Systematic Risk and Measures of Monopoly Power

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Agenda

1. Purpose and Value
2. Theoretical Model
3. Previous Studies
4. Data
5. Measures of Power
6. Regressions
7. Robustness Checks
8. Conclusion

Why is the relationship between Risk and Monopoly Power important?

Why Relate Risk and Power?

- Understand firm decision making
  - Managers, risk, and reward
  - Interaction between risk and power
- Investors and valuation
  - How much is monopoly power worth?
- Better measures of power
  - Measuring risk is easy
  - Measuring monopolism is tricky

Relating Power and Risk

What is Monopoly Power?

- Excess profits
  - “Rents”
  - Value of firm exceeds inputs, or
  - Profits of firm exceed accounting costs and returns to investors
- Decisions impact output markets
  - “Price setter”

How Are Risk and Power Related?

- Firm makes choices under uncertainty
  - Output market
  - Input market
- Firms are risk-averse
- Monopolies might use their power to “hedge”
  - Constrict quantity *more* than usual to avoid loss
  - Protects profitability in bad times, sacrifice profit in good times
  - Competitive firms can’t do this because they don’t have the market power to make it work

Previous Models

- Popular topic in the 1980s and 1990s
- Half a dozen independent models
- Shared similarities
  - Single period model of the firm under uncertainty
- Cornerstone: Subrahmanyam and Thomadakis (1980)
- Consistent negative association
  - $\uparrow$ Monopoly Power $\Rightarrow$ $\downarrow$ Systematic Risk

My Model

Connecting Monopoly Power and Systematic Risk

Overview of Model

- Single period model of firm
- Uncertain demand
- Firm is risk-averse
- Firm chooses quantity
- No defined market or competitors
  - Not like Cournot or Bertrand
- Emphasis on simplicity
  - ...for my sake

Without Uncertainty

- Linear Demand
  - Rotates around the efficient quantity q_{ie}
- Constant Marginal Cost
- Firm chooses Quantity

Demand

$$\mathbb{E}[P_i(q_i)] = (b_i q_{ie} + c_i) - b_i q_i$$

where q_{ie} is q_i such that $P_i = c_i$

Profit

$$\mathbb{E}[\Pi_i(q_i)] = q_i((b_i q_{ie} + c_i) - b_i q_i - c_i)$$

Without Uncertainty

- Linear Demand
  - Rotates around the efficient quantity q_{ie}
- Constant Marginal Cost
- Firm chooses Quantity

Monopoly power appears in $\boldsymbol{b_i}$.

$\uparrow \boldsymbol{b_i} \Rightarrow \uparrow$ Monopoly Power

Demand

$$\mathbb{E}[P_i(q_i)] = (\boxed{b_i} q_{ie} + c_i) - \boxed{b_i} q_i$$

where q_{ie} is q_i such that $P_i = c_i$

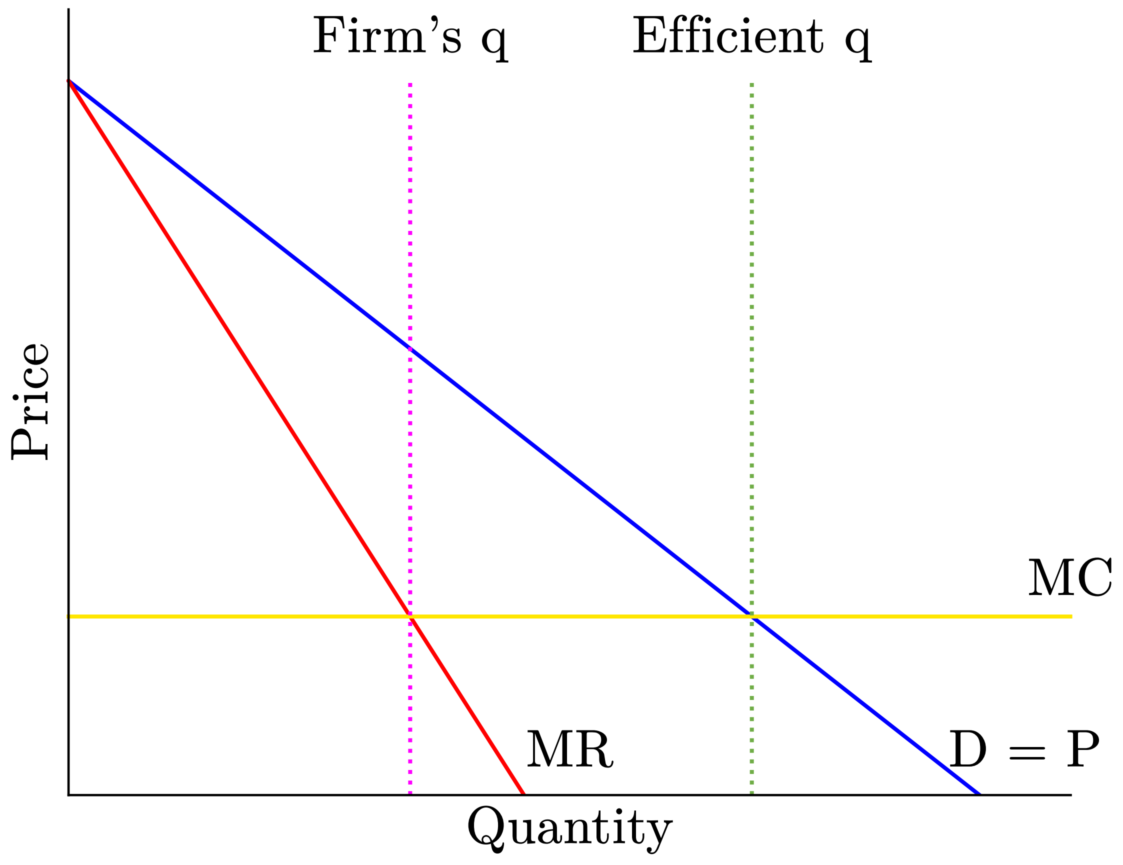
Profit

$$\mathbb{E}[\Pi_i(q_i)] = q_i((\boxed{b_i} q_{ie} + c_i) - \boxed{b_i} q_i - c_i)$$

Without Uncertainty

- Linear Demand
  - Rotates around the efficient quantity q_{ie}
- Constant Marginal Cost
- Firm chooses Quantity

Slope of demand is $-\boldsymbol{b}_i$.



Introducing Uncertainty

- Demand exposed to systematic risk
- Simple exogenous shock
- Economy-wide source of risk
- Firm chooses q_i before it knows e

Uncertain Demand

$$P_i(q_i) = (b_i q_{ie} + c_i)(1+e) - b_i q_i$$

Exogenous Shock

$$\mathbb{E}(e) = 0 \quad \mathrm{Var}(e) = \sigma^2$$

Profit under Uncertainty

Uncertain Demand

$$P_i(q_i) = (b_i q_{ie} + c_i)\boxed{(1 + e})- b_i q_i$$

Uncertain Profit

$$\Pi_i(q_i) = q_i\left((b_i q_{ie} + c_i)\boxed{(1 + e})- b_i q_i - c_i\right)$$

Variance of Profit

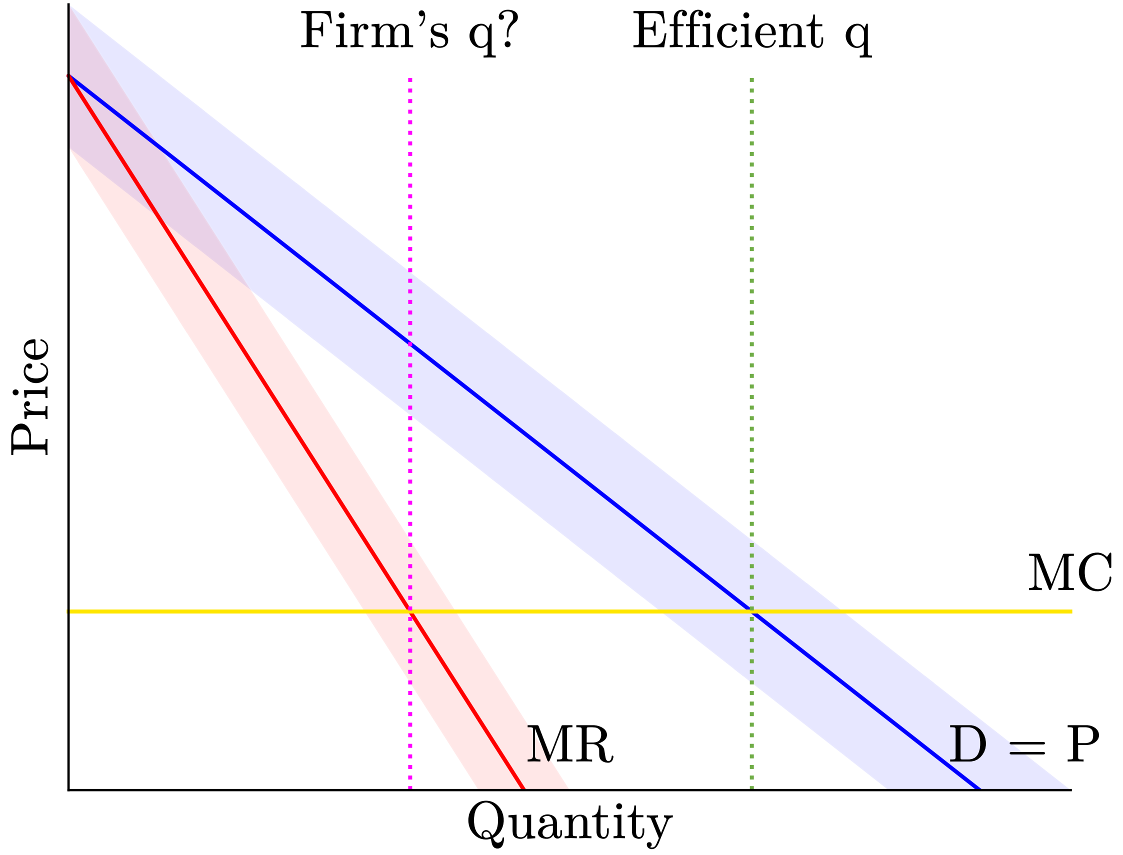
$$\mathrm{Var}(\Pi_i) = q_i^2 (b_i q_{ie} + c_i)^2 \boxed{\sigma^2}$$

Firm Under Uncertainty

- *Uncertain* Linear Demand
- Constant Marginal Cost
- Firm chooses Quantity

$\text{Var}(D) = \text{Var}(MR) = (b_i q_{ie} + c_i)^2 \sigma^2$.

