919	21,042	39,164	172,748
Loans	7,232	3,572	4,878	3,679	3,172	3,857	8,072	41,319

Sales around RR dates - mean across 6 cycles

Sales around NBER peaks - mean across 9 cycles
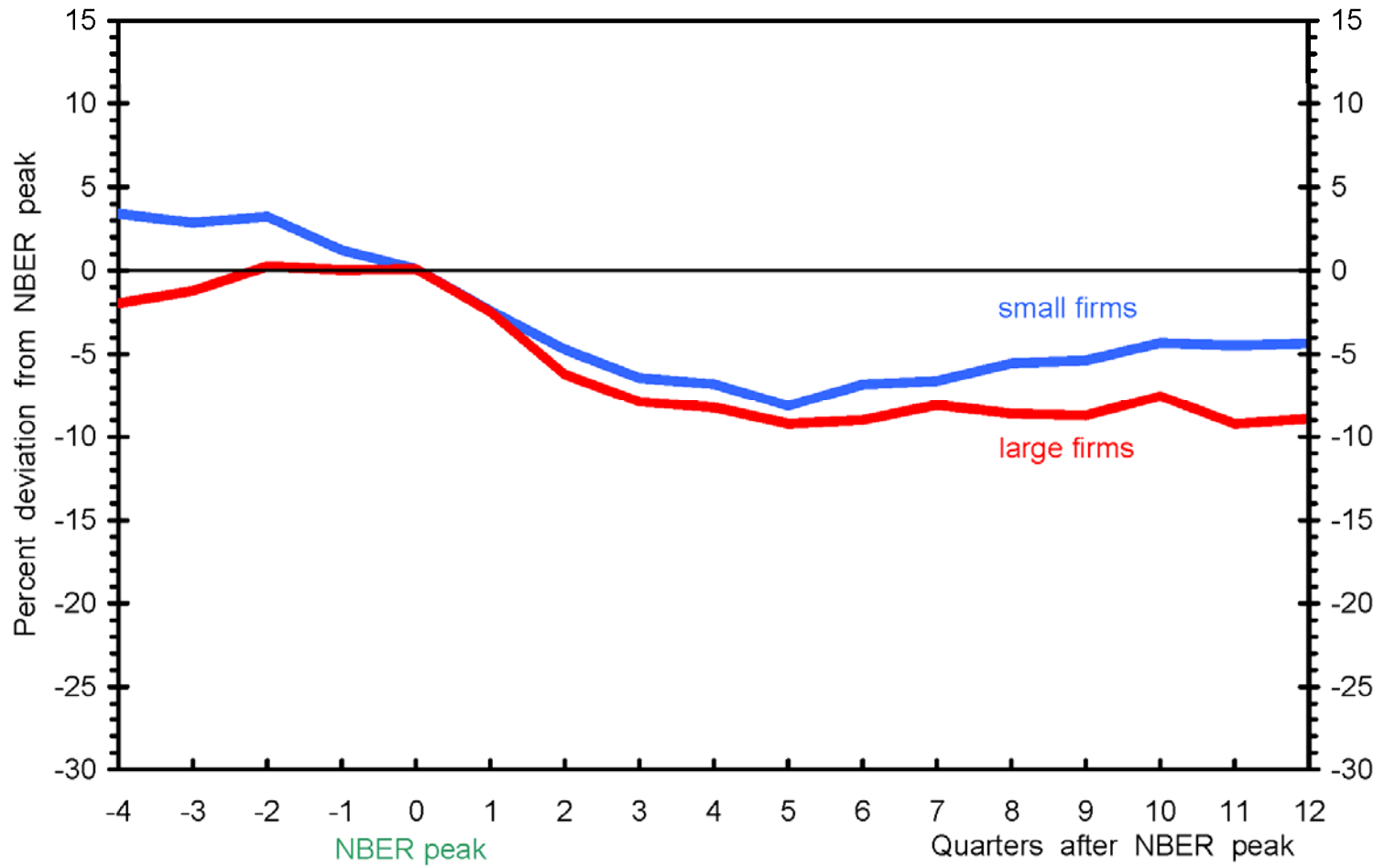
Percent deviation from NBER peak

