The Great Divorce Between Investment and Profitability

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Motivation

Firm investment and profitability are related to cross-sectional returns

- high-investment firms have low expected returns

  Titman, Wei, and Xie (2004), Cooper, Gulen, and Schill (2008), Xing (2008) ...

- high-profitability firms have high expected returns

  Novy-Marx (2013), Ball et.al. (2015), Ball et.al. (2016) ...

Theories tend to explain the two premia separately

- examine investment and expected returns keeping profitability constant

  Fama and French (2015), Hou, Xue, and Zhang (2015)

Recent empirical work suggests that the premia are due to data snooping

- investment and profitability premia are only significant in recent decades

  Linnainmaa and Roberts (2018)

THIS PAPER

- Document novel facts about the relation between firm investment and profitability in two episodes of the U.S. stock market history
- Shed light on the common component of investment premium and profitability premium
- Explain the "rise" of investment and profitability premia

Preview of main findings

1. Completely different landscape of public firms in 1930-1979 and 1980-2017
   - opposite cross-sectional correlation between investment and profitability
   - opposite correlation between CMA and RMW factors

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2. Differences largely due to entry of firms with high cash flow duration

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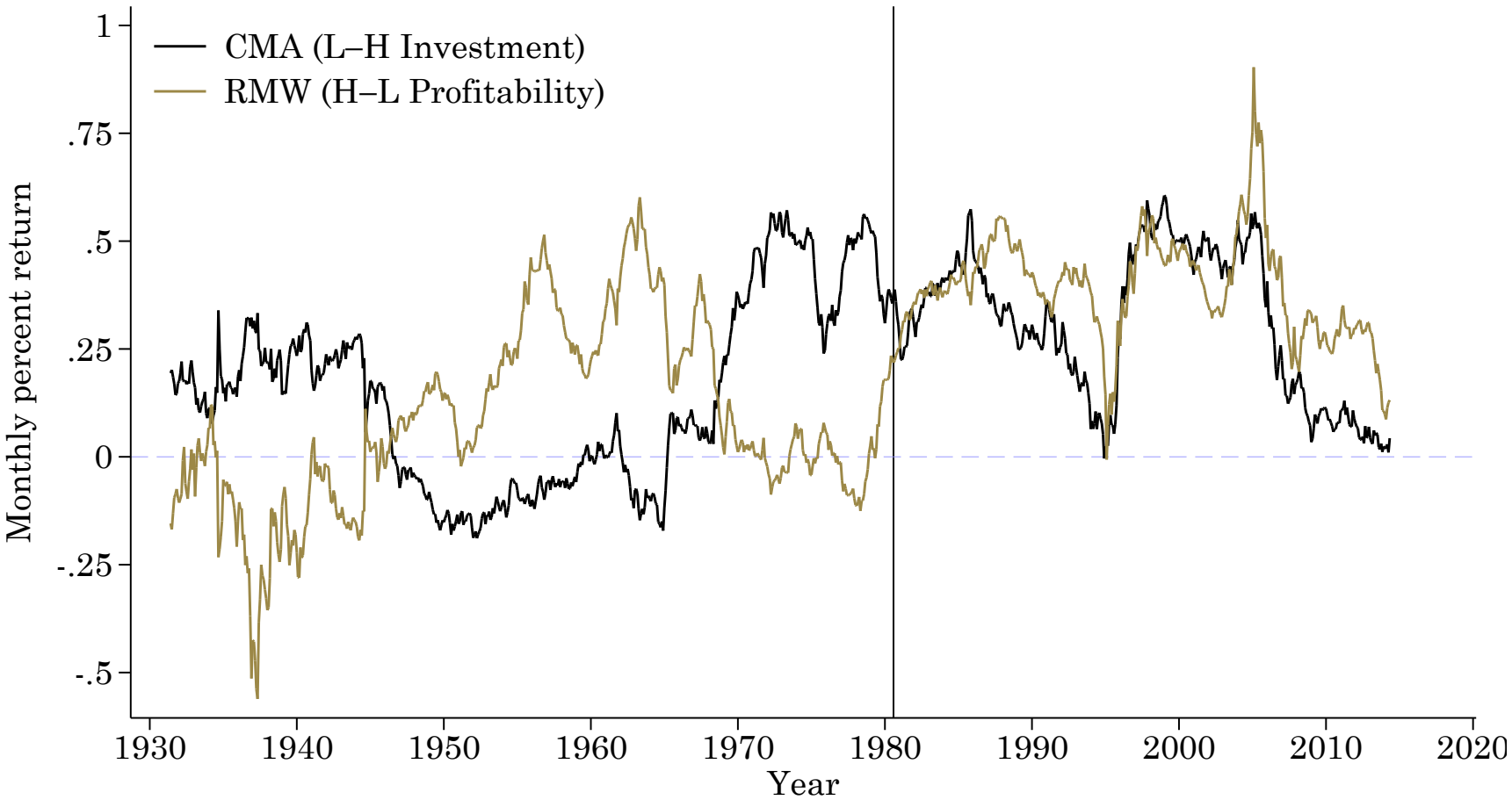
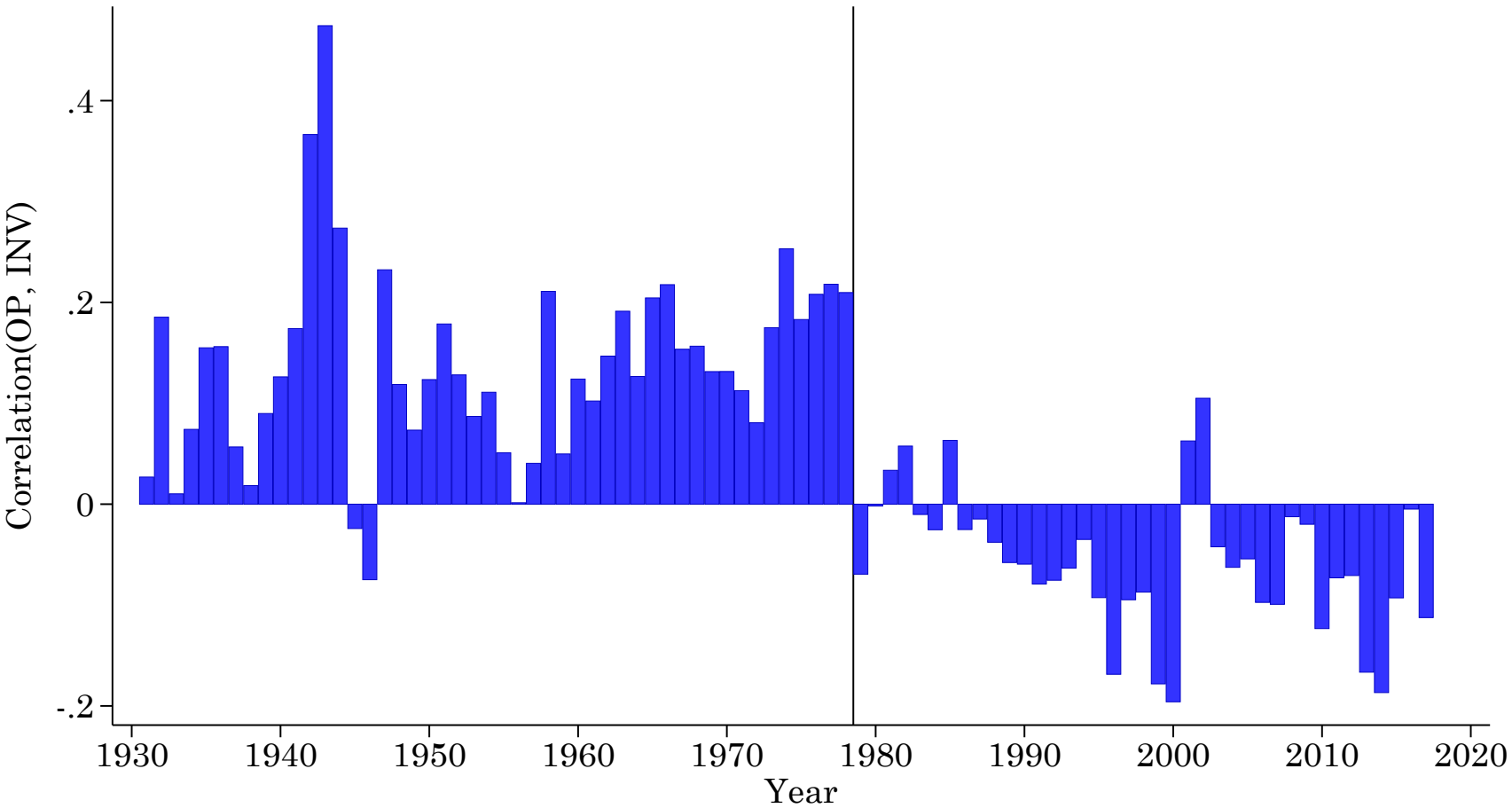
1. Completely different landscape of public firms in 1930-1979 and 1980-2017
   - opposite cross-sectional correlation between investment and profitability
   - opposite correlation between CMA and RMW factors
2. Differences largely due to entry of firms with high cash flow duration
3. New listing of high-duration firms boosts up investment and profitability premia because of duration premium

