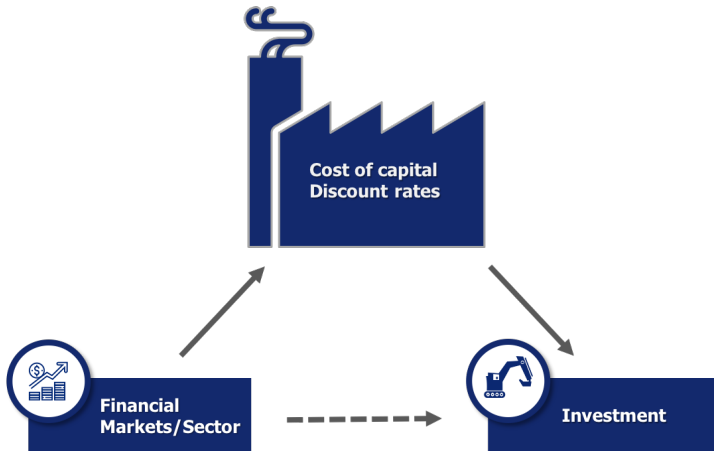
Summary Slides:
Corporate Discount Rates and Cost of Capital

Niels Joachim Gormsen and Kilian Huber

Introduction



Stylized view

- Asset prices and interest rates $\rightarrow$ firms' discount rates $\rightarrow$ investment

Challenges to stylized view

- Firms estimate a "perceived cost of capital (COC)" based on asset prices and interest rates, which is difficult
- Firms choose whether to incorporate the COC into discount rates or whether other factors dominate
- Key objects for firm growth, monetary and financial policy, and the link between financial markets and business cycles

Framework

Firms invest if $$\text{NPV} = \sum_{s=0}^{S} \delta^{-s} \mathbb{E}[\text{Revenue}_s - \text{Cost}_s] > 0,$$

$\delta = 1 + \text{discount rate} = 1 + \text{required return on investment}$

Stylized view:

$\delta = 1 + \text{weighted avg. cost of debt and equity (fin. COC)} = 1 + r^{\text{fin.}}$

- $r^{\text{fin.}}$ represents investors' and banks' required return
- Setting $\delta = r^{\text{fin.}}$ maximizes short-run stock prices

$\Rightarrow$ monetary policy, stock market, credit supply have powerful real effects

Framework

Firms invest if $$\text{NPV} = \sum_{s=0}^{S} \delta^{-s} \mathbb{E}[\text{Revenue}_s - \text{Cost}_s] > 0,$$

Stylized view: $\delta = 1 + r^{\text{fin.}}$

Challenges to stylized view:

1. $r^{\text{fin.}}$ difficult to estimate (Fama and French 1997; Campbell and Thompson 2008; Greenwood and Shleifer 2014)
   $\Rightarrow r^{\text{perceived}} = r^{\text{fin.}} + \upsilon$
2. Managers choose whether to incorporate $r^{\text{perceived}}$ or other determinants (e.g., risk, irreversibility, market power, signaling) into δ
   $\Rightarrow \delta = 1 + r^{\text{perceived}} + \kappa$

$\Rightarrow$ Any relation btw. $\Delta r^{\text{fin.}}$, $\Delta\delta$, and investment?

Data from Corporate Conference Calls

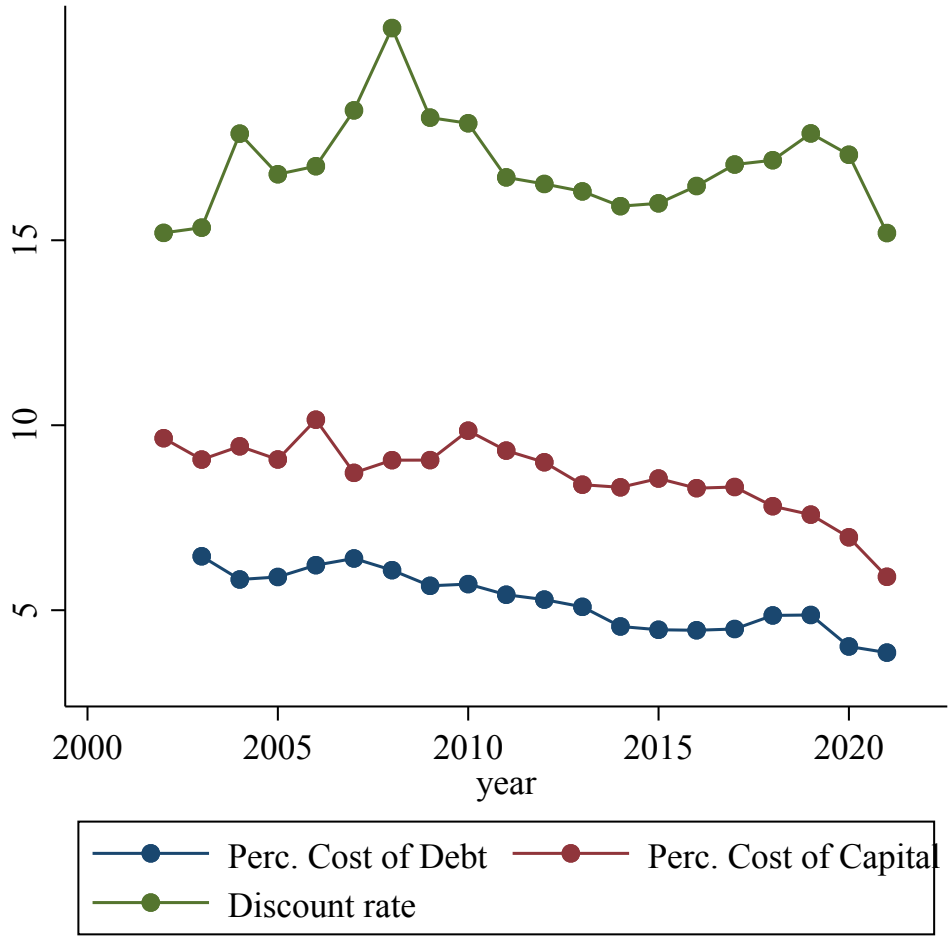
Example Air Products and Chemicals, 9/17/2015, S&P 500 firm:

