Going Public over the Business Cycle

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Motivation

“For business owners who want to take their companies to the next level, this bill will **make it easier for you to go public**. And that’s a big deal because **going public is a major step towards expanding and hiring more workers**.”

Source: *Remarks by President Obama at JOBS Act Bill Signing* (April 5th, 2012)

What does going public mean?

- *Private* firms become *public* as they begin trading shares in the public stock market
- Firms typically go public through an Initial Public Offering (IPO)

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  $\rightarrow$ Raise capital via IPO $\rightarrow$ Invest $\rightarrow$ Expand

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  → It is well-established that the number of IPOs is procyclical ◂ Figure

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- **The timing of an IPO matters for post-IPO employment growth**

  → Firms going public during recessions experience **persistently slower growth**

Research questions

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How does the cyclicality of IPOs matter for aggregate employment dynamics?

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$\Rightarrow$ Job creation margin during economic downturns

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- **Calibrate the model to the U.S. economy**
- **Simulate recovery process from a negative shock on aggregate productivity**
  - → Quantify the role of IPO cyclicality on aggregate employment response

Literature and contributions

- **Cyclical IPOs** Empirics (Helwege and Liang (2004), Tran and Jeon (2011), Angelini and Foglia (2018))

  Theory (Alti (2005), Pastor and Veronesi (2005), Aghamolla and Guttman (2021))

- **IPO decision and firm dynamics** Firm dynamics over the business cycle (Lee (2005), Choi (2014), Lee and Mukoyama (2015), Sedlacek (2015), Clementi and Palazzo (2016), Moreira (2016), Sedlacek and Sterk (2017))

  Endogenous IPO choice (Clementi (2004), Gonzalez (2021), Casella, Lee and Villavazo (2023))

- **Capital misallocation over the business cycle** (Kiyotaki and Moore (1997), Jermann and Quadrini (2012), Khan and Thomas (2013), Gopinath, Kalemli-Ozcan, Karabarbounis, and Villegas-Sanchez (2017))

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  → Examine the misallocation driven by the **dynamics between private and public firms**

Empirical evidence

Data

- **Compustat/CRSP**
  - → Panel data based on the financial reporting of public firms in the U.S.
  - → Sample: 1980 - 2019

    ... $\sim$ 110,400 firm-year observations ◂ Sample selection

    ... $\sim$ 10,900 number of IPOs

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- **Timing of IPO is identified by IPO dates**
  - → Define cohorts: **Expansion** (trough-peak) and **Contraction** (peak-trough)

Descriptive statistics

Median, at the IPO

	Expansion	Contraction
Debt-to-assets ratio	0.41	0.44
Industry		
Mining	0.06	0.12
Manufacturing	0.47	0.46
Service	0.47	0.42
Employment (1K)	0.20	0.13
Assets (1M, $)	2,575	470
Sale of stock (1M, $)	622.60	54.41
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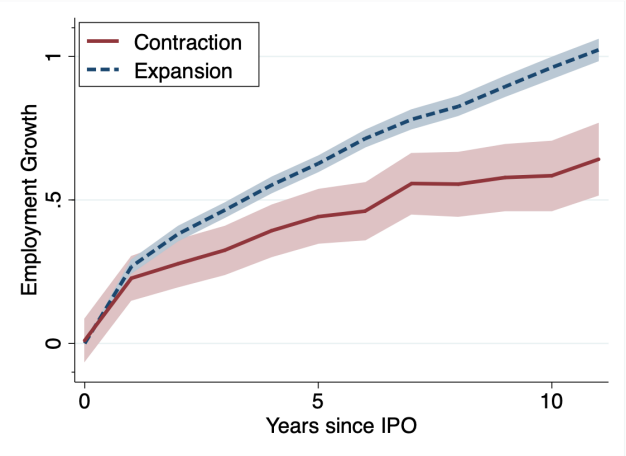
- **Cyclical capital injection**
  - → **Contraction** cohort raises less capital through IPOs Regression

Heterogeneous Post-IPO growth



(Controls: Pre-IPO size / sales per worker / capital intensity / debt to asset, detrended GDP) Equation

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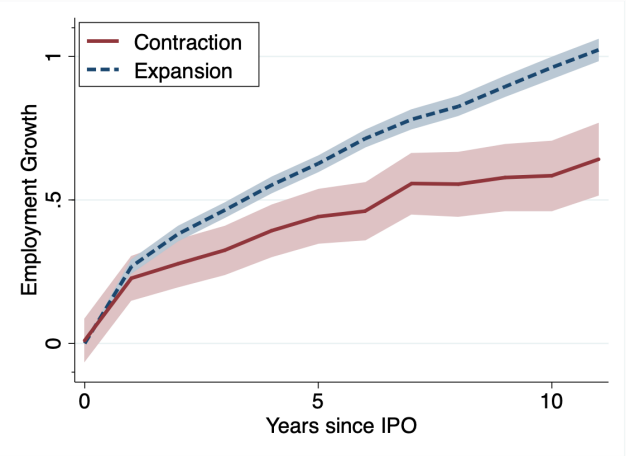

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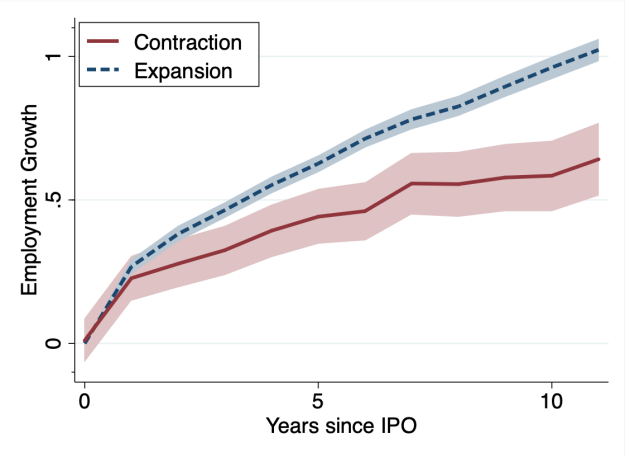

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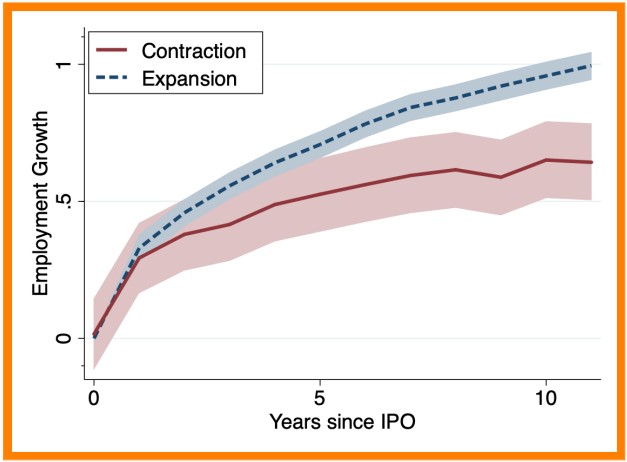