Investment and profitability factors



- 10-year moving average of investment and profitability factors
- Pre 1980: $corr(RMW, CMA) < 0$, RMW and CMA averages are not significant
- Post 1980: $corr(RMW, CMA) > 0$, RMW and CMA averages are both significant

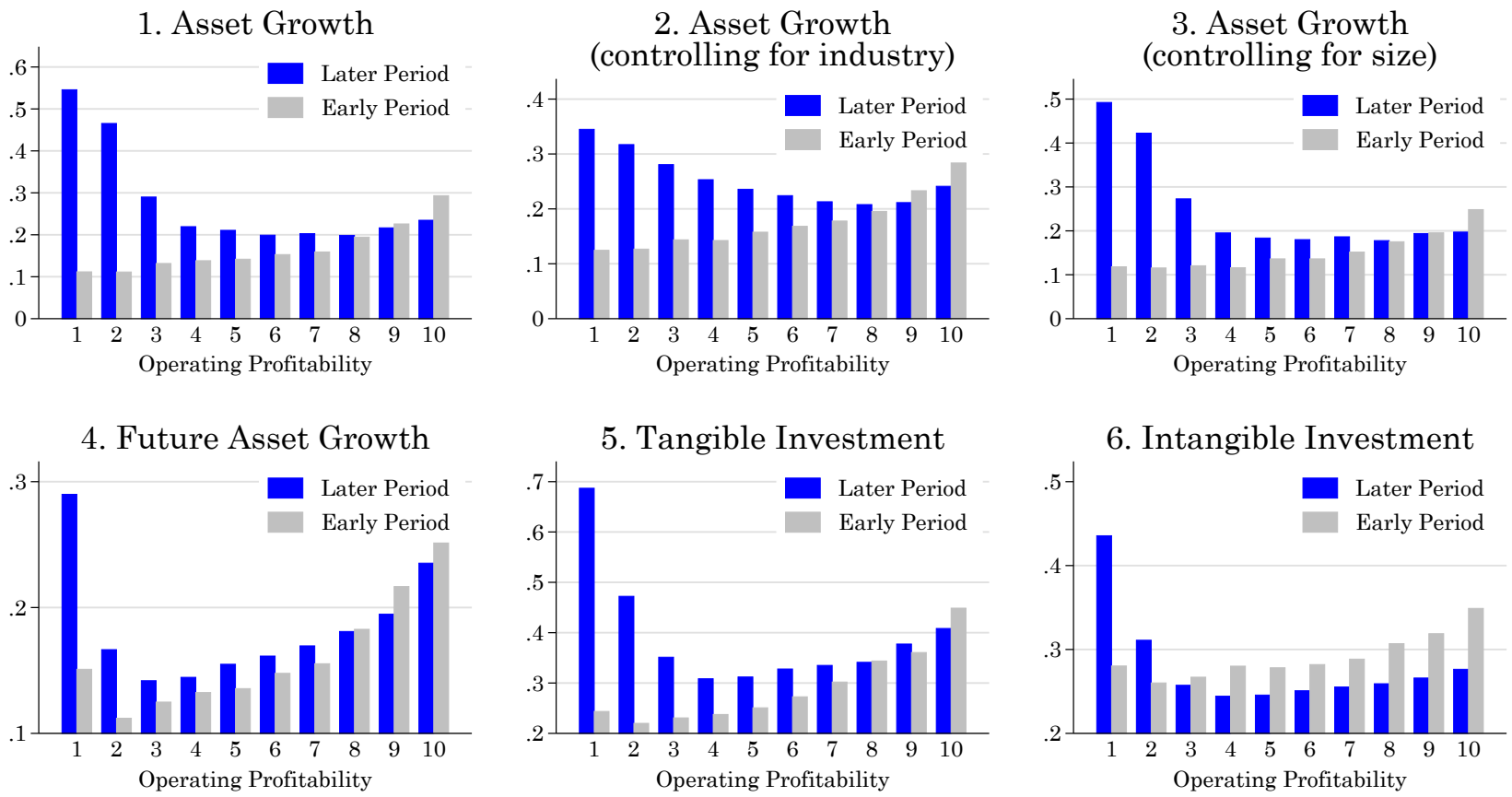
Firm investment and profitability



- The cross-sectional correlation between investment and profitability in each year
- Pre 1980: $corr(inv, prof) > 0$ in most years
- Post 1980: $corr(inv, prof) < 0$ in most years

By industry By characteristic

Rise of low-profit and high-investment firms



Fact 1: different landscape of public firms in early and later periods

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Next: Which firms caused the differences between the two periods?