NBER peak

Quarters after NBER peak

small firms

large firms

Sales Summary

- Small firm's sales

  - ○ **May well** fall more than large after monetary contractions
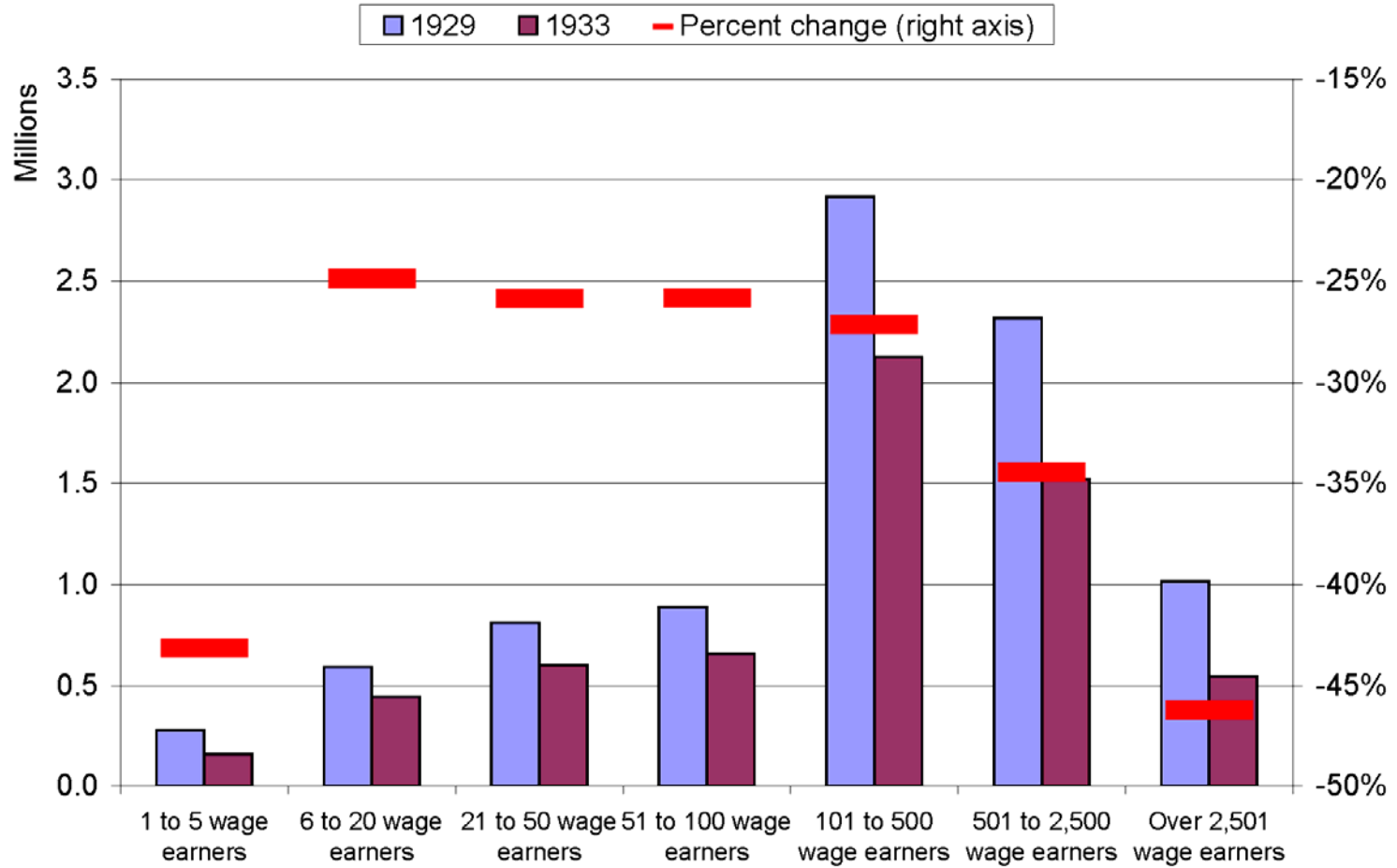
Sales Summary _____

- Small firm's sales

    - **May well** fall more than large after monetary contractions

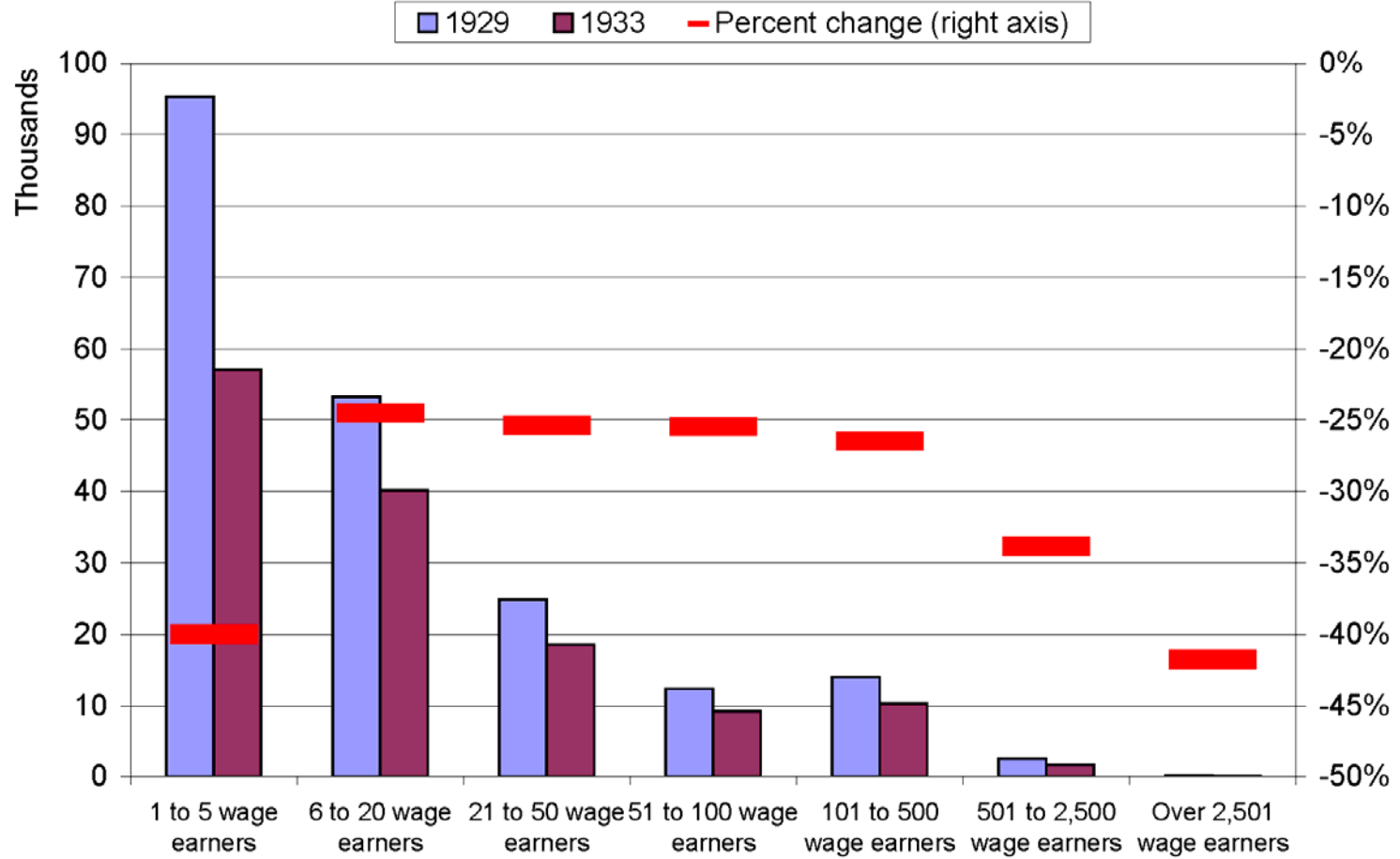   - Do **not** fall more than large in recessions