Slope of demand is $-\boldsymbol{b_i}$.



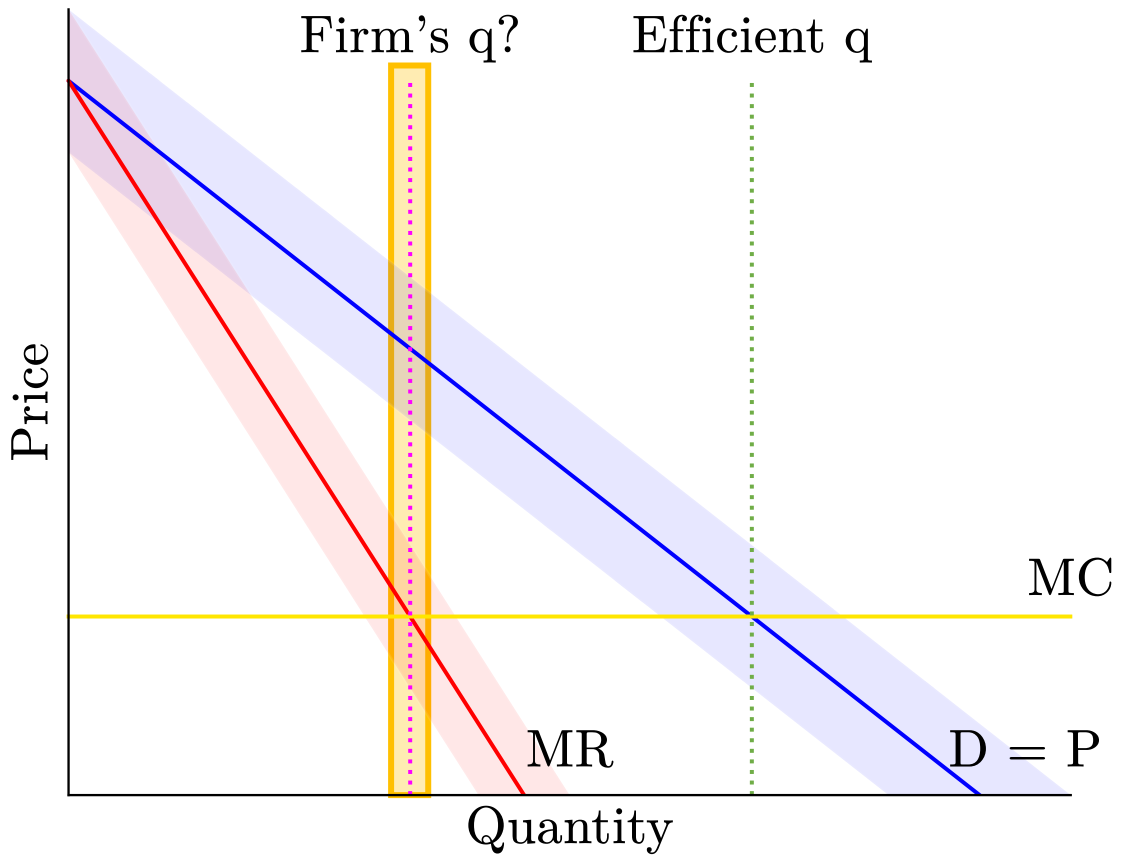
Firm Under Uncertainty

- *Uncertain* Linear Demand
- Constant Marginal Cost
- Firm chooses Quantity

$\mathrm{Var}(D)=\mathrm{Var}(MR)=(b_i q_{ie}+c_i)^2\sigma^2.$

Slope of demand is $-\boldsymbol{b_i}$.

But do we know the ***firm's q****?*



Mean-Variance Utility

Investors dislike variance.

Firm managers reflect investors' preferences. Directors specifically have a fiduciary responsibility to represent owners.

Firm is managed with risk-aversion—a common assumption in this area of economics.

Mean-Variance Utility

$$U_i(q_i) = \mathbb{E}[\Pi_i(q_i)] - \mu_i \mathrm{Var}(\Pi_i)$$

$$\max_{q_i} \mathbb{E}[\Pi_i(q_i)] - \mu_i \mathrm{Var}(\Pi_i)$$

Mean-Variance Utility

Investors dislike variance.

Firm managers reflect investors' preferences. Directors specifically have a fiduciary responsibility to represent owners.

Firm is managed with risk-aversion—a common assumption in this area of economics.

$\boldsymbol{\mu}_i$ *is risk-aversion coefficient.*

Mean-Variance Utility

$$U_i(q_i) = \mathbb{E}[\Pi_i(q_i)] - \boxed{\mu_i}\mathrm{Var}(\Pi_i)$$

$$\max_{q_i} \mathbb{E}[\Pi_i(q_i)] - \boxed{\mu_i}\mathrm{Var}(\Pi_i)$$

Solving for Quantity

$$\max_{q_i} \mathbb{E}[\Pi_i(q_i)] - \mu_i \mathrm{Var}(\Pi_i)$$

Solving for Quantity

$$\max_{q_i} \mathbb{E}[\Pi_i(q_i)] - \mu_i \mathrm{Var}(\Pi_i)$$

Firm's Optimal Quantity

$$q_i = \frac{b_i q_{ie}}{2(\mu_i b_i^2 q_{ie}^2 + \sigma^2 + 2\mu_i b_i q_{ie} \sigma^2 + b_i + \mu_i c_i^2 \sigma^2)}$$

Solving for Quantity

$$\max_{q_i} \mathbb{E}[\Pi_i(q_i)] - \mu_i \mathrm{Var}(\Pi_i)$$

Firm's Optimal Quantity

$$q_i = \frac{b_i q_{ie}}{2(\mu_i b_i^2 q_{ie}^2 + \sigma^2 + 2\mu_i b_i q_{ie} \sigma^2 + b_i + \mu_i c_i^2 \sigma^2)}$$

From this solution, we have three theorems.

Uncertainty and Quantity

Theorem 1

$$\frac{\delta q_i}{\delta \sigma^2} < 0$$

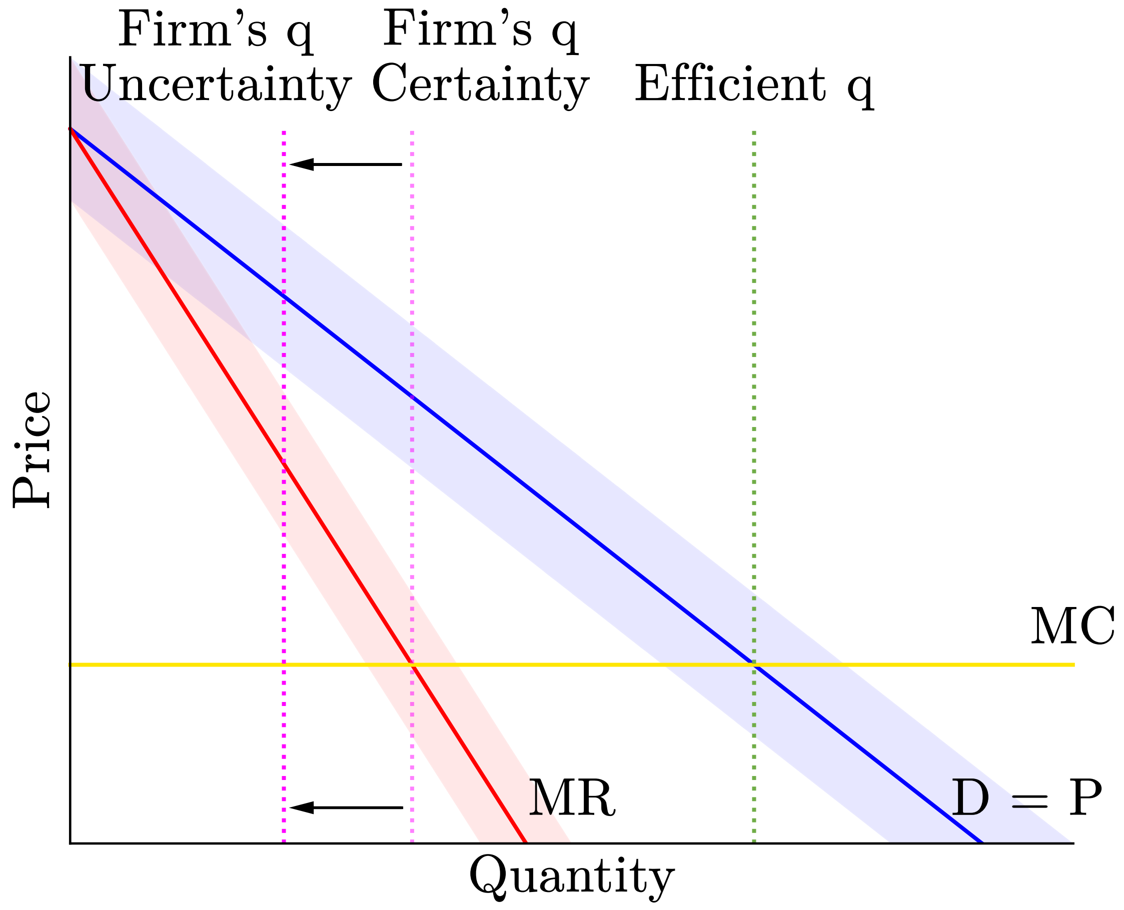
Uncertainty and Quantity

Theorem 1

$$\frac{\delta q_i}{\delta \sigma^2} < 0$$

$$q_i = \frac{b_i q_{ie}}{2(\mu_i b_i^2 q_{ie}^2 + \boxed{\sigma^2} + 2\mu_i b_i q_{ie} \boxed{\sigma^2} + b_i + \mu_i c_i^2 \boxed{\sigma^2})}$$