Decomposing inv-prof relation

What drives the change in the sign of $corr(inv, prof)$?

- Incumbents change investment policy, or
- Change in composition of firms due to entry & exit

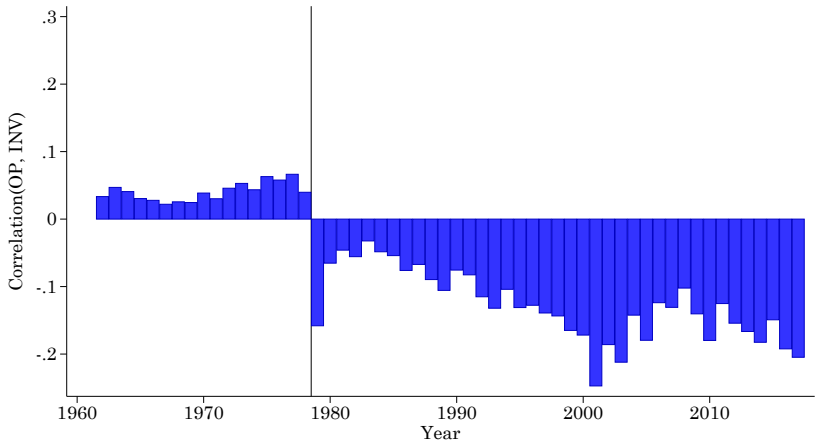
Decomposition of the cross-sectional correlation:

$$corr(u_{j,t}, i_{j,t}) = \frac{cov(u_j + \tilde{u}_{j,t}, i_j + \tilde{i}_{j,t})}{\sigma_u(t)\sigma_i(t)}$$

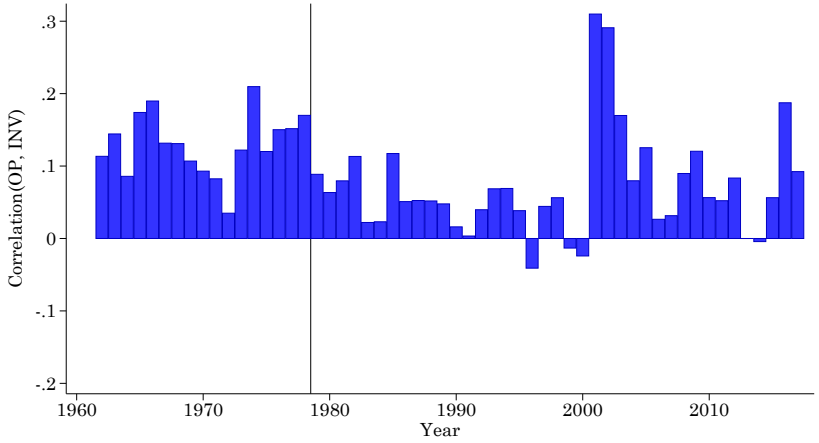
$$= \underbrace{\frac{cov(u_j, i_j)}{\sigma_u(t)\sigma_i(t)}}_{\text{Between-firm component}}$$

$$+ \text{ Within-firm component}$$

Between-firm component



Within-firm component



Counterfactual analysis

What happens if we exclude new listing firms in the later period?

$$Inv_{f,t} = \beta Prof_{f,t} + FE_t + \epsilon_{f,t}$$

	Later Periods (1979-2017)			
	All	Ex. New Listing	Ex. Delisting	Ex. Both
	(1)	(2)	(3)	(4)
Profitability	-0.15***	0.05***	-0.13***	0.02
	(0.03)	(0.02)	(0.03)	(0.02)
Fixed Effects	Yr	Yr	Yr	Yr
Observations	111,234	41,551	47,820	16,557
Adjusted R^2	0.04	0.02	0.02	0.02

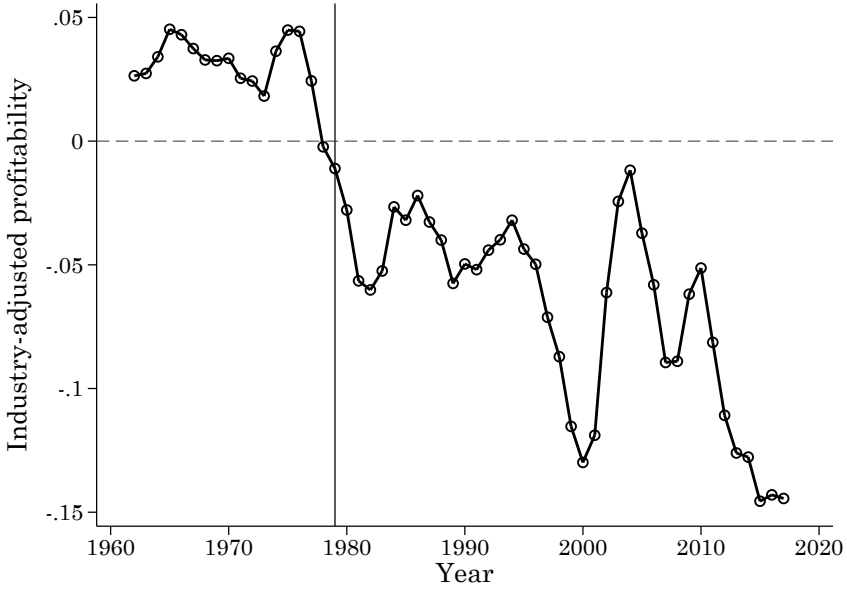
Counterfactual analysis

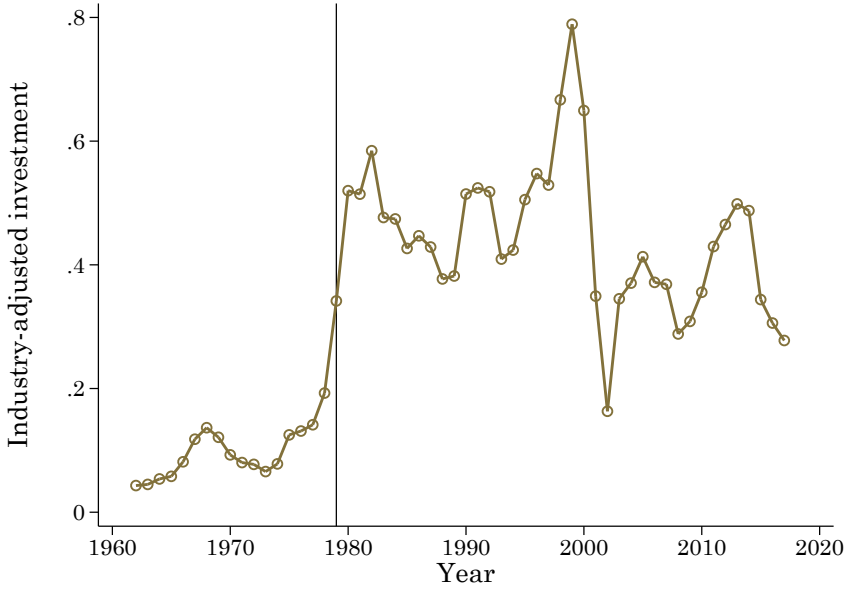
Do not see similar impact if we exclude new listing firms in early period

$$Inv_{f,t} = \beta Prof_{f,t} + FE_t + \epsilon_{f,t}$$

	Early Periods (1963-1978)			
	All	Ex. New Listing	Ex. Delisting	Ex. Both
	(1)	(2)	(3)	(4)
Profitability	0.22***	0.15***	0.22***	0.16***
	(0.02)	(0.03)	(0.02)	(0.03)
Fixed Effects	Yr	Yr	Yr	Yr
Observations	26,298	11,201	24,660	10,597
Adjusted R^2	0.06	0.05	0.05	0.05