Census Data for Great Depression _____

- All manufacturing firms

Census Data: Number of employees by size

□ 1929   ■ 1933   — Percent change (right axis)

Census Data: Number of establishments by size

Legend: 1929 | 1933 | Percent change (right axis)

Summary _____

- Variety of data sources and time periods

  - **Is** evidence that small firms hurt more than large by monetary contractions

  - **No** evidence that small firms hurt more than large in recessions

- Contribution

  Show popular belief is a myth

- Where to go from here?

How to Interpret These Results? _____

- Option 1: Dismiss evidence from Romer-Romer dates

  o No objective criterion for choice of dates

  o Therefore, stop working on financial friction models

- Option 2: Accept evidence from Romer-Romer dates

  o Find financial friction model consistent with both business cycle evidence and financial-tightness evidence

Pursuing Option 2 _____

- Want model

  ○ Small firms contract more after financial-tightening

  ○ Small and larger firms similar in business cycle downturns

- Ingredients

  ○ Firms born small, grow, stochastically die

  ○ Small firms financially constrained, large not

  ○ Business cycle shocks different from financial shocks

    – Symmetric response to business cycle shocks (both hurt)

    – Asymmetric response to financial shocks (small hurt more)

Pursuing Option 2

- General setup (generic financial constraint model)

  - Two types of agents

    - Managers (entrepreneurs) and workers

- Enforcement constraints on managers

  - Can abscond with fraction of firm's capital stock

- Two types of shocks

  - Productivity shocks A_t (business cycle shocks)

  - Enforcement constraint shocks θ_t (financial shocks)

Infinite Horizon Deterministic (A_t, θ_t) _____

Manager

$$\max \sum_{t=1}^{\infty} \beta_t c_t$$

Budget constraint

$$k_1 + \sum_{t=1}^{\infty} \beta^t [c_t + k_{t+1}] \leq \sum_{t=1}^{\infty} \beta^t A_t F(k_t)$$

Enforcement constraint

$$Bc_1 + \beta^2 c_2 + \beta^3 c_3 + \ldots \geq \beta \theta_1 k_1$$

$$\beta^2 c_2 + \beta^3 c_3 + \ldots \geq \beta^2 \theta_2 k_2$$

$$\beta^3 c_3 + \ldots \geq \beta^3 \theta_3 k_3$$

Non-negativity

$$c_t \geq 0$$

Infinite Horizon Deterministic _____

Proposition: Under sufficient conditions, there exists T such that

$$c_t = 0, \quad t = 1, \dots T \text{ (backloading is optimal)}$$

$$k_{t+1} = \begin{cases} \dfrac{\theta_t}{\beta\theta_{t+1}} & t < T \\ k^*(A_{t+1}) & t \geq T \end{cases}$$

where $k^*(A_t)$ is unconstrained level of capital: $\beta F_k(k^*(A_t)) = 1$

- Small firms run along constraint: only θ_t matters for invest.

  Large firms unconstrained: θ_t irrelevant for investment

Implications

- Financial shocks θ_t asymmetric

  - Affect small firms

  - No affect large firms

- Business cycle shocks A_t symmetric

  - Direct effect on both small and large sales $A_t F(kt)$

Spirit of Assumption Needed in Proposition _____

- Unconstrained level of capital: $\beta F_k(k^*) - 1 = 0$

- Payments to managers: marginal product of labor

$$\beta c_1 + \beta^2 c_2 + \ldots = [\beta F(k_1^*) - k_1^*] + [\beta F(k_2^*) - k_2^*] + \ldots$$
$$= [\beta F_k(k_1^*) - 1]k_1^* + \beta F_I(k_1^*) + \beta[\beta F_k(k_2^*) - 1]k_2^* + \beta^2 F_I(k_1^*) + \ldots$$
$$= \beta F_I(k_1^*) + \beta^2 F_I(k_1^*) + \ldots$$

- Assume: Unconstrained level of capital not enforceable

$$\sum_{t=1}^{\infty} \beta^t c_t = \sum_{t=1}^{\infty} \beta^t F_I(k^*) < \beta \theta k_1^*$$

- Assume: A_t not vary too much

Why Backloading Optimal: Intuition with A and θ Constant __

- Budget constraint pins down p.v. of c_t

$$\sum_{t=1}^{\infty} \beta^t c_t = \sum_{t=1}^{\infty} \beta^t [A_t F(k_t) = k_{t+1}] - k_1 \equiv S$$

