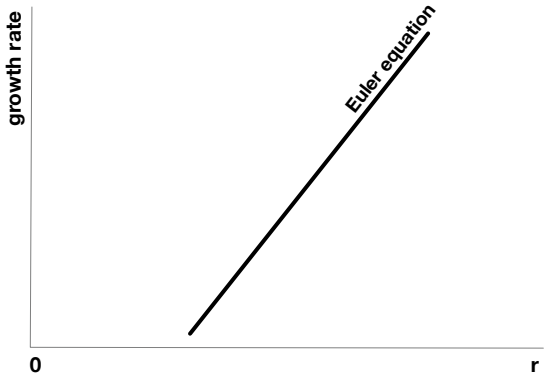
Low Interest Rates, Market Power, and Productivity Growth

Ernest Liu, Atif Mian, and Amir Sufi

Introduction

- Secular decline in the long-run real interest rate over past decades
- What is the supply-side response to low interest rates?
  - investment decisions, market concentration, and productivity growth



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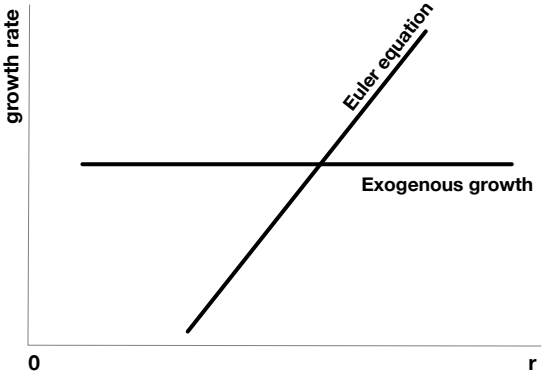

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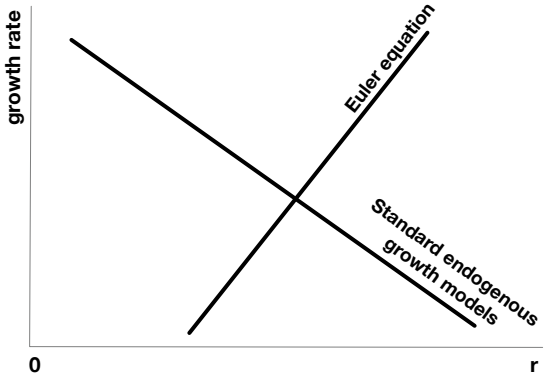

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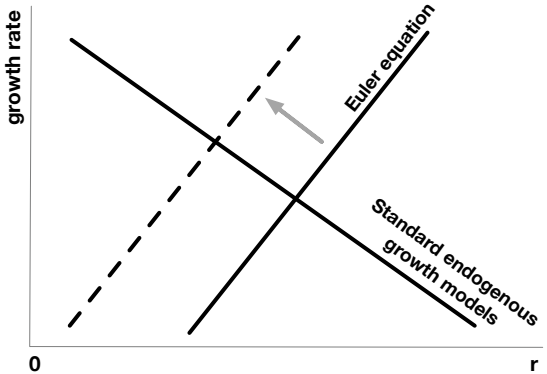
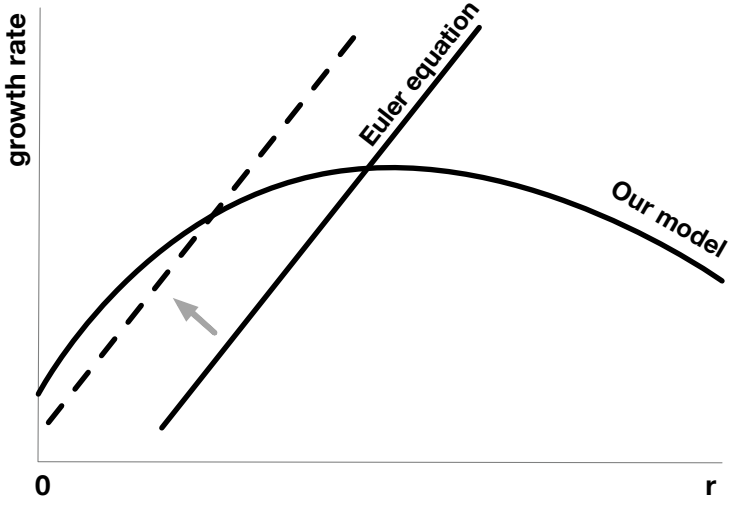


