A Market-Based Cost of Capital

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Motivation

One common definition of the cost of capital (CoC)

$$\text{CoC} = \text{Expected long-run return}$$

Vital input in financial and economic analysis

- Researchers: discount cash flows and discipline models
- Firms and investors: make investments and allocate capital

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Challenge: CoC unobserved, no available measures/methods

- Classical models are biased (e.g., CAPM)
- Newer models focus on short-run returns (e.g., Fama and French 2015; Gu, Kelly, and Xiu 2020)

This paper: New method that estimates expected long-run return out of sample and calculates the cost of capital

This Paper: A Market-Based Cost of Capital

1. New method for predicting long-run returns
   - Predict cash flows (CF) and infer expected returns (ER) from prices
   - Better than direct ER prediction out-of-sample
     - Why? Model for CF more stable than model for ER

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   - Global sample of $\sim$16,000 firms across 93 countries from 1950 to 2023
   - Predict firm cash flows using LightGBM
   - Outcome: out-of-sample estimates of long-run exp. returns (firm-level)

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   - Lower MSE than competing alternatives
4. A "market-based cost of capital" (MCC)
   - Firms whose perceived CoC is closer to the MCC have higher market values

Existing Literature

1. Return expectations

- Expectations deviate from rational benchmarks (Greenwood and Shleifer 2014; Coibion and Gorodnichenko 2015; Bordalo et al. 2020; Bianchi, Ludvigson, and Ma 2022; Jensen 2024; Bordalo et al. 2024; Bianchi et al. 2025)
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2. Long-run stock returns

– Does long-run predictability exist, and does it work out of sample? (Welch and Goyal 2008; Keloharju, Linnainmaa, and Nyberg 2021; van Binsbergen et al. 2023; Cho and Polk 2024)

– This paper: out-of-sample predictability at the 10-year horizon

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3. Finance in Practice

- How should firms and investors calculate CoC? How do they? (Stein 1996; Graham and Harvey 2001; Décaire and Graham 2024; Gormsen and Huber 2025; Hommel, Landier, and Thesmar 2025)
- This paper: an unbiased cost of capital firms can use — and evidence that using it is associated with higher market value

Methodology

Two Approaches to Estimating Long-Run Returns

Consider an equity claim to a cash flow paid out in one period

$$p_t = \frac{\mathbb{E}_t(CF_{t+1})}{1 + \mathbb{E}_t(r_{t+1})}$$

Expected returns and expected cash flows are driven by K state variables f_t

$$\begin{aligned}\mathbb{E}_t(r_{t+1}) &= \alpha^{\text{ER}} + \beta_t^{\text{ER}\prime} f_t \\ \mathbb{E}_t(CF_{t+1}) &= \alpha^{\text{CF}} + \beta^{\text{CF}\prime} f_t\end{aligned}$$

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$$\mathbb{E}_t(r_{t+1}) = \alpha^{\text{ER}} + \beta_t^{\text{ER}\prime} f_t$$
$$\mathbb{E}_t(CF_{t+1}) = \alpha^{\text{CF}} + \beta^{\text{CF}\prime} f_t$$

Two approaches to estimating $\mathbb{E}_t(r_{t+1})$:

1. **ER approach:** regress realized returns on f_t
2. **CF approach:** regress realized cash flows on f_t, back out exp. returns from prices

$$1 + \widehat{\mathbb{E}}_t^{\text{CF}}(r_{t+1}) = \frac{\widehat{\mathbb{E}}_t(CF_{t+1})}{p_t}$$

Two Approaches to Estimating Long-Run Returns

Assumption: asset pricing dynamics vary over time, cash flow dynamics are constant

$$\beta_t^{\mathrm{ER}} = \mu + \rho \left(\beta_{t-1}^{\mathrm{ER}} - \mu\right) + \eta_t, \qquad \eta_t \overset{iid}{\sim} \left(0, \sigma_\eta^2 I_K\right)$$

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Proposition 1

The MSE gain of the CF method over the ER method in the population is

$$\mathrm{MSE}^{\mathrm{ER}} - \mathrm{MSE}^{\mathrm{CF}} = K \ \mathrm{var}\left(\beta_t^{\mathrm{ER}}\right)$$