Uncertainty and Quantity



Power and Quantity

Theorem 2

$$b_i q_{ie} - c_i > 0 \Rightarrow \frac{\delta q_i}{\delta b_i} < 0$$

Power and Quantity

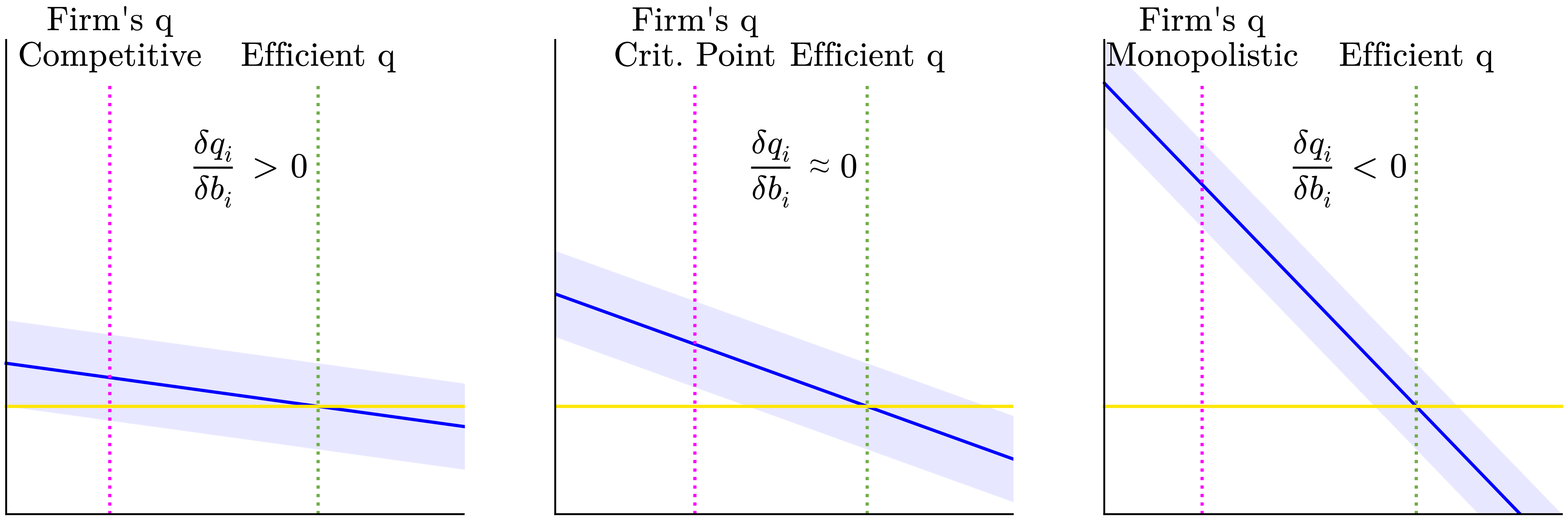
Theorem 2

$$b_i q_{ie} - c_i > 0 \Rightarrow \frac{\delta q_i}{\delta b_i} < 0$$

$$\frac{\delta q_i}{\delta b_i} = \frac{-\mu_i q_{ie} \sigma^2 (b_i q_{ie} - c_i)(b_i q_{ie} + c_i)}{2(\mu_i b_i^2 q_{ie}^2 + \sigma^2 + 2\mu_i b_i q_{ie} \sigma^2 + b_i + \mu_i c_i^2 \sigma^2)^2}$$

Power and Quantity

The firm needs some monopoly power to produce.
Relationship between b_i and q_i not monotonic.



In a competitive market, power results in increased production.
After demand intercept $> 2\times c_i$, power results in lower q_i.

Power and Quantity

Theorem 3

$$\frac{\delta \Pi_i}{\delta b_i} > 0$$

Power and Quantity

Theorem 3

$$\frac{\delta \Pi_i}{\delta b_i} > 0$$

$$\frac{\delta \Pi_i}{\delta b_i} = \frac{b_i q_{ie}^2 \left(4b_i^3 c_i \mu_i^2 q_{ie}^3 \sigma^4 + 3b_i^3 \mu_i q_{ie}^2 \sigma^2 + 12b_i^2 c_i^2 \mu_i^2 q_{ie}^2 \sigma^4 + 6b_i^2 c_i \mu_i q_{ie} \sigma^2 + b_i^2 + 12b_i c_i^3 \mu_i^2 q_{ie} \sigma^4 + 3b_i c_i^2 \mu_i \sigma^2 + 4c_i^4 \mu_i^2 \sigma^4\right)}{4\left(b_i^2 \mu_i q_{ie}^2 \sigma^2 + 2b_i c_i \mu_i q_{ie} \sigma^2 + b_i + c_i^2 \mu_i \sigma^2\right)^3}$$

Systematic Risk (Beta)

Real-Life Beta

$$\beta_i = \frac{\mathrm{Cov}(r_i - r_f, r_m - r_f)}{\mathrm{Var}(r_m - r_f)}$$

Single-Period Beta

$$\beta_i = \frac{\mathrm{Cov}(\Pi_i, \Pi_m)}{\mathbb{E}[\Pi_i]} \times \frac{\mathbb{E}[\Pi_m]}{\mathrm{Var}(\Pi_m)}$$

Market Variables

Single-Period Beta

$$\beta_i = \frac{\mathrm{Cov}(\Pi_i, \boxed{\Pi_m})}{\mathbb{E}[\Pi_i]} \times \boxed{\frac{\mathbb{E}[\Pi_m]}{\mathrm{Var}(\Pi_m)}}$$

Aggregate Profits

$$\boxed{\Pi_m} = \sum_j \Pi_j = q_m(A_m(1+e) - b_m q_m - c_m)$$

$$\boxed{\mathrm{Var}(\Pi_m)} = q_m^2 A_m^2 \sigma^2$$

Shared Source of Uncertainty

Single-Period Beta

$$\beta_i = \frac{\mathrm{Cov}(\Pi_i, \Pi_m)}{\mathbb{E}[\Pi_i]} \times \frac{\mathbb{E}[\Pi_m]}{\mathrm{Var}(\Pi_m)}$$

Aggregate Profits

$$\Pi_m = \sum_j \Pi_j = q_m(A_m(1 + \boxed{e}) - b_m q_m - c_m)$$

$$\mathrm{Var}(\Pi_m) = q_m^2 A_m^2 \boxed{\sigma^2}$$

Covariance of Firm and Market

Single-Period Beta

$$\beta_i = \frac{\boxed{\mathrm{Cov}(\Pi_i, \Pi_m)}}{\mathbb{E}[\Pi_i]} \times \frac{\mathbb{E}[\Pi_m]}{\mathrm{Var}(\Pi_m)}$$

$$\boxed{\mathrm{Cov}(\Pi_i, \Pi_m)} = q_i(b_i q_{ie} + c_i) q_m A_m \sigma^2$$

Solving for Beta

$$\beta_i = \frac{q_i(b_i q_{ie} + c_i) q_m A_m \sigma^2}{q_i((B_i q_{ie} + c_i) - b_i q_i - c_i)} \times \frac{\mathbb{E}[\Pi_m]}{q_m^2 A_m^2 \sigma^2}$$

$$\beta_i = \frac{(b_i q_{ie} + c_i)}{(B_i q_{ie} + c_i) - b_i(\frac{b_i q_{ie}}{2(\mu_i b_i^2 q_{ie}^2 + \sigma^2 + 2\mu_i b_i q_{ie}\sigma^2 + b_i + \mu_i c_i^2 \sigma^2)}) - c_i} \times \frac{\mathbb{E}[\Pi_m]}{q_m^2 A_m^2 \sigma^2}$$

$$\beta_i = \frac{2\mathbb{E}[\Pi_m]\left(b_i q_{ie} + c_i\right)\left(b_i^2 \mu_i q_{ie}^2 \sigma^2 + 2 b_i c_i \mu_i q_{ie} \sigma^2 + b_i + c_i^2 \mu_i \sigma^2\right)}{A_m b_i q_{ie} q_m \left(2 b_i^2 \mu_i q_{ie}^2 \sigma^2 + 4 b_i c_i \mu_i q_{ie} \sigma^2 + b_i + 2 c_i^2 \mu_i \sigma^2\right)}$$

Solving for Beta

$$\beta_i = \frac{q_i(b_i q_{ie} + c_i) q_m A_m \sigma^2}{q_i((B_i q_{ie} + c_i) - b_i q_i - c_i)} \times \frac{\mathbb{E}[\Pi_m]}{q_m^2 A_m^2 \sigma^2}$$

$$\beta_i = \frac{(b_i q_{ie} + c_i)}{(B_i q_{ie} + c_i) - b_i(\frac{b_i q_{ie}}{2(\mu_i b_i^2 q_{ie}^2 + \sigma^2 + 2\mu_i b_i q_{ie} \sigma^2 + b_i + \mu_i c_i^2 \sigma^2)}) - c_i} \times \frac{\mathbb{E}[\Pi_m]}{q_m^2 A_m^2 \sigma^2}$$

$$\boxed{\beta_i = \frac{2\mathbb{E}[\Pi_m]\left(b_i q_{ie} + c_i\right)\left(b_i^2 \mu_i q_{ie}^2 \sigma^2 + 2 b_i c_i \mu_i q_{ie} \sigma^2 + b_i + c_i^2 \mu_i \sigma^2\right)}{A_m b_i q_{ie} q_m \left(2 b_i^2 \mu_i q_{ie}^2 \sigma^2 + 4 b_i c_i \mu_i q_{ie} \sigma^2 + b_i + 2 c_i^2 \mu_i \sigma^2\right)}}$$

Beta and Monopoly Power

Theorem 4

$$\frac{\delta \beta_i}{\delta b_i} < 0$$

Beta and Monopoly Power

Theorem 4

$$\frac{\delta \beta_i}{\delta b_i} < 0$$

$$\frac{\delta \beta_i}{\delta q_i} = -\frac{2\Pi_m \left(2b_i^4 c_i \mu_i^2 q_{ie}^4 \sigma^4 + b_i^4 \mu_i q_{ie}^3 \sigma^2 + 8b_i^3 c_i^2 \mu_i^2 q_{ie}^3 \sigma^4 + 4b_i^3 c_i \mu_i q_{ie}^2 \sigma^2 + 12b_i^2 c_i^3 \mu_i^2 q_{ie}^2 \sigma^4 + 5b_i^2 c_i^2 \mu_i q_{ie} \sigma^2 + b_i^2 c_i + 8b_i c_i^4 \mu_i^2 q_{ie} \sigma^4 + 2b_i c_i^3 \mu_i \sigma^2 + 2c_i^5 \mu_i^2 \sigma^4\right)}{A_m b_i^2 q_{ie} q_m \left(2b_i^2 \mu_i q_{ie}^2 \sigma^2 + 4b_i c_i \mu_i q_{ie} \sigma^2 + b_i + 2c_i^2 \mu_i \sigma^2\right)^2}$$

Beta and Monopoly Power

Systematic risk is negatively *related to monopoly power.*

The relationship is not linear.