Our take

- Traditional "demand side" secular stagnation view is problematic in terms of long-run consequences as not clear that ZLB / nominal rigidities can last that long.
  - demand-driven fall in long run rates is *not* "supply neutral"
- Intuition: low rates increase NPV of investment today, *but* also reduce market competitiveness
- The anti-competition force is *guaranteed* to dominate at sufficiently low interest rates
  - quite general theoretical result
  - requires no financial (or other) frictions
  - holds for a range of innovation processes, except "leap-frogging"
- Unified framework explains a wide range of empirical facts
  - direct empirical evidence in favor of the key mechanism

Key result



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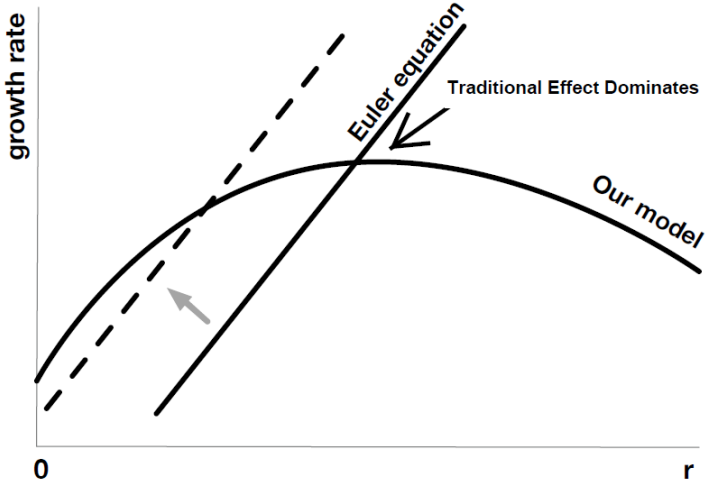
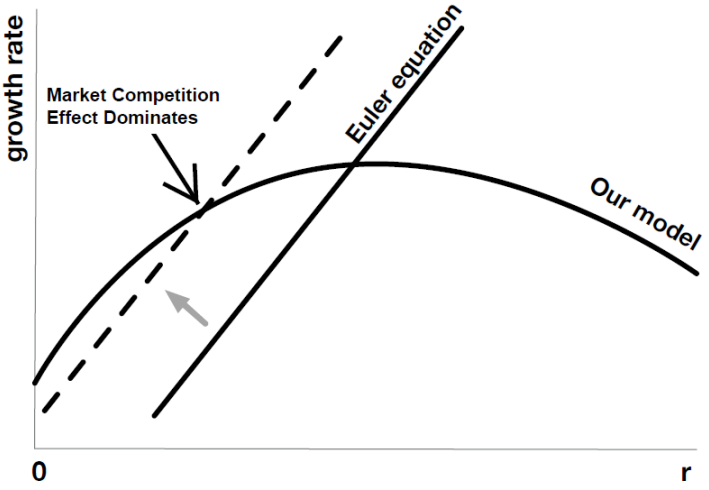

growth rate
Euler equation
Traditional Effect Dominates
Our model
0
r

Key result


growth rate
Market Competition
Effect Dominates
Euler equation
Our model
0
r

Model

- Continuous time; a continuum (measure 1) of markets
- Each market has two forward-looking firms competing for profits
  - interest rate r: rate at which future profits are discounted

$$v(t) = \int_0^\infty e^{-r\tau} \left\{ \pi(t+\tau) - c(t+\tau) \right\} d\tau$$