Investment and profitability of new firms





- Newly listed firms since 1980 features low profitability and high investment

Fact 2: decoupling between investment and profitability is largely due to entry of low-profit and high-investment firms

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Next: How does this affect investment and profitability premia?

A SIMPLE THEORETICAL FRAMEWORK

We propose a framework featuring two types of firms

1. Classic firms
   - Discount rate is r_s
   - Profitability process $$\frac{du_t}{u_t} = \sigma dB_t$$
   - Optimal investment $$i_c(u_t) = \frac{1}{c(r_s + \delta)} u_t$$
2. Boom firms
   - Discount rate is r_l
   - Profitability process $$\frac{du_t}{u_t} = \sigma dB_t + (e^{Z_t} - 1) dN_t \leftarrow \text{jump process}$$ Example
   - Optimal investment $$i_b(u_t) = \frac{1}{c(r_l + \delta - \lambda \mu_z)} u_t$$

Key assumption:

- Investors charge lower discount rate for longer-term cash flows $\rightarrow r_s < r_l$ (Duration Premium)

  van Binsbergen et al. (2012), van Binsbergen and Koijen (2017), Dechow et al. (2014), Weber (2018), Chen and Li (2018), Goncalves (2020), Gormsen and Lazarus (2020) ...

Intuition from the framework

Classic: $i_c(u_t) = \frac{1}{c(r_s+\delta)} u_t$ Boom: $i_b(u_t) = \frac{1}{c(r_l+\delta-\lambda\mu_z)} u_t$

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- investment and profitability are positively related within a firm

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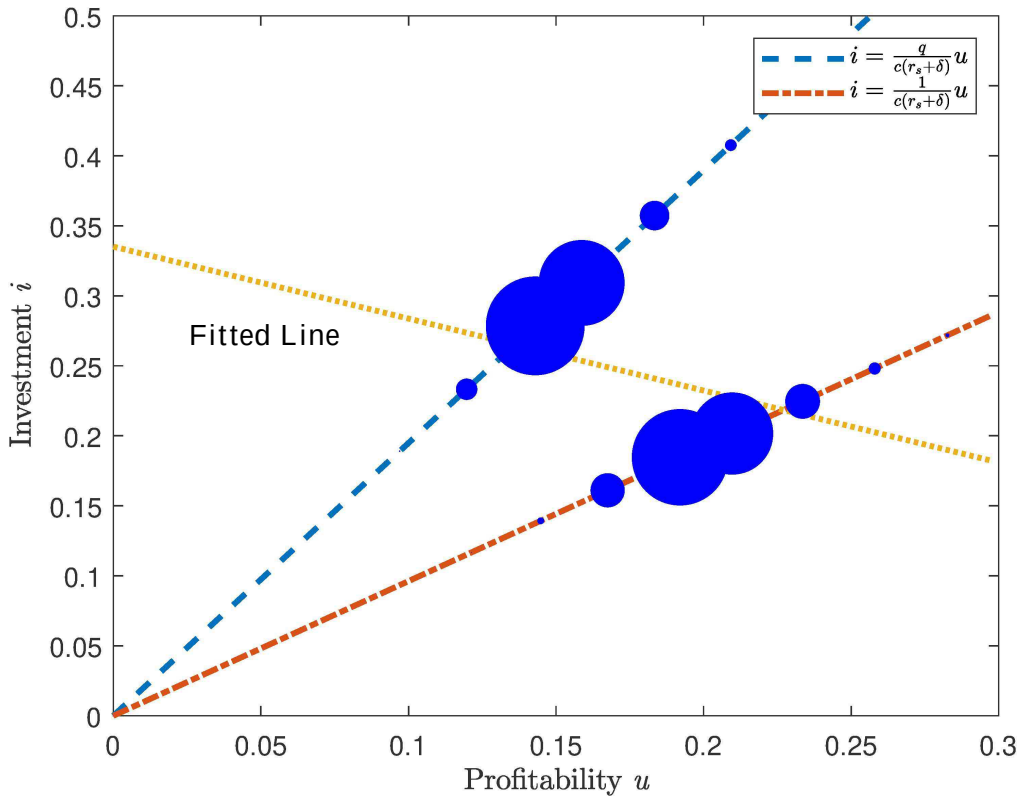
- investment and profitability are positively related within a firm
- boom firms may invest more than classic firms despite having lower current profitability, leading to negative cross-sectional relation



Data consistent with model intuition

$$Inv_{f,t} = \beta Prof_{f,t} + FE_t + \epsilon_{f,t}$$

	Early Period			Later Period		
	baseline (1)	ctrl.duration (2)	firm FE (3)	baseline (4)	ctrl.duration (5)	firm FE (6)
Profitability	0.22***	0.30***	0.21***	-0.15***	0.18***	0.20***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Observations	26,298	25,978	25,809	111,234	86,771	109,023
Adjusted R^2	0.06	0.17	0.17	0.04	0.12	0.22

Investment and profitability premia

- In this framework, cross-section of returns is fully characterized by the "duration premium" $r_s - r_l$ across classic and boom firms
- In aggregate, the mass of boom firms is tilted towards lower current profitability
  - Profitability premium (RMW)

