Systematic Risk and Monopoly Power

John Schleider

Tuesday, January 30, 2024

Agenda

1. Purpose and Value
2. Theoretical Model
3. Data
4. Measures of Power
5. Preliminary Regressions

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
- 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 $\Rightarrow$ $\downarrow$ Beta

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
- Constant Marginal Cost
- Firm chooses Quantity

Demand

$$P(q) = A - bq$$

Marginal Revenue

$$MR = \frac{d}{dq} q(A - bq) = A - 2bq$$

Costs

$$MC = c$$

$$TC = cq$$

Total Profit

$$\Pi = q(A - bq - c)$$

Without Uncertainty

- Linear Demand
- Constant Marginal Cost
- Firm chooses Quantity

Monopoly power appears in ***b****.*

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

Demand

$$P(q) = A - bq$$

Marginal Revenue

$$MR = \frac{d}{dq} q(A - bq) = A - 2bq$$

Costs

$$MC = c$$

$$TC = cq$$

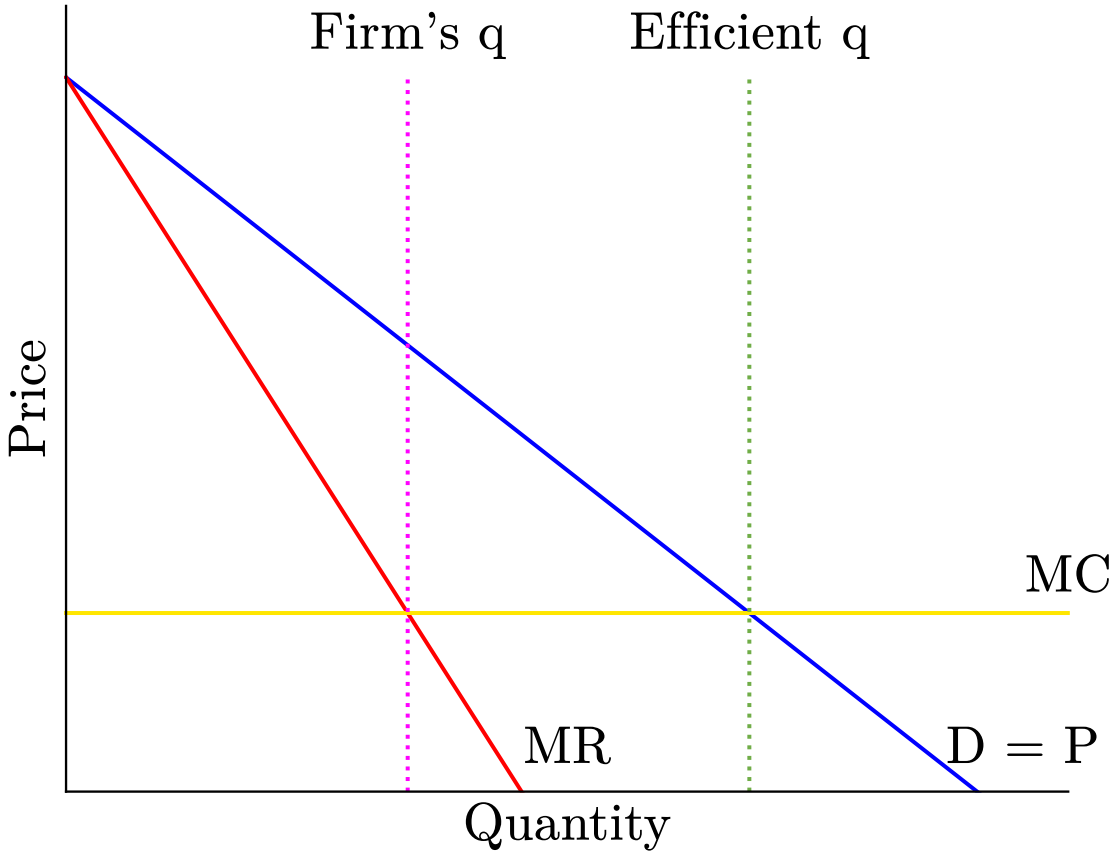
Total Profit

$$\Pi = q(A - bq - c)$$

Without Uncertainty

- Linear Demand
- Constant Marginal Cost
- Firm chooses Quantity

*Slope of demand is –**b**.*



Introducing Uncertainty

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

Uncertain Demand

$$P(q) = A(1+e) - bq$$

Exogenous Shock

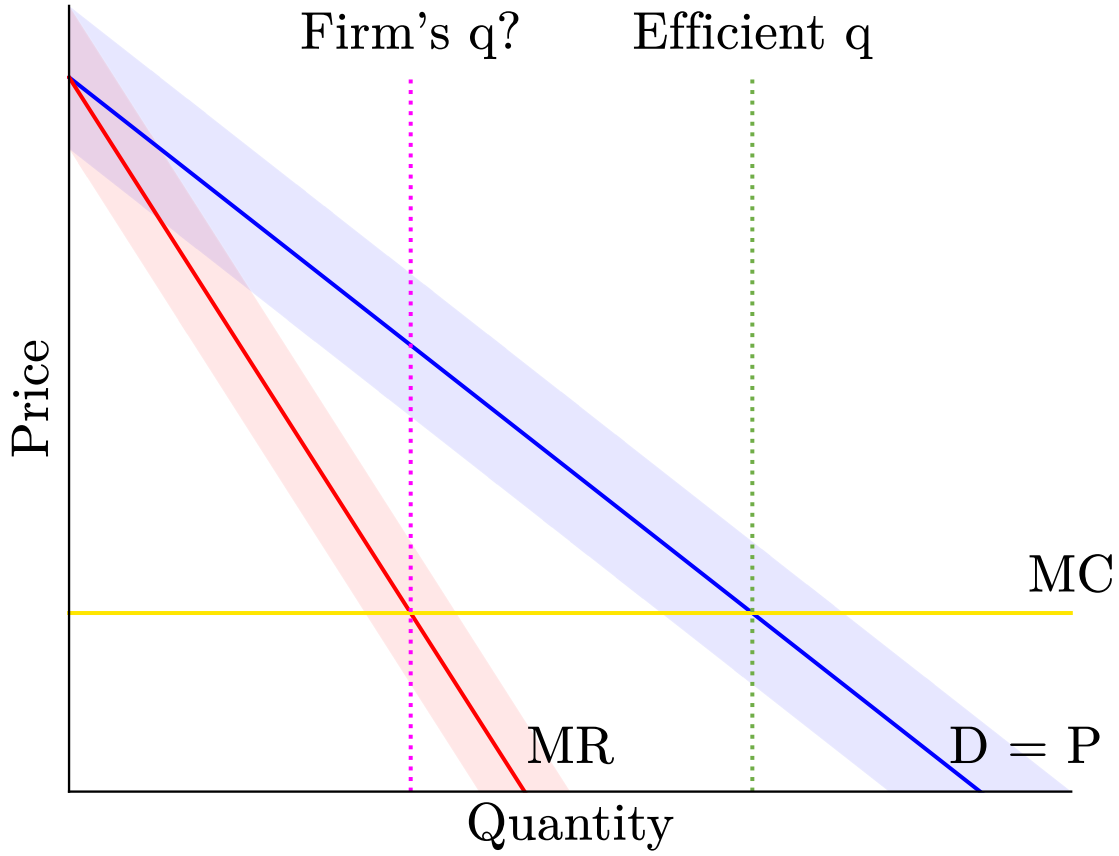
$$\mathbb{E}(e) = 0 \quad \text{Var}(e) = \sigma^2$$

Firm Under Uncertainty

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

$\mathrm{Var}(D)=\mathrm{Var}(MR)=A^2\sigma^2$.

