External Financing and the Role of Financial Frictions over the Business Cycle: Measurement and Theory

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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 $\Rightarrow$ *Decline* in economic activity

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  - 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.

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  - . . . public firms finance only 20% with external funds.

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  - . . . 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

Evidence: A Conceptual Framework

- **Firm's budget constraint**

$$\underbrace{div_{it}}_{\text{dividends}} + \overbrace{\Delta FA_{it}}^{\text{financial assets}} + \underbrace{r_{it} B_{it}}_{\text{interest payments}} + \overbrace{X_{it}}^{\text{investment}} = \underbrace{\Pi_{it}}_{\text{profits}} + \overbrace{IFA_{it}}^{\text{returns on } FA} + \underbrace{\Delta B_{it}}_{\text{change in debt}} + \overbrace{\Delta EQ_{it}}^{\text{change in equity}}$$

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- **Available Funds**

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- **External Funding:** For a set of firms $\mathcal{J}$

$$\frac{\sum_{i\in\mathcal{J}}(X_{it} - AF_{it})\,\mathbf{1}_{[X_{it}\geq AF_{it}]}}{\sum_{i\in\mathcal{J}} X_{it}}$$

Evidence: No external funding on aggregate

UK

- Aggregate available funds are larger than investment.

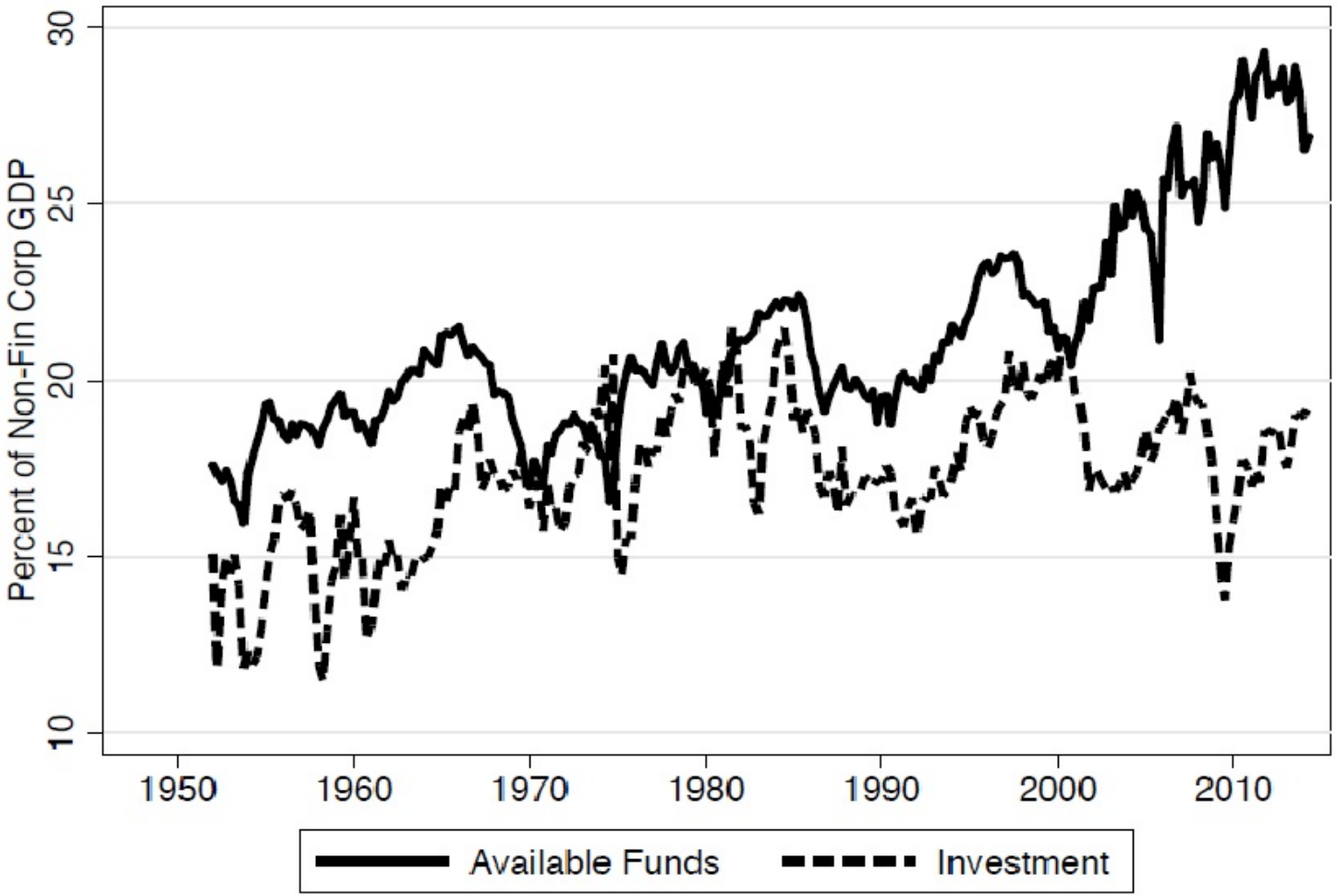

Figure: U.S. Flow of Funds, 1952-2013.