- State variable $s \in \{0, 1, \cdots, \infty\}$: a "ladder" of productivity differences
  - $s = 0$: two firms are said to be "neck-to-neck"
  - $s \neq 0$: one firm is the temporary leader while the other is the laggard
- Flow profits depend on the state: $\{\pi_s, \pi_{-s}\}_{s=0}^{\infty}$
  - assume π_s, $-\pi_{-s}$, and $(\pi_s + \pi_{-s})$ are bounded, weakly increasing, and weakly concave in the state

Model

- Firms invest in order to enhance market position
  - binary decision: incur cost c for Poisson rate η to gain productivity
- Given investments $\eta_s, \eta_{-s} \in \{0, \eta\}$, the state s evolves to

$$\begin{cases} s+1 & \text{with rate } \eta_s \\ s-1 & \text{with rate } (\eta_{-s} + \kappa) \end{cases}$$

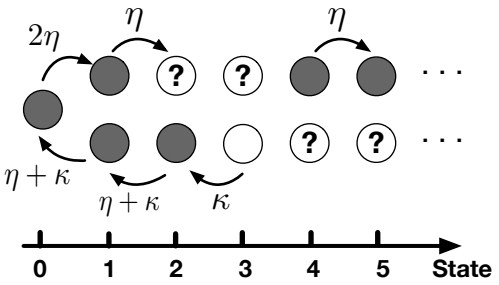
- $\kappa < \eta$ is the exogenous rate of catching up
- Catch up is gradual: no leapfrogging
- Firms are forward-looking and maximize present-discounted-value v_s:

$$rv_s = \pi_s + (\eta_{-s} + \kappa)(v_{s-1} - v_s) + \max\{\eta(v_{s+1} - v_s) - c, 0\}$$

- An example microfoundation: suppose s is the difference in log-productivity
  - perfect substitutes and Bertrand competition yield

$$\pi_{-s} = 0, \quad \pi_s = 1 - e^{-s}$$

Stationary symmetric MPE: collection of $\{\eta_s, v_s\}_{s=-\infty}^{\infty}$

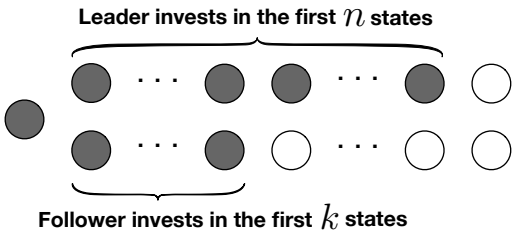


- Equilibrium induces steady-state distribution $\{\mu_s\}_{s=0}^{\infty}$ of market structure

$$\eta_s \mu_s = \left(\eta_{-(s+1)} + \kappa\right) \mu_{s+1}$$

- Aggregate productivity growth: average rate that firms invest successfully

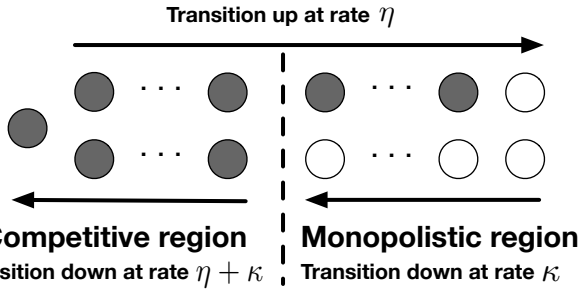
Equilibrium structure: leader dominance



Lemma. Leader invests (weakly) more than the follower does.

