Markups, Production Technology, and the Cost of Capital

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Markup Measurement is a Big Open Issue

- Firm-level markups are key to a wide variety of economic phenomena
  - Static: Market power, misallocation
  - Dynamic: Investment, innovation, entry
- Increasingly popular approach applies cost shares

$$\mu = \frac{\text{Revenue}}{\text{Labor Costs} + \text{Capital Costs}}$$

- But! Current practice assumes firms have same cost of capital
- Even though finance shows **huge heterogeneity** in risk premia!

Solution: Finance Approach to Production Functions

- **What we do**
  - Measure firm-year risk premia with finance and accounting tools
  - Connect to production technology and markups
  - $\rightarrow$ highly granular measures of both!
- **Key empirical findings in Compustat**
  - Average markups stable ≈ 1.0 (not rising!)
  - But dispersion increasing, especially right tail
  - Financing advantages $\rightarrow$ high markups
- **Broader contribution: New approach for rich production heterogeneity**

Production-Based Markups: A New Hope for Heterogeneity

- Many economic models **need firm-year markups**
- How? $Y_{it} = F_{it}(L_{it}, K_{it})$, cost min implies

$$\mu_{it} = \theta_{it} \times \frac{\text{Revenue}_{it}}{\text{Labor Costs}_{it}}$$

- μ is the markup
- $\theta = \frac{\partial \log F}{\partial \log L}$ is the output elasticity for labor
- **Key challenge: identify θ!**

The Empirics Strike Back

- Standard approaches face severe challenges to measuring output elasticity θ
- **Underidentified for markups** (Flynn, Gandhi, and Traina 2019)
- **Fundamentally needs micro price data** (Bond et al. 2021)
- **Limited scope for heterogeneity** (Foster, Haltiwanger, and Tuttle 2024)

Return of the Cost Shares

- Growing consensus applies cost shares to solve these problems
- Under constant returns to scale

$$\theta_{it} = \frac{\text{Labor Costs}_{it}}{\text{Labor Costs}_{it} + \text{Capital Costs}_{it}}$$

$$\mu_{it} = \frac{\text{Revenue}_{it}}{\text{Labor Costs}_{it} + \text{Capital Costs}_{it}}$$

- **Challenge is measuring capital costs Capital Costs** $= R_{it}K_{it}$
- **This paper:** R_{it}

Cost of Capital Heterogeneity Matters

- **Biases are $\approx$ proportional!**
- 10% mismeasure in risk $\rightarrow$ $\approx$10% mismeasure in technology and markups
- Example calibration with different risk premia

Risk Premium	θ	μ
0.05	0.84	1.26
0.10	0.80	1.20
0.15	0.76	1.14
0.20	0.73	1.09

Measuring Firm-Specific Cost of Capital

- **Key insight: Use market prices to infer cost of capital**
- We use Implied Cost of Capital (ICC)

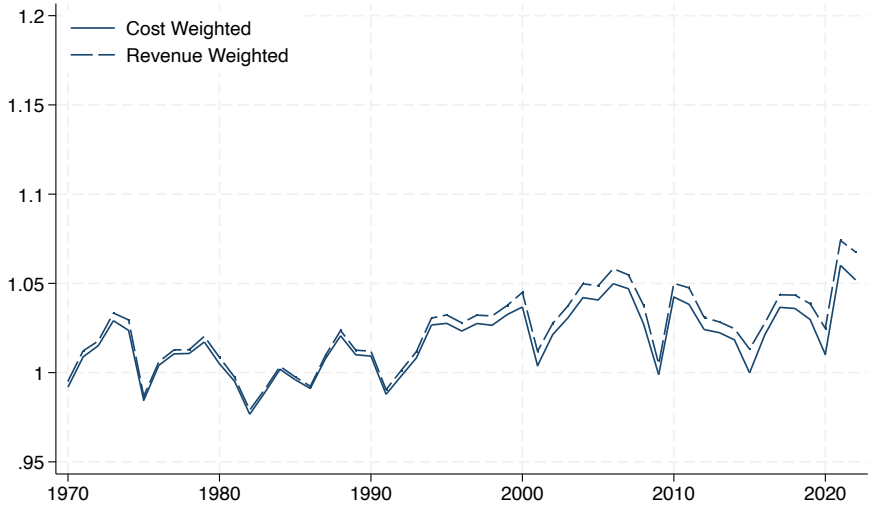
$$\text{Market Price}_{it} = \sum_{s=1}^{\infty} \frac{\mathbb{E}_t[\text{Earnings}_{i,t+s}]}{(1 + \text{ICC}_{it})^s}$$