*"Our weighted average cost of capital for the company is **8%**. We are not going to do any project which has a less than a **10%** internal rate of return. (...) We have established a minimum hurdle rate of **10%** internal rate of return for all new projects."*

- Perceived cost of capital: **8%**
- Hurdle rate: **10%**
- In practical usage, hurdle rates = minimum required IRRs = discount rates (Jagannathan et al. 2017)

Data by year, country, sector under costofcapital.org

Raw Averages for US Firms



Financial COC → Perceived COC

	Perceived COC	Perceived COC	Perceived COC
Financial COC (country)	0.67***		
	(0.19)		
Financial COC (firm)		0.49***	
		(0.13)	
Cost of equity (scaled)			0.47***
			(0.16)
Cost of debt (scaled)			0.54***
			(0.16)
Observations	1,968	1,520	1,520
FE	Firm	Firm	Firm
Within R^2	0.07	0.09	0.09

Use standard measures of fin. COC:

- Country-level fin. cost equity$_t$ = Earnings yield$_t$ + inflation$_t$
- Country-level fin. cost debt$_t$ = Long-run bond yield$_t$
- Firm-level fin. cost equity$_t$ = CAPM$_t$
- Firm-level fin. cost debt$_t$ = avg. interest expenses$_t$

Financial COC $\rightarrow$ Perceived COC

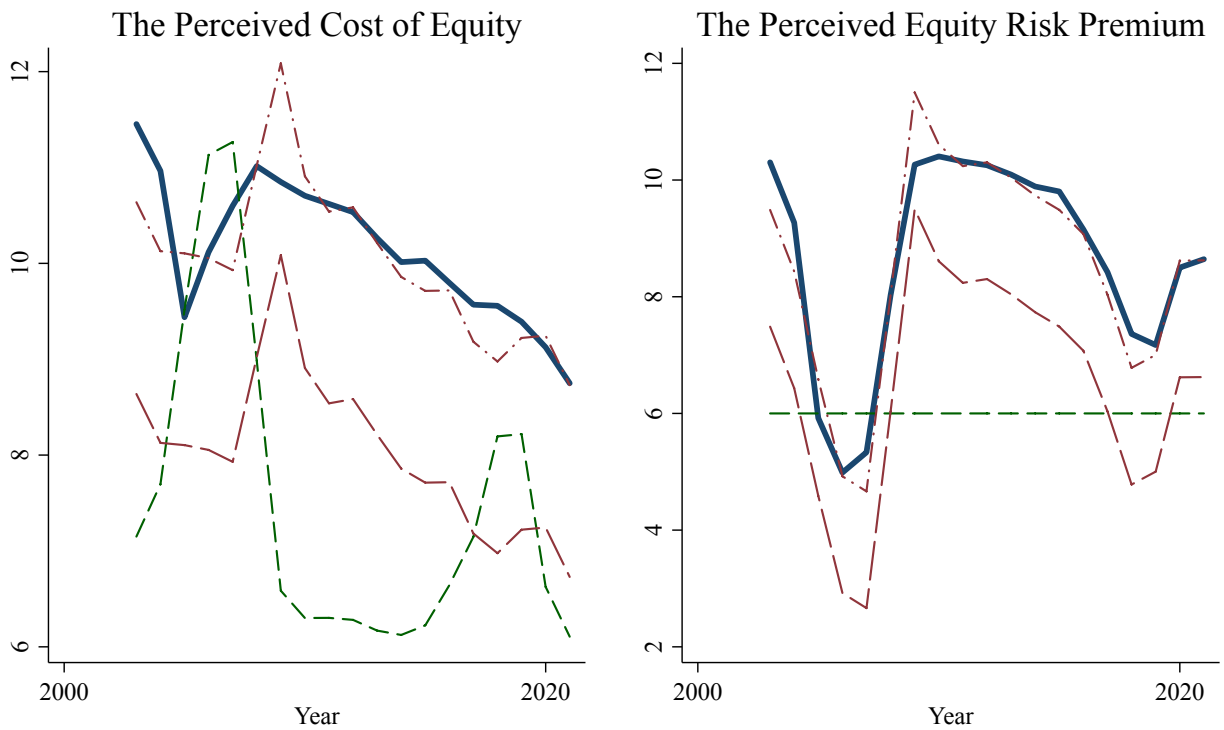
On average, firms incorporate fin. COC into perceptions

R^2 low, implying large heterogeneity

Example of partial incorporation
2014-11-07, IAG (3rd largest airline), Enrique Dupuy, CFO:

