External Financing and the Role of Financial Frictions over the Business Cycle: Measurement and Theory
Ariel Zetlin-Jones and Ali Shourideh

Discussion by Gaston Navarro

March 3, 2015
Motivation

▶ Previous work: Financial markets and macroeconomics.
  - Firms use external funds to finance their activities (ex: investment)
  - *Disruptions* in financial markets ⇒ *Decline* in economic activity
Motivation

- **Previous work:** Financial markets and macroeconomics.
  - Firms use external funds to finance their activities (ex: investment)
  - *Disruptions* in financial markets $\Rightarrow$ *Decline* in economic activity

- **Fact:**
  - Funds flow from firms to the rest of the economy!
  - Firms can “*self-finance*” their investment
  - Why care about financial markets?
This Paper

- Differences in external funding across **privately held** and **publicly traded** firms.
Differences in external funding across **privately held** and **publicly traded** firms.

**Evidence:** private firms rely more on external funds.

- Private firms finance 80% of investment with external funds . . .
- . . . public firms finance only 20% with external funds.
Differences in external funding across privately held and publicly traded firms.

**Evidence:** private firms rely more on external funds.
- Private firms finance 80% of investment with external funds . . .
- . . . public firms finance only 20% with external funds.

**Model:** with private and public firms
- Match firms’ funding evidence.
- Disruptions in financial markets will affect private firms.
- Extends to public firms through non-financial linkages.
- Financial conditions matter!
Outline

1. Evidence
2. Model
3. Conclusions and questions
Evidence
Firm's budget constraint

\[
\text{div}_{it} + \Delta FA_{it} + r_{it}B_{it} + X_{it} = \Pi_{it} + IFA_{it} + \Delta B_{it} + \Delta EQ_{it}
\]

- **Dividends**: \(\text{div}_{it}\)
- **Financial assets change**: \(\Delta FA_{it}\)
- **Interest payments**: \(r_{it}B_{it}\)
- **Investment**: \(X_{it}\)
- **Profits**: \(\Pi_{it}\)
- **Returns on financial assets**: \(IFA_{it}\)
- **Change in debt**: \(\Delta B_{it}\)
- **Change in equity**: \(\Delta EQ_{it}\)
Evidence: A Conceptual Framework

- Firm’s budget constraint

\[
div_{it} + \Delta FA_{it} + r_i B_{it} + X_{it} = \Pi_{it} + IFA_{it} + \Delta B_{it} + \Delta EQ_{it}
\]

- Available Funds

\[
div_{it} + \Delta FA_{it} - \Delta B_{it} - \Delta EQ_{it} = \Pi_{it} + IFA_{it} - r_i B_{it} - X_{it}
\]

Available Funds: \( AF_{it} \)
Evidence: A Conceptual Framework

- **Firm’s budget constraint**

  \[ div_{it} + \Delta FA_{it} + r_{it} B_{it} + X_{it} = \Pi_{it} + IFA_{it} + \Delta B_{it} + \Delta EQ_{it} \]

  - dividends
  - financial assets
  - returns on FA
  - change in equity
  - interest payments
  - investment
  - change in debt
  - profits
  - change in debt

- **Available Funds**

  \[ div_{it} + \Delta FA_{it} - \Delta B_{it} - \Delta EQ_{it} = \Pi_{it} + IFA_{it} - r_{it} B_{it} - X_{it} \]

  Available Funds: \( AF_{it} \)

- **External Funding:** For a set of firms \( J \)

  \[ \sum_{i \in J} (X_{it} - AF_{it}) 1[X_{it} \geq AF_{it}] \]

  \[ \sum_{i \in J} X_{it} \]
Evidence: No external funding on aggregate

- Aggregate available funds are larger than investment.

**Figure:** U.S. Flow of Funds, 1952-2013.
Evidence: Private firms use external funding

- For private firms, external funding as % of investment is larger.

Figure: U.K. and U.S., Compustat and Amadeus
Evidence: Difference is not Industry

Across different industries, private firms rely more on external funding.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Private</th>
<th>Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>67%</td>
<td>20%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>66%</td>
<td>20%</td>
</tr>
<tr>
<td>Mining</td>
<td>33%</td>
<td>38%</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>56%</td>
<td>10%</td>
</tr>
<tr>
<td>Services</td>
<td>87%</td>
<td>24%</td>
</tr>
<tr>
<td>Transportation</td>
<td>97%</td>
<td>12%</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>61%</td>
<td>51%</td>
</tr>
</tbody>
</table>

Notes: U.K Data, Compustat and Amadeus. Time series averages.
Evidence: Difference is not Size

▶ Across different sizes, private firms rely more on external funding.
▶ **Note:** Quartiles are defined by using *public firms only!*

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<tbody>
<tr>
<td>Q1</td>
<td>136%</td>
<td>244%</td>
</tr>
<tr>
<td>Q2</td>
<td>98%</td>
<td>73%</td>
</tr>
<tr>
<td>Q3</td>
<td>83%</td>
<td>41%</td>
</tr>
<tr>
<td>Q4</td>
<td>73%</td>
<td>15%</td>
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**Notes:** *U.K Data, Compustat and Amadeus. Time series averages.*
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**Notes:** U.K Data, Compustat and Amadeus. Time series averages.