- Try to support k^* in earliest possible period

$$S = \beta c_1 + \beta^2 c_2 + \beta^3 c_3 + ... \geq \beta \theta k$$
$$\beta^2 c_2 + \beta^3 c_3 + ... \geq \beta^2 \theta k$$
$$\beta^3 c_3 + ... \geq \beta^3 \theta k$$

- Suppose enforcement binds at t + 1 but $c_t > 0$

  ○ Decrease c_t (put in bank)

  ○ Decrease c_s, s > t (take out later)

- Budget constraint pins down p.v. of c_t

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Why Backloading Optimal: Intuition with A and θ Constant __

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$$S = \qquad \qquad \beta^3 c_3 + ... \geq \beta^3 \theta k$$

- Suppose enforcement binds at $t + 1$ but $c_t > 0$
  - No change in p.v. of consumption (still S)
  - But relaxes incentive constraints (timing)

Why Backloading Optimal: Intuition with A and θ Constant __

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- Try to support k^* in earliest possible period

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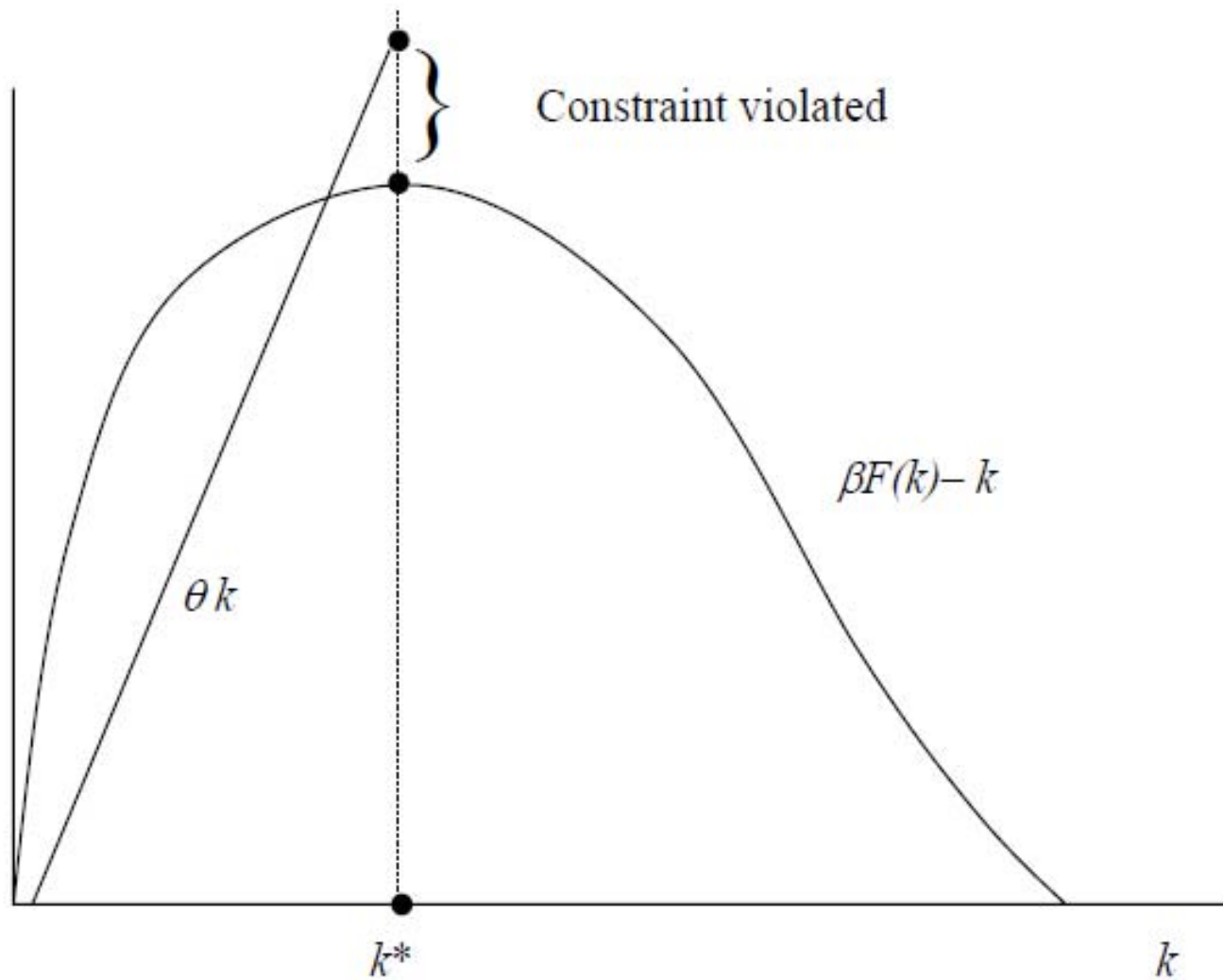$$S = \qquad \qquad \beta^3 c_3 + ... \geq \beta^3 \theta k$$