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Predictability gain when model for CF is more stable than model for ER

Caveats

- May not hold for short horizons
- Could model time-varying ER loading

Predicting Cash Flows

- We estimate a model with the form

$$y^i_{t+h} = f(X^i_t)$$

  where

X_t	382 firm characteristics from accounting, price, analyst, industry, and country data based on Jensen, Kelly, and Pedersen (2023)
$f(\cdot)$	A LightGBM machine learning model
y_{t+h}	Realized CF at year $t+1, \ldots, t+10$ (real NI and FCFE)

- Sample: data pooled across 93 countries (U.S. 1950–2023; non-U.S. 1985–2023)
- Out-of-sample period:
  - US: 1984–2023
  - Non-US: 1996–2023,

  with parameters re-estimated yearly

From Expected Cash Flows to Expected Returns

10-year explicit horizon, terminal value grows at constant rate g_t

$$p_t = \sum_{h=1}^{10} \frac{\mathbb{E}_t[\mathrm{CF}_{t+h}]}{(1 + r_t^{\text{equity}})^h} + \frac{\mathbb{E}_t[\mathrm{CF}_{t+10}](1 + g_t)}{r_t^{\text{equity}} - g_t} \frac{1}{(1 + r_t^{\text{equity}})^{10}}$$

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- g_t: country-specific forward real GDP growth (IMF)
- Solve for $r_t^{\mathrm{equity}} \in (g_t,\, 10\%)$
- Final estimate: average of the NI- and FCFE-based estimates

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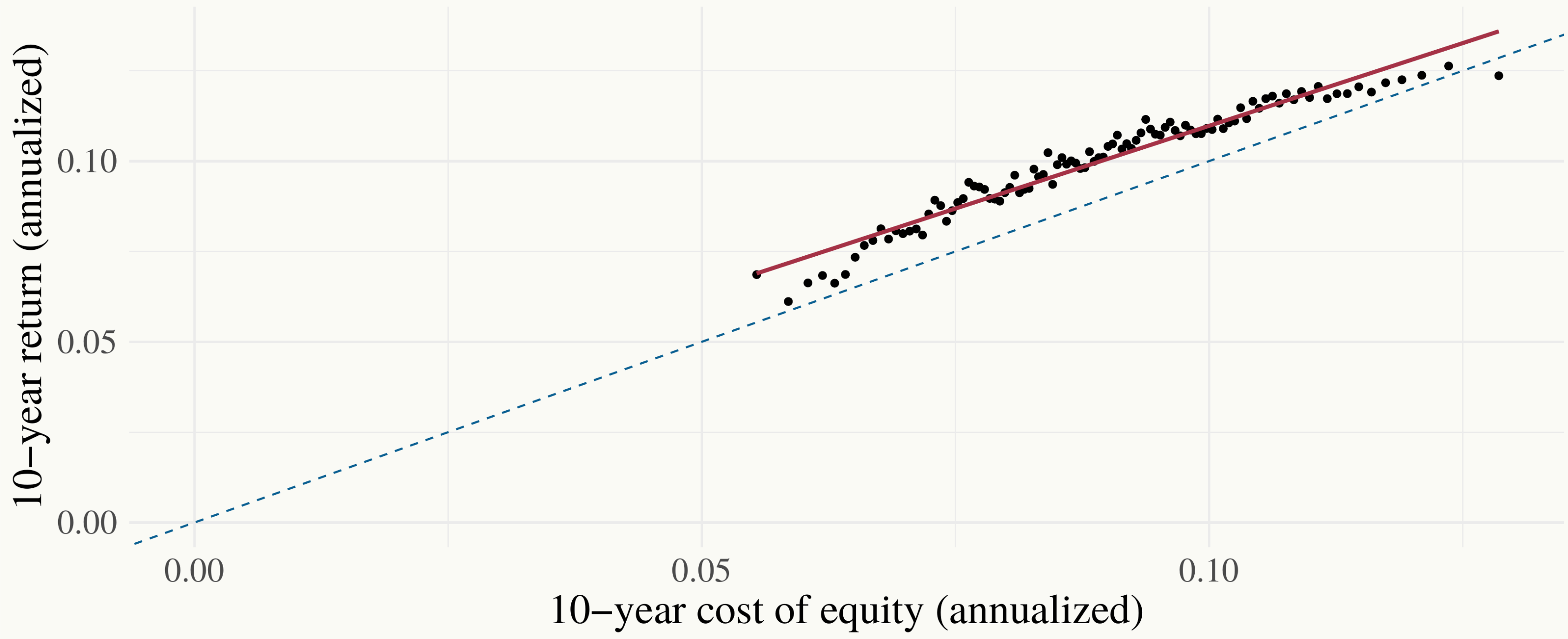
$\Rightarrow$ **The market-based cost of equity (MCE)**: the expected return that equates discounted expected cash flows with the observed market value