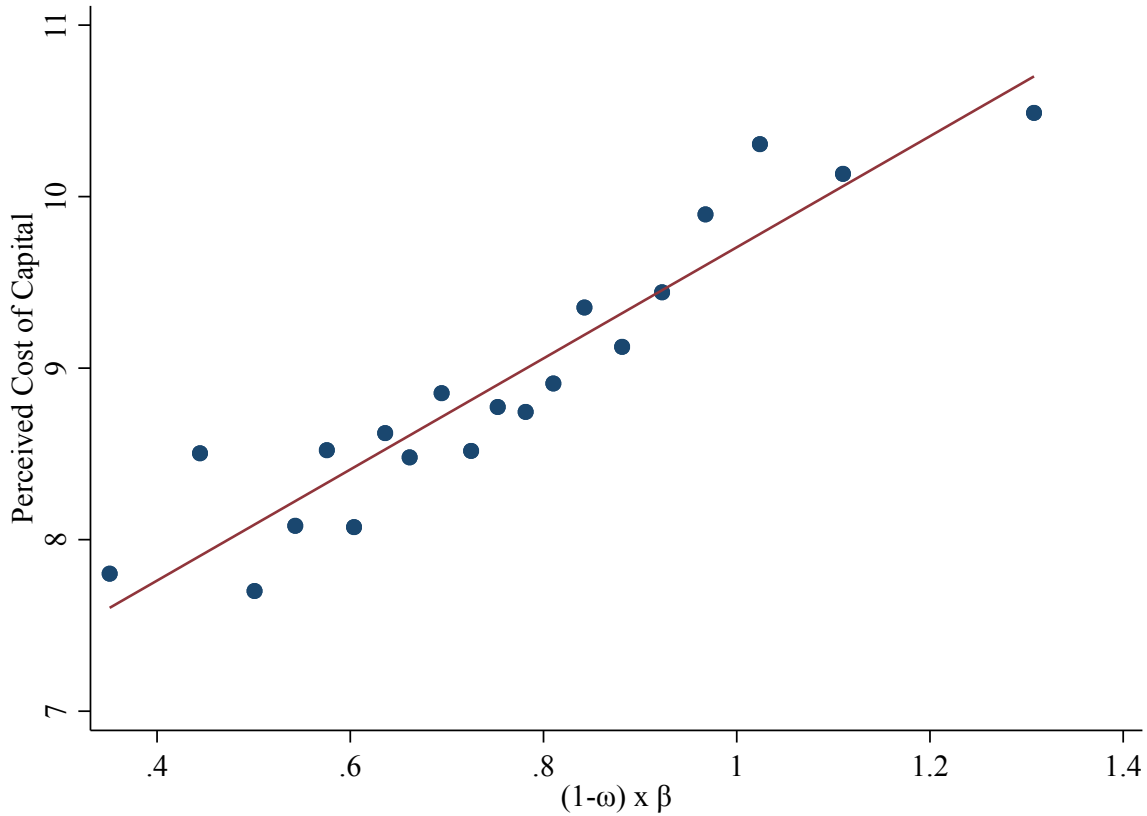
"A cost of capital of 10% is getting very conservative. Through the crisis in Spain and Europe we increased it to this 10% level. But the 15% cost of equity appears to have a big premium there. Maybe it could be brought down slightly. We may be having to change it through '15 and beyond."

Perceived Equity Risk Premium



$$\text{earnings yield}: \frac{1}{\text{CAPE}} + 4\%, \quad \text{earnings yield + high}: \frac{1}{\text{CAPE}} + 6\%, \quad \text{constant}: r^f + 6\%$$

Perceived COC and the CAPM Beta



Firms' perceived cost of capital is closely related to risk (measured by the CAPM beta—comovement with the market—times the equity ratio)

Perceived COC → Discount Rate

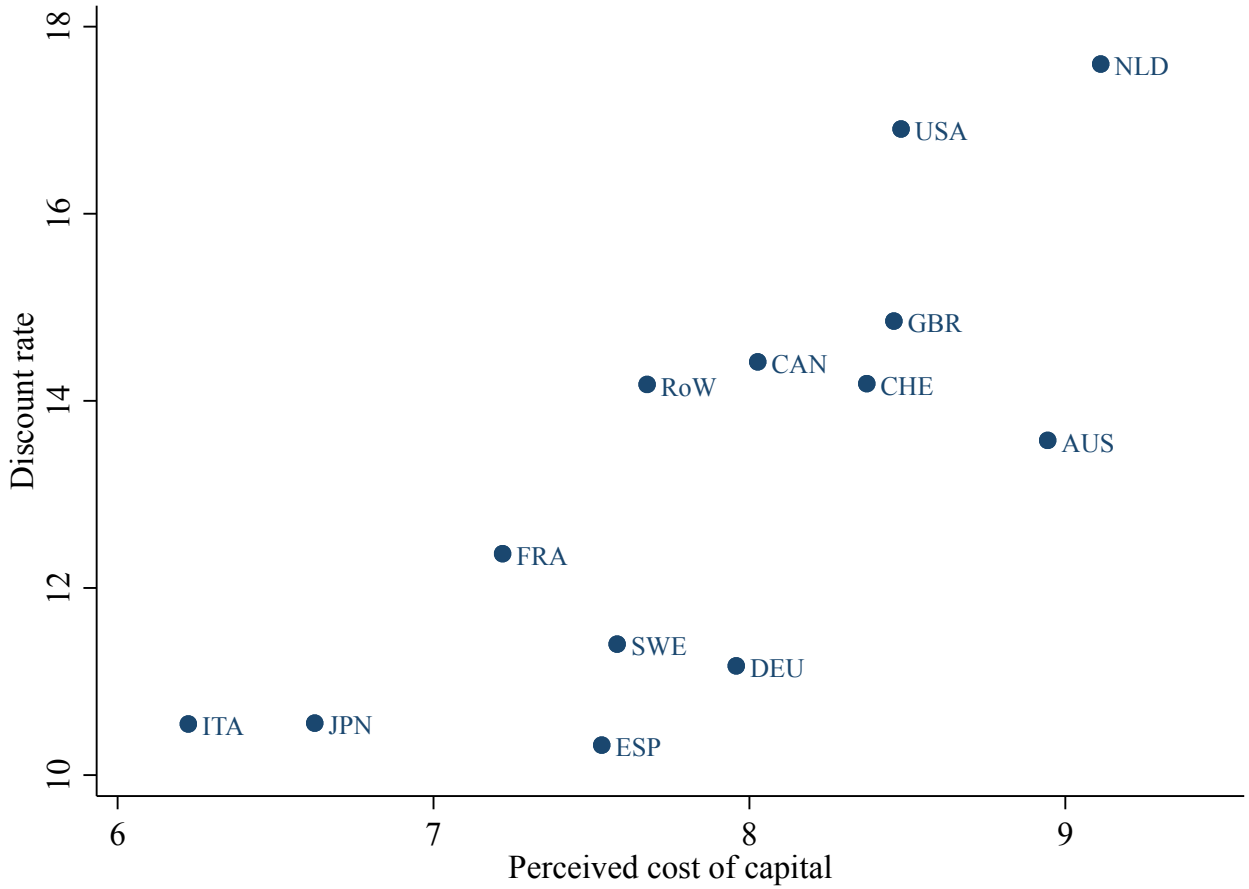
	Discount rate	Discount rate	Investment rate (net)
Perceived COC	0.38***		
	(0.12)		
Perceived COC (lasso)		0.40*	
		(0.23)	
Discount rate			
Financial COC			
Observations	127	1,388	
FE	Firm/Year	Firm/Year	
Within R^2	0.27	0.01	