This finding is consistent with previous theory from Subrahmanyam & Thomadakis (1980), Booth (1980), and Lee, Thomas, & Rahman (1990).

Beta and Power

Could risk and power be positively *related?*

Beta and Power

Could risk and power be positively *related?*

Literature is not unanimous.

Beta and Power

Beta and monopoly power could have a *positive* relationship due to...

- Risk as a barrier to entry
  - Bustamante & Donangelo (2017)
- Monopolies absorb all the variance of demand
  - Abdoh & Varela (2017)
- Reward should match risk
  - Competitive firms have low rewards, so they should be less risky
  - Monopolistic firms' excess rents imply higher risk

Literature Review

Empirical Works

Empirical Papers

Negative Relationship

- Sullivan (1978, 1982)
  - Concentration (HHI)
- Alexander & Thistle (1999)
  - Concentration (4-Firm)
  - Insignificant HHI Relationship
  - Claim that firm-level regressions are not reliable
  - Inverse U-shape?
- Hollstein et al. (2023)
  - "Total product market similarity" and HHI

Positive or No Relationship

- Abdoh & Varela (2017)
  - C-CAPM as risk
  - Concentration (HHI)
- Jose & Stevens (1987)
  - Concentration & Barriers
- Stevens (1986)
  - Tobin's q ratio
- Abdoh & Varela (2017)
  - Competition (HHI) and tariffs
  - Fama-French risk models

Empirical Papers

Negative Relationship

- Booth & Zhou (2015)
  - Connects power to dividend policy via business risk
  - HHI and "Lerner" (actually EBITDA margin)
  - Also examines import competition

Positive or No Relationship

- Bustamante & Donangelo (2017)
  - Threat of new entry lowers exposure to systematic risk
  - Higher risk is a barrier to entry
  - HHI and "Characteristics-based concentration" (modified HHI)

Empirical Papers

Empirical studies disagree because...

- Different measures of monopoly power
- Different datasets
- Different empirical strategies

My Contribution

My paper adds to the literature by comparing several measures of monopoly power with the same data, resulting in an apples-to-apples comparison.

I also use the Lerner index, unused by previous studies, which is more theoretically rigorous.

Data

Wharton Research Database

- CompustatIQ
- Quarterly financial data
  - Revenues, earnings, costs, taxes, assets, debt, etc.
- Monthly stock price data
  - Total return and price return
  - I use total return to calculate systematic risk
- My subset includes only US non-financial firms
- Used commonly in literature

Basic Filtering

To be included in any analysis, a firm must

- be public for 5 consecutive years from 1976 to 2022,
- have a 5-year monthly CAPM beta during that interval,
- have revenue values greater than 0,
- have a market capitalization greater than 0.

Filtered Data

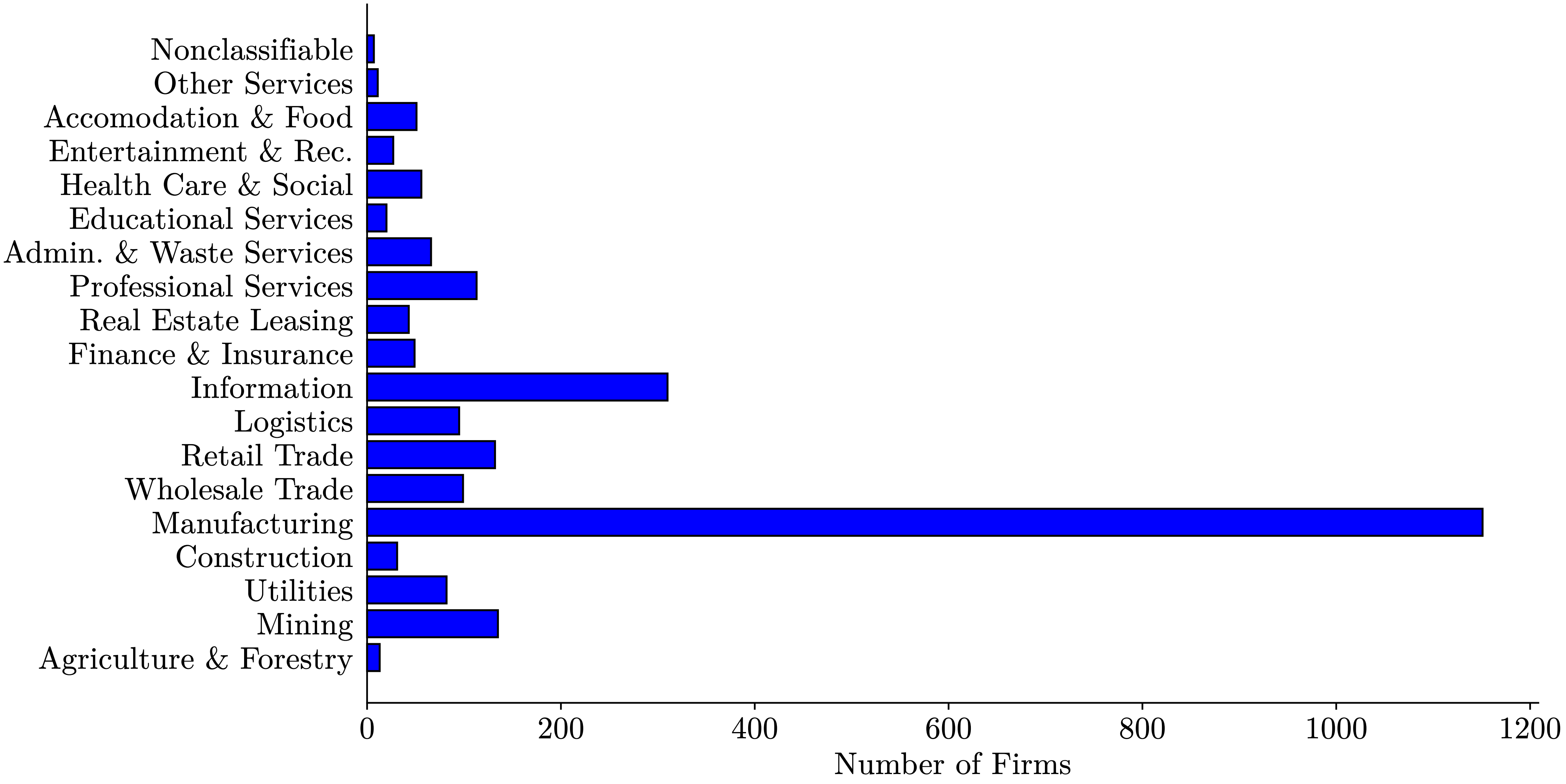
- Public for 5 consecutive years from 2007 to 2022
  - Observations from end of 2012 to 2022
- Statistics within the middle 90% of the data
  - Unlevered CAPM Beta
  - Price-Cost Margin
  - EBIT Margin
  - Lerner
- Assets greater than zero
- Market capitalization greater than $25 million
- Valid current ratio

I perform analysis on this dataset.

Filtering Process

Filter	Remaining Observations	Remaining Firms
Dataset after Basic Filtering	419,238	11,879
Assets > \$0	416,014	11,862
Market Cap > \$25 Million	341,665	10,264
Year >= 2012	159,891	6,547
EBIT Margin < 90th or > 10th Percentiles	329,963	10,758
Unlevered Beta < 90th or > 10th Percentiles	186,953	7,091
Lerner < 90th or > 10th Percentiles	78,584	3,732
Price-Cost Margin < 90th or > 10th Percentiles	278,299	9,623
Valid Current Ratio	366,795	10,776
Combined Filters	45,349	2,491

Remaining Firms by Industry

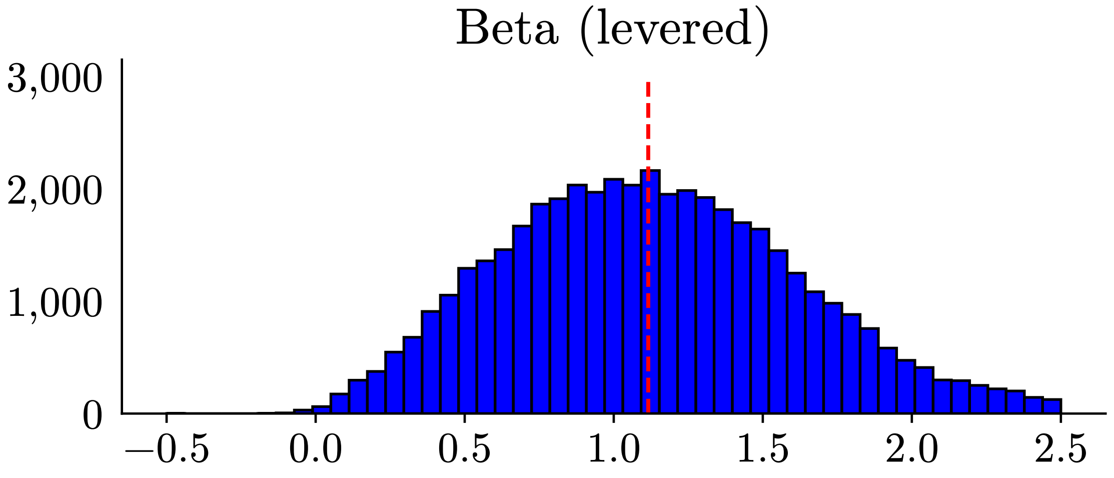


Betas

Calculating Beta

- Explanation by the S&P 500
- 252-day rolling regressions
- β>1, higher systematic risk
- β<1, lower systematic risk