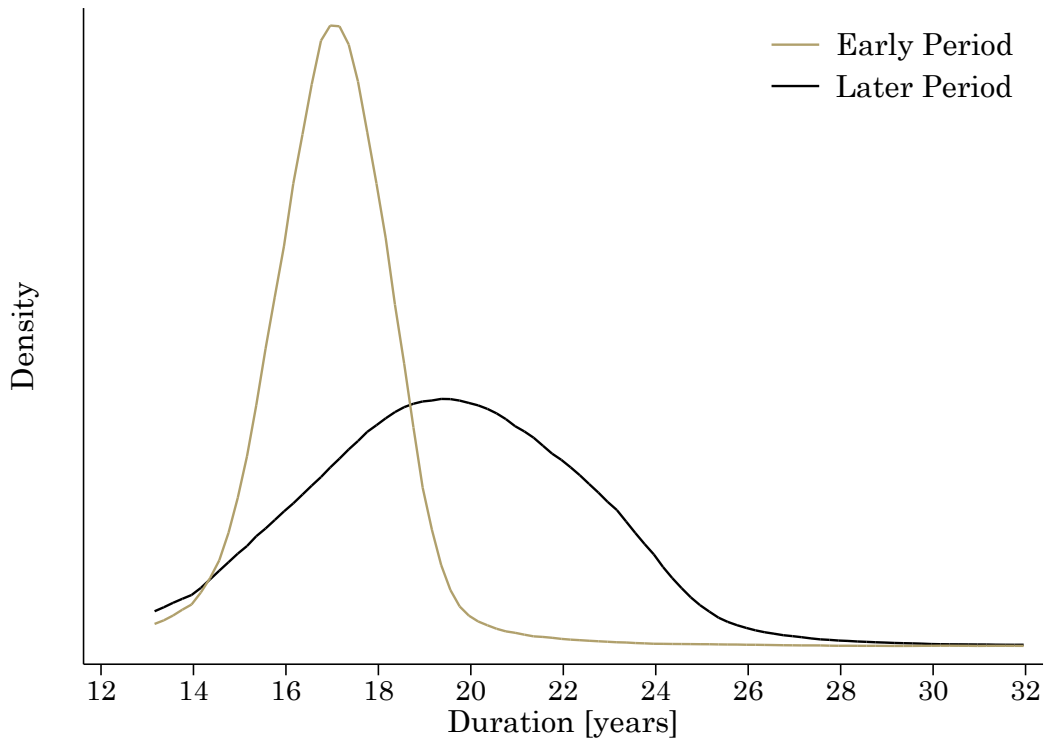
$$r_R - r_W = \xi(r_s - r_l),$$

- the mass of boom firms is tilted towards higher investment rate
  - Investment premium (CMA)

$$r_C - r_A = \psi(r_s - r_l)$$

Distribution of expected cash flow duration

How does firm duration look like during the two periods in the data?



- Early period characterized by absence of high-duration firms
- Later period characterized by presence of high-duration firms

Duration calculation

Duration premium

- Monthly average returns of portfolios sorted on duration

Early period								
	Sorted by duration				Sorted by duration within size group			
	1	5	10	10−1	1	5	10	10−1
Dur	15.83	17.01	18.75		16.05	16.93	18.48	
Ret	0.59**	0.81**	0.79	0.19	0.83**	1.02***	0.83	0.00
SE	(0.29)	(0.38)	(0.54)	(0.36)	(0.34)	(0.38)	(0.53)	(0.26)

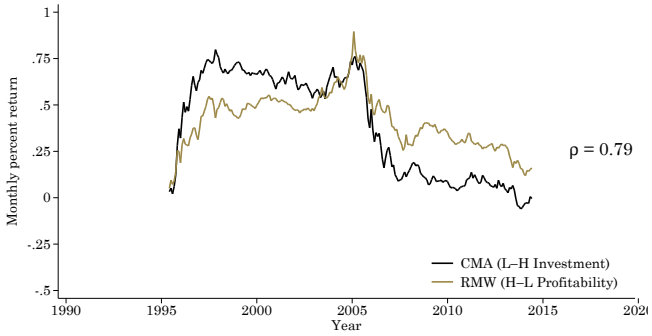
Later period								
	Sorted by duration				Sorted by duration within size group			
	1	5	10	10−1	1	5	10	10−1
Dur	15.28	19.08	23.43		16.05	18.25	21.38	
Ret	0.94***	1.21***	0.13	−0.81**	1.04***	1.07***	0.41	−0.64**
SE	(0.24)	(0.32)	(0.51)	(0.35)	(0.25)	(0.29)	(0.47)	(0.29)

- Little variation in duration and expected returns in early period
- High-duration firms in later period have lower expected returns

Cross-country evidence of the premia

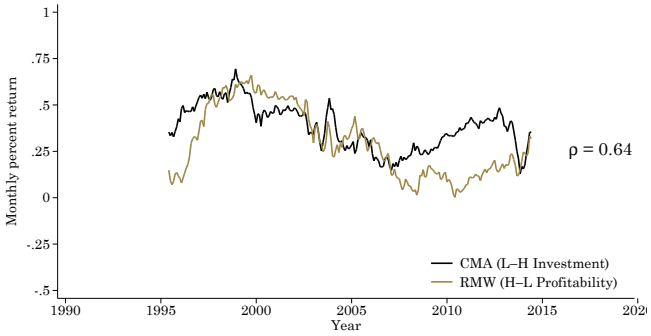
Panel A: North American

$(\text{Inv}^{VC}/\text{Inv}^{TOT} = 1.27\%)$



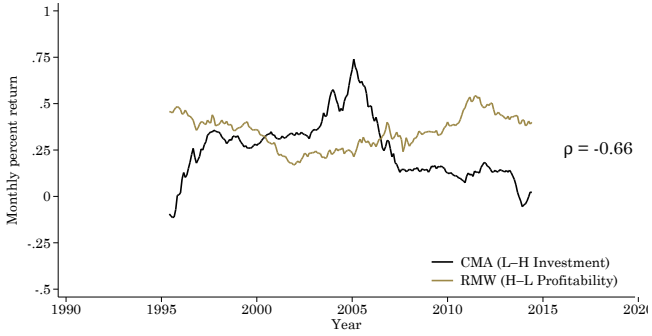
Panel B: Asian Pacific Except Japan

$(\text{Inv}^{VC}/\text{Inv}^{TOT} = 0.35\%)$



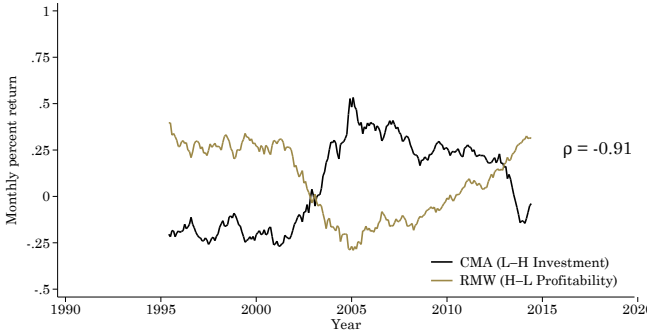
Panel C: Europe

$(\text{Inv}^{VC}/\text{Inv}^{TOT} = 0.27\%)$



Panel D: Japan

$(\text{Inv}^{VC}/\text{Inv}^{TOT} = 0.03\%)$



Countries with higher $Corr(CMA, RMW)$ also tend to have higher long-term investments in the private market, proxied by Venture Capital (Gompers & Lerner (2001))

Rise of VC in the US

Conclusion

- Two periods in the U.S. stock market over the last century exhibit completely different joint distributions of investment and profitability
- Our analysis
  - reveals several novel facts about what is different before and after 1980
  - suggests that investors' tolerance for long-duration cash flows ("duration premium") is an important driver for understanding cross-sectional stock returns