Intuition: the leader's incentive to ***protect current profits*** is stronger than the follower's to ***capture future profits***

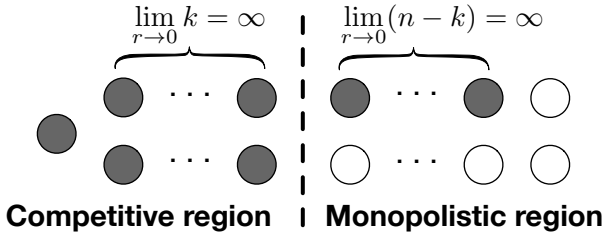
Steady-state, two regions, and growth



Lemma. Productivity growth and aggregate investment are **increasing** in the size of the competitive region and **decreasing** in the size of the monopolistic region

$$g \approx \underbrace{\left(\sum_{s=1}^{k} \mu_s\right)}_{\text{size of the competitive region}} \times (\eta + \kappa) \quad + \quad \underbrace{\left(\sum_{s=k+1}^{n+1} \mu_s\right)}_{\text{size of the monopolistic region}} \times \kappa$$

As $r \to 0$, the monopolistic region dominates



- Traditional effect: low interest rate raises investments in all states
  - Both regions expand... what's the net effect on aggregate growth?

As $r \to 0$, the monopolistic region dominates

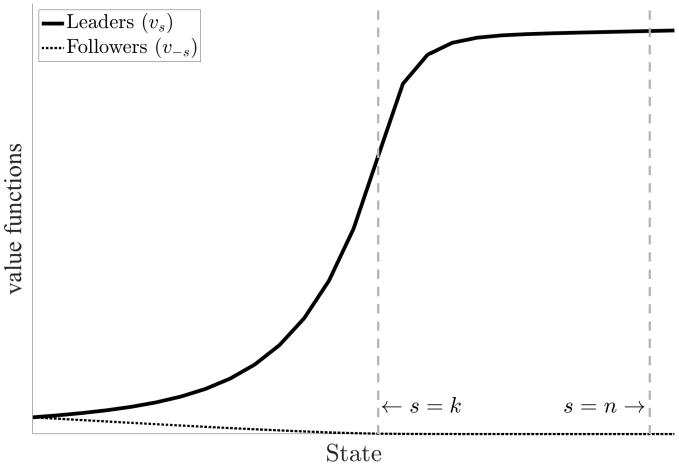
Theorem. As $r \to 0$,

1. The monopolistic region becomes absorbing: $\sum_{s=k+1}^{n+1} \mu_s \to 1$, and monopoly power becomes **permanently persistent**;
2. Aggregate investment drops and productivity growth **slows down**:

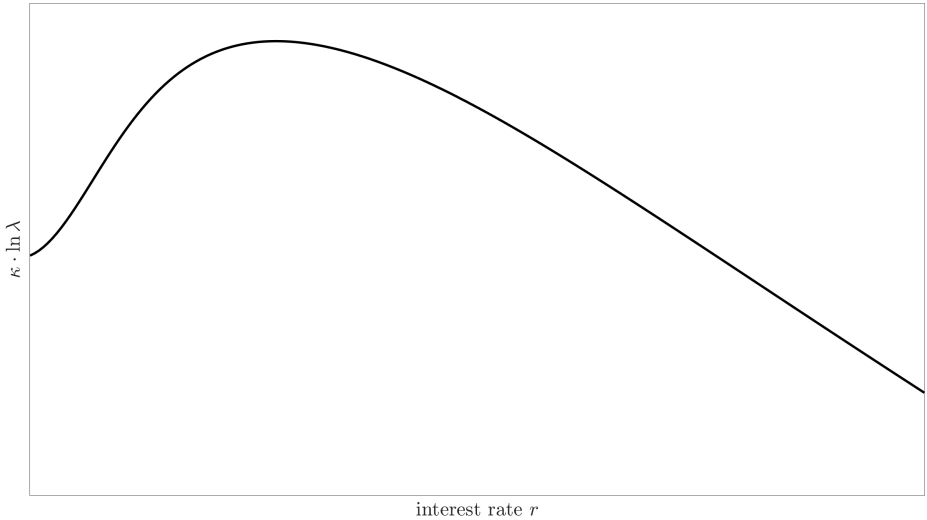
$$\lim_{r \to 0} g = \kappa.$$

3. Productivity gap between leaders and followers diverges: $\lim_{r \to 0} \sum_{s=0}^{\infty} \mu_s s = \infty$
4. Market dynamism declines, and leadership becomes permanently persistent: $\lim_{r \to 0} \sum_{s=0}^{\infty} M_s \mu_s = \infty$