- Suppose enforcement binds at t + 1 but $c_t > 0$

  Within finite time T: $c_t = 0$, $t = 1, ..., T$

$$S \geq \beta^T \theta k^*$$

How Is Constrained Level Determined? _____

Constraint violated

$\beta F(k) - k$

θk

k^*

k

**How Enforcement Constraint Determines Capital Stock**

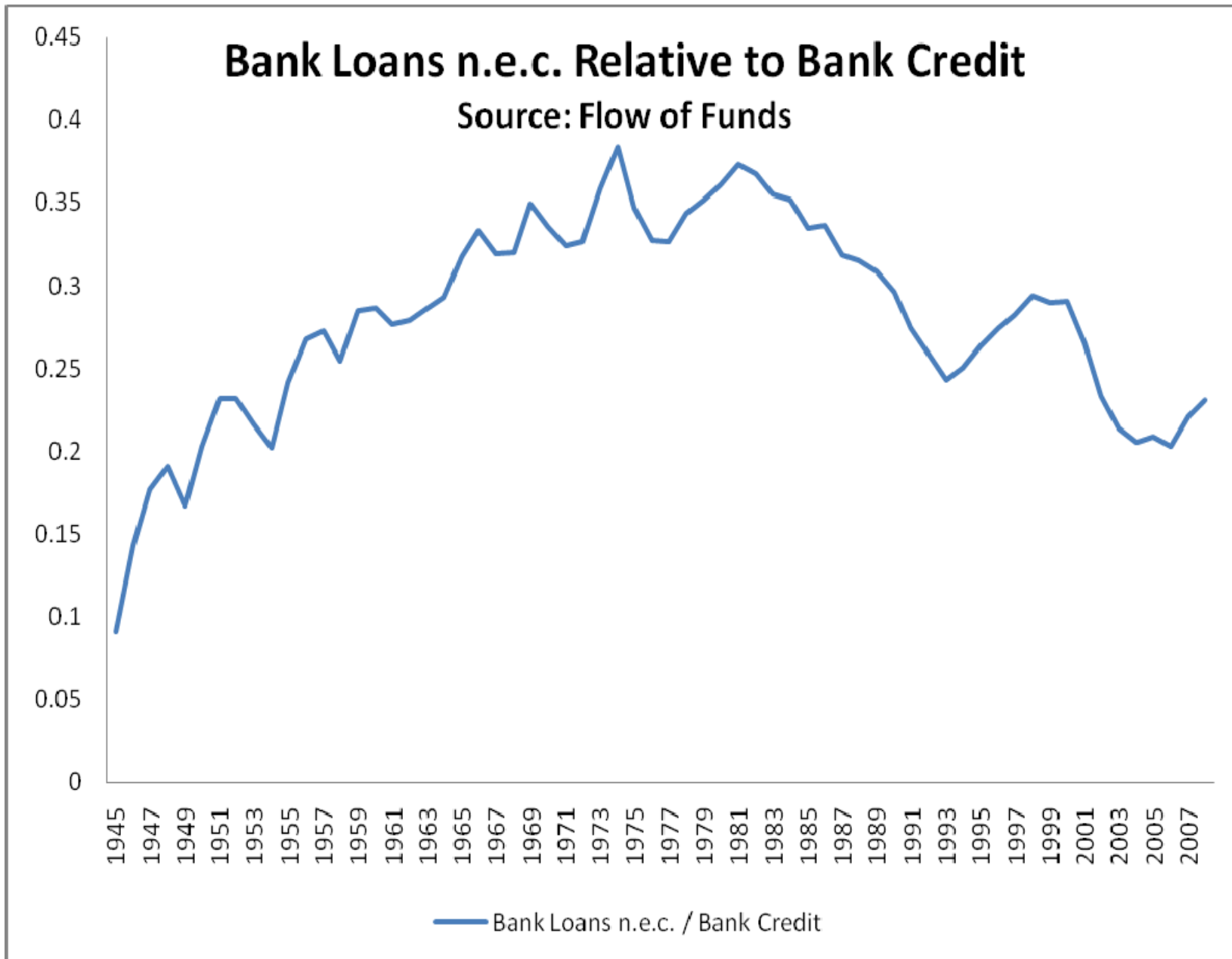# Are Banks Special?

Are Banks Special?

- Banks have lots of short-term debt

- More so than pension funds, mutual funds, insurance companies

- Diamond-Dybvig: Technology differences for short- and long-run projects, liquidity shocks

- Popular story: Incentive problems in managing financial assets, can change risk easily. Need short-term debt to discipline managers

Are Banks Special?