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



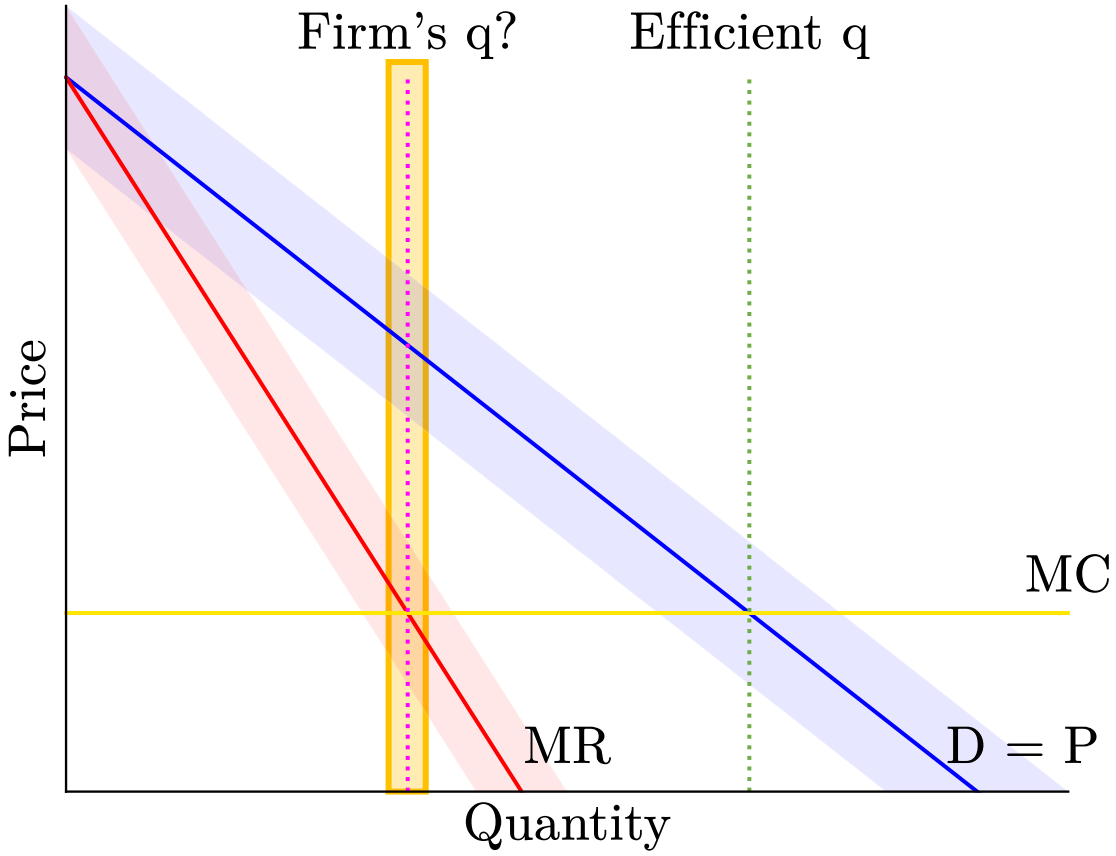
Firm Under Uncertainty

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

$\mathrm{Var}(D)=\mathrm{Var}(MR)=A^2\sigma^2$.

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

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



Profit under Uncertainty

Uncertain Profit

$$\Pi = q(A(1+e) - bq - c)$$

Variance of Profits

$$\text{Var}(\Pi) = q^2 A^2 \sigma^2$$

Utility and Beta

In real life, investors evaluate investments through discounting.

Real-Life Utility

$$U = \frac{\mathbb{E}(\Pi)}{RFR + ERP \times \beta}$$

Utility and Beta

In real life, investors evaluate investments through discounting.

Beta represents systematic risk and is measured with a regression using observations collected over time, often at least one year.

Real-Life Utility

$$U = \frac{\mathbb{E}(\Pi)}{RFR + ERP \times \beta}$$

Real-Life Beta

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

Utility and Beta

In real life, investors evaluate investments through discounting.

Beta represents systematic risk and is measured with a regression using observations collected over time, often at least one year.

For single-period models, we calculate beta with variance of profits or firm values.

Real-Life Utility

$$U = \frac{\mathbb{E}(\Pi)}{RFR + ERP \times \beta}$$

Real-Life Beta

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

Single-Period Beta

$$\beta_i = \frac{\text{Var}(\Pi_i)}{\Pi_i} \times \frac{\Pi_m}{\text{Var}(\Pi_m)}$$

Utility and Beta

$$U(q) = \frac{\Pi_i}{RFR + ERP \times \frac{\mathrm{Var}(\Pi_i)}{\Pi_i} \times \frac{\Pi_m}{\mathrm{Var}(\Pi_m)}}$$