Levered Beta	
Count	45,349
Mean	1.163
Std. Dev	0.574
Minimum	-0.489
25th Percentile	0.771
Median	1.116
75th Percentile	1.484
Maximum	20.050



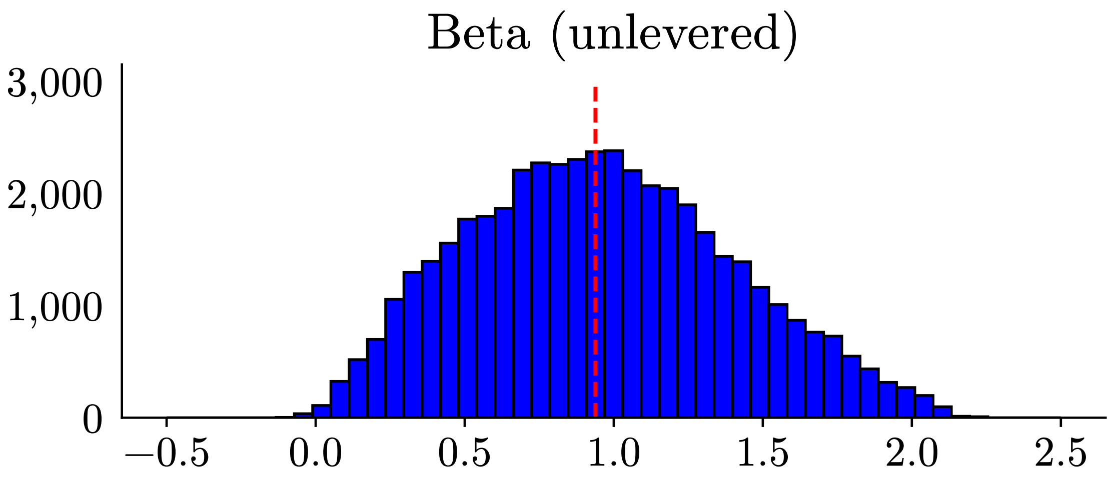
Unlevered Beta

- Explanation by the S&P 500
- 252-day rolling regressions
- β>1, higher systematic risk
- β<1, lower systematic risk
- Unlevered beta adjustment used in the literature and by practitioners
  - Jose & Stevens, 1987

Unlevered Beta

$$\beta_{UL} = \frac{\beta_L}{1 + (1 - \tau)(\frac{\text{Debt}}{\text{Equity}})}$$

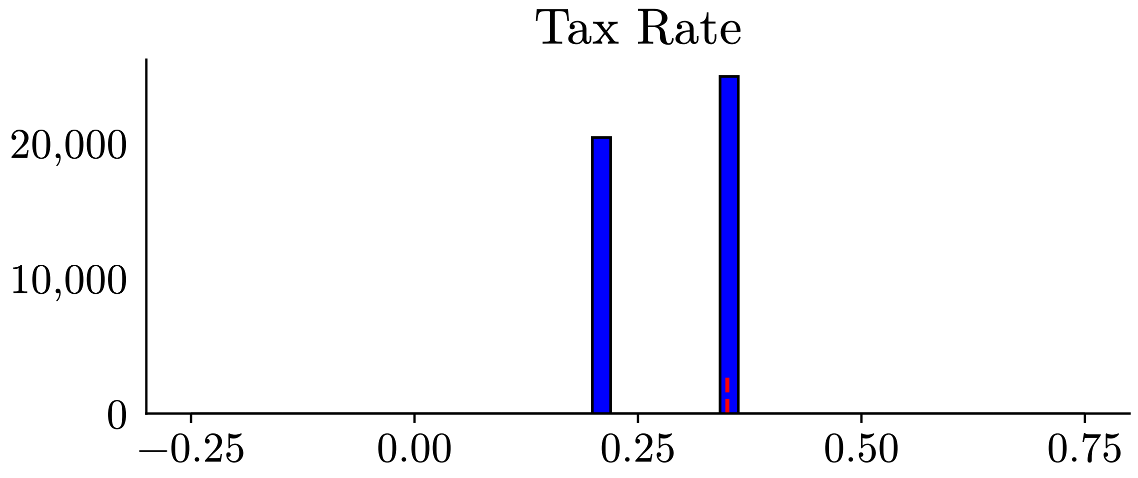
Unlevered Beta	
Count	45,349
Mean	0.957
Std. Dev	0.441
Minimum	-0.082
25th Percentile	0.628
Median	0.939
75th Percentile	1.261
Maximum	2.243



Taxes and Tax Rate

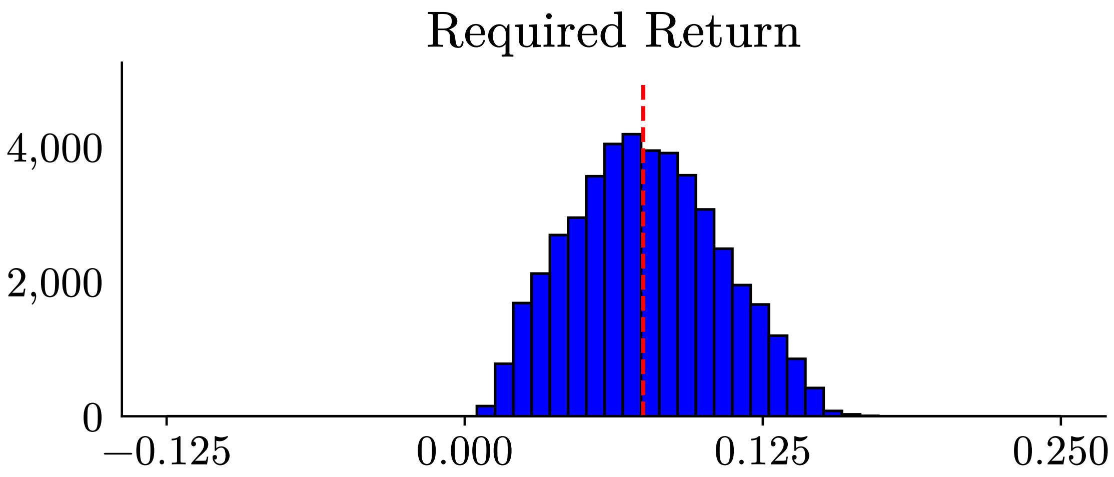
- I use the statutory tax rate of the last year of the observation to compute the unlevered beta and other tax-dependent statistics

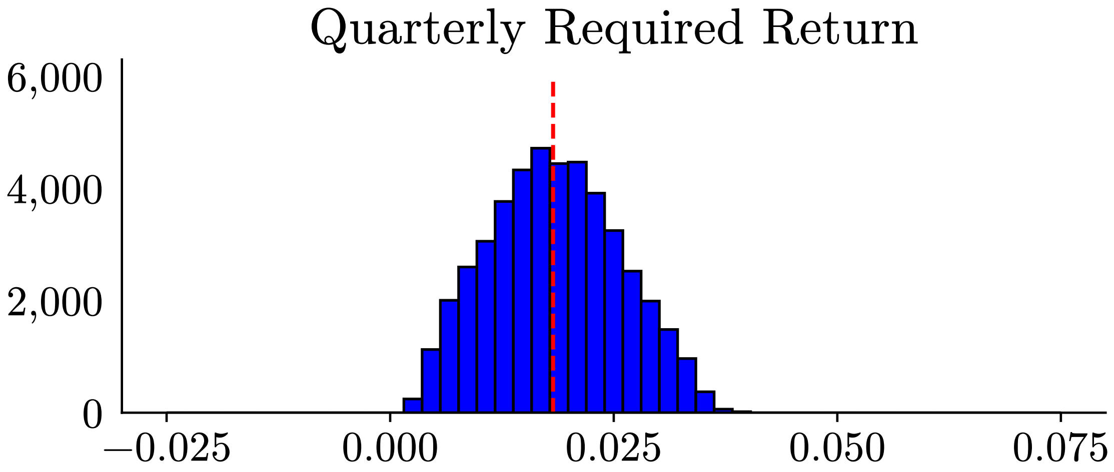
	Tax Rate
Count	45,349
Mean	0.287
Std. Dev	0.070
Minimum	0.210
25th Percentile	0.210
Median	0.350
75th Percentile	0.350
Maximum	0.350



Required Return

- Based on a simple CAPM
- RFR+ERP$\times\beta_{UL}$
- Simple way of measuring required return to capital
- Used in the Lerner Index





Measures of Power

Measures Include

- Profit metrics
  - Lerner index
  - Price-Cost Margin
- Concentration (HHI and NAICS)
  - Herfindahl-Hirshman index
  - Market Share
- Valuation
  - Tobin's q