- Solve for ICC_{it} that equates market price to expected earnings

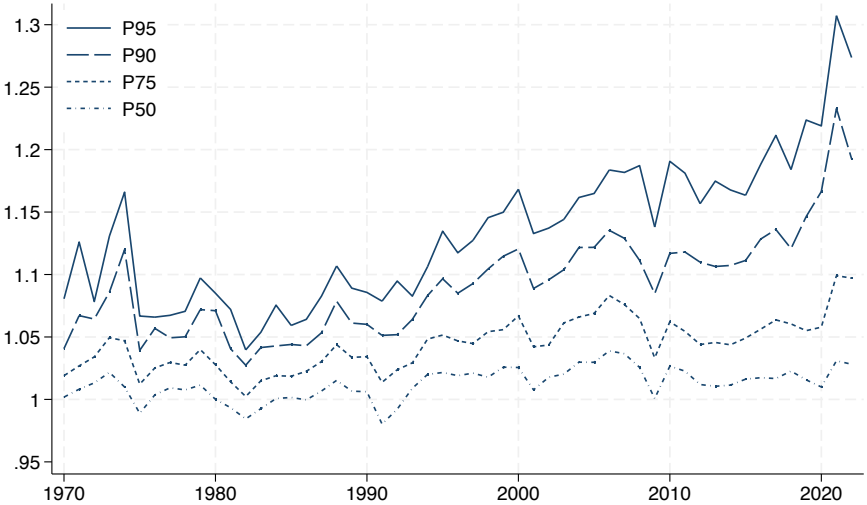
From Theory to Practice

- Follow established methods in accounting
  - Forecast earnings using cross-sectional model (Hou, van Dijk, and Zhang 2012)
  - Solve numerically for discount rate (Gebhardt, Lee, and Swaminathan 2001)
- Extensive validation in finance, e.g.,
  - Predicts returns out-of-sample (Pastor, Sinha, and Swaminathan 2008)
  - Predicts investment decisions (Frank and Shen 2016)
- Adjust for leverage, depreciation, and taxes (Hall and Jorgenson 1967)
- Apply to Compustat

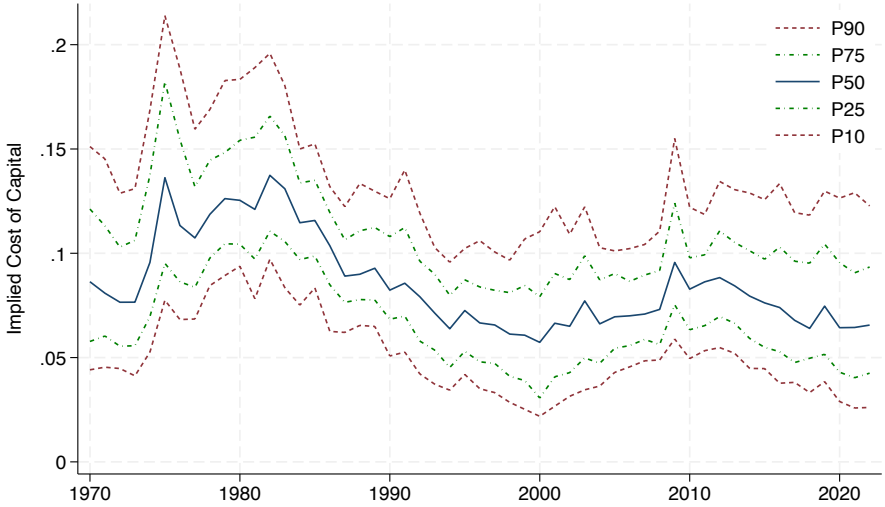
Average Markups Remain Stable Near 1



Rising Dispersion Still a Robust Fact



Big Heterogeneity in Cost of Capital



Cost of Capital Varies Wildly Within Industries

	Cost of Capital		
	(1)	(2)	(3)
Year FE	Yes	Yes	Yes
Industry FE		Yes	
Firm FE			Yes
Obs	161k	161k	161k
R^2	0.23	0.26	0.57

- Industry effects explain little variation
- Variation is about half firm, half firm-year!

Low Cost of Capital Predicts High Markup

	Log(Markup)		
	(1)	(2)	(3)
Cost of Capital	–0.001***	–0.003***	–0.005***
	(0.000)	(0.000)	(0.000)
Year FE	Yes	Yes	Yes
Industry FE		Yes	
Firm FE			Yes
Obs	161k	158k	158k
R^2	0.02	0.09	0.57

These Differences Are Persistent

Cost of Capital Persistence		
Cost of Capital$_{t-1}$	0.61***	0.34***
	(0.01)	(0.01)
Year FE	Yes	Yes
Firm FE	No	Yes
Obs	136k	134k
R^2	0.53	0.60

Markup Persistence		
Log(Markup)$_{t-1}$	0.78***	0.43***
	(0.01)	(0.01)
Year FE	Yes	Yes
Firm FE	No	Yes
Obs	136k	134k
R^2	0.53	0.62

Do Intangibles Drive Markups?

- Common hypothesis: Intangibles $\rightarrow$ Market power $\rightarrow$ High markups
- Our findings do not support this hypothesis:
  - R&D intensity negatively correlated with markups
  - Asset tangibility uncorrelated with markups

Takeaways

- **Approach**
  - Integrate firm-year implied cost of capital into cost-share markup estimation
  - $\rightarrow$ Rich heterogeneity in production technology and markups
- **Contribution**
  - New approach applying micro market-based capital costs to production
  - Superstar story = financing advantages