Utility and Beta

$$U(q) = \frac{\Pi_i}{RFR + ERP \times \frac{\text{Var}(\Pi_i)}{\Pi_i} \times \frac{\Pi_m}{\text{Var}(\Pi_m)}}$$

We simplify to approximate the relationship between β and $\boldsymbol{b}$.

$$U(q) = \ln(\Pi_i) - \ln\left(RFR + ERP \times \frac{\text{Var}(\Pi_i)}{\Pi_i} \times \frac{\Pi_m}{\text{Var}(\Pi_m)}\right)$$

Simplifying the Relationship

$$U(q) = \ln(\Pi_i) - \ln\left(RFR + ERP \times \frac{\text{Var}(\Pi_i)}{\Pi_i} \times \frac{\Pi_m}{\text{Var}(\Pi_m)}\right)$$

RFR is a constant with respect to q, so we ignore it.

$$U(q) = \ln(\Pi_i) - \ln(ERP) - \ln\left(\frac{\text{Var}(\Pi_i)}{\Pi_i}\right) - \ln\left(\frac{\Pi_m}{\text{Var}(\Pi_m)}\right)$$

ERP and total market variables are also constant.

$$U(q) = \ln(\Pi_i) - \ln\left(\frac{\text{Var}(\Pi_i)}{\Pi_i}\right) = \ln(\Pi_i) + \ln(\Pi_i) - \ln(\text{Var}(\Pi_i))$$

Simplifying Utility

Since utility is ordinal, we don't need to worry about the logarithmic functions.

To make things more simple, we ignore the squared profits—I performed the derivations with squared profits and get a similar, but less clean, relationship between $\boldsymbol{b}$ *and* $\boldsymbol{\beta}$.

$$U(q) = 2\ln(\Pi_i) - \ln(\text{Var}(\Pi_i))$$

Simplified Utility

$$U(q) = \Pi - \mu\text{Var}(\Pi)$$

Solving for Quantity

$$U(q) = \Pi - \mu \text{Var}(\Pi)$$

Substituting, we have

$$U(q) = (qA + qAe - bq^2 - cq) - \mu(q^2A^2\sigma^2)$$

Maximization Problem

$$\max_q qA + qAe - bq^2 - cq - \mu q^2 A^2 \sigma^2$$

Solving for Quantity

$$A + Ae - 2bq - c - 2\mu q A^2 \sigma^2 = 0$$

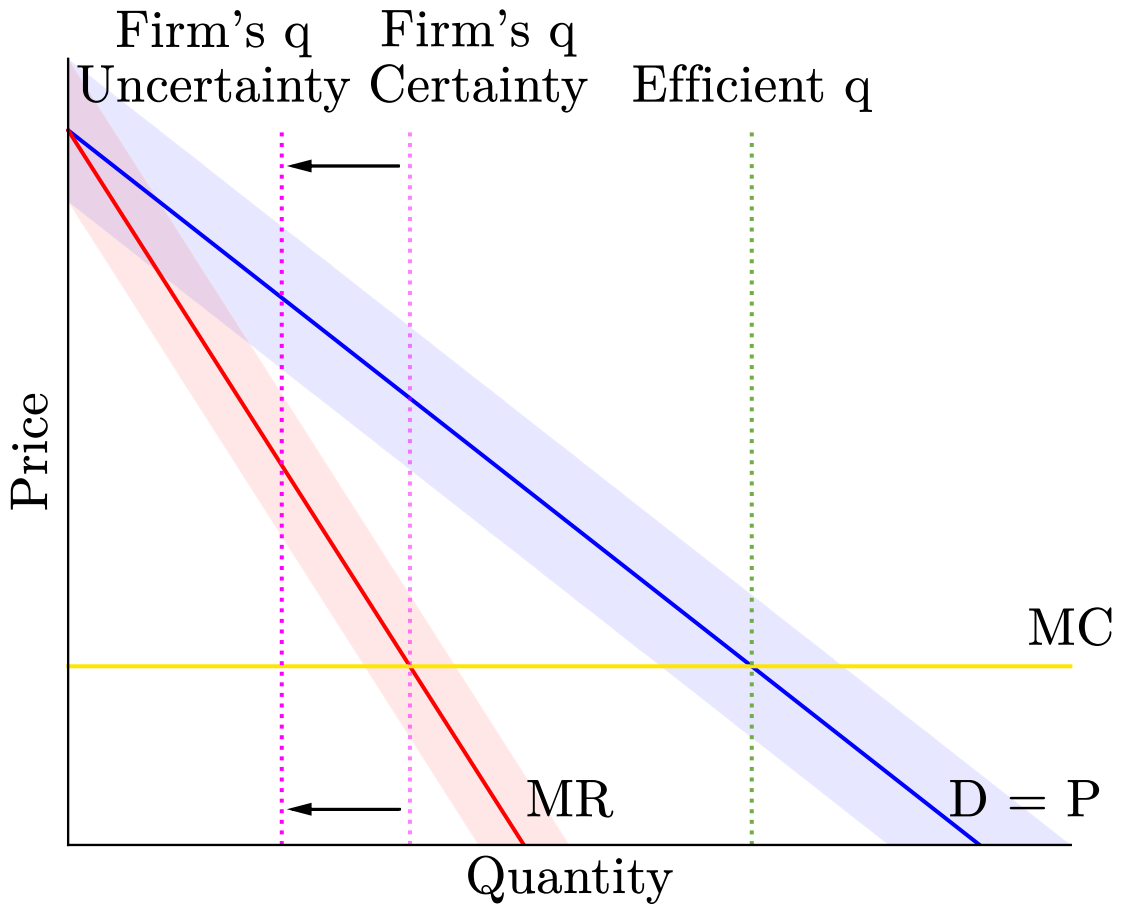
$$A + Ae - c = q(2b + 2\mu A^2 \sigma^2)$$