Lerner Index

- Marginal profit over price
- Common in literature
- Positive values imply monopoly power
- Hard to interpret the competitive environment

$$\text{Lerner Index} = \frac{P - C}{P}$$

$$(EBIT - RR_{IC}) \approx \Pi = Pq - cq - FC$$

$$\Pi = (P - c)\, q - FC$$

$$\Pi = \left(\frac{P - c}{q}\right) Pq - FC$$

Lerner Index

- Marginal profit over price
- Common in literature
- Positive values imply monopoly power
- Hard to interpret the competitive environment

$$\text{Lerner Index} = \frac{P - C}{P}$$

$$(EBIT - RR_{IC}) \approx \Pi = Pq - cq - FC$$

$$\Pi = (P - c)\,q - FC$$

$$\Pi = \left(\frac{P - c}{q}\right) Pq - FC$$

Estimate Lerner with

$$(\text{EBIT} - \text{RR}) = c_0 + \boxed{m_{\text{Lerner}}}(\text{Revenue})$$

Calculate Required Return with

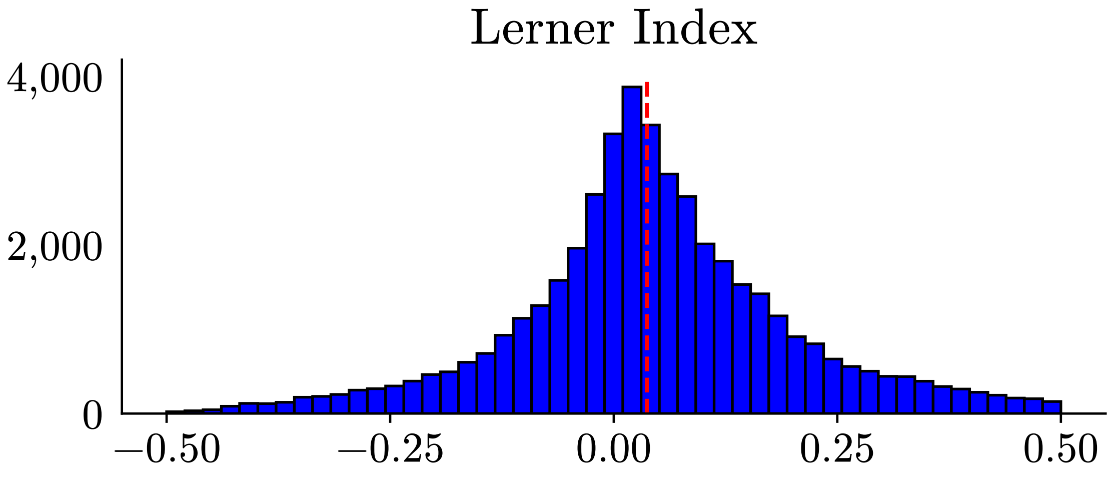
$$\text{RR} = \text{IC}(\beta_{UL} \times ERP + RFR)$$

Lerner Index

- Marginal profit over price
- Common in literature
- Positive values imply monopoly power
- Hard to interpret the competitive environment

Lerner Index

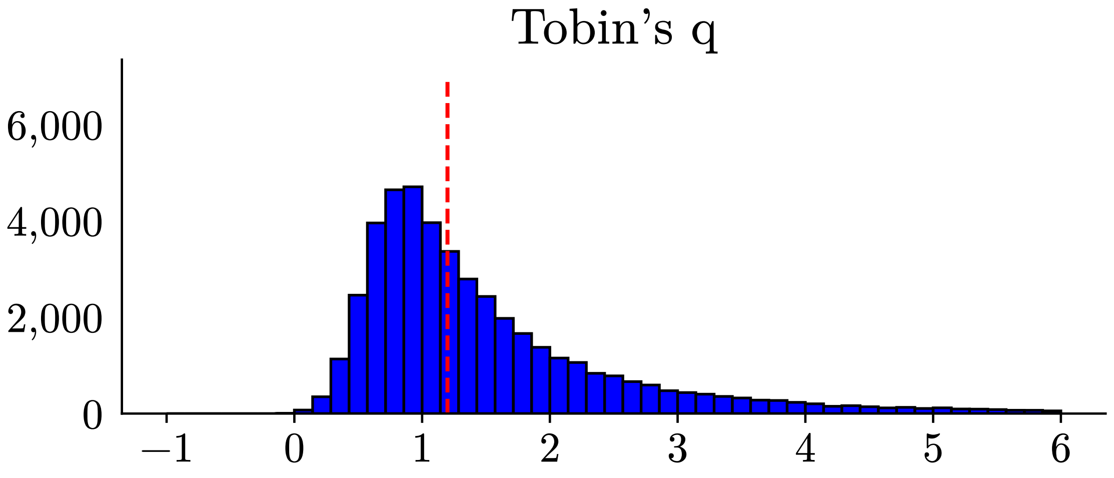
Count	45,349
Mean	0.051
Std. Dev	0.171
Minimum	-0.624
25th Percentile	-0.034
Median	0.037
75th Percentile	0.131
Maximum	0.947



Tobin's Q

- Ratio of a firm's replacement value to its current market value
  - Higher implies monopoly power (whole is worth more than the sum of the parts)
- I use total assets instead of replacement value
  - Replacement value hard to calculate in practice
- Enterprise Value (debt plus equity market values) as numerator

Tobin's q	
Count	45,349
Mean	1.668
Std. Dev	2.046
Minimum	-2.91E-02
25th Percentile	0.819
Median	1.199
75th Percentile	1.905
Maximum	2.25E+02



Accounting Profits

- Often simple GAAP margins
- Easy to compute, not a rigorous measure of power
- Higher values imply power
- Difficult to connect to models of the firm

EBIT

- Earnings Before Interest and Taxes

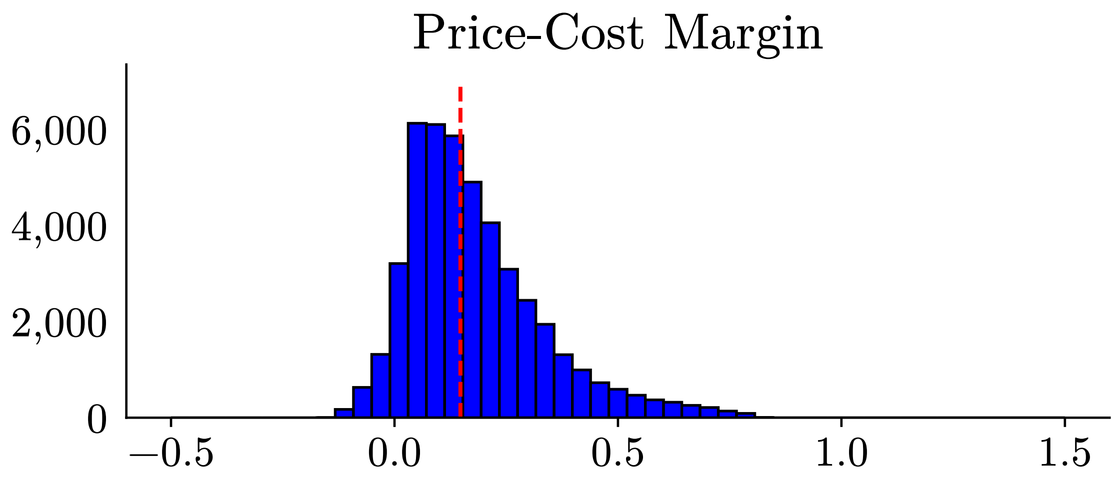
Estimate Price-Cost Margin with

$$\text{EBIT} = c_0 + \boxed{m_{\text{PCM}}}(\text{Revenue})$$

Price-Cost Margin

- "Marginal Profit Margin"
- Like the Lerner, but no consideration for required return to capital
- Used in literature

Price-Cost Margin	
Count	45,349
Mean	0.180
Std. Dev	0.154
Minimum	-0.133
25th Percentile	0.071
Median	0.148
75th Percentile	0.255
Maximum	0.842