Testing the MCE

The MCE: an Unbiased Estimate of Returns

Each month, stocks are sorted into 100 portfolios on the MCE; realized returns over the next 10 years



Global stocks, 1983–2023. Both axes annualized.

The MCE: an Unbiased Estimate of Returns

Regressions of 10-year realized returns on the 10-year MCE (month fixed effects)

	10-year realized return		
	U.S.	Global	Global ex-U.S.
	(i)	(ii)	(iii)
Panel A: Regression estimates			
Cost of equity	0.93***	0.96***	1.01***
	(0.08)	(0.18)	(0.23)
Observations	1,106,464	2,610,489	1,504,025
Panel B: Predictive accuracy ($\alpha = 0$, $\beta = 1$)			
Avg. error	0.25	0.14	0.06
	(0.12)	(0.10)	(0.15)
OOS R^2_{CAPM} (%)	2.1	3.8	5.3
OOS R^2_{MKT} (%)	0.4	2.1	4.1
OOS R^2_{OWN} (%)	9.0	12.1	14.7

The MCE vs Alternatives

Machine-learned returns (MLR): predict returns directly

- Same LightGBM model and predictors as the MCE — only the target differs: 10-year returns instead of cash flows
- The empirical counterpart of the ER approach

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Implied cost of capital (ICC): back out expected returns from analyst forecasts

- CT (Claus and Thomas 2001), GLS (Gebhardt, Lee, and Swaminathan 2001), PEG (Easton 2004), OJ (Ohlson and Juettner-Nauroth 2005)
- Same valuation logic as the MCE — but cash flow forecasts from analysts

The MCE Versus Alternatives

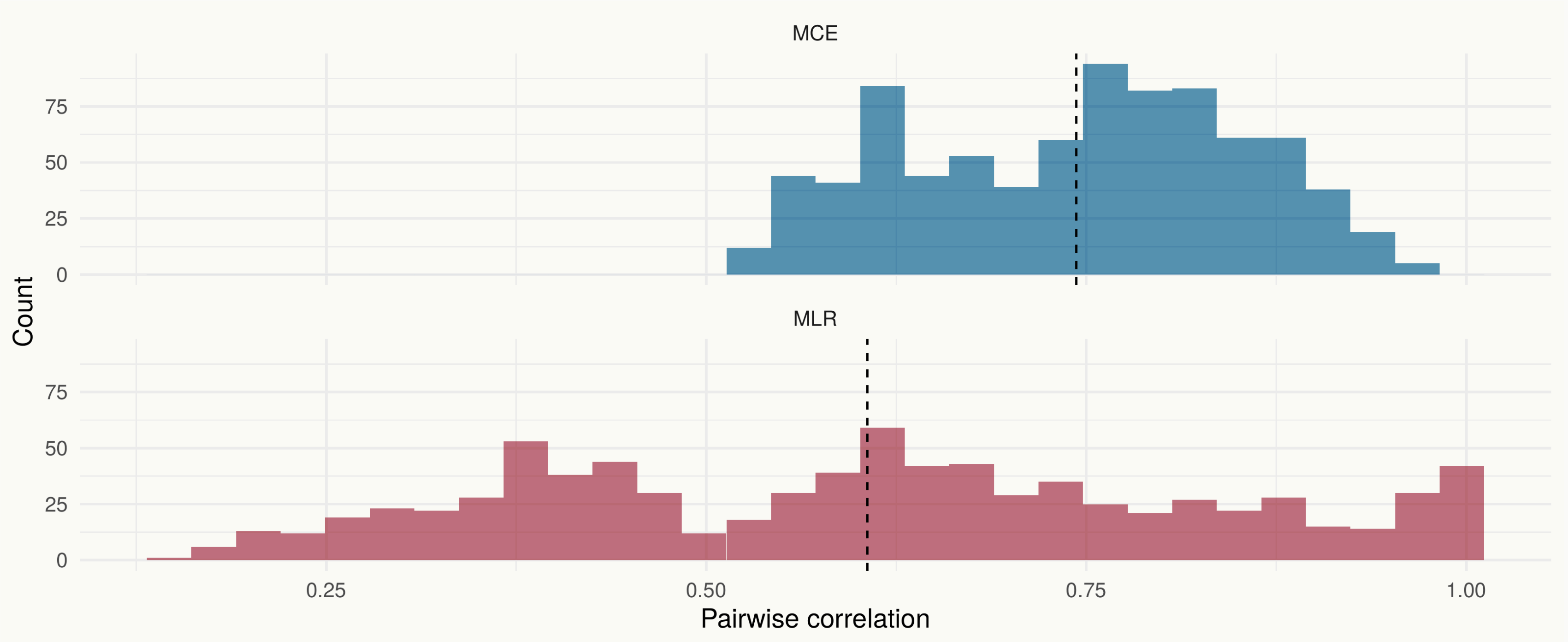
Regressions of 10-year realized returns on each cost of equity estimate (month FEs)