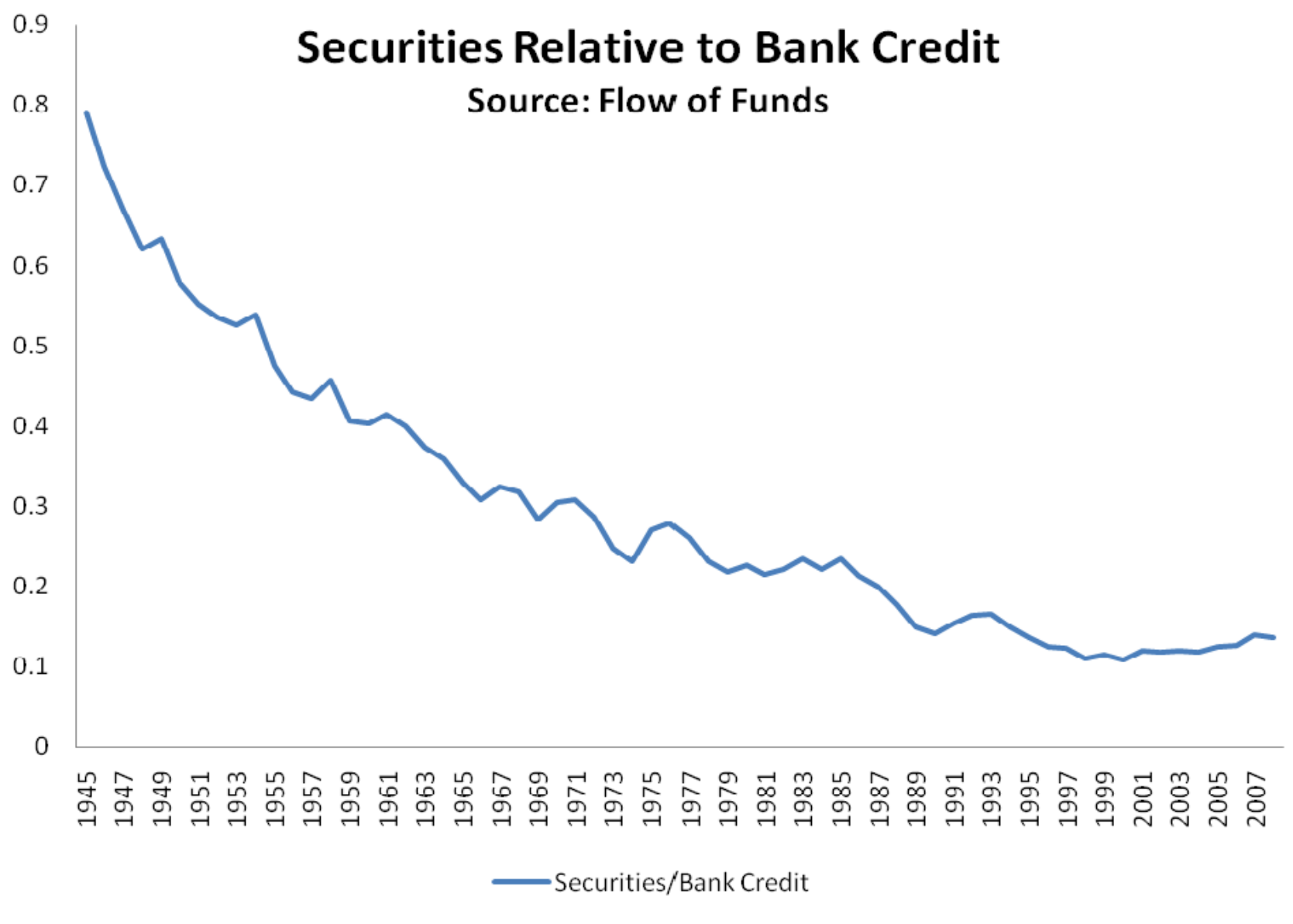- Yes, in terms of liabilities

- Not so much in terms of assets