- Also, small firms rely more on external funding!
Model
Model: Environment

- **Demography:** Household, entrepreneurs, public and private firms, and a final good producer.

- **Technology:** 
  \[ y_i = z_i \left( k_i^{\alpha} \ell_i^{1-\alpha} \right)^{\eta} l_i^{1-\eta} \], where \( l_i \) is the final good.

- **Firms’**
  - Entrepreneur owns his *private* firm: \( i \in [0, s] \).
  - Household owns all *public* firms: \( i \in [s, 1] \).
  - Monopolistically supply their good.
  - Firms exit with prob \( \xi \). A new firm takes over the exiting one.

- **Intra-period Capital Market**
  - Firms rent capital from firms and household.
  - Firms are constrained by their assets \( a_i: k_i \leq \lambda a_i \) with \( \lambda \geq 1 \).

- **Key assumption:** exit risk is . . .
  - *non-diversifiable* for private firms.
  - *perfectly diversifiable* for public firms.

- **Shocks:** \( z' \sim \Psi(z'|z) \). No aggregate shocks.
Let $V_h(A)$ be the value of a household with assets $A$.

$$V_h(A) = \max_{C, L, A'} \{ U(C, L) + \beta V_h(A') \}$$

subject to

$$C + A' = wL + (1 + r)A + \int_s^1 d_i di$$
Model: Household

Let $V_h(A)$ be the value of a household with assets $A$.

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subject to

$$C + A' = wL + (1 + r)A + \int_s^1 d_i di$$

Let $M = \beta \frac{U_C(C')}{U_C(C)}$ be the household’s SDF.
Model: Final Good Producer

- **Static problem:**

\[
\max_{Q,q_i} \left\{ Q - \int p_i q_i di \right\} \quad \text{subject to:} \quad Q = \left[ \int q_i^{\frac{\rho-1}{\rho}} di \right]^{\frac{\rho}{\rho-1}}
\]

- **Result:** Inverse demand function

\[
p_i = Q^{\frac{1}{\rho}} q_i^{-\frac{1}{\rho}}
\]
Let $V_l(a, z)$ be the value of a public firm with assets $a$ and productivity $z$.

$$V_l(a, z) = \max_{d, a', \ell, k, l} \left\{ d + \mathcal{M} \int_{z'} V_l(a', z') d\Psi(z'|z) \right\}$$

subject to

$$d + a' \leq pz \left( k^\alpha \ell^{1 - \alpha} \right)^\eta I^{1 - \eta} - w\ell - l - (r + \delta)k + (1 + r)a$$

$$p = Q^{\frac{1}{\rho}} \left( z \left( k^\alpha \ell^{1 - \alpha} \right)^\eta I^{1 - \eta} \right)^{-\frac{1}{\rho}}$$

$$k \leq \lambda a, \quad d \geq 0$$
Model: Public Firm

Let $V_l(a, z)$ be the value of a public firm with assets $a$ and productivity $z$.

\[
V_l(a, z) = \max_{d, a', \ell, k, I} \left\{ d + M \int_{z'} V_l(a', z') d\Psi(z'|z) \right\}
\]

subject to

\[
d + a' \leq pz \left( k^\alpha \ell^{1-\alpha} \right)^\eta l^{1-\eta} - w\ell - l - (r + \delta)k + (1 + r)a
\]

\[
p = Q^\frac{1}{\rho} \left( z \left( k^\alpha \ell^{1-\alpha} \right)^\eta l^{1-\eta} \right)^{-\frac{1}{\rho}}
\]

\[
k \leq \lambda a, \quad d \geq 0
\]

Let $d_l(a, z), a'_l(a, z), \ell_l(a, z), k_l(a, z), l_l(a, z)$ be the public firm’s optimal policies.
Model: Private Firm

Let $V_u(a, z)$ be the value of a private firm with assets $a$ and productivity $z$.