Reject coefficient of 1, which is assumed in stylized view

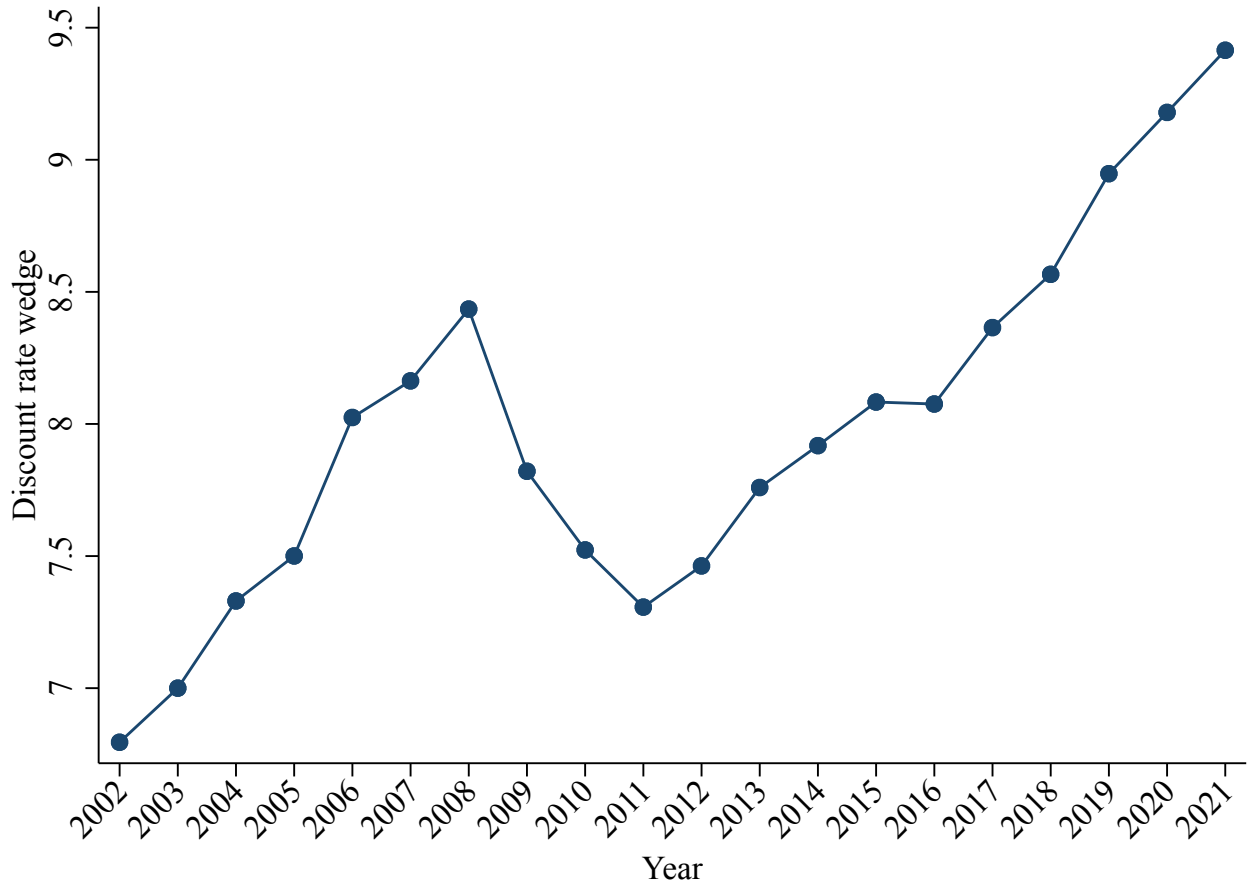
Partial incorporation of perceived COC into discount rates

Implies time-varying discount rate wedges

Discount Rates and Perceived Cost of Capital Across Countries



Within-Firm, Average Discount Rate Wedge in the US



Large magnitudes: QE1 reduced corp. bond yields by 0-0.5 ppt (Krishnamurthy and Vissing-Jørgensen 2011). Natural real rate down by 1 ppt since 2002 (Bauer and Rudebusch 2020).