$$q = \frac{A(1+e) - c}{2(b + \mu A^2 \sigma^2)}$$

Since $\mathbb{E}(e) = 0$,

$$q = \frac{A - c}{2(b + \mu A^2 \sigma^2)}$$

Solving for Quantity



Beta and Power

Systematic risk decreases with increased monopoly power.

For any positive value of b, β decreases monotonically with an asymptote of 0.

Derivative with respect to $\boldsymbol{b}$.

$$\frac{d}{db}\beta_i = \frac{-A^2\sigma^2}{(2\mu A^2\sigma^2 + b)^2} \times \frac{\Pi_m}{\mathrm{Var}(\Pi_m)}$$

Recall

$$\beta_i = \frac{\mathrm{Var}(\Pi_i)}{\Pi_i} \times \frac{\Pi_m}{\mathrm{Var}(\Pi_m)}$$

$$\beta_i = \frac{q^2A^2\sigma^2}{q(A - bq - c)} \times \frac{\Pi_m}{\mathrm{Var}(\Pi_m)}$$

$$\beta_i = \frac{\left(\frac{A(1+e)-c}{2(b+\mu A^2\sigma^2)}\right)A^2\sigma^2}{A - b\left(\frac{A(1+e)-c}{2(b+\mu A^2\sigma^2)}\right) - c} \times \frac{\Pi_m}{\mathrm{Var}(\Pi_m)}$$

$$\beta_i = \frac{A^2\sigma^2}{2\mu A^2\sigma^2 + b} \times \frac{\Pi_m}{\mathrm{Var}(\Pi_m)}$$

Beta and 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"

Positive or No Relationship

- Abdoh & Varela (2017)
  - C-CAPM as risk
  - Concentration (HHI)
- Bernier (1987)[1]
  - Tobin's q ratio
  - "No consistent relationship"
- Manuel & Stevens (1987)
  - Concentration & Barriers
- Stevens (1986)
  - No significant relationship

(1) Couldn't access the actual paper—some papers that cite it claim it supports a negative relationship, but the abstract says otherwise.