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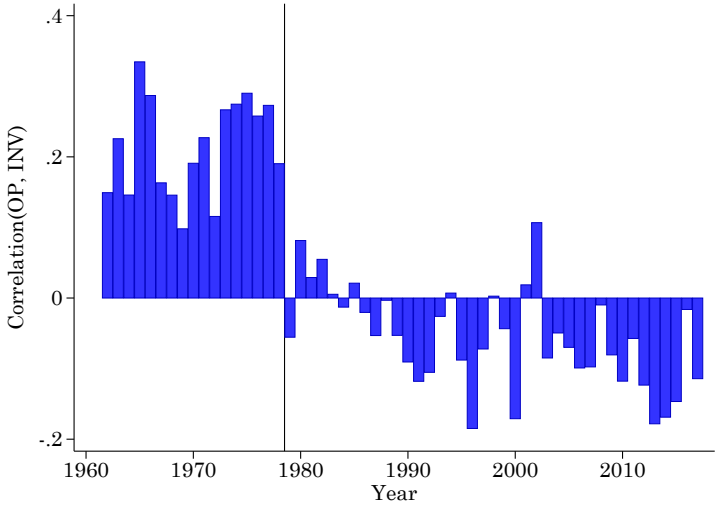
- Two periods in the U.S. stock market over the last century exhibit completely different joint distributions of investment and profitability
- Our analysis
  - reveals several novel facts about what is different before and after 1980
  - suggests that investors' tolerance for long-duration cash flows ("duration premium") is an important driver for understanding cross-sectional stock returns
- Several important questions remain:
  - why investors charge low discount rate for long-duration cash flows
  - what caused the influx of high-duration firms into the stock market after 1980?

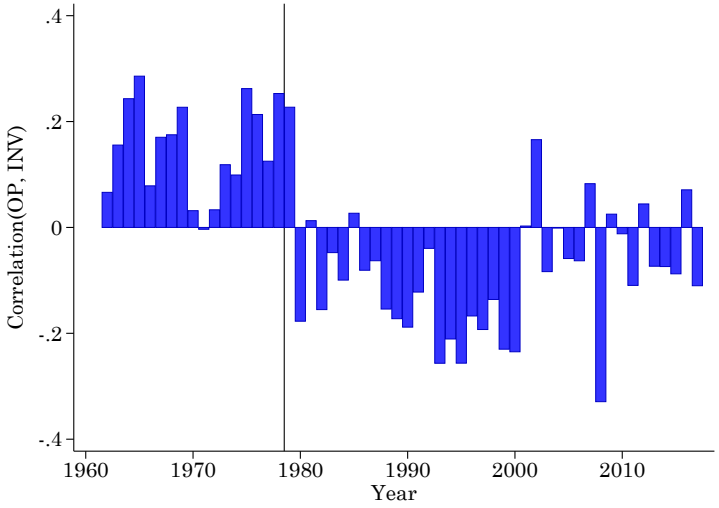
Correlation by industry

Back

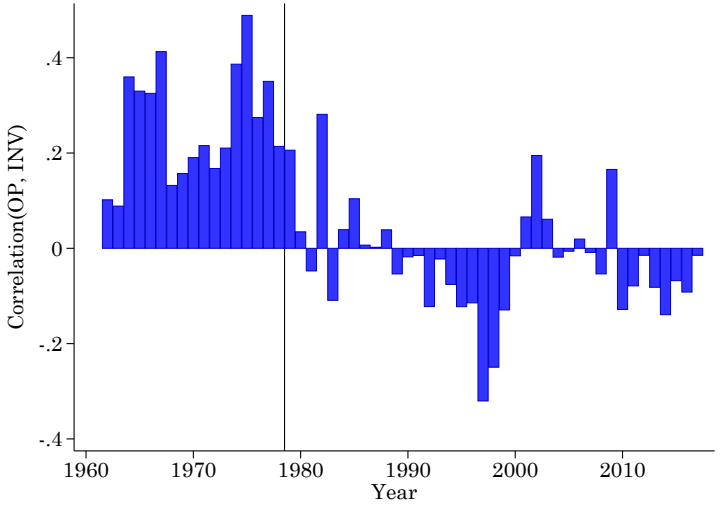
Panel A: Manufacturing



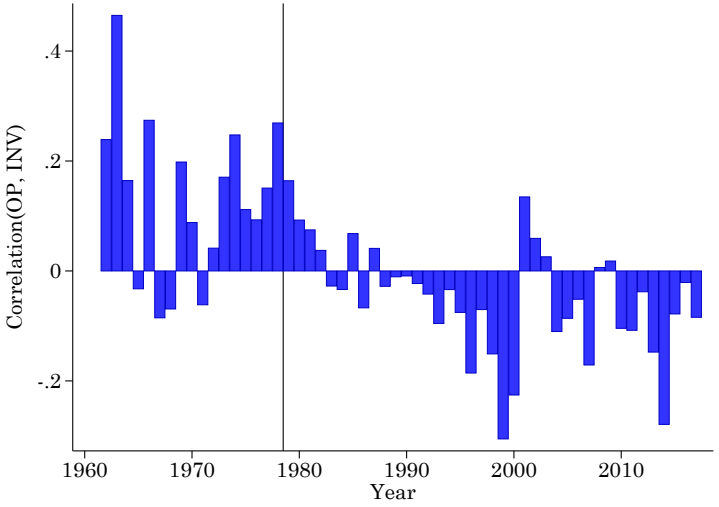
Panel B: Transportation



Panel C: Wholesale & Retail



Panel D: Service & Finance



Correlation by other characteristics

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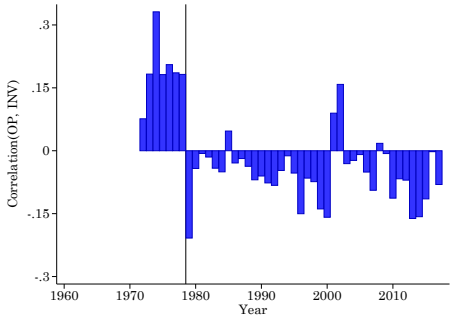
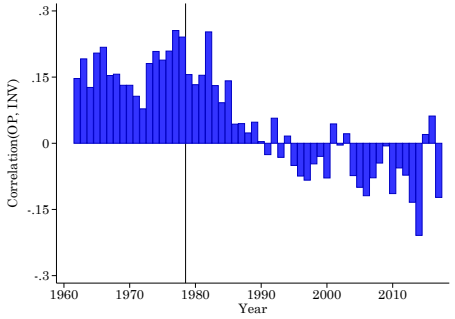
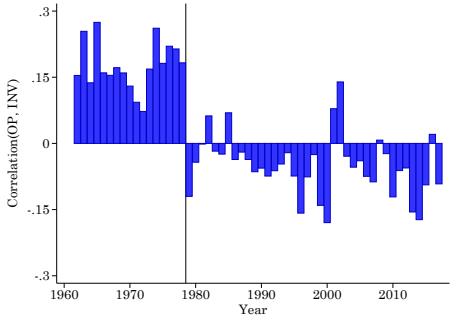
Panel A: NASDAQ firms