Evidence: Private firms use external funding

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

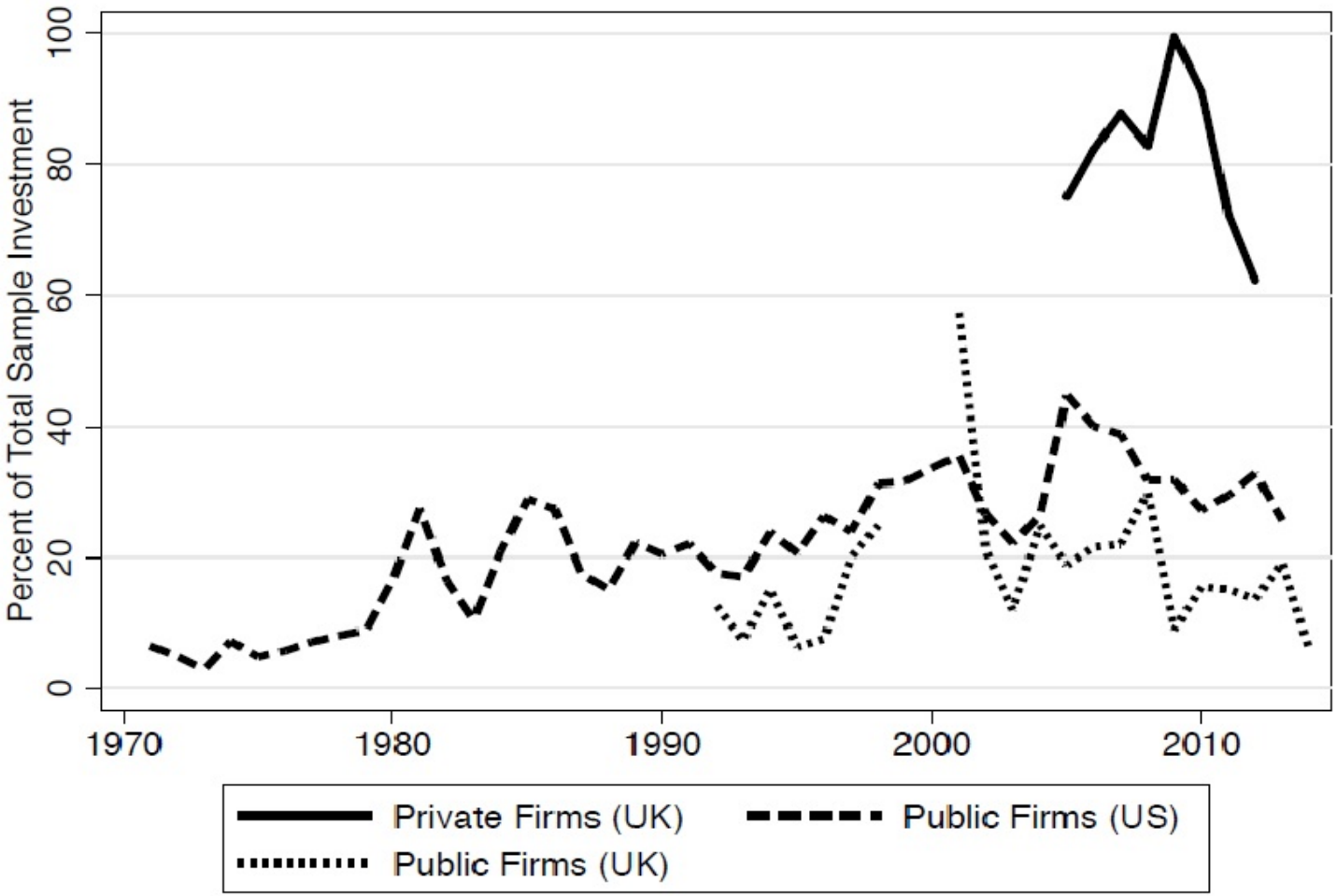

Figure: U.K. and U.S., Compustat and Amadeus

Evidence: Difference is not Industry

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

	External Funding as % of Investment	
Industry	Private	Public
Agriculture	67%	20%
Manufacturing	66%	20%
Mining	33%	38%
Retail Trade	56%	10%
Services	87%	24%
Transportation	97%	12%
Wholesale Trade	61%	51%

Notes: *U.K Data, Compustat and Amadeus. Time series averages.*

Evidence: Difference is not Size

Firms' Statistics

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

	External Funding as % of Investment	
Industry	Private	Public
Q1	136%	244%
Q2	98%	73%
Q3	83%	41%
Q4	73%	15%

Notes: *U.K Data, Compustat and Amadeus. Time series averages.*

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- Also, small firms rely more on external funding!

Model

Model: Environment

- **Demography:** Household, entrepreneurs, public and private firms, and a final good producer.
- **Technology:** $y_i = z_i \left(k_i^{\alpha} \ell_i^{1-\alpha}\right)^{\eta} I_i^{1-\eta}$, where I_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 ξ. 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.

Model: Household

Let $V_h(\mathcal{A})$ be the value of a household with assets $\mathcal{A}$.

$$
\begin{aligned}
V_h(\mathcal{A}) &= \max_{C,L,\mathcal{A}'} \left\{ \mathcal{U}(C,L) + \beta V_h(\mathcal{A}') \right\} \\
\text{subject to} & \\
C + \mathcal{A}' &= wL + (1+r)\mathcal{A} + \int_s^1 d_i \, di
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Let $\mathcal{M} = \beta \frac{U_C(C')}{U_C(C)}$ be the household's SDF.

Model: Final Good Producer

- Static problem:

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

- **Result:** Inverse demand function

$$p_i = Q^{\frac{1}{\rho}} q_i^{-\frac{1}{\rho}}$$

Model: Public Firm