Empirical Papers

Negative Relationship

- Goldenberg (1987)
  - Earnings volatility
  - Regulated electric utilities
- Booth & Zhou (2015)
  - Connects power to dividend policy via business risk
  - Lerner and HHI
  - Also examines import competition

Positive or No Relationship

- Abdoh & Varela (2017)
  - Competition (HHI) and tariffs
  - Fama-French and single-factor models for risk
- 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

Negative Relationship

- Hou & Robinson (2006)
  - Concentrated industries (HHI) earn lower stock-market returns
- Sharma (2011)
  - Concentration (HHI) negatively related to stock returns
  - Product substitutability positively related to stock returns

Positive or No Relationship

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

"Unfiltered" Data

To be included in any analysis, a firm must

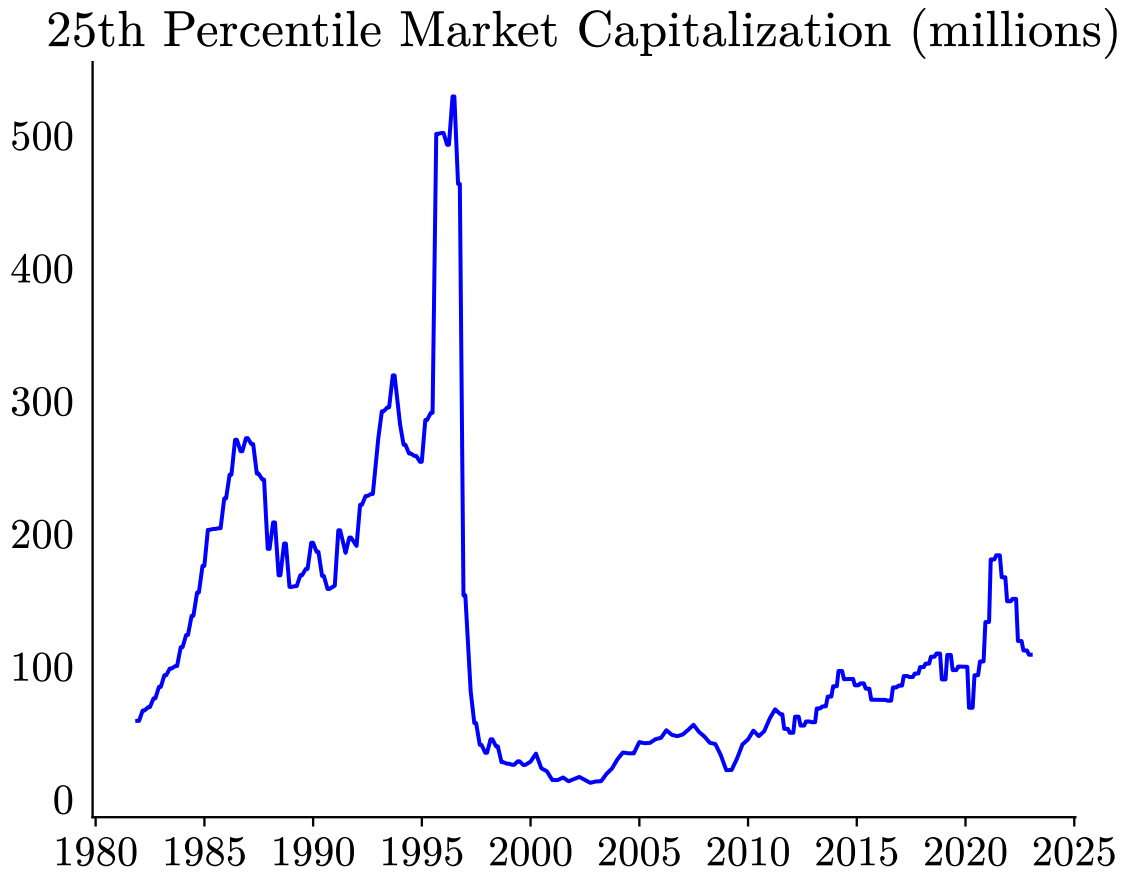
- be public for 5 consecutive years from 1976 to 2022,
- have a 5-year monthly CAPM beta during that interval,
- have revenue values greater than 0,
- have a market capitalization greater than 0.

I call this "unfiltered" because it contains the minimum amount of data to compute the CAPM beta and the core monopoly statistics.

Filtered Data

I create a second dataset with additional filters, keeping only firms that

- have a market capitalization greater than the 25^{th} percentile of that quarter,
- have assets greater than 0,
- have an EBIT margin, price-cost margin, Lerner, and CAPM beta within the 10^{th} and 90^{th} percentiles for each variable.



Filtering methodology still in flux.

Four Subsets

- Unfiltered and Filtered
- Currently traded and Full 1981-2022