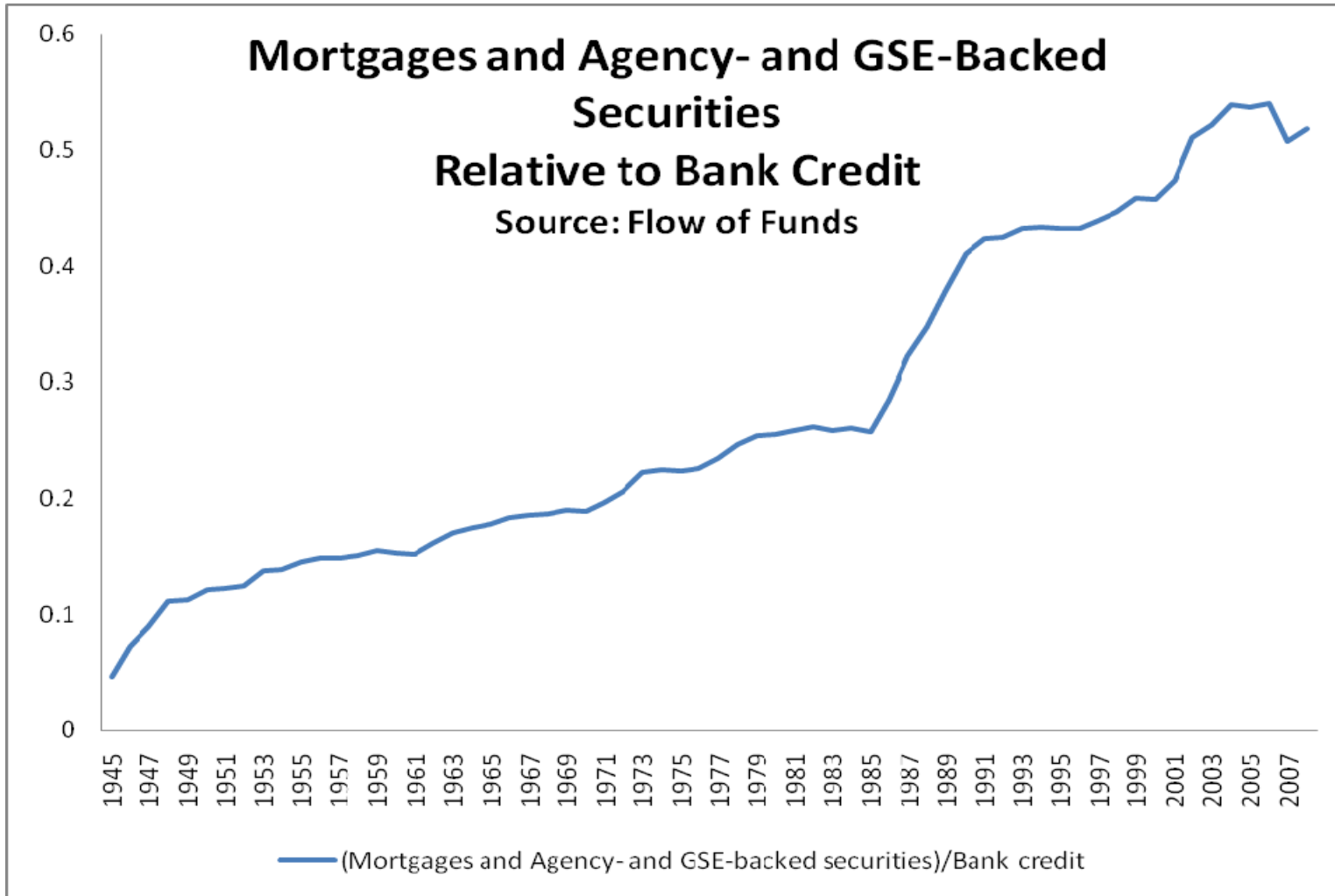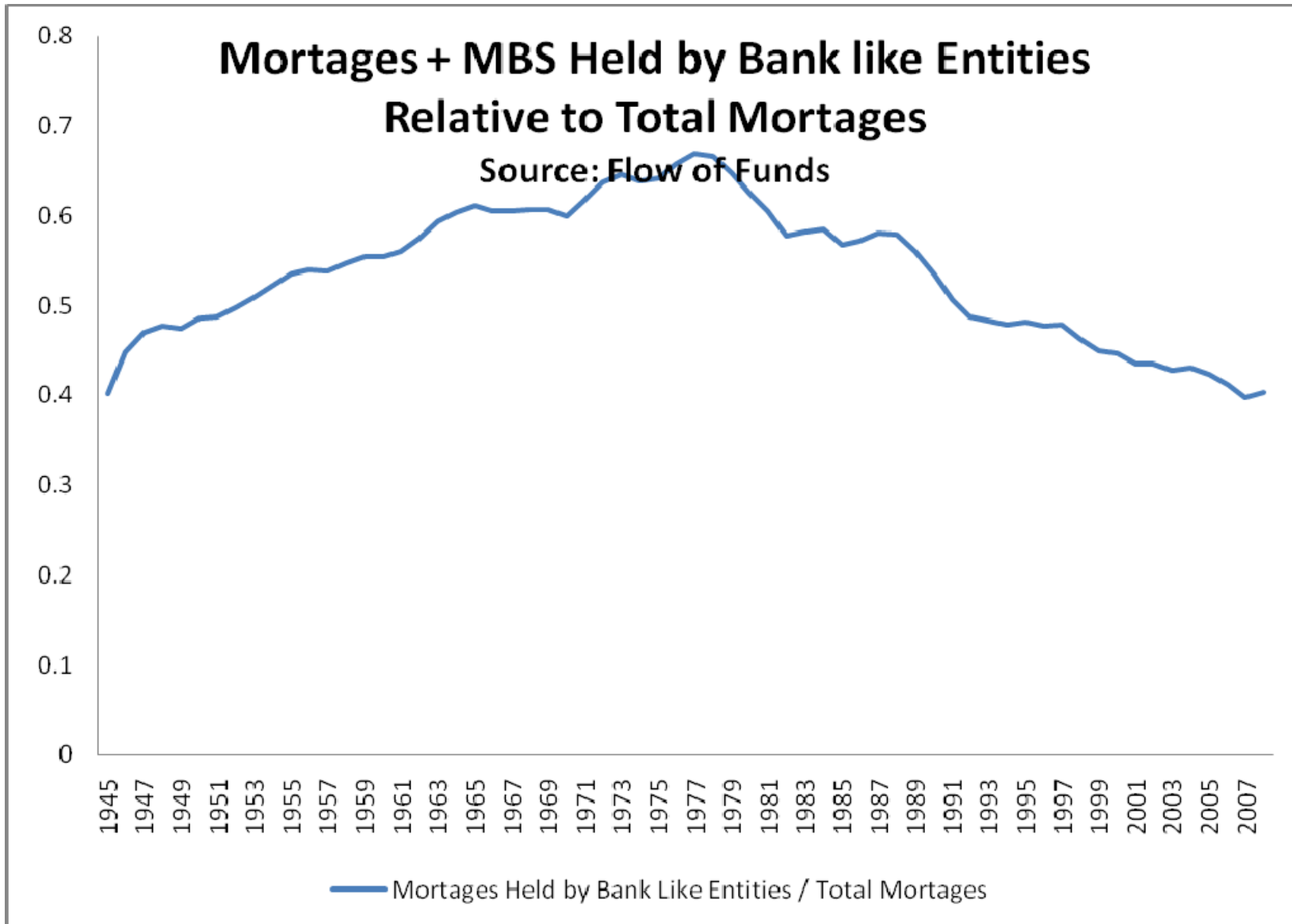
Banks hold lots of mortgages