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

$$
\begin{aligned}
V_I(a,z) &= \max_{d,a',\ell,k,I} \left\{ d + \mathcal{M} \int_{z'} V_I(a',z') d\Psi(z'|z) \right\} \\
\text{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^{\frac{1}{\rho}} \left(z \left(k^{\alpha} \ell^{1-\alpha} \right)^{\eta} I^{1-\eta} \right)^{-\frac{1}{\rho}} \\
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Let $d_I(a,z)$, $a'_I(a,z)$, $\ell_I(a,z)$, $k_I(a,z)$, $I_I(a,z)$ be the public firm's optimal policies.

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

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\begin{aligned}
V_u(a,z) &= \max_{d,a',\ell,k,I} \left\{ \log(d) + \beta(1-\xi) \int_{z'} V_u(a',z') d\Psi(z'|z) \right\} \\
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Model: Aggregates

- **Capital market** clears:

$$\sum_{i=u,l} \int_{a,z} k_i(a,z) dG_i(a,z) \leq K = \sum_{i=u,l} \int_{a,z} a dG_i(a,z) + \mathcal{A}$$

where $G_i(a,z)$ is the measure over firms for $i = u, l$.

- **Final goods** market clears:

$$\begin{aligned} Q &= C + \int_{a,z} d_u(a,z) dG_u(a,z) + \sum_{i=u,l} \int_{a,z} I_i(a,z) dG_i(a,z) \\ &+ \mathcal{A}' + \sum_{i=u,l} \int_{a,z} a_i'(a,z) dG_i(a,z) - (1-\delta)K \end{aligned}$$

- **Labor market** clears:

$$L = \sum_{i=u,l} \int_{a,z} \ell_i(a,z) dG_i(a,z)$$

Model: Equilibrium

Definition

A **stationary recursive equilibrium** consists of value functions $\{V_i\}_{i=u,l,h}$; firms' policies $\{d_i, a_i', \ell_i, k_i, I_i\}_{i=u,l}$; household policies $\{C, \mathcal{A}', L\}$; 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.

Model: Theoretical Results

Proposition

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

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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.

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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.