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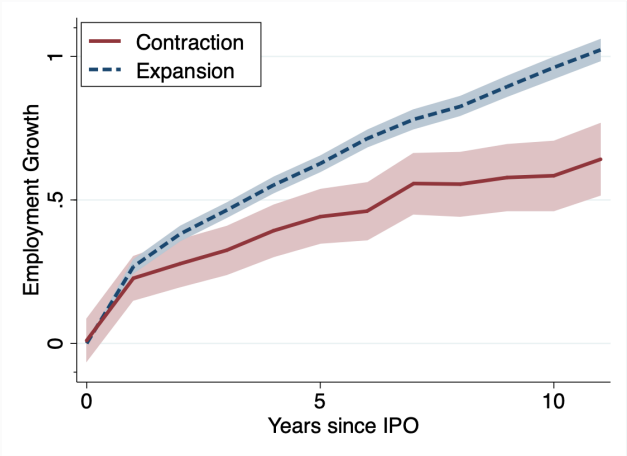

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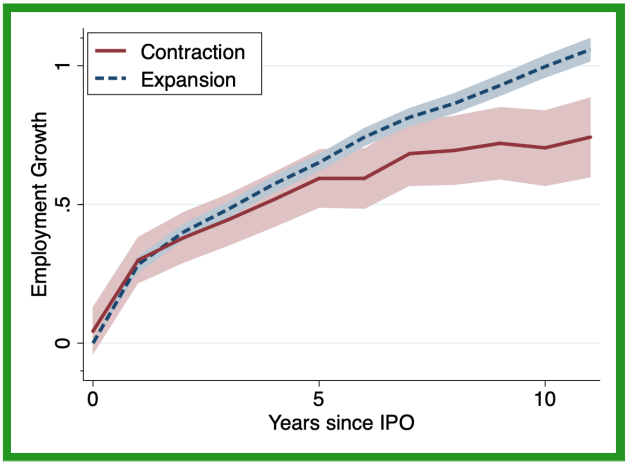

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- **Cyclical capital injection?**
  - → Control for the **sales of stock** in the IPO year

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IPO Cyclicality

- Procyclical number of IPOs
- IPO firms during **contractions** ...
  - → **are smaller** (different selection)
  - → **raise less capital** (capital injection cyclicality)
  - → **grow persistently slower after the IPO** (heterogeneous post-IPO growth)

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- **Next step**
  - → Develop **heterogeneous firm dynamics model** with **business cycle**
    - Financial frictions + Competitive labor market
    - Endogenous entry/exit
    - **Endogenous transition** from private to public through **IPO decisions**

The model

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  - → **Aggregate productivity** $\log(z_{t+1}) = \rho_z \log(z_t) + \varepsilon_{z,t}, \;\; \varepsilon_{z,t} \sim \mathcal{N}(0, \sigma_z)$
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- **Initial Public Offering**
  - → **Financially constrained private firms** can raise capital from the public stock market

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→ From $t+1$, χ share of public firms belongs to public investors

- Dividend payment to public investors

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- **Trade-off at IPO decision**

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→ **The amount of capital injection depends on the aggregate state!**

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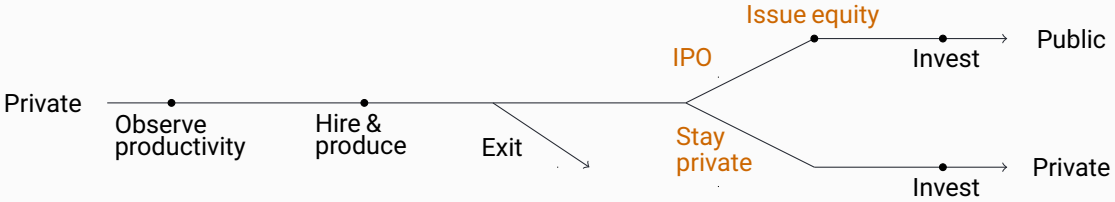

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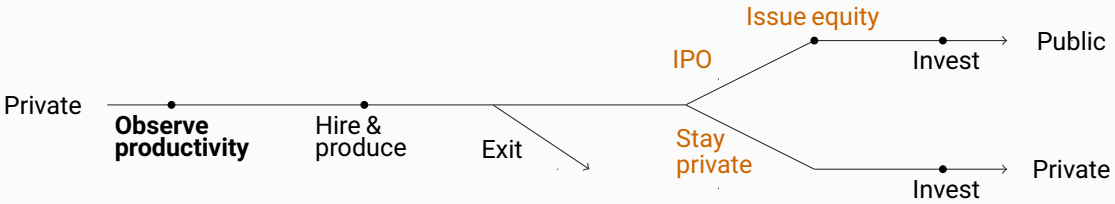

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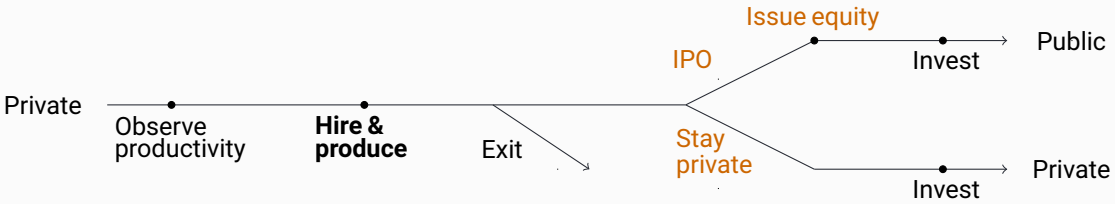

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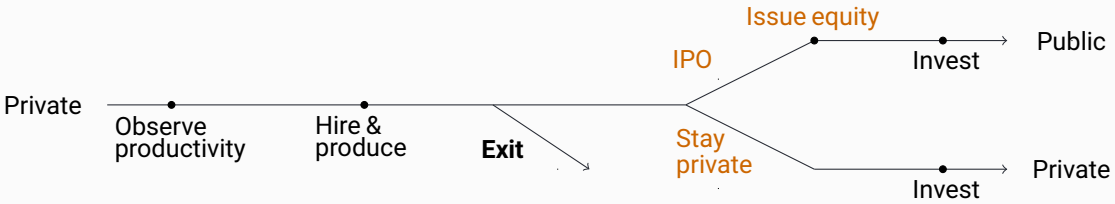

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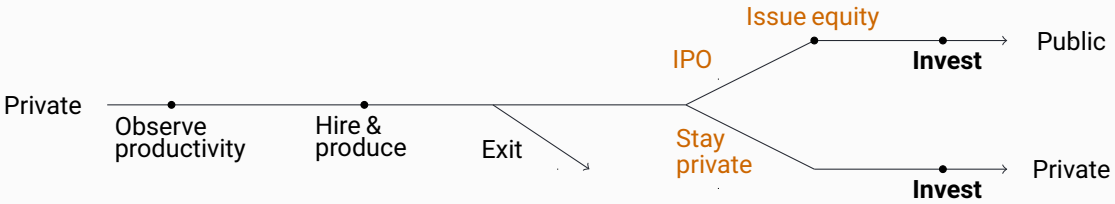