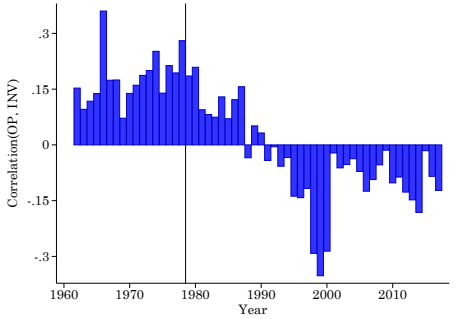
Panel B: NYSE&Amex firms



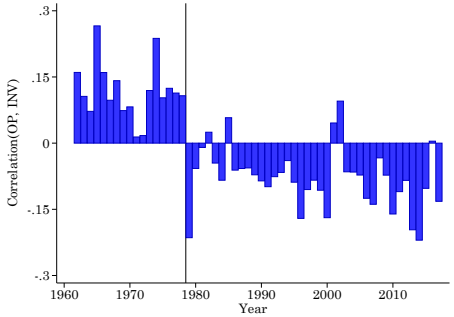
Panel C: Small cap firms



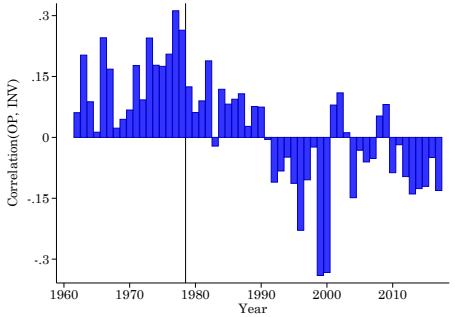
Panel D: Large cap firms



Panel E: Growth firms



Panel F: Value firms



Expected dividend growth

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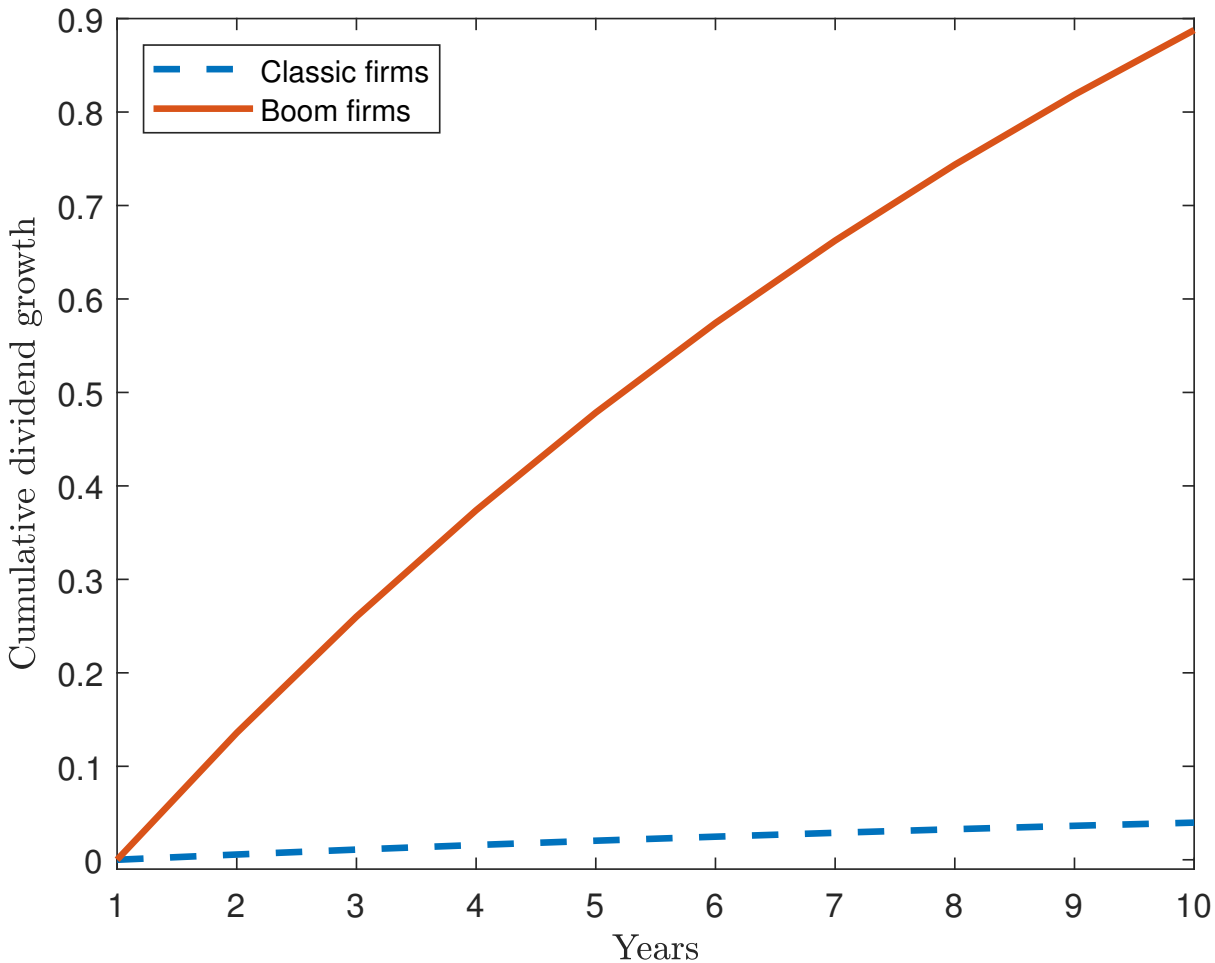
The parameter values are:
$r_s = 0.16, r_l = 0.03, \delta = 0.1, c = 4, \phi = 0.75, \sigma = 0.04, u_0 = 0.2, \lambda = 0.01$. Z has a normal distribution with mean $\mu_z = 0.15$ and $\sigma_z = 0.1$. We simulate 1,000,000 firms and use $\tau = 10$ and $m_c = m_b = 0.5$. The correlation between i and u is -28%. The model implied values are $q = 2.026$ and $\underline{q} = 1.714$ satisfying the negative covariance condition $q > \underline{q}$.