Model: Calibration

Full Calibration

Key parameters:

- Three important parameters: λ, ρ_z and σ_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 $(\lambda, \rho_z, \sigma_z) = (6.98, 0.95, 0.33)$

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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 $t = 1$, λ declines and slowly returns to its original value.
- Unexpected shock, perfect foresight thereafter.
- Drop in λ to induce a 3% in Debt/Assets.

The Effects of a Financial Shock

Crisis Experiment

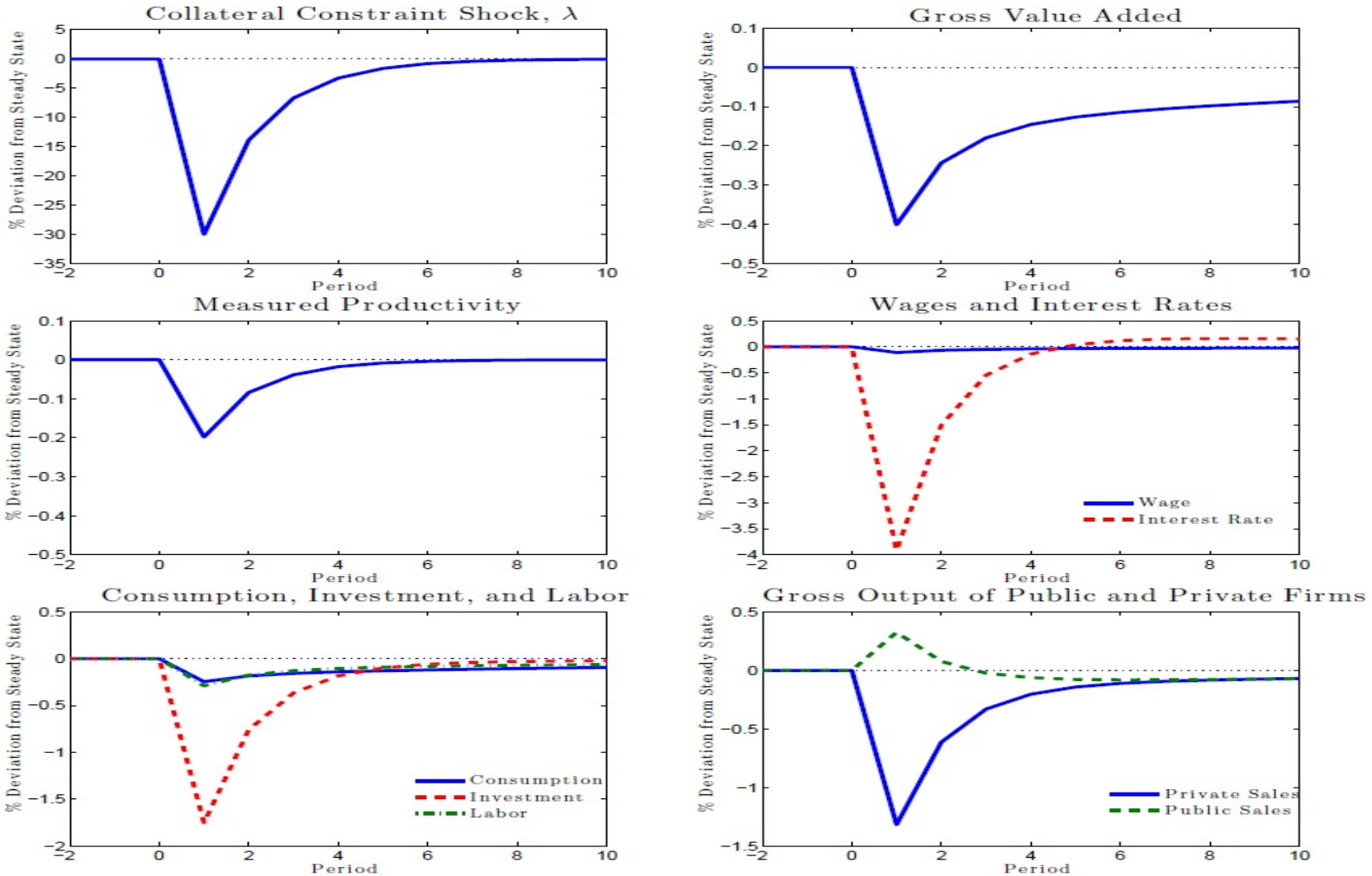

Figure: Response to a decline in λ

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

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- **Evidence:** Large firms, rely **less on external funds** but **borrow more**.