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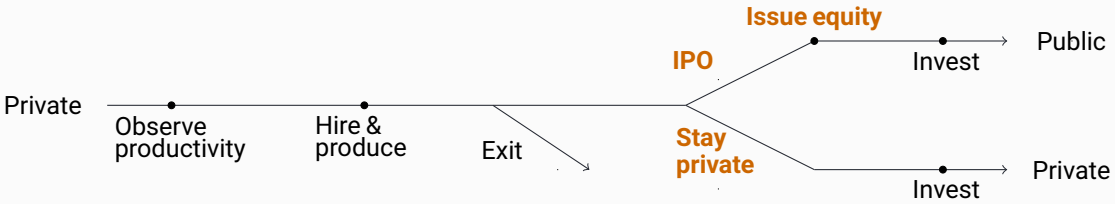

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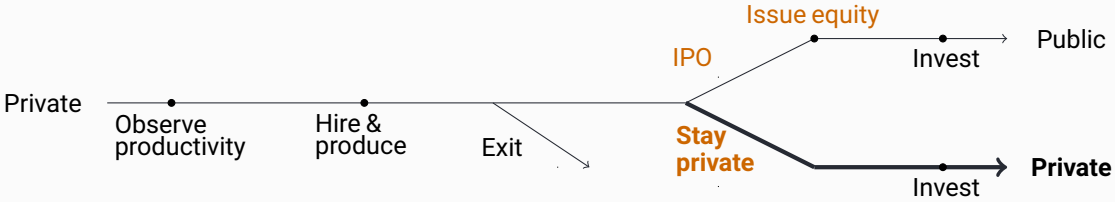

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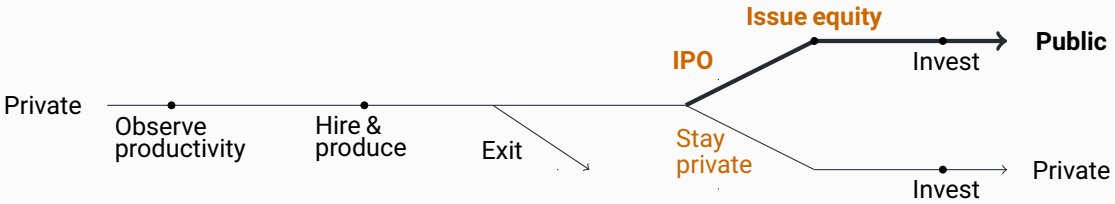

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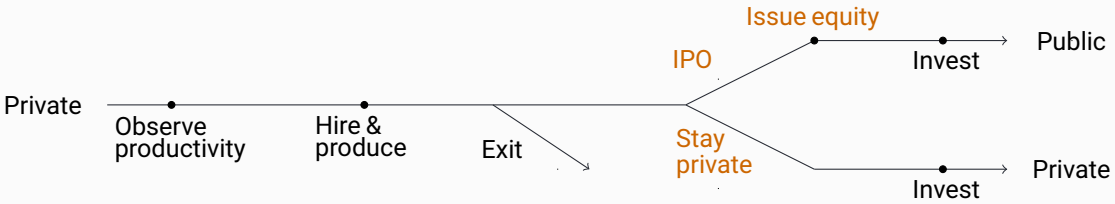
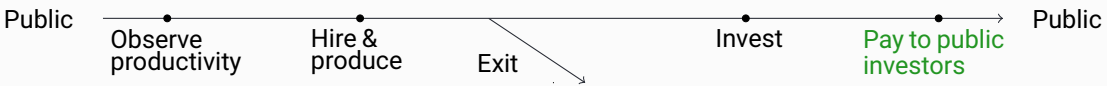


- **Public firm**



Timeline

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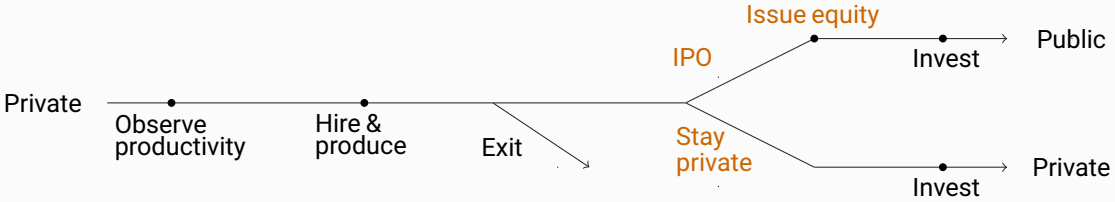

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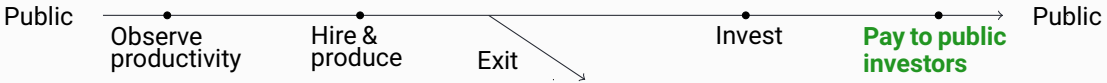

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- **Potential entrants solve**

$$V^e(\mathcal{S}_0) = \max_{a'} -a' + \mathbb{E}[M(z, z')V^{pr}(\mathcal{S}')|\mathcal{S}_0]$$

  - → Given $\mathcal{S}_0 = (s_0, z, a_0)$, choose to enter if $V^e(\mathcal{S}_0) \geq c_e$.

Quantitative Analysis

Calibration

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  → Public ∼ Compustat, Private ∼ BDS & Flow of Funds, IPO cost ∼ Compustat + BDS

Externally calibrated

	Meaning	Value
η	Returns to scale	0.88
α	Capital share	0.30
δ	Depreciation rate	0.03
ρ_z	Persistence aggregate shock	0.95
σ_z	SD aggregate shock	0.007
χ	Equity share sold at IPO	0.10
β	Time discount	0.97
ϕ_0	Stochastic discount factor	28.59
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ρ_s	Persistence idio. shock	0.93	AC of log sales	0.63	0.41
σ_s	SD idiosyncratic shock	0.07	SD of log sales	0.35	0.35
θ^{pb}	Borrowing constraint	0.55	Debt-to-assets	0.77	0.77
θ^{pr}	Borrowing constraint	0.35	Debt-to-assets	0.42	0.40
f^{pb}	Operating cost	5.2	Exit rate	0.02	0.03
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κ	IPO fixed cost	170	Emp. share of public	0.33	0.35

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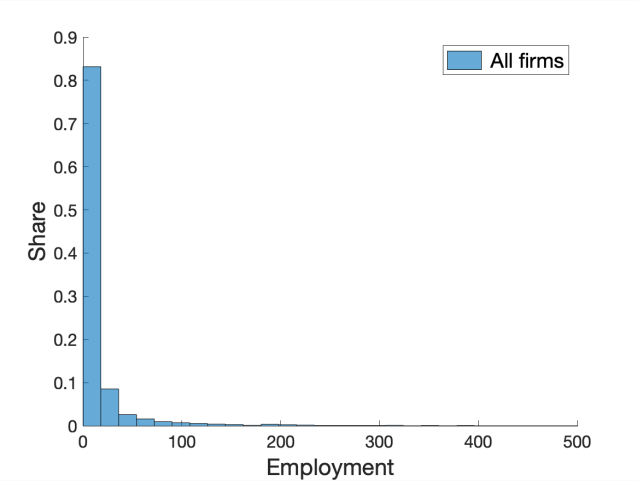
⇒ **Costs and benefits of IPO**