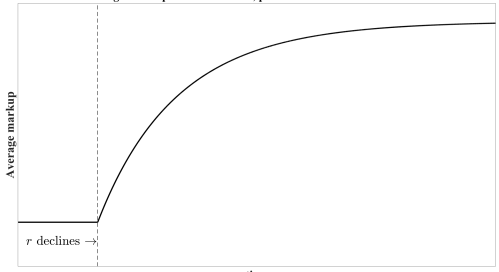
Intuitions


Leaders (v_s)
Followers (v_{-s})
value functions
$\leftarrow s = k$
$s = n \rightarrow$
State

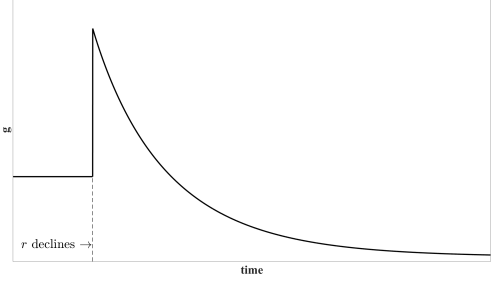
Steady-state growth rate as a function of the interest rate



Average markup after a one-time, permanent decline in interest rate



Productivity growth after a one-time, permanent decline in interest rate



Empirical test for the model

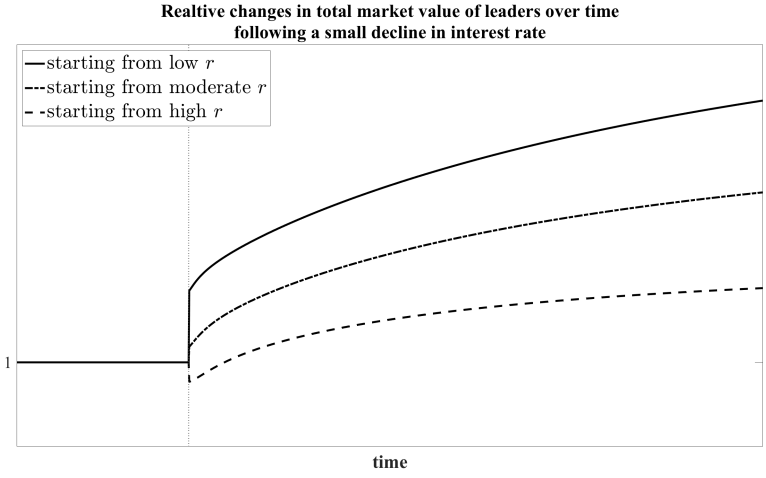


Figure: market value of leaders respond more to decline in r, especially when initial r is low

Empirical test for the model

Table: Differential Interest Rate Responses of Leaders vs. Followers: Top 5 Percent

	Stock Price Growth			
	(1)	(2)	(3)	(4)
Top 5 Percent=1 x Δi	-1.187***	-3.879**	-4.407***	-4.181***
	(0.260)	(1.113)	(0.842)	(0.529)
Top 5 Percent=1 x Δi x Lagged i		0.293**	0.346***	0.301***
		(0.095)	(0.075)	(0.045)
Firm β x Δi				14.10***
				(0.794)
Firm β x Δi x Lagged i				-1.260***
				(0.082)
Sample	All	All	All	All
Controls	N	N	Y	
Industry-Date FE	Y	Y	Y	Y
N	61,313,604	61,313,604	44,568,088	61,299,546