	Quartiles by Assets Size		
	External Funding % of Investment	Debt/Assets	Assets
Q1	258%	14%	3.98
Q2	145%	13%	27.35
Q3	79%	19%	107.85
Q4	34%	37%	768.57

Notes: *US Data, Compustat. Time series averages.*

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- Crucial to understand the effects of financial disruptions!

Thank you!!!

Evidence: Data Sources

Return

- UK:
  - Aggregate data: UK National Economic Accounts, 1970-2013.
  - 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:
  - Aggregate data: Flow of Funds, 1952 to 2013.
  - Public firms: Compustat, 51,00 firm-year observations (1,400 per year), 1974 to 2013.

Evidence: No external funding on aggregate UK ... Return

- Aggregate available funds are larger than investment, also for UK.

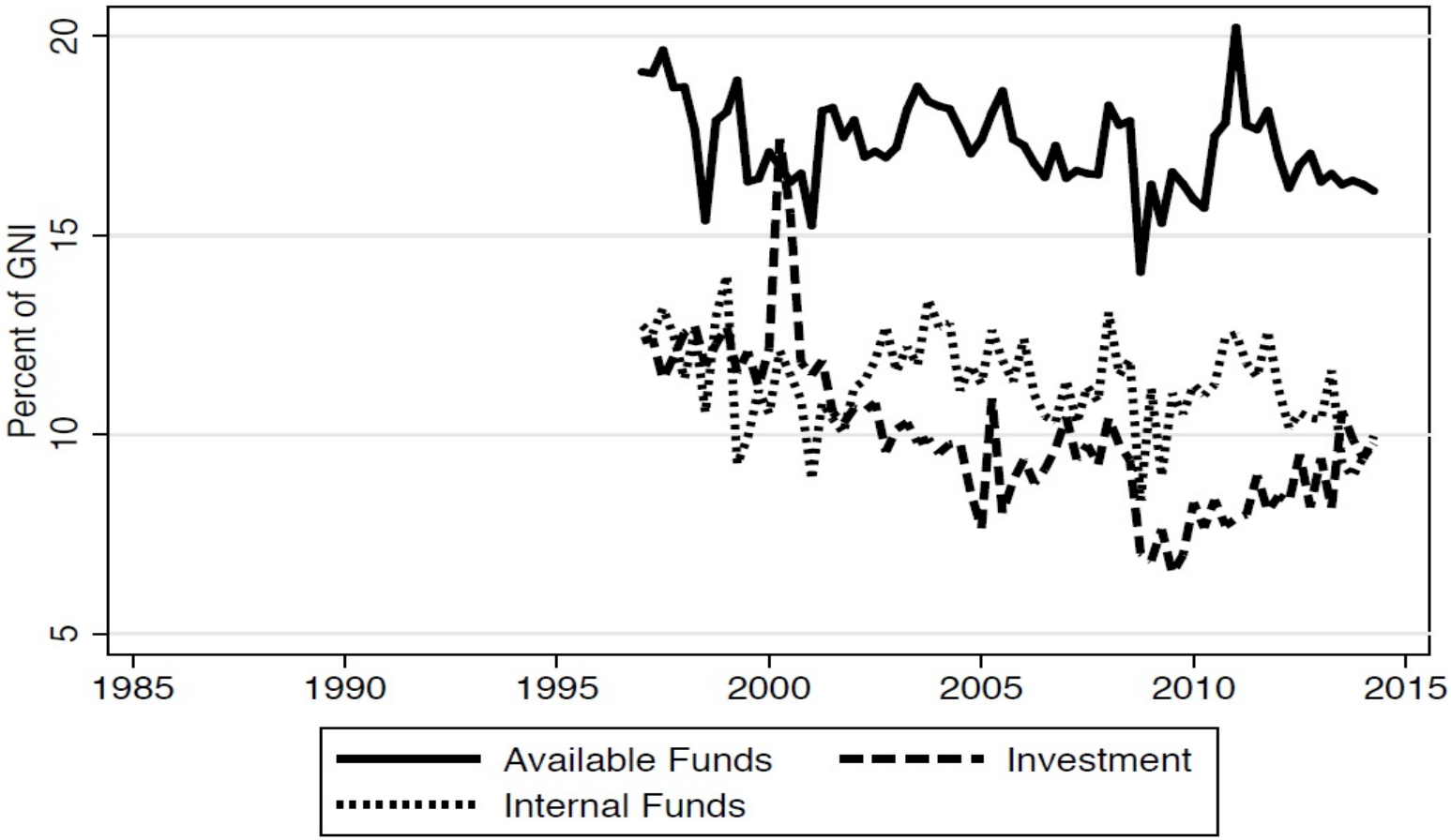

Figure: UK National Economic Accounts, 1997-2011.