Model performance: Size distribution



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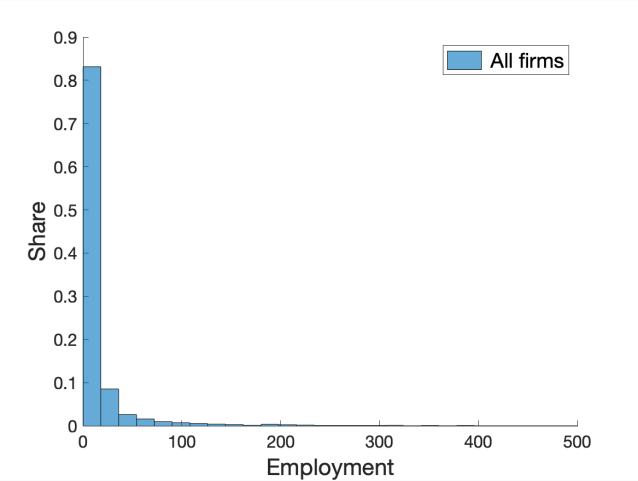

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Size	1-9	10-19	20-99	100+
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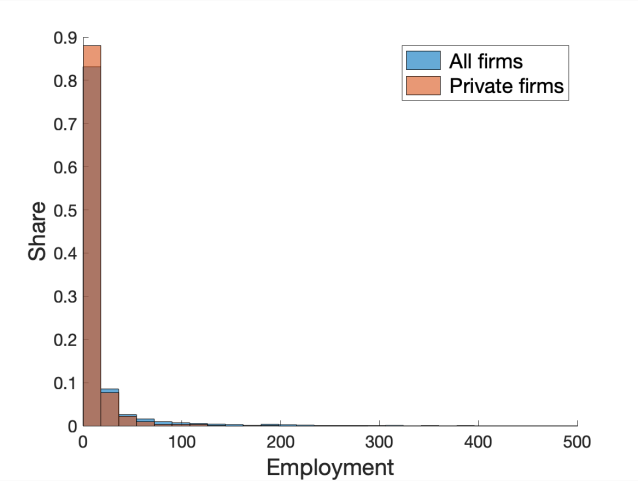

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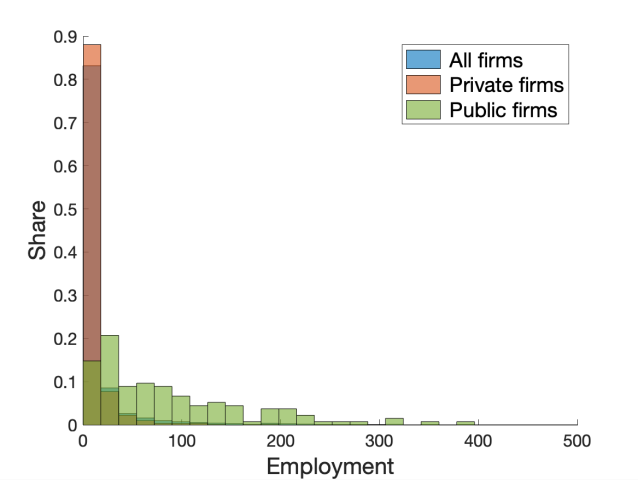

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- **Public firms are larger**

Size	1-9	10-19	20-99	100+
Private	0.65	0.25	0.10	0.01
Public	0.04	0.13	0.50	0.32
Data	0.04	0.03	0.17	0.76

Model performance: IPO dynamics

- **Firm-level IPO effect** (Untargeted)
  - → On one-year employment growth
    - ... Data: 0.37 (Borisov et al., 2021)
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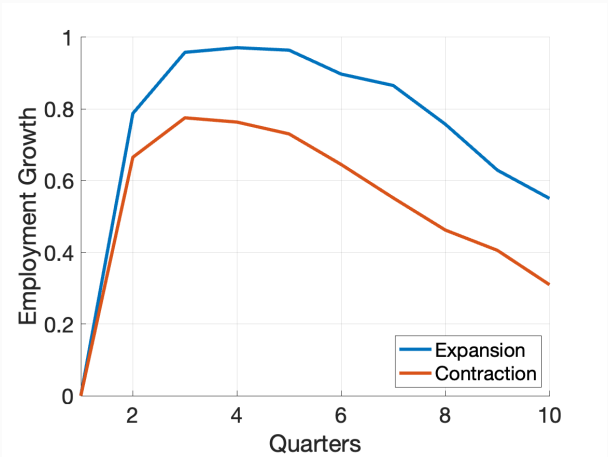

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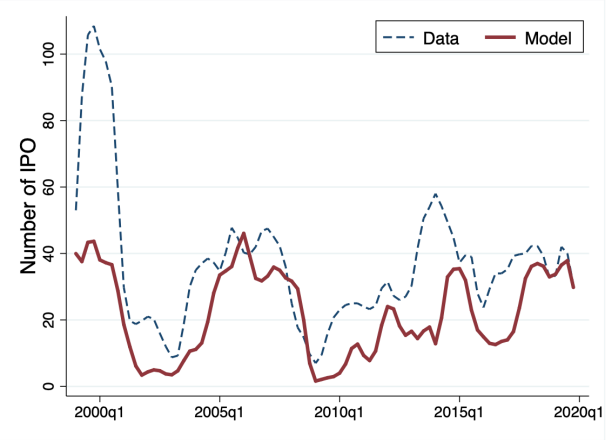
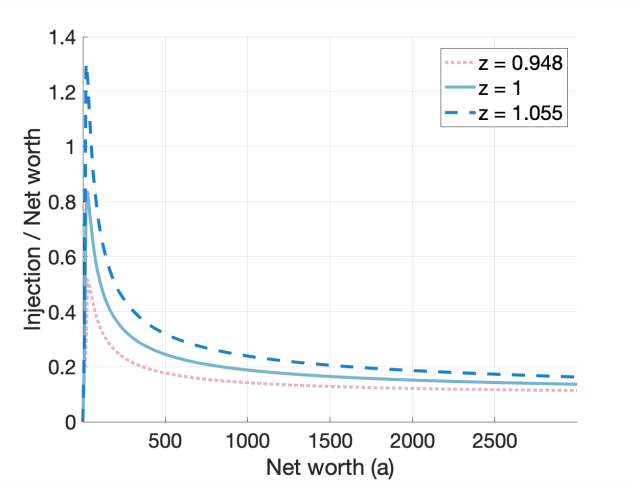