Empirical test for the model

Table: Portfolio Returns Response to Interest Rate Changes: Top 5 Percent

	Portfolio Return				
	(1)	(2)	(3)	(4)	(5)
Δi_t	-1.152***	-3.815***	-2.263***	-3.654***	-3.212***
	(0.309)	(0.641)	(0.601)	(0.948)	(0.775)
i_{t-1}		0.0829	0.0323	0.159*	0.146*
		(0.050)	(0.045)	(0.071)	(0.071)
$\Delta i_t \times i_{t-1}$		0.293***	0.116*	0.327***	0.262**
		(0.059)	(0.056)	(0.081)	(0.101)
Excess Market Return			-0.168***		
			(0.023)		
High Minus Low			0.0368		
			(0.045)		
$(\Delta i_t > 0)$=1 $\times$ Δi_t				0.346	
				(1.715)	
$(\Delta i_t > 0)$=1 $\times$ $\Delta i_t \times i_{t-1}$				-0.102	
				(0.170)	
PE Portfolio Return					-0.278***
					(0.075)
N	9,016	9,016	9,016	9,016	7,402
R-sq	0.044	0.080	0.220	0.092	0.195

Figure: Distribution of Interest Rate Changes at Varying Frequencies

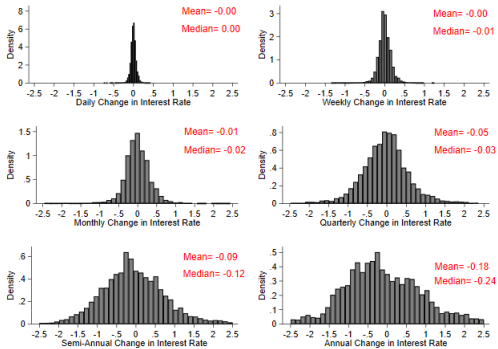
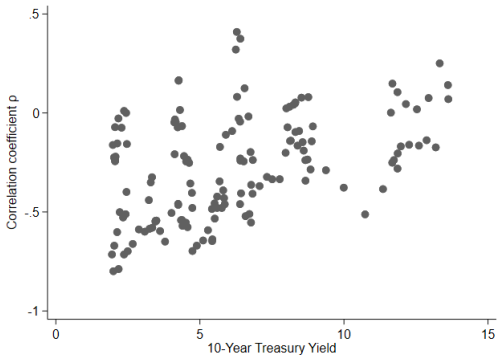


Figure: Leaders See Higher Returns from a Drop in Interest Rates as Interest Rate Goes to Zero



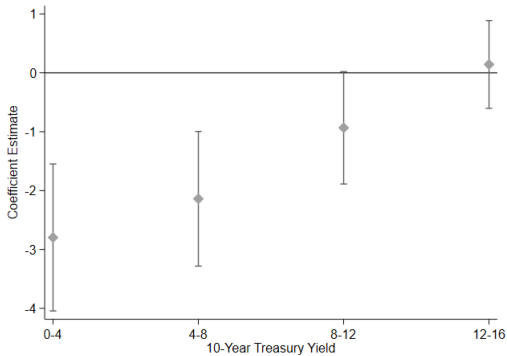
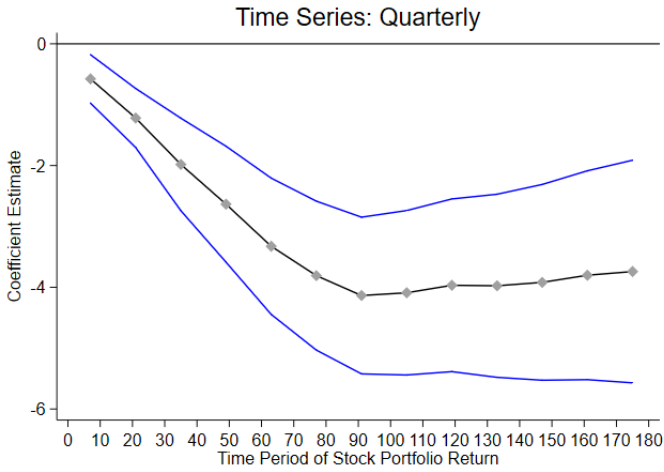