Notes: *Internal funds = Available funds - Dividends.*

Evidence: Firms' statistics - UK

Return

	Cross-sectional Median				
	Assets	Investment	Sales	I/A	AF/A
Private	0.24	0.002	0.38	1.23	1.23
Public	115.86	2.66	126.71	3.07	3.07

Notes: *Time averages for public and private firms in the United Kingdom. Assets, Investment, and Sales reported in millons of punds.*

Calibration

Return

Parameter	Value	Moment	Value
Calibrated Parameters			
Collateral Constraint (λ)	6.98	External Financing	0.82
Persistence of Idio. TFP (ρ_z)	0.95	Debt-to-Assets	0.49
Std. of Idio. TFP (σ_z)	0.33	Dispersion in Debt-to-Assets	0.54
Disutility of Labor (ψ)	0.41	Aggregate Hours	0.30
Share of private firms (s)	0.41	Private Firms Share of Output	0.40
Share of Intermediate Inputs (η)	0.43	Intermediate Input Share	0.43
Fixed Parameters			
Discount Rate (β)	0.96		
Labor Supply Elasticity (ε)	2.6		
Elasticity of Substitution (ρ)	4		
Capital Share (α)	0.3		
Depreciation Rate (δ)	0.07		
Exit Risk of Private Firms (ξ)	0.10		

The Effects of a Large Financial Shock

Return

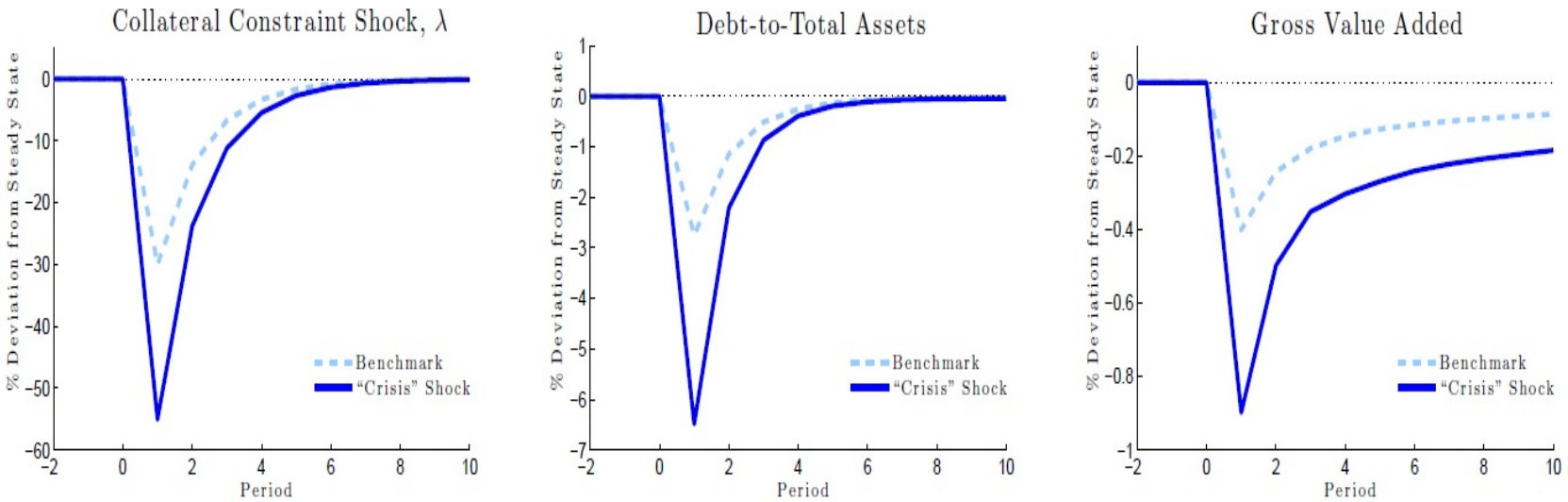

Figure: Response to a **large** decline in λ