Capital Injection Cyclicality



- **Capital injection at IPO** by prod.
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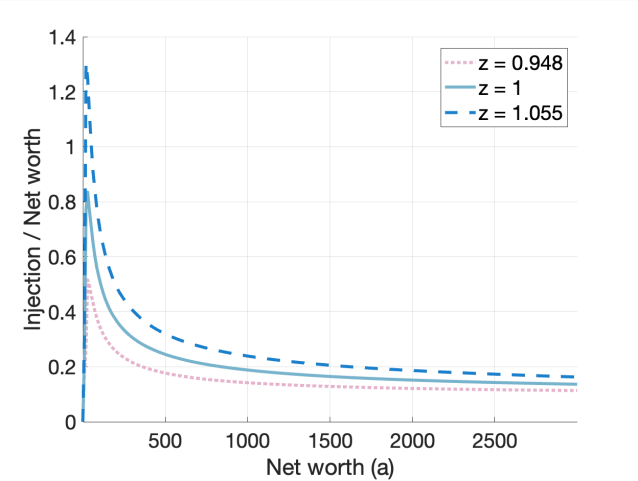

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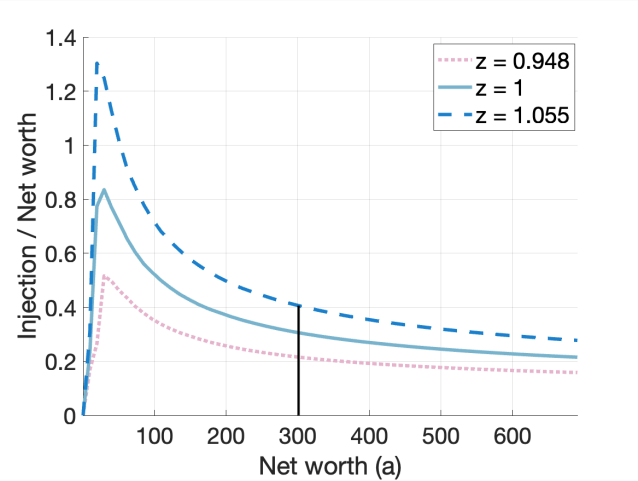

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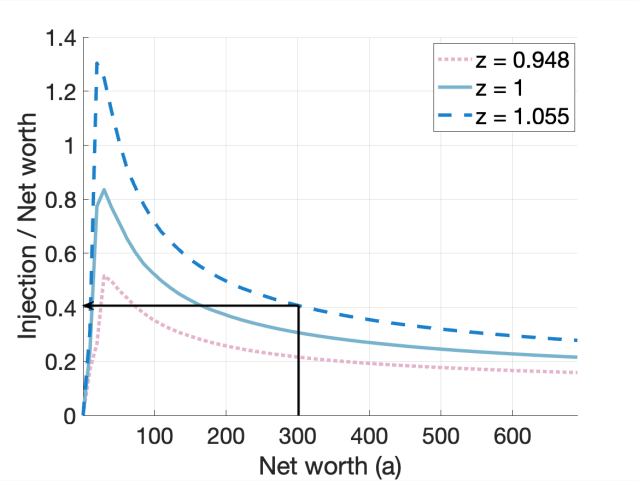
Example

For a firm with $a = 300$,
an IPO would increase a by ...

Capital Injection Cyclicality



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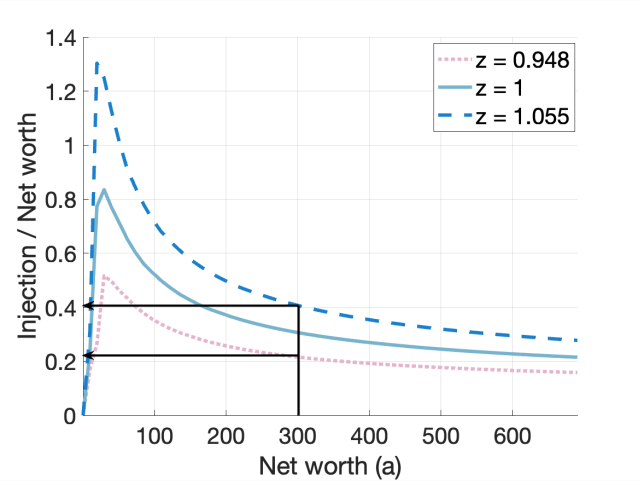

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Example

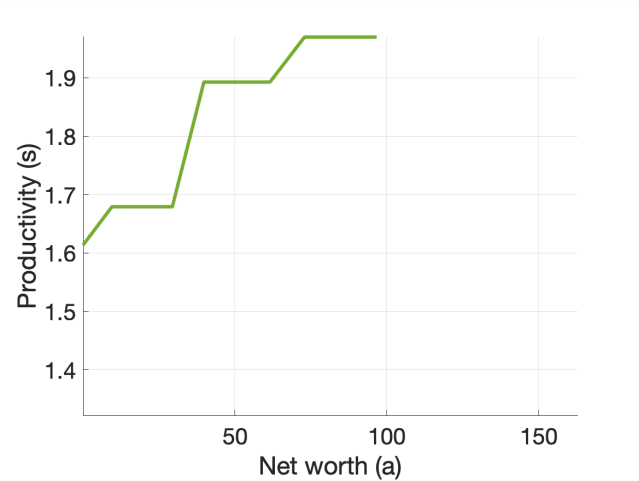
For a firm with $a = 300$,
an IPO would increase a by ...

→ 40% during booms

→ 22% during recessions

IPO decision

IPO Threshold (Firms above the threshold go public)



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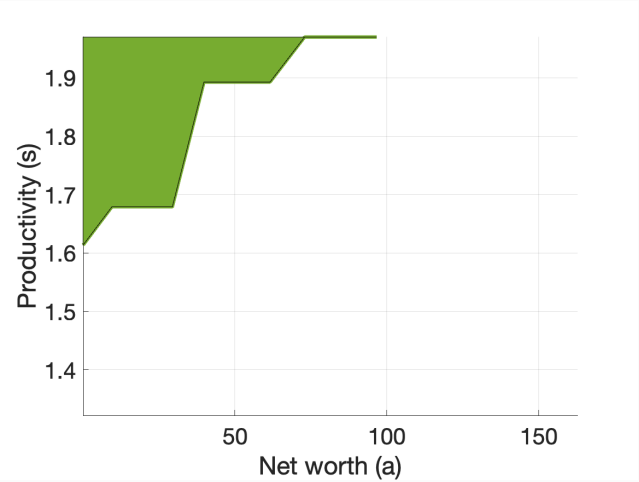

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  Small & productive firms

  (most financially constrained)