	LightGBM		Implied Cost of Capital			
	MCE	MLR	CT	GLS	PEG	OJ
Slope	0.96***	0.50***	0.11	0.38**	0.10	0.07
	(0.18)	(0.16)	(0.13)	(0.17)	(0.10)	(0.10)
ΔMSE relative to MCE	—	0.94	0.25	0.12	0.34	0.88
$p^{\mathrm{bs}}_{\mathrm{ind}}$		0.000	0.000	0.004	0.000	0.000
$p^{\mathrm{bs}}_{\mathrm{time}}$		0.004	0.093	0.109	0.048	0.010

– Only the MCE has a slope near 1, and all alternatives have larger MSE

The MCE Beats MLR: Model Stability

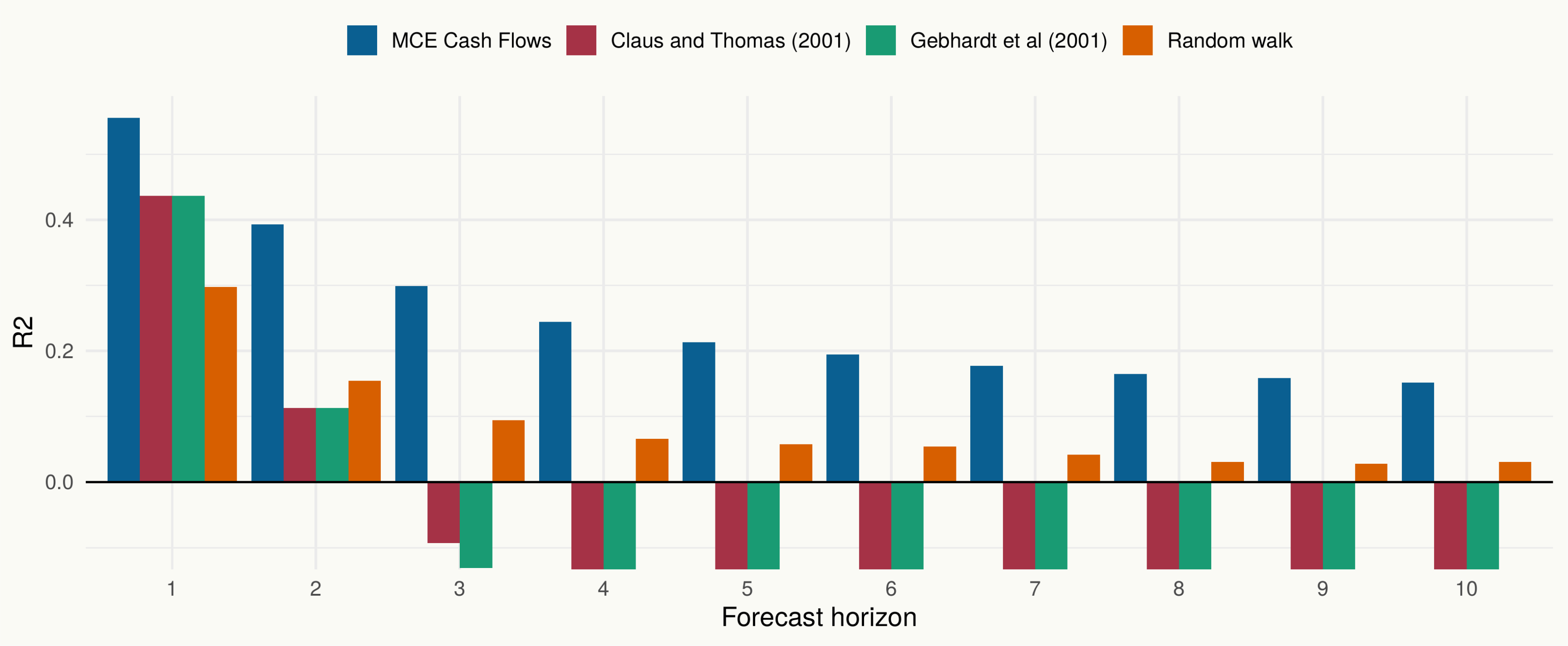
Predictions from every training vintage (1983, ..., 2023) applied to the same stocks; pairwise correlations between vintages