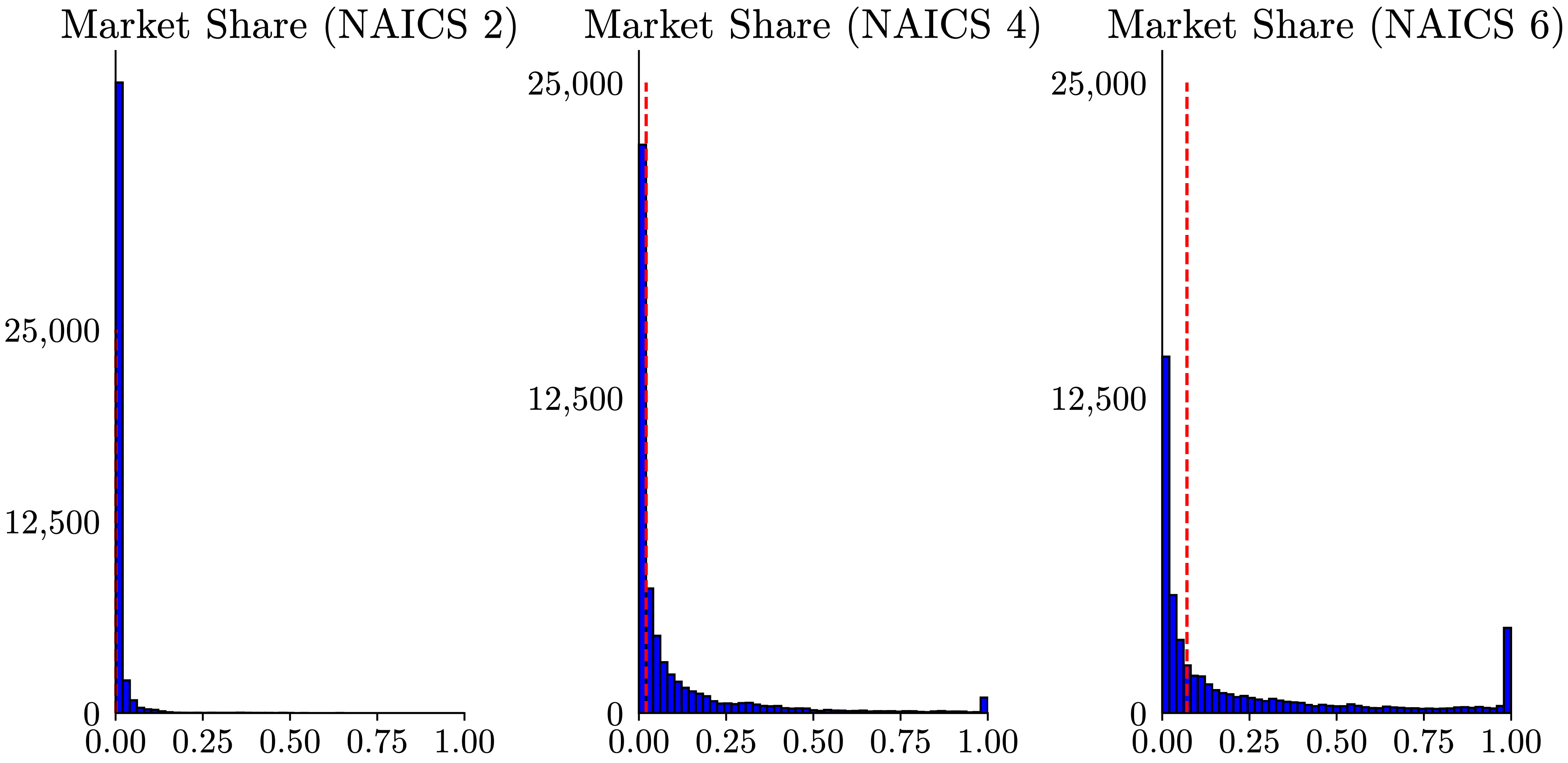


Market Share

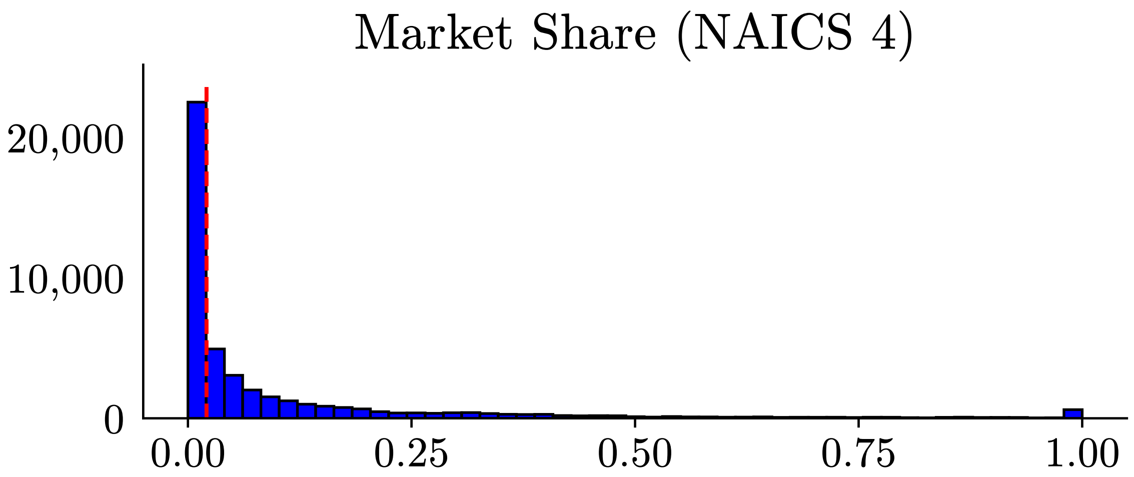
$$\text{Market Share} = \frac{\text{Revenue}_{\text{Firm}}}{\text{Revenue}_{\text{Industry}}}$$

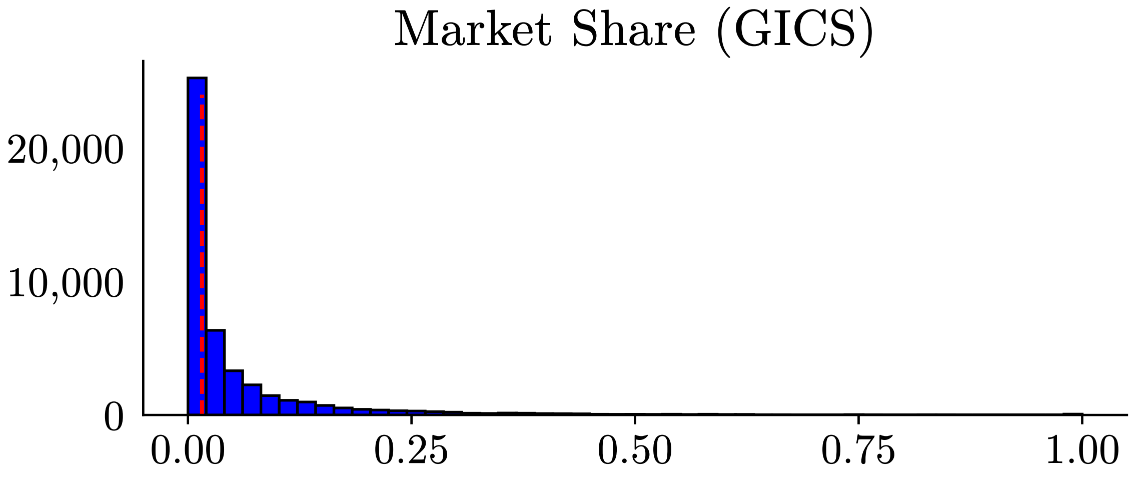
I compute Market Share and HHI after filtering only for Revenue >0.

Market Share (NAICS)



Market Share (GICS and NAICS4)