◂ Original

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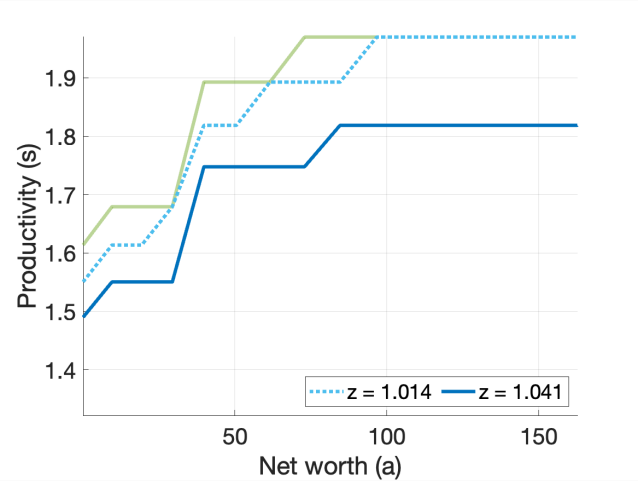

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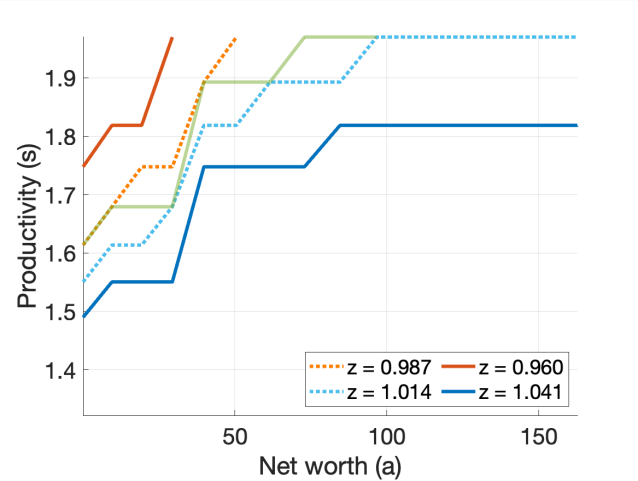

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  - → In a **recession**, IPO firms are

◂ Original

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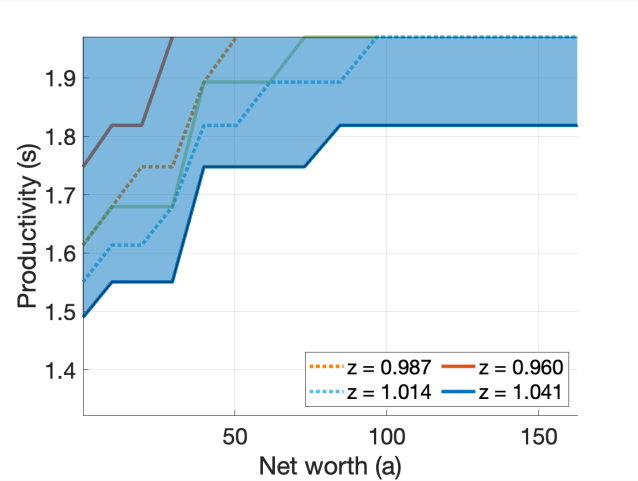

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    ... fewer in number

◂ Original

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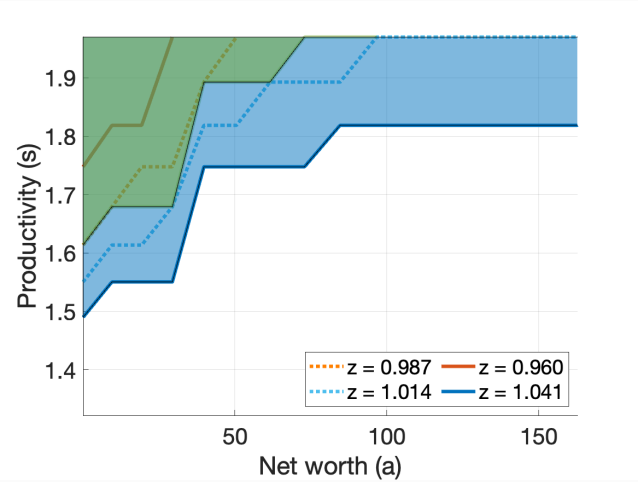

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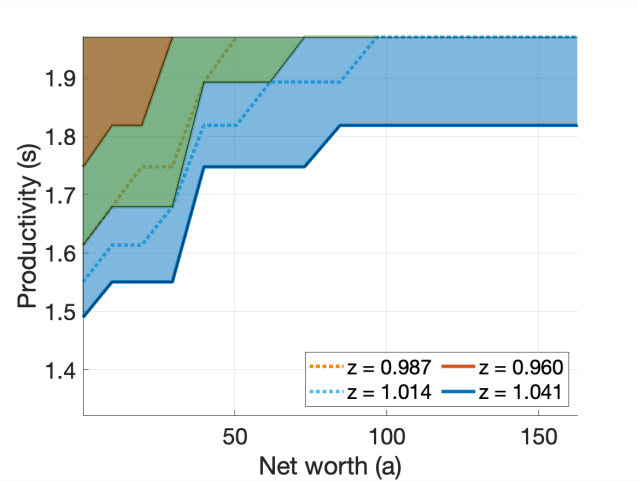

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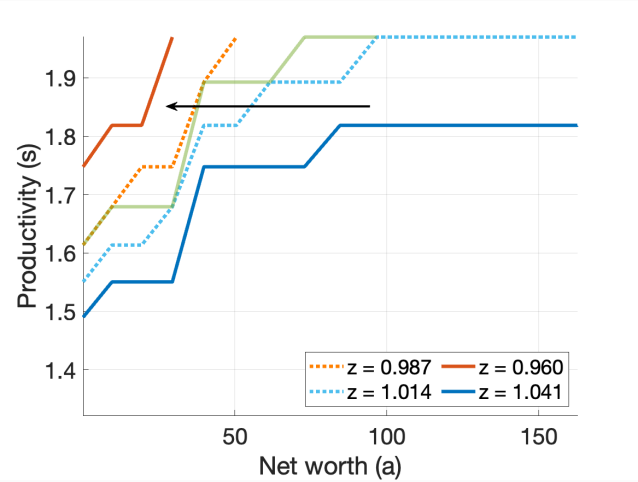

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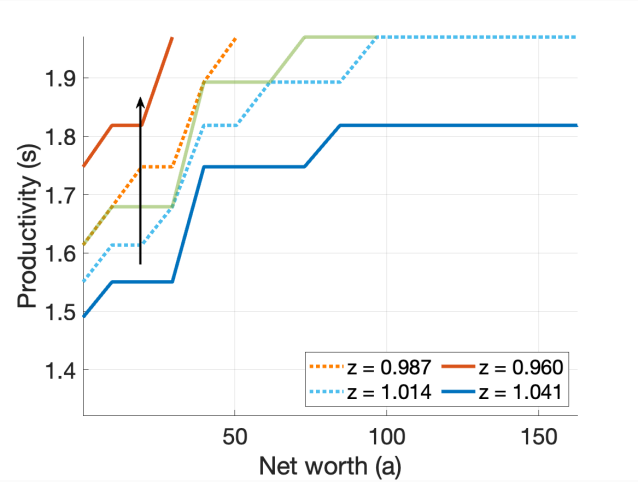