MCE predictions are similar across model vintages; MLR predictions are not
$\Rightarrow$ **the cash flow model is more stable**

The MCE Beats ICC: Better Cash Flow Estimates

Out-of-sample R^2 for net income forecasts at horizons 1–10 years



Does the MCE Capture Risk or Expectation Errors?

Panel regressions of risk and mispricing proxies on the MCE

- Risk: analyst risk ratings (Jensen 2024) and market beta
- Mispricing: earnings announcement returns (EAR) and realized and expected analyst forecast errors (FE, $\mathbb{E}[\mathbf{FE}]$)

	Risk			Mispricing		
	Morningstar	Value Line	Beta	EAR	FE	$\mathbb{E}[\mathbf{FE}]$
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
MCE	−0.08∗∗∗	−0.22∗∗∗	−0.13∗∗∗	0.10∗∗∗	0.66∗∗∗	1.08∗∗∗
	(0.02)	(0.01)	(0.01)	(0.01)	(0.05)	(0.05)
Observations	112,979	382,036	375,295	191,573	24,806	24,806
R^2	0.015	0.117	0.038	0.004	0.062	0.177

Time fixed effects; risk proxies standardized; SEs clustered by firm and time

The Market-Based Cost of Capital

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Insert the MCE into the weighted average cost of capital

$$\mathrm{MCC} = \frac{\mathrm{D}}{\mathrm{D+E}}\,(1-\tau)\,r_t^{\mathrm{debt}} + \frac{\mathrm{E}}{\mathrm{D+E}}\,r_t^{\mathrm{equity}}$$

- r_t^{equity}: the MCE
- r_t^{debt}: bond yields net of expected default losses
  - Projected on distance-to-default for firms without traded bonds
- Leverage from market equity and book debt; τ from effective tax rates

Using a Market-Based Cost of Capital

Standard theory: firms maximize market value by using expected returns as CoC

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Challenges

- Firms’ perceived CoC deviates from expected returns (Gormsen and Huber 2025)
- No estimate of long-run expected returns for firms to use — until now