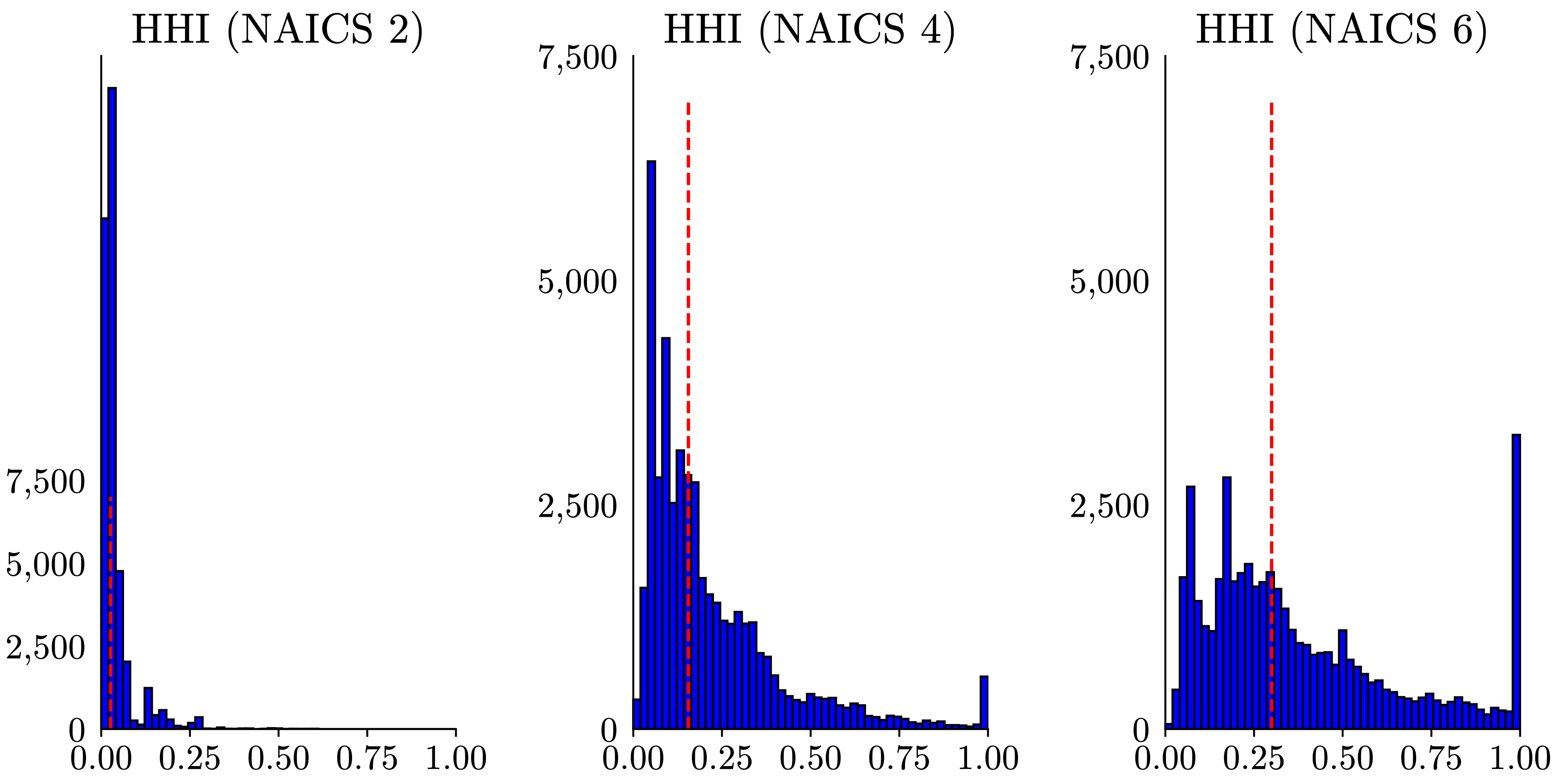


Hirschman-Herfindahl Index

$$\text{HHI} = (\text{MS}_1)^2 + (\text{MS}_2)^2 + \cdots + (\text{MS}_n)^2$$

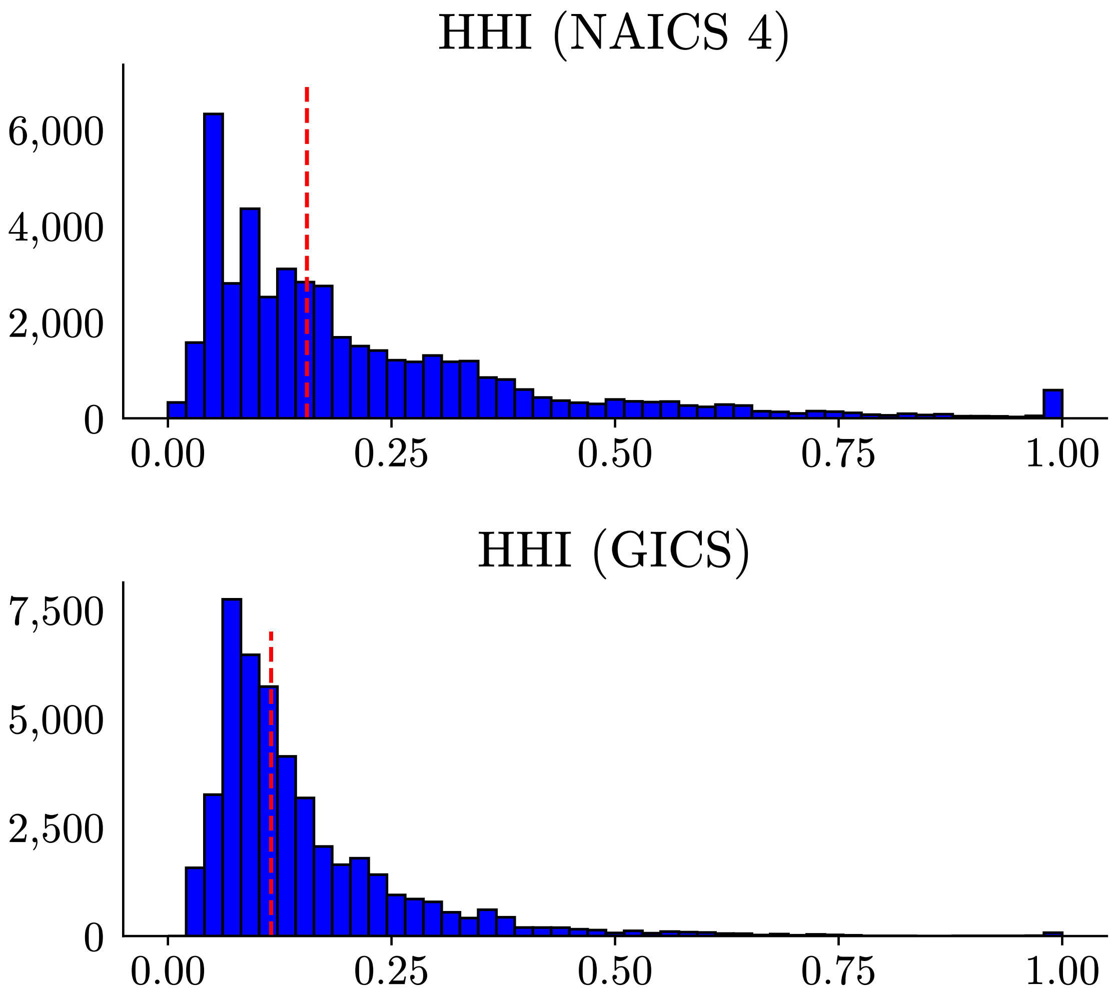
I compute Market Share and HHI after filtering only for Revenue >0.

HHI (NAICS)



HHI (NAICS 2)
7,500
5,000
2,500
0
0.00
0.25
0.50
0.75
1.00
HHI (NAICS 4)
7,500
5,000
2,500
0
0.00
0.25
0.50
0.75
1.00
HHI (NAICS 6)
7,500
5,000
2,500
0
0.00
0.25
0.50
0.75
1.00

HHI (GICS AND NAICS4)



Correlation among Measures

	Lerner	PCM	Mkt Share 4	HHI4	Mkt Share GICS	HHI GICS	Tobin's Q
Lerner	1.00	0.18	0.01	-0.01	0.02	0.01	0.11
PCM	0.18	1.00	-0.10	-0.06	-0.08	-0.02	0.15
Mkt Share 4	0.01	-0.10	1.00	0.63	0.42	0.17	-0.03
HHI4	-0.01	-0.06	0.63	1.00	0.12	0.25	-0.04
Mkt Share GICS	0.02	-0.08	0.42	0.12	1.00	0.45	-0.03
HHI GICS	0.01	-0.02	0.17	0.25	0.45	1.00	-0.02
Tobin's Q	0.11	0.15	-0.03	-0.04	-0.03	-0.02	1.00

Regressions

Regressions

1. UL Beta ~ Monopoly Stat + Controls & FEs
2. UL Beta ~ Monopoly Stat × Revenue + Controls & FEs

Measures of power are

- Lerner, PCM, Tobin's q, MS_4, HHI_4, $\mathrm{MS}_{\mathrm{GICS}}$, $\mathrm{HHI}_{\mathrm{GICS}}$

All regressions are heteroskedastic

Model 1: Beta vs Monopoly Stats

$$\beta_{UL,it} = a_0 + b_1(\text{Monopoly Metric}_{it}) + b_2(\text{Mkt. Cap}_{it}) + b_3(\ln(\text{Stock Price})_{it}) + b_4(\text{Current Ratio}_{it}) + \Gamma_{I,Y}$$

Model 1: Basic Regression

Model 1	Lerner	PCM	MS_4	HHI_4	MS_{GICS}	HHI_{GICS}	Q
b_1 Coefficient	-0.240	0.052	0.063	0.078	-0.042	-0.049	-0.002
	(0.012)	(0.013)	(0.012)	(0.012)	(0.021)	(0.019)	(0.001)
Z-Score	-20.568	3.843	5.308	6.623	-2.049	-2.628	-1.459
$\Delta\beta_{UL}$ for $1\sigma\,\Delta$ in monopoly metric	-0.041	0.008	0.012	0.015	-0.004	-0.006	-0.003
(Corresponding change in cost of capital assuming ERP = 7%)	-0.287%	0.055%	0.084%	0.106%	-0.031%	-0.039%	-0.021%

Observations: 45,349 firm-quarters; Firms: 2,491

Model 2: Interaction with Revenue

$$\begin{aligned}\beta_{UL,it} =& a_0 + b_1(\text{Monopoly Metric}_{it}) + b_2(\text{Mkt. Cap}_{it}) + b_3(\text{Revenue}_{it}) \\ &+ b_4(\text{Current Ratio}_{it}) + b_5(\text{Revenue}_{it} \times \text{Monopoly Metric}_{it}) + \Gamma_{I,Y}\end{aligned}$$

Model 2: Revenue Interaction

- Maybe size interacts with monopoly power
- Relationship between measures and power could change as a firm grows larger

Model 2: Revenue Interaction

Model 2	Lerner	PCM	MS_4	HHI_4	MS_{GICS}	HHI_{GICS}	Q
b_1 Coefficient	-0.219	0.042	0.105	0.050	0.079	-0.077	0.000
	(0.012)	(0.014)	(0.012)	(0.012)	(0.022)	(0.019)	(0.001)
Z-Score	-17.940	3.040	8.655	4.119	3.587	-3.986	0.144
b_3 Revenue	-4.21E-06	-3.95E-06	-5.92E-06	-5.50E-06	-6.61E-06	-6.53E-06	-5.51E-06
	(3.14E-07)	(3.46E-07)	(4.11E-07)	(4.00E-07)	(4.63E-07)	(5.18E-07)	(3.53E-07)
Z-Score	-13.411	-11.428	-14.398	-13.769	-14.278	-12.601	-15.604
b_5 Interaction	-3.89E-06	-5.41E-06	3.66E-06	4.58E-06	5.60E-06	8.81E-06	1.91E-06
	(1.69E-06)	(1.98E-06)	(9.86E-07)	(1.13E-06)	(1.14E-06)	(1.79E-06)	(3.18E-07)
Z-Score	-2.308	-2.730	3.710	4.034	4.899	4.933	6.009
Quarterly Revenue	Mean: \$2,673; Median: \$475; Std. Dev: \$8,451 million per quarter						

Observations: 45,349 firm-quarters; Firms: 2,491

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Model 2: Revenue Interaction

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For large firms (>$7.7B quarterly revenue), the relationship between PCM and beta is negative, like the Lerner index.

Robustness Checks

Robustness Checks

- Weaker Filters
  - Middle 95% instead of 90%
  - Shows that filters don't really impact the results
    - As long as we exclude the unreasonable extremes
- Split Manufacturing and Everything Else
  - Manufacturing makes up half of all firms
  - Maybe there is a different relationship for different industries
- Large Firms (Quarterly Revenue > $7.76 Billion)
  - Model 2 suggests large firms' measures of power have a different relationship with systematic risk

Filtering and Manufacturing

Model 1	Lerner	PCM	MS_4	HHI_4	MS_{GICS}	HHI_{GICS}	Q
b_1 Weaker Filters	-0.143	0.076	0.058	0.075	-0.103	-0.061	-0.001
58,636 obs.	(0.007)	(0.010)	(0.012)	(0.012)	(0.021)	(0.018)	(0.001)
Z-Score	-20.535	7.593	4.731	6.282	-4.961	-9.306	-2.104
b_1 Manufacturing	-0.188	0.051	0.242	0.228	0.061	0.024	-0.008
21,595 obs.	(0.017)	(0.021)	(0.022)	(0.018)	(0.031)	(0.028)	(0.002)
Z-Score	-11.119	2.455	11.211	12.430	1.939	0.860	-4.407
b_1 excl. Manuf.	-0.290	0.064	-0.028	-0.039	-0.158	-0.131	0.002
23,754 obs.	(0.016)	(0.018)	(0.014)	(0.015)	(0.028)	(0.025)	(0.001)
Z-Score	-18.116	3.585	-2.026	-2.588	-5.667	-5.244	1.706

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Manuf. demonstrates positive relationship, non-manuf. the opposite.

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Manuf. demonstrates positive relationship, non-manuf. the opposite.
S&T suggests capital intensity...

Large Firms

Mod. 1 Rev > \$8B	Lerner	PCM	MS_4	HHI_4	MS_{GICS}	HHI_{GICS}	Q
b_1 Coefficient	-0.307	-0.268	0.379	0.454	0.391	0.590	0.010
	(0.038)	(0.053)	(0.035)	(0.044)	(0.038)	(0.058)	(0.007)
Z-Score	-8.088	-5.091	10.690	10.281	10.202	10.176	1.392
$\Delta\beta_{UL}$ for $1\sigma\,\Delta$ in monopoly metric	-0.052	-0.041	0.073	0.088	0.042	0.067	0.020
(Corresponding change in cost of capital assuming ERP = 7%)	-0.367%	-0.288%	0.508%	0.619%	0.291%	0.468%	0.140%

Observations: 3,191 firm-quarters; Firms: 162

Large Firms

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Observations: 3,191 firm-quarters; Firms: 162

PCM now negatively associated, but concentration measures all positive and stronger.

Conclusion

Conclusions

- Relationship between risk and power depends on the measure
  - Lerner consistently negative relationship
  - Concentration measures have mixed results
  - Size and industry also important factors that change the relationship
- Complex relationship between risk and power
  - Needs to be investigated more

Future Research

- Different industries
  - "Information" and "Manufacturing"
- Better industry definitions for market share and HHI
- Different measures of risk

Questions

Thank you