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    - ... more productive

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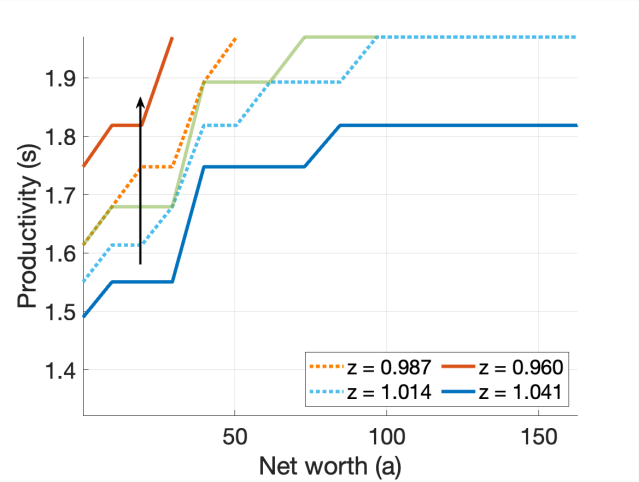

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  - → **Selection at IPO**
    Small & productive firms
    (most financially constrained)
- **Non-stationary case**
  - → In a **recession**, IPO firms are
    - ... fewer in number
    - ... smaller in size
    - ... more productive
  - ⇒ **IPO cyclicality!**

◂ Original

Counterfactual analysis

How does IPO cyclicality affect aggregate employment dynamics?

Counterfactual analysis

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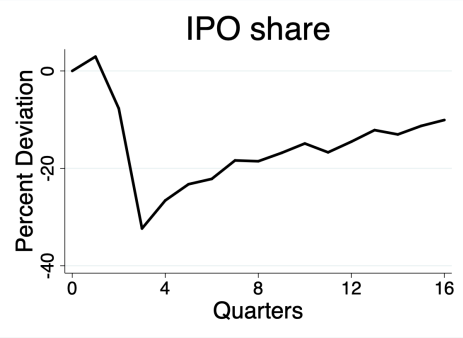
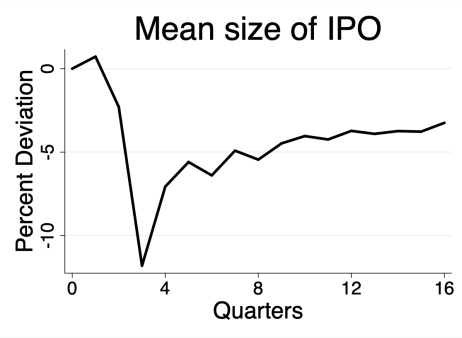
- Simulate recovery process from -1% shock on aggregate productivity

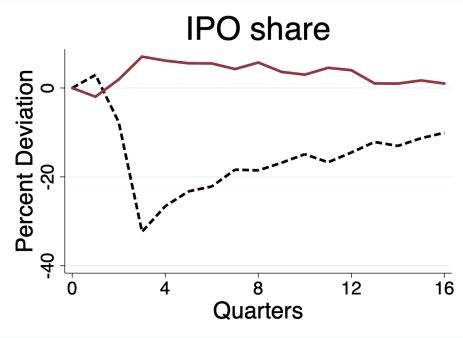


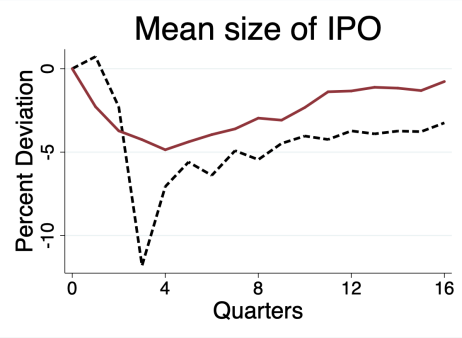


Counterfactual analysis

How does IPO cyclicality affect aggregate employment dynamics?

- Simulate recovery process from -1% shock on aggregate productivity
- **Shut down cyclicality of IPOs** (Assign stationary IPO policy function)





Results and mechanisms

- Without IPO cyclicality, **employment decreases less**

	Baseline	Counterfactual	Dev. (%)
Employment	-6.44	-5.77	10.40
Mean size of firms	-4.05	-3.68	9.14
Public firm share	-2.39	1.12	146.86
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→ **They grow fast, increasing mean size of firms**

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→ **More entries, increasing the number of firms**

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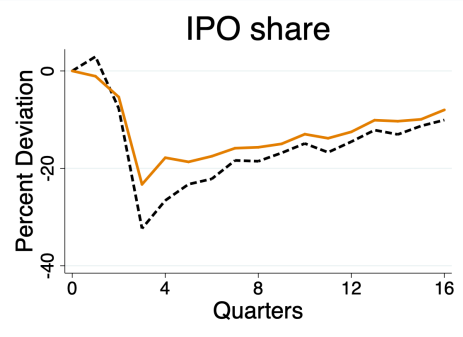
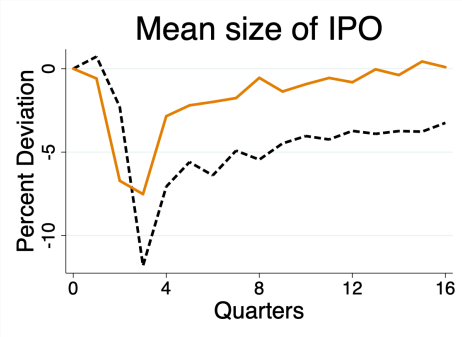
- **Shut down cyclicality of capital injection** (Assign constant price $p(a, s)$)
  - → Constant discount factor → Firms and investors **expect faster recovery**
  - → Share of IPO decreases by at most 30%





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- **I develop a quantitative model and calibrate to the U.S. economy**
- **I quantify the role of IPO cyclicality on aggregate employment during recessions**
  - → It amplifies aggregate employment volatility by **10 percent**!
  - → Fewer IPOs during recessions
    - mean size of firms decreases by **9 percent** (capital misallocation)
    - number of firms decreases by **15 percent** (business dynamism)
  - → Here, cyclicality of capital injection plays a role by **1.4 percent**