Post-2010 increase driven by falling COC

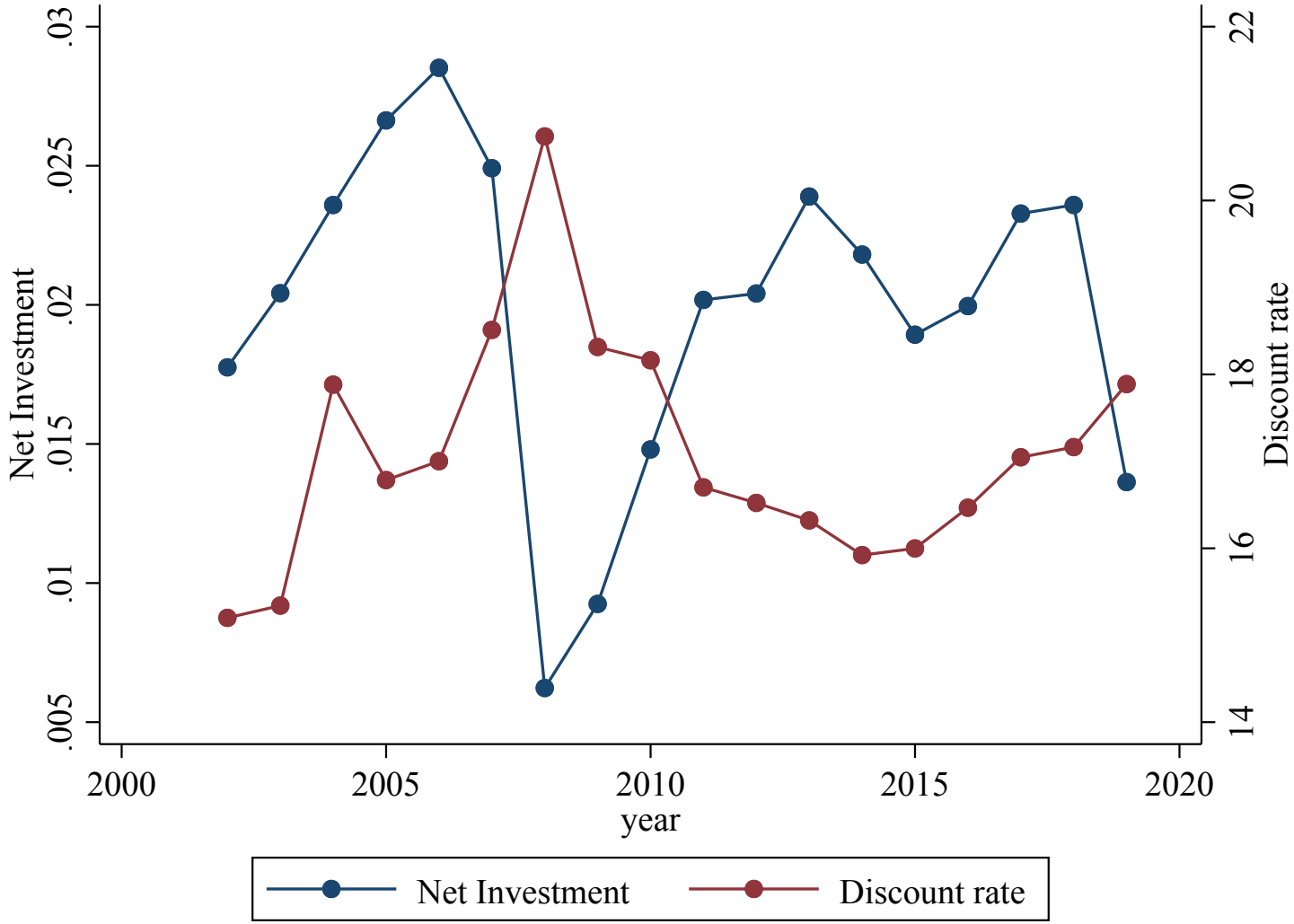
Discount Rate → Investment

	Discount rate	Discount rate	Investment rate (net)
Perceived COC	0.38***		
	(0.12)		
Perceived COC (lasso)		0.40*	
		(0.23)	
Discount rate			-0.86***
			(0.27)
Financial COC			0.78
			(0.91)
Observations	127	1,388	957
FE	Firm/Year	Firm/Year	Firm/Year
Within R^2	0.27	0.01	0.04

Simple Q-model (Philippon 2009) predicts -0.9

Measured discount rates capture investment demand, conditional on investment opportunities

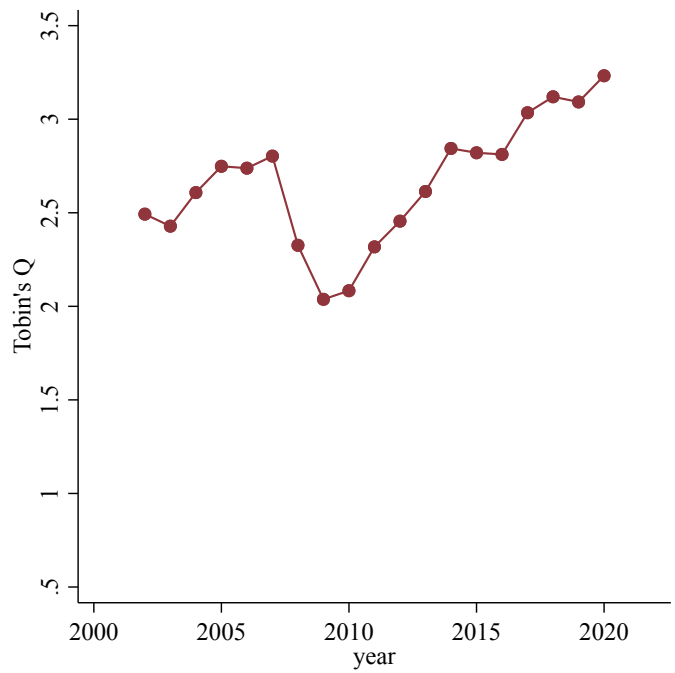
Measured Discount Rates Predict Aggregate US Investment