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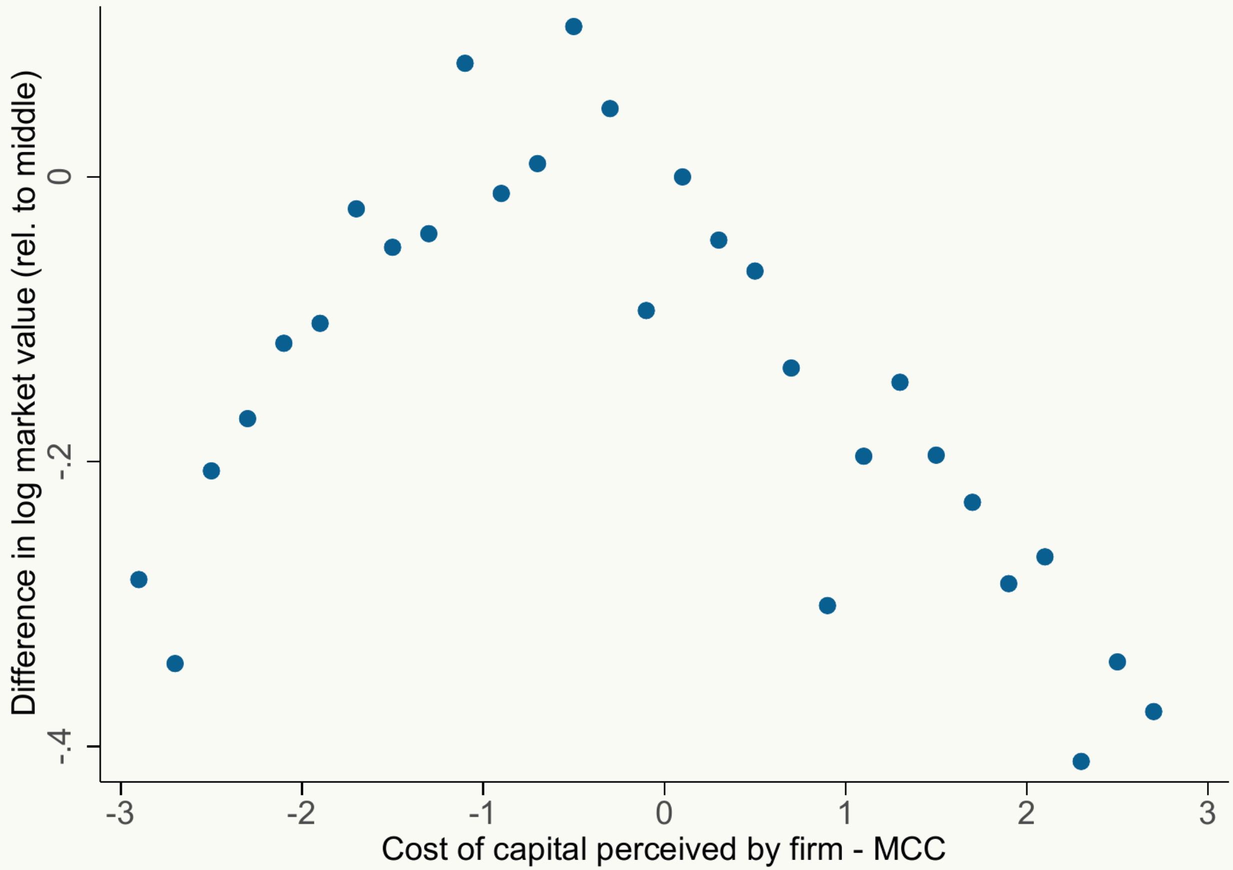
Prediction

- Firms with a perceived CoC closer to the MCC have higher market values
- Deviations destroy value: too low $\Rightarrow$ overinvest, too high $\Rightarrow$ underinvest

The Inverted U: Market Value and Deviations from the MCC

Log market value on bins of the cost of capital deviation (perc. CoC — MCC)



Book equity decile and quarter-by-country fixed effects

Stock Returns and Investment Announcements

Abnormal returns around new investment announcements on the CoC deviation

	(1)	(2)	(3)	(4)
	U.S.	Global	U.S.	Global
(Perc. CoC $-$ MCC) $>$ 0	0.199**	0.199**		
	(0.100)	(0.098)		
Perc. CoC $-$ MCC			0.032*	0.034*
			(0.019)	(0.019)
Observations	414	709	414	709
Within R^2	0.0121	0.0107	0.00472	0.00465

Book equity decile and quarter-by-country fixed effects

Conclusions

New method to calculate expected returns and firms' cost of capital: **the MCC**

- Theoretically preferable in setting with stable cash flows and volatile asset pricing dynamics
- Works in practice: unbiased OOS estimates and lower MSE than alternatives

The MCC can be used by

- **firms** that wish to maximize current market value
- **investors** that make long-run capital allocation decisions or valuations
- **researchers** that need unbiased estimates of expected long-run returns

Bonus: Method produces unbiased estimates of expected cash flows

Data to be shared soon!

Thank You!

APPENDIX

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