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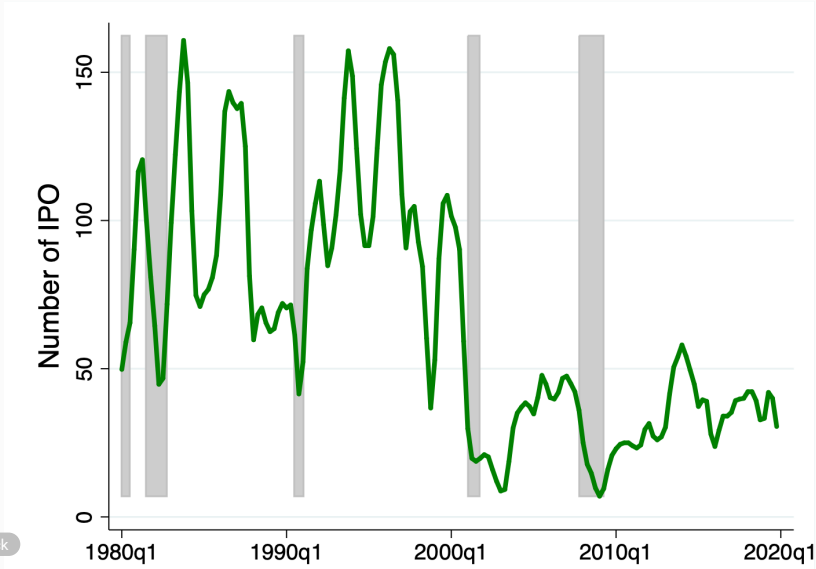
- **Promoting more IPOs during recessions could accelerate economic recovery!**

Procyclical Number of IPOs



Source: *Compustat*

Sample Selection

- **Exclude ...**
  - → Utilities, financial firms, and public administration
  - → Headquartered outside the U.S.
  - → Underwent leveraged buyouts and subsidiaries

- **Focus on IPO firms seeking financing**
  - → Firms typically conduct IPOs to **raise funds** or **establish public valuation**
  - → Exclude firms delisted shortly after going public for the following reasons:
    - *Acquisition or merger* (11.8%)
    - *Reverse acquisition* (1.3%)
    - *Leveraged buyout* (0.5%)

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Industry Composition - Service

	Expansion	Contraction
Service		
Wholesale Trade	0.04	0.04
Retail Trade	0.06	0.03
Transportation and Warehousing	0.02	0.02
Information	0.17	0.13
Real Estate	0.01	0.01
Professional, Scientific, and Technical	0.06	0.06
Management	0.02	0.02
Administrative	0.01	0.01
Educational	0.03	0.04
Health	0.01	0.01
Arts and Entertainment	0.03	0.03
Accommodation	0.01	0.00

- **Mostly no difference**
  - → including *Professional, Scientific, and Technical*
- **Expansion** cohort's 5 pp higher share of service comes from ...
  - → *Retail Trade* (6% vs. 3%)
  - → *Information* (17% vs. 13%)

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Capital Injection Cyclicality

Log **sale of stock** at IPO	(1)	(2)	(3)
IPO in Contraction	-0.378*		
	(-2.22)		
Detrended Log GDP		0.295***	0.195***
		(13.87)	(7.50)
Detrended PE Ratio			0.062***
			(6.67)
Firm Characteristics at IPO	✓	✓	✓
Industry FE	✓	✓	✓
State FE	✓	✓	✓
Observations	5,096	5,096	5,096
R^2	0.297	0.322	0.328

- **IPO Firms in Contraction**
  - → Raise 38% less capital compared to those in **Expansion**.
- **Detrended Log GDP**
  - → 1% increase in GDP $\Rightarrow$ 30% increase
  - → When controlling for stock market performance, ... $\Rightarrow$ 20% increase

Back

Non-parametric Regression

$$\Delta^{ipo} N_{it} = \beta_{a,c} Age_{it} \times Cohort_i^{ipo} + \Phi Y_t + \Gamma \mathbf{X_i} + \epsilon_{it}$$

- $\Delta^{ipo} N_{it}$: employment growth (log difference) from the year of IPO

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Exit Rates by IPO Cohort

Delisting rate	Expansion	Contraction
in 5 years	0.34	0.34
Merger and acquisition	0.11	0.08
Exit (Bankruptcy or unknown)	0.16	0.22
Back to private	0.06	0.02
in 3 years	0.18	0.19
Merger and acquisition	0.02	0.01
Exit (Bankruptcy or unknown)	0.11	0.16
Back to private	0.03	0.00
in a year	0.05	0.06
Exit (Bankruptcy or unknown)	0.04	0.05
Back to private	0.01	0.00

- **Delisting rates are similar**
  - → **Contraction cohort**
    Higher likelihood of exiting the market
  - → **Expansion cohort**
    More likely to delist due to mergers or reverting to private ownership

Back

Aggregate fluctuation

- **Stochastic discount factor** (Clementi and Palazzo, 2019)

$$M(z_t, z_{t+1}) \equiv \beta \exp(\phi_0 \log(z_t) + \phi_1 \log(z_{t+1}))$$

→ $\phi_0 > 0, \quad \phi_1 < 0$ ... **procyclical**

- **Interest rate**

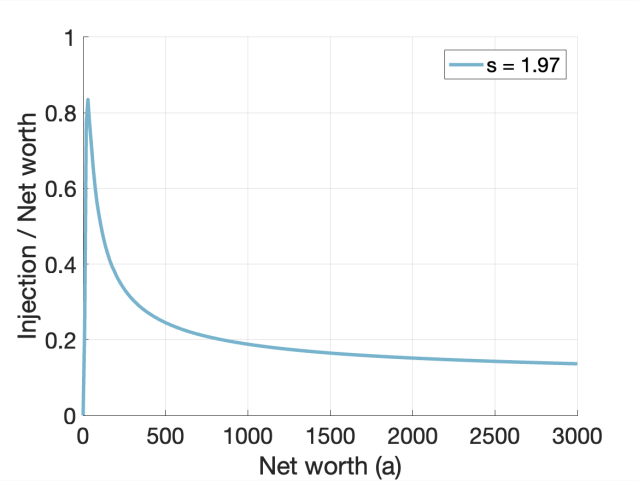
→ Defined as the inverse of the expected stochastic discount factor

$$r(z_t) = \frac{1}{\beta} \exp\left(-z_t(\phi_0 + \rho_z \phi_1) - \frac{\phi_1^2 \sigma_z^2}{2}\right) - 1$$

→ $\phi_0 + \rho_z \phi_1 > 0$ ... **countercyclical**

Back to r Back to M

Capital injection at IPO



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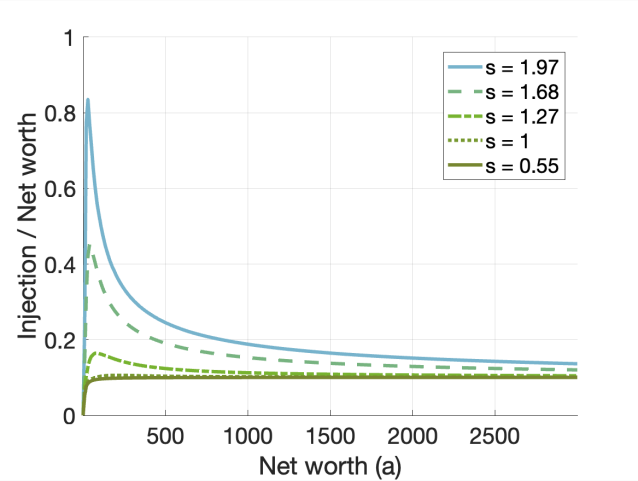

- **Asymmetric increase**
  over firm-specific productivity
  → **Large variance in small firms**

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IPO threshold