"Missing Investment"

Low investment since 2000 is puzzling in light of stylized view and Q-theory (Gutiérrez and Philippon 2017; Alexander and Eberly 2018)

- Asset prices up, int. rates down $\rightarrow$ financial COC down $\rightarrow$ Tobin's Q up
- Theory: Investment should rise until Tobin's Q = 1.
- Reality:



A Model of Adjusted Q

We develop a new Q framework based on observed discount rates

$$\text{Firms} \quad \max_{I_t} \quad \sum_{t=0}^{\infty} \frac{\Pi_t(k_t) - I_t - \Phi(I_t, k_t, \xi)}{\left(1 + r^{\text{fin.}} + \upsilon + \kappa\right)^t},$$
$$\text{s.t.} \qquad k_{t+1} = I_t + (1 - \xi)k_t,$$

- $r^{\text{fin.}} + \upsilon + \kappa$ = discount rate
- Tobin's Q and stylized view: $\upsilon + \kappa = 0$, i.e., firms calculate $r^{\text{fin.}}$ perfectly and set $\delta = r^{\text{fin.}}$ passively
- I_t = capital investment at time t
- $\Pi_t(k_t)$ = profits earned at t
- $\Phi(I_t, k_t, \xi)$ = adjustment costs (quadratic in net inv.)
- Profit and cost functions homogeneous of degree one

Optimal Investment

$$\frac{I_t}{k_t} - \xi \approx \left[Q_t^{\text{Adjusted}} - 1 \right] \times \frac{1}{\phi}$$

Adjusted Q uses actual discount rates

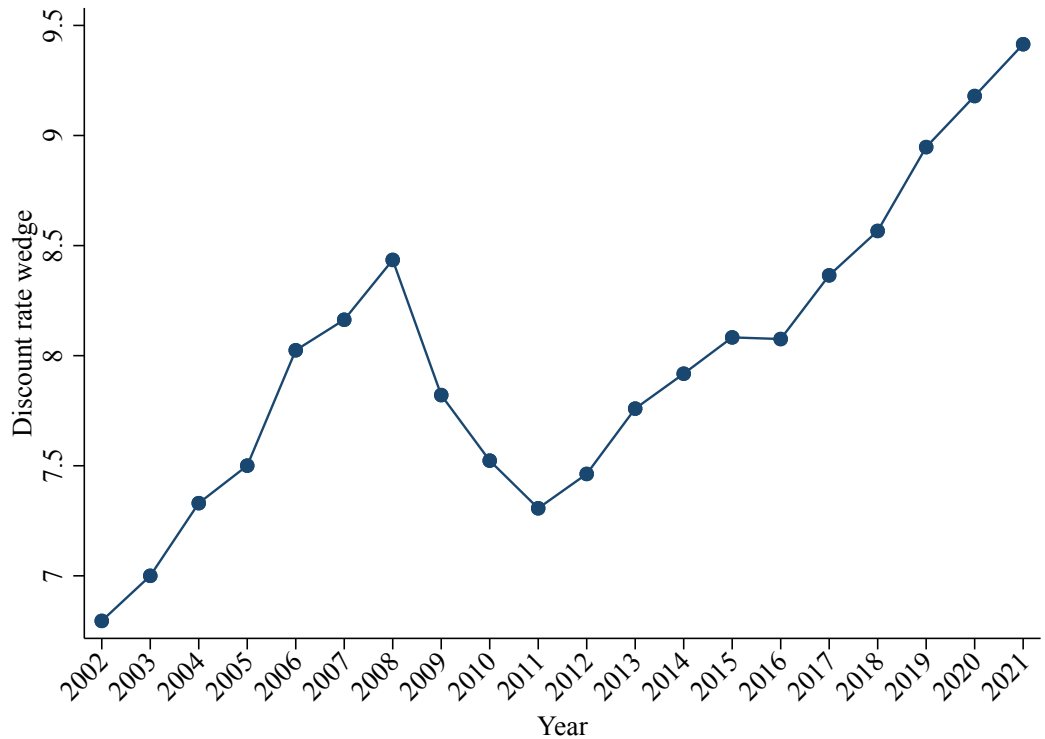
$$Q_t^{\text{Adjusted}} = Q_t^{\text{Tobin}} \times \frac{1}{(\upsilon + \kappa) \times \text{Dur} + 1}$$

Intuition:

- Wedges imply that firms and fin. markets use different discount rates and required returns
- The further away cash flows (high Dur), the more important wedges

