Confronting Models of
Financial Frictions with the Data

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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
  – Interest payments – Taxes

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

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

Data for U.S. Nonfinancial Corporations
Noninterest Flow from Households to Firms,
Source: Flow of Funds and BEA.

Sample Average:
(\frac{\text{Capital Expenditure} - \text{Available Funds}}{\text{Corporate GDP}} = -0.03)
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 no 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

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

Source: COMPSTAT and BEA

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

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

Percent of GDP

-4%  -2%  0%  2%  4%  6%  8%  10%


- Net new equity repurchases
- Net New Debt Issue

Have Firms Increased Leverage? _________________________

• No and Yes
Data are for U.S. Nonfinancial Corporations
Data are for U.S. Nonfinancial Corporations
Consistency of Findings with Growth Model

- In steady state of growth model
  \[ c + x = wl + rk \]

- \[ x = \delta k, \quad r = \rho + \delta \]

- 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

<table>
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<tr>
<th>Asset size</th>
<th>&lt;5m</th>
<th>5m</th>
<th>10m</th>
<th>25m</th>
<th>50m</th>
<th>100m</th>
<th>250m</th>
<th>1000m</th>
<th>10000m</th>
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<tbody>
<tr>
<td>Sales</td>
<td>57,319</td>
<td>20,821</td>
<td>30,149</td>
<td>22,785</td>
<td>21,412</td>
<td>34,504</td>
<td>67,175</td>
<td>310,291</td>
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<tr>
<td>Inv</td>
<td>23,377</td>
<td>10,900</td>
<td>17,374</td>
<td>13,221</td>
<td>12,919</td>
<td>21,042</td>
<td>39,164</td>
<td>172,748</td>
<td></td>
</tr>
<tr>
<td>Loans</td>
<td>7,232</td>
<td>3,572</td>
<td>4,878</td>
<td>3,679</td>
<td>3,172</td>
<td>3,857</td>
<td>8,072</td>
<td>41,319</td>
<td></td>
</tr>
</tbody>
</table>
Sales around RR dates - mean across 6 cycles

Percent deviation from RR date

Quarters after RR date

-4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12

large firms

small 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
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
  - No objective criterion for choice of dates
  - Therefore, stop working on financial friction models

- Option 2: Accept evidence from Romer-Romer dates
  - 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 $\theta_t$ (financial shocks)
Infinite Horizon Deterministic \((A_t, \theta_t)\) ________________

Manager

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

Budget constraint

\[
k_1 + \sum_{t=1}^{\infty} \beta' [c_t + k_{t+1}] \leq \sum_{t=1}^{\infty} \beta' A_t F(k_t)
\]

Enforcement constraint

\[
Bc_1 + \beta^2 c_2 + \beta^3 c_3 + ... \geq \beta \theta_1 k_1 \\
\beta^2 c_2 + \beta^3 c_3 + ... \geq \beta^2 \theta_2 k_2 \\
\beta^3 c_3 + ... \geq \beta^3 \theta_3 k_3
\]

Non-negativity

\[
c_t \geq 0
\]
Proposition: Under sufficient conditions, there exists $T$ such that

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

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

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

- Small firms run along constraint: only $\theta_t$ matters for invest.

  Large firms unconstrained: $\theta_t$ irrelevant for investment
Implications

- Financial shocks $\theta_t$ asymmetric
  - Affect small firms
  - No affect large firms

- Business cycle shocks $A_t$ symmetric
  - Direct effect on both small and large sales $A_tF(kt)$
Spirit of Assumption Needed in Proposition ________________

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

- Payments to managers: marginal product of labor

$\beta c_1 + \beta^2 c_2 + ... = [\beta F(k_1^*) - k_1^*] + [\beta F(k_2^*) - k_2^*] + ...$

$= [\beta F_k(k_1^*) - 1]k_1^* + \beta F_I(k_1^*) + \beta[\beta F_k(k_2^*) - 1]k_2^* + \beta^2 F_I(k_1^*) + ...$

$= \beta F_I(k_1^*) + \beta^2 F_I(k_1^*) + ...$

- 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 \( \theta \) 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

\[
S = \beta c_1 + \beta^2 c_2 + \beta^3 c_3 + \ldots \geq \beta \theta k
\]

\[
\beta^2 c_2 + \beta^3 c_3 + \ldots \geq \beta^2 \theta k
\]

\[
\beta^3 c_3 + \ldots \geq \beta^3 \theta k
\]

- Suppose enforcement binds at \( t + 1 \) but \( c_t > 0 \)
  - Decrease \( c_t \) (put in bank)
  - Decrease \( c_s, s > t \) (take out later)
Why Backloading Optimal: Intuition with $A$ and $\theta$ Constant

- Budget constraint pins down p.v. of $c_t$

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

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

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

- 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 $\theta$ Constant

- Budget constraint pins down p.v. of $c_t$
  \[
  \sum_{t=1}^{\infty} \beta^t c_t = \sum_{t=1}^{\infty} \beta^t [A_tF(k_t) = k_{t+1}] - k_1 \equiv S
  \]

- Try to support $k^*$ in earliest possible period
  \[
  S = \beta c_1 + \beta^2 c_2 + \beta^3 c_3 + ... \geq \beta \theta k
  \]
  \[
  S = \beta^2 c_2 + \beta^3 c_3 + ... \geq \beta^2 \theta k
  \]
  \[
  S = \beta^3 c_3 + ... \geq \beta^3 \theta k
  \]

- Suppose enforcement binds at $t+1$ but $c_t > 0$
  Within finite time $T$: $c_t = 0$, $t = 1, \ldots, T$
  \[
  S \geq \beta^T \theta k^*
  \]
How Is Constrained Level Determined?

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

Loans smaller fraction of bank assets
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

Jan-87 Jan-89 Jan-91 Jan-93 Jan-95 Jan-97 Jan-99 Jan-01 Jan-03 Jan-05 Jan-07
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?