Duration calculation Back

- Estimate realized cash flows for each firm

  (Clean Surplus Accounting)

$$CF_{i,t+s} = BV_{i,t+s-1}\left(ROE_{i,t+s} - \Delta BV_{i,t+s}\right)$$

- Estimate an *ex-post* duration for each firm

  (Dechow, Sloan, and Soliman (2004) and Weber (2018))

$$Dur_{i,t} = \frac{\sum_{s=1}^{T} s \times CF_{i,t+s}/(1+r)^s}{P_{i,t}} + \left(T + \frac{1+r}{r}\right)\frac{P_{i,t} - \sum_{s=1}^{T} CF_{i,t+s}/(1+r)^s}{P_{i,t}}$$

- Estimate *ex-ante* duration for each firm using projection

  (Da (2009) and Hou, Mo, Xue, and Zhang (2018))

$$\log(Dur_{i,t}) = \alpha_t + \beta_{1,t}\log(ME_{i,t}) + \beta_{2,t}ROE_{i,t} + \beta_{3,t}\Delta BV_{i,t} + \varepsilon_{i,t}$$

$$E_t\left[\log(Dur_{i,t})\right] = \overline{\alpha}_t + \overline{\beta}_{1,t}\log(ME_{i,t}) + \overline{\beta}_{2,t}ROE_{i,t} + \overline{\beta}_{3,t}\Delta BV_{i,t}$$

- $T = 10$ years, $r = 0.12$

Institutional VC investment

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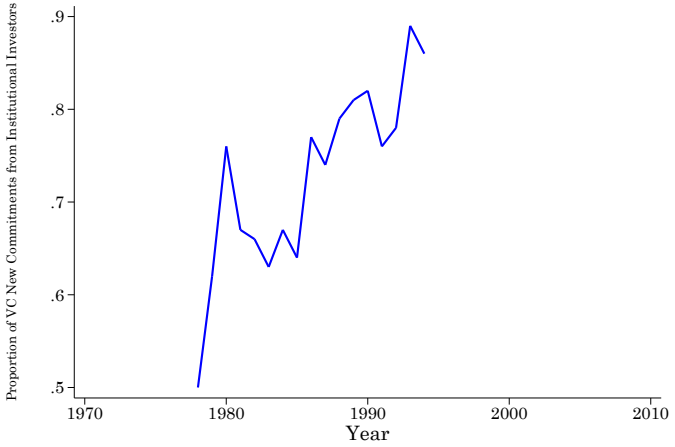
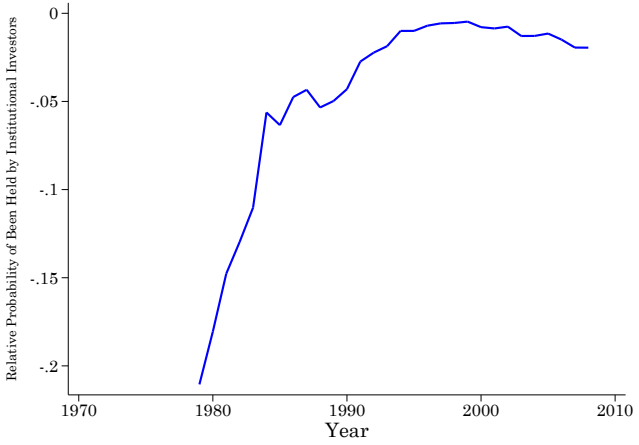
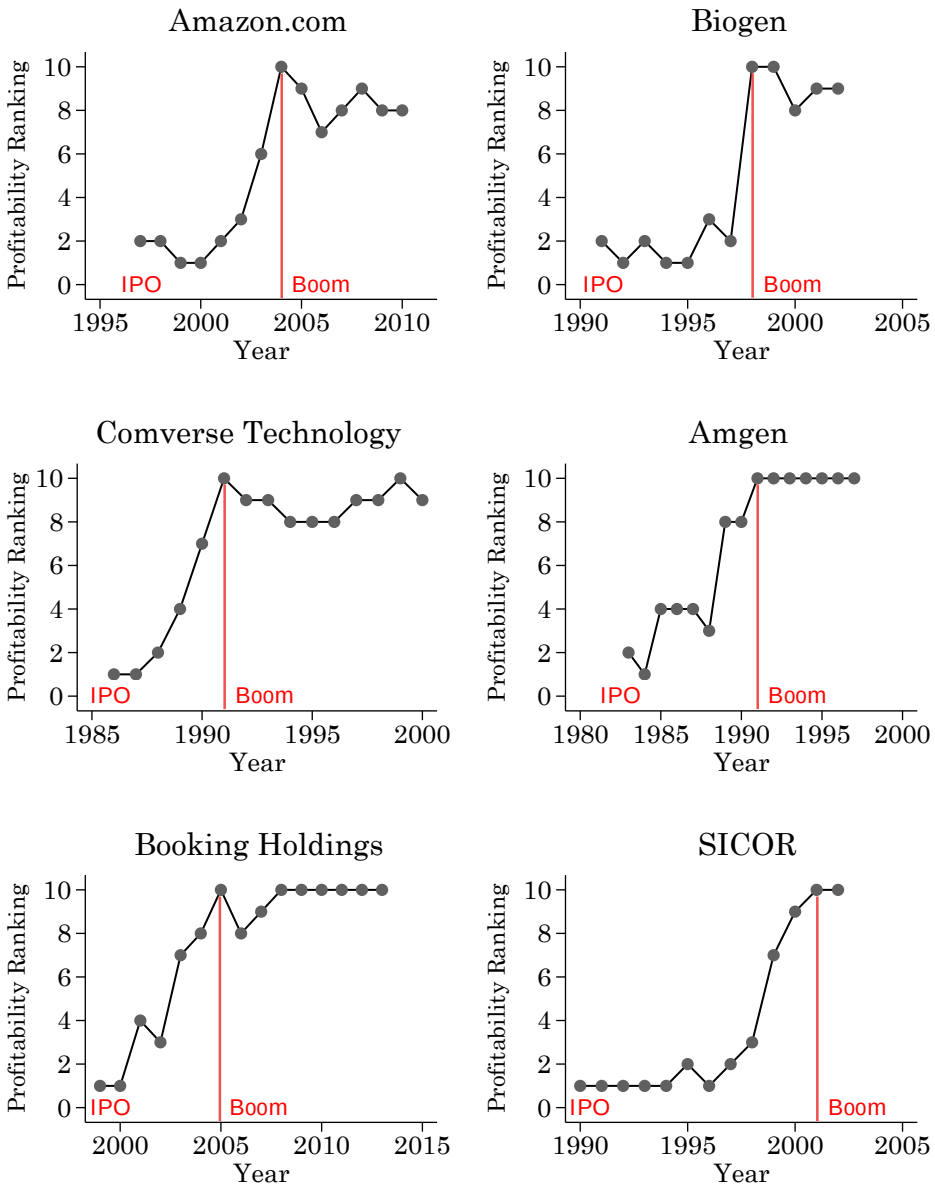
Institutional investors targeting venture capital funds



Institutional investors targeting long-duration stocks



Examples of boom firms



Back

"Because of our emphasis on the long term, we may make decisions and weigh tradeoffs differently than some companies. [...] We will continue to make investment decisions in light of long-term market leadership considerations rather than short-term profitability considerations"

— Jeffrey P. Bezos, *"Amazon.com 1997 Letter to Shareholders" (page 1)*