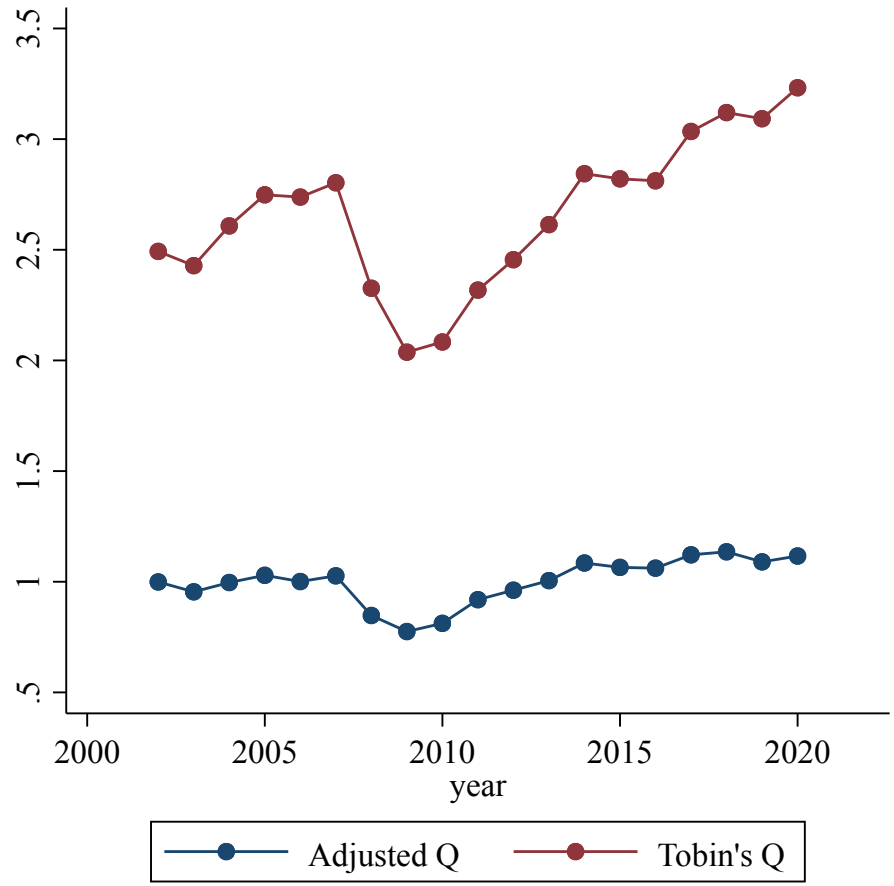
Measuring Adjusted Q

- We measure adjusted Q using new data
- Focus on κ—wedges actively chosen by firms—and set $\upsilon = 0$
- Recall: large time variation in avg. κ



Measuring Adjusted Q

- We measure adjusted Q using new data
- Focus on κ—wedges actively chosen by firms—and set $\upsilon = 0$
- Adjusted Q accounts for investment dynamics better

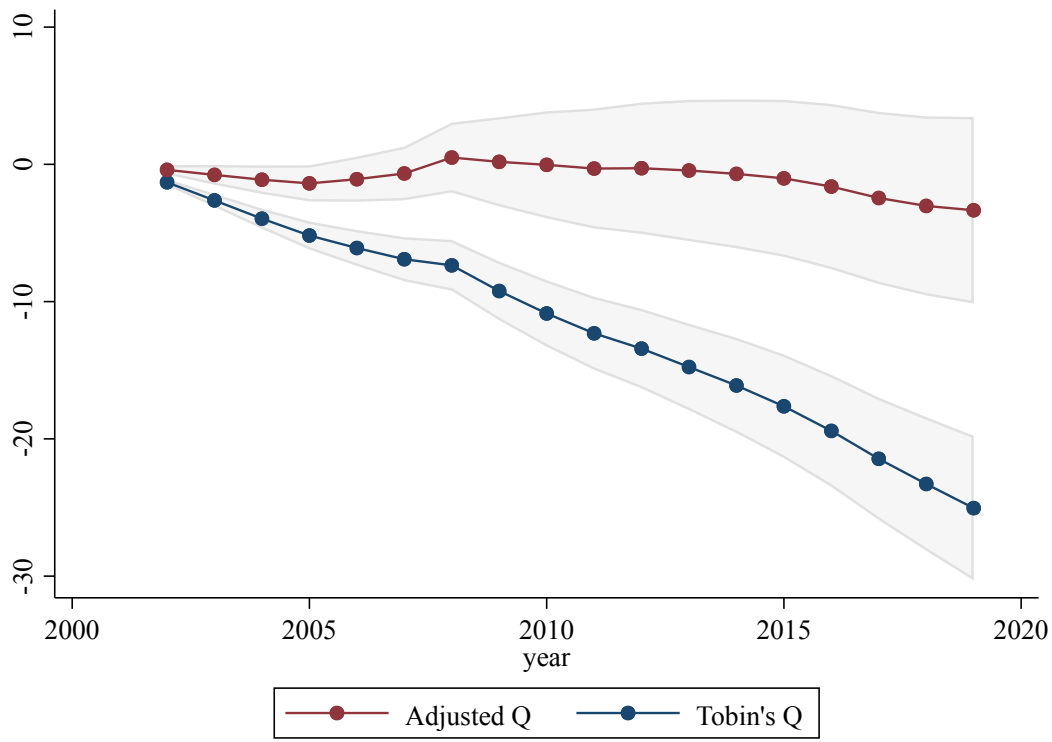


US Aggregate Investment Shortfall

Method of Gutiérrez and Philippon (2017)

- Estimate relation btw. Tobin's Q and investment for 1990-2002
- Predict investment for 2002-2019
- Deviation from prediction is "missing investment," $>$ 20% of capital

Adjusted Q largely accounts for investment dynamics



Investment and the Financial COC

General lesson: adjusted Q decouples investment from asset prices and interest rates

In a standard Q-model (Philippon 2009), a 1 ppt. shock to financial COC changes investment by:

- 25% with zero discount rate wedge
- 5% with observed average wedge

In theory, many shocks affect investment through the financial COC:

- equity and bond prices
- bank interest rates
- corporate taxes
- monetary policy
- etc.