\[
V_u(a, z) = \max_{d, a', \ell, k, l} \left\{ \log(d) + \beta(1 - \xi) \int_{z'} V_u(a', z') d \psi(z' | z) \right\}
\]

subject to

\[
d + a' \leq pz \left( k^{\alpha} \ell^{1-\alpha} \right)^\eta l^{1-\eta} - w \ell - l - (r + \delta)k + (1 + r)a
\]

\[
p = Q^{1 \rho} \left( z \left( k^{\alpha} \ell^{1-\alpha} \right)^\eta l^{1-\eta} \right)^{-\frac{1}{\rho}}
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k \leq \lambda a, \quad d \geq 0
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Model: Private Firm

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subject to

$$d + a' \leq pz \left( k^\alpha \ell^{1-\alpha} \right)^\eta I^{1-\eta} - w\ell - I - (r + \delta)k + (1 + r)a$$

$$p = Q_1^{1/\rho} \left( z \left( k^\alpha \ell^{1-\alpha} \right)^\eta I^{1-\eta} \right)^{-1/\rho}$$

$$k \leq \lambda a, \quad d \geq 0$$

Let $d_u(a, z), a'_u(a, z), \ell_u(a, z), k_u(a, z), I_u(a, z)$ be the private firm's optimal policies.
Model: Aggregates

- **Capital market** clears:
  \[
  \sum_{i=u,l} \int_{a,z} k_i(a, z) dG_i(a, z) \leq K = \sum_{i=u,l} \int_{a,z} a dG_i(a, z) + A
  \]
  where \(G_i(a, z)\) is the measure over firms for \(i = u, l\).

- **Final goods** market clears:
  \[
  Q = C + \int_{a,z} d_u(a, z) dG_u(a, z) + \sum_{i=u,l} \int_{a,z} l_i(a, z) dG_i(a, z) \\
  + A' + \sum_{i=u,l} \int_{a,z} a_i'(a, z) dG_i(a, z) - (1 - \delta)K
  \]

- **Labor market** clears:
  \[
  L = \sum_{i=u,l} \int_{a,z} \ell_i(a, z) dG_i(a, z)
  \]
Definition

A **stationary recursive equilibrium** consists of value functions \( \{V_i\}_{i=u,l,h} \); firms’ policies \( \{d_i, a'_i, \ell_i, k_i, l_i\}_{i=u,l} \); household policies \( \{C, A', L\} \); firms measures \( \{G_i\}_{i=u,l} \); aggregate output \( Q \); and prices \( \{r, w\} \); such that given prices

+ Agents optimize and achieve their respective value functions.
+ Markets clear.
+ The measures \( G_i \) are stationary and consistent with firms’ policies.
Proposition

Assume $z$ is bounded above. Then, in a stationary equilibrium, the collateral constraint does not bind for public firms.
Proposition

Assume \( z \) is bounded above. Then, in a stationary equilibrium, the collateral constraint does not bind for public firms.

Intuition:

- In a stationary equilibrium: \( M = \beta \) and \( \beta(1 + r) = 1 \).
  \[ \Rightarrow \text{Household, public firms and markets discount at the same rate} \]

- If constraint binds in some state next period: \( a' > a + \varepsilon, \varepsilon > 0 \)
  \[ \Rightarrow \text{A submartingale arises!} \]

- For \( a > \bar{a} \), no finite \( z \) induces the constraint to bind.
Proposition

Assume $z$ is bounded above. Then, in a stationary equilibrium, the collateral constraint does not bind for public firms.

Intuition:
- In a stationary equilibrium: $\mathcal{M} = \beta$ and $\beta(1 + r) = 1$.

  $\Rightarrow$ Household, public firms and markets discount at the same rate

- If constraint binds in some state next period: $a' > a + \varepsilon$, $\varepsilon > 0$

  $\Rightarrow$ A submartingale arises!

- For $a > \bar{a}$, no finite $z$ induces the constraint to bind.

Implication:
- Public firms rely less on external funding, as in data.
- Because $\beta(1 - \xi)(1 + r) < 1$, private firms issue more debt, as in data.
**Key parameters:**

- Three important parameters: $\lambda$, $\rho_z$ and $\sigma_z$ where
  \[
  \ln z' = \rho_z \ln z + \sigma_z \epsilon'
  \]

- Match three moments
  
  1. Debt/Assets = 0.49 as in US for 1986-2012 where Debt = $k - a$
  
  2. External Funding = 0.82 for private firms as in UK 2005-2012 where AF = $py - w\ell - I - r(k - a)$
  
  3. Dispersion of Debt/Assets = 0.54 for private firms as in UK 2005-2012

- Obtain $(\lambda, \rho_z, \sigma_z) = (6.98, 0.95, 0.33)$
**Key parameters:**

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- Obtain \( (\lambda, \rho_z, \sigma_z) = (6.98, 0.95, 0.33) \)

**Other parameters:**

- Measure of firms: \( s = 0.41 \), private firms produce 40\% of GDP, as in US.