Figure: Impulse Response of Changes in Interest Rate when Rate is Zero



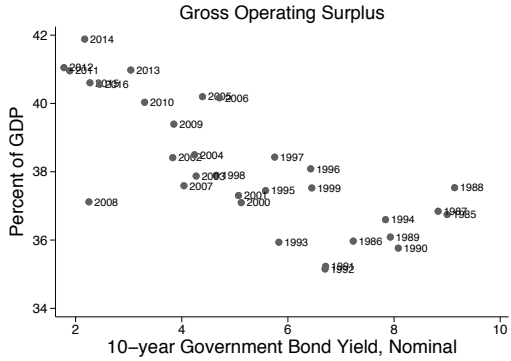


Figure: Aggregate profit share, market concentration and interest rate

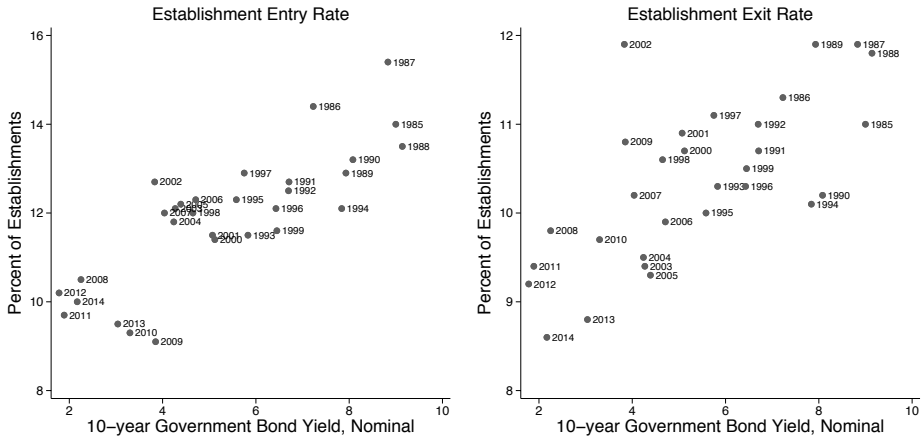
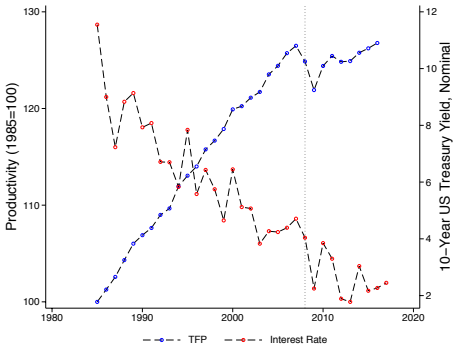


Figure: Business Dynamism



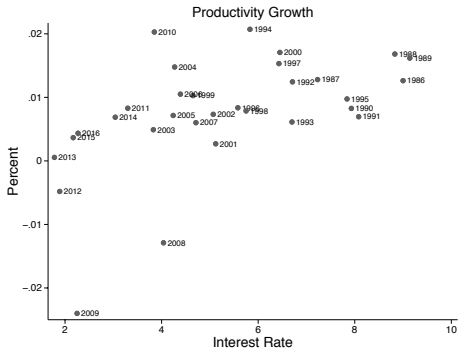


Figure: Productivity growth and interest rates

Conclusion

- Low interest rates raise market concentration and reduce creative destruction
  - through strategic and dynamic incentives
- As $r \to 0$, aggregate investment and productivity growth slows down
  - $g(r)$ has the shape of an inverted-U
- A long-run, supply-side perspective of secular stagnation
  - sidestepping short-run, demand-side Keynesian forces
- Empirical tests confirm predictions