Two channels: Wedges shorten cash flow duration and generate partial transmission

Drivers of Discount Rate Dynamics

1) Risk and real options

- When investment is irreversible and risky, investment is postponed (Abel and Eberly 1996, McDonald 2000, Bloom 2009)
- High wedges approximate the optimal timing
- $\Rightarrow$ Uncertainty and disaster risk affect wedges of irreversible firms (e.g., 2008 disaster risk spike)

	κ	$\kappa+\upsilon$
Risk	0.027	-0.90
	(1.86)	(1.59)
Risk*Irreversibility	8.29*	12.1**
	(4.09)	(4.86)
Observations	581	581
FE	Firm	Firm
Within R^2	0.03	0.06

Drivers of Discount Rate Dynamics

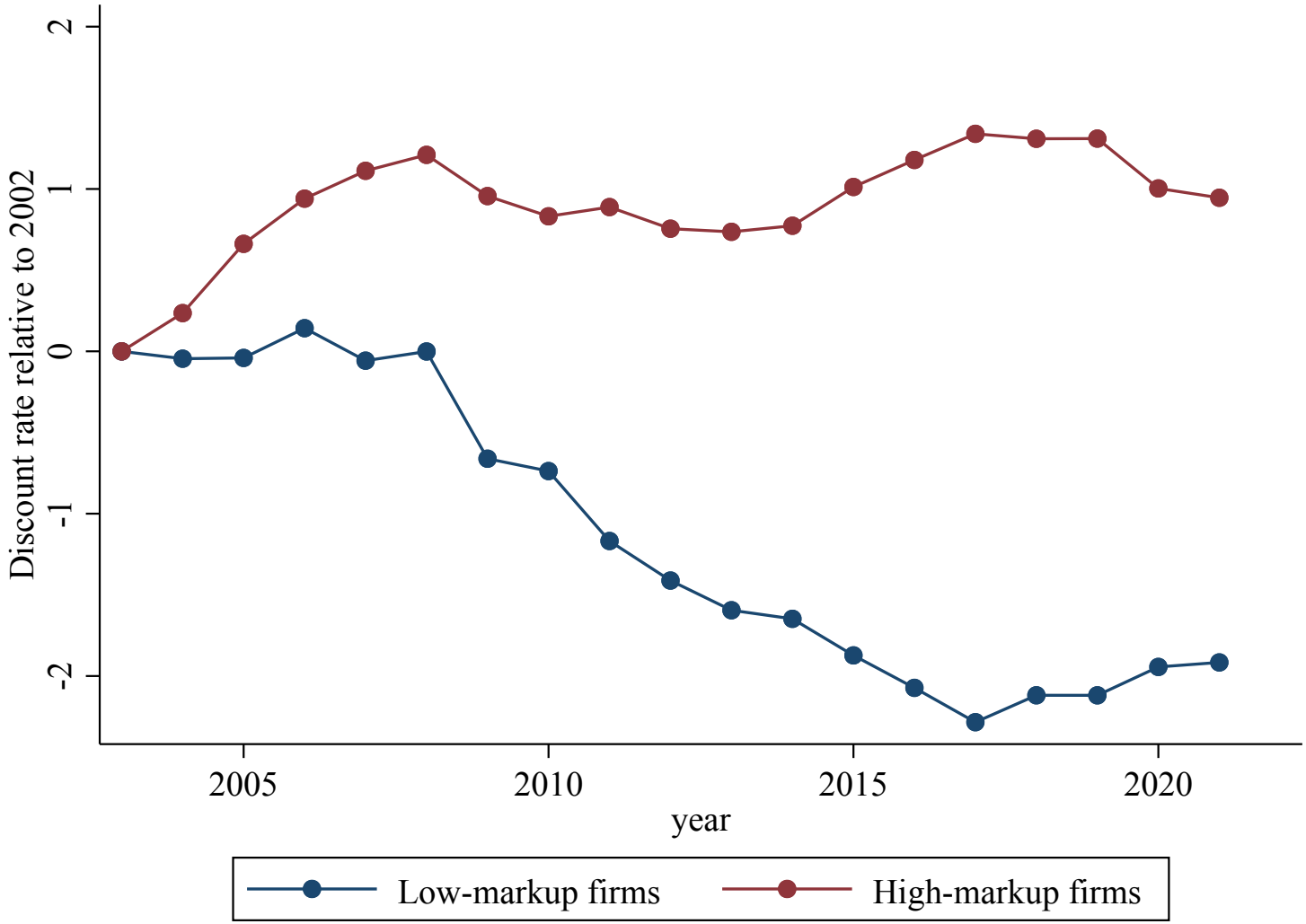
1) Risk and real options

- When investment is irreversible and risky, investment is postponed (Abel and Eberly 1996, McDonald 2000, Bloom 2009)
- High wedges approximate the optimal timing
- $\Rightarrow$ Uncertainty and disaster risk affect wedges of irreversible firms (e.g., 2008 disaster risk spike)

2) Market power

- Firms reduce rates when forced to by competition
- Managers prefer high rates, either to signal prudence (Jensen 1986) or because high returns are part of investors' sparse information set and salient (Gabaix 2014; Bordalo et al. 2022)
- 59% of managers believe that wedges "add value"
- $\Rightarrow$ High-market power firms responsible for secular rise in avg. wedge since 2002

Competition Forces Discount Rates To Fall



Average market power in 2000-02 measured using accounting profits/costs (Baqaee and Farhi 2020)

Competition Forces Discount Rates To Fall

	Discount rate (δ)		Disc. rate wedge (κ)		Both wedges ($\kappa+\upsilon$)	
Mkt. P. (2002)*	0.13**		0.12**		0.13**	
Year	(0.061)		(0.054)		(0.055)	
Mkt. P. (2002)*		-0.43**		-0.38**		-0.40**
Perc. COC		(0.19)		(0.18)		(0.19)
Observations	723	720	723	720	723	720
FE	Firm	Firm	Firm	Firm	Firm	Firm
Within R^2	0.11	0.044	0.056	0.023	0.049	0.021

Std. dev. increase in market power $\rightarrow$ discount rates by 2.5 ppt higher since 2002

High-market power firms are less likely to incorporate drops in perceived COC

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