- GHH preferences: \( U(C, L) = \ln \left( C - \frac{\psi}{1+\frac{1}{\epsilon}} L^{1+\frac{1}{\epsilon}} \right) \) with \( \epsilon = 2.6 \).
The Effects of a Financial Shock

**Experiment:**

- At $t = 0$, the economy is at its stationary equilibrium.
- At $t = 1$, $\lambda$ declines and slowly returns to its original value.
- Unexpected shock, perfect foresight thereafter.
- Drop in $\lambda$ to induce a 3% in Debt/Assets.
**Figure:** Response to a decline in $\lambda$
Conclusions

- **Evidence:** differences in external funding across public and private firms
  - Private firms rely more on external funding.

- **Model:** Constraints in channeling funds towards productive firms.
  - Financial disruptions affect private firms’ borrowing . . .
  - . . . have effects on economic activity.

- **Quantitatively:** effects are a bit small ...
Questions

- Why do firms borrow?
  - This paper: firms borrow because they are small.
Questions

- Why do firms borrow?
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- Evidence: Large firms, rely less on external funds but borrow more.

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- (Maybe) firms borrow for a variety of reasons
  - Need of funds.
  - Tax advantage (Hennessy and Whited, 2007)
  - Agency problems (Jensen, 1986)
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  - Precautionary motives (Acharya, 2013)

- Crucial to understand the effects of financial disruptions!
Thank you!!!
Evidence: Data Sources

- **UK:**
  - Public firms: Compustat Global, 10,000 firm-year observations (550 per year), 1992 to 2013.
  - Private firms: Amadeus, 980,000 firm-year observations (100,000 per year), 2005 to 2012.

- **US:**
  - Public firms: Compustat, 51,000 firm-year observations (1,400 per year), 1974 to 2013.
Aggregate available funds are larger than investment, also for UK.

**Figure:** UK National Economic Accounts, 1997-2011.

**Notes:** Internal funds = Available funds - Dividends.
Cross-sectional Median

<table>
<thead>
<tr>
<th></th>
<th>Assets</th>
<th>Investment</th>
<th>Sales</th>
<th>I/A</th>
<th>AF/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>0.24</td>
<td>0.002</td>
<td>0.38</td>
<td>1.23</td>
<td>1.23</td>
</tr>
<tr>
<td>Public</td>
<td>115.86</td>
<td>2.66</td>
<td>126.71</td>
<td>3.07</td>
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</tr>
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Notes: Time averages for public and private firms in the United Kingdom. Assets, Investment, and Sales reported in millions of pounds.
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<th>Moment</th>
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<td><strong>Calibrated Parameters</strong></td>
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<td></td>
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<td>Collateral Constraint ($\lambda$)</td>
<td>6.98</td>
<td>External Financing</td>
<td>0.82</td>
</tr>
<tr>
<td>Persistence of Idio. TFP ($\rho_z$)</td>
<td>0.95</td>
<td>Debt-to-Assets</td>
<td>0.49</td>
</tr>
<tr>
<td>Std. of Idio. TFP ($\sigma_z$)</td>
<td>0.33</td>
<td>Dispersion in Debt-to-Assets</td>
<td>0.54</td>
</tr>
<tr>
<td>Disutility of Labor ($\psi$)</td>
<td>0.41</td>
<td>Aggregate Hours</td>
<td>0.30</td>
</tr>
<tr>
<td>Share of private firms ($s$)</td>
<td>0.41</td>
<td>Private Firms Share of Output</td>
<td>0.40</td>
</tr>
<tr>
<td>Share of Intermediate Inputs ($\eta$)</td>
<td>0.43</td>
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<td><strong>Fixed Parameters</strong></td>
<td></td>
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<tr>
<td>Discount Rate ($\beta$)</td>
<td>0.96</td>
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<tr>
<td>Labor Supply Elasticity ($\varepsilon$)</td>
<td>2.6</td>
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<tr>
<td>Elasticity of Substitution ($\rho$)</td>
<td>4</td>
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<tr>
<td>Capital Share ($\alpha$)</td>
<td>0.3</td>
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<tr>
<td>Depreciation Rate ($\delta$)</td>
<td>0.07</td>
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<tr>
<td>Exit Risk of Private Firms ($\xi$)</td>
<td>0.10</td>
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The Effects of a Large Financial Shock

Figure: Response to a large decline in $\lambda$