Bank Loans n.e.c. Relative to Bank Credit

Source: Flow of Funds

Bank Loans n.e.c. / Bank Credit

Loans smaller fraction of bank assets

Securities Relative to Bank Credit

Source: Flow of Funds

Securities/Bank Credit

Large decline in publicly traded securities

Banks not only holders of mortgages

Policy Responses to Recent Financial Crises

Nature of Recent Financial Crisis

- Housing prices rise dramatically 2000-2006

- Fell over last two years

- Financial institutions had big exposure to mortgages

- Financial institutions threatened

- Policymakers went crazy

- Markets guessing what they know

Index of Housing Prices

S&P/Case-Shiller Home Price Index
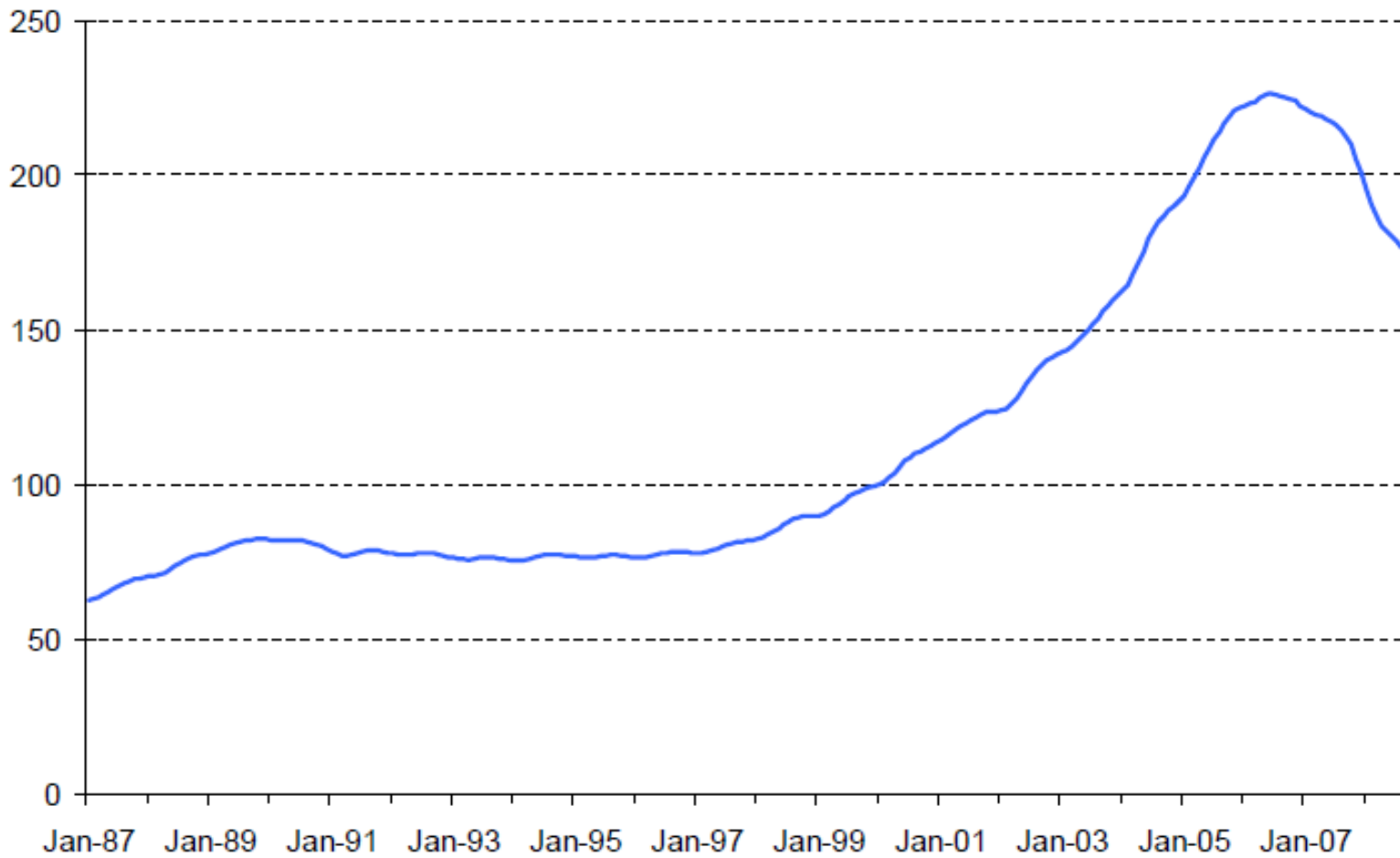
History of Financial Crisis

- Japan

  - Prevented banks from failing
  - Forces banks to lend to zombies
  - Lost decade of 90s

- RTC in U.S.

  - Sold assets quickly
  - Recognized loss early
  - No long term harm

- Sweden
  - Nationalized two banks
  - Returned them quickly to private sector
  - Quick recovery

The Great Depression

- Banking, financial, confidence crises

    - Smoot-Hawley tariffs

    - Marginal tax rates were increased

    - National Recovery Administration

    - Cartelization of many industries

- Slow recovery until WWII

Recent Financial Crises

- Evidence of Financial Crisis

  - Major institutions have failed

  - Stock markets down dramatically

  - Spreads have widened dramatically

- Evidence of financial crisis indisputable

Claims about Mechanisms

- Bank lending to nonbank entities has declined a lot

- Bank lending to banks has declined a lot

- Nonfinancial firms not borrowing in CP market

Spreads versus Levels

- Rationale for looking at spreads

    ○ Real rates on T Bills constant

    ○ Spreads give good information on real rates of loans

- Flight to Quality in Crises

    ○ Real rates on T Bills fall a lot

    ○ Spreads give poor information on real rates of loans

Nature of Credit Market Difficulties

- Ivasina-Scharfstein document big fall in syndicated loans

- One possible story: Banks originate loans, syndicate, or resell them

- Given banks hold only 20% of all debt, need large intervention with banks

- Possible need more data

- Most important: Why did credit markets freeze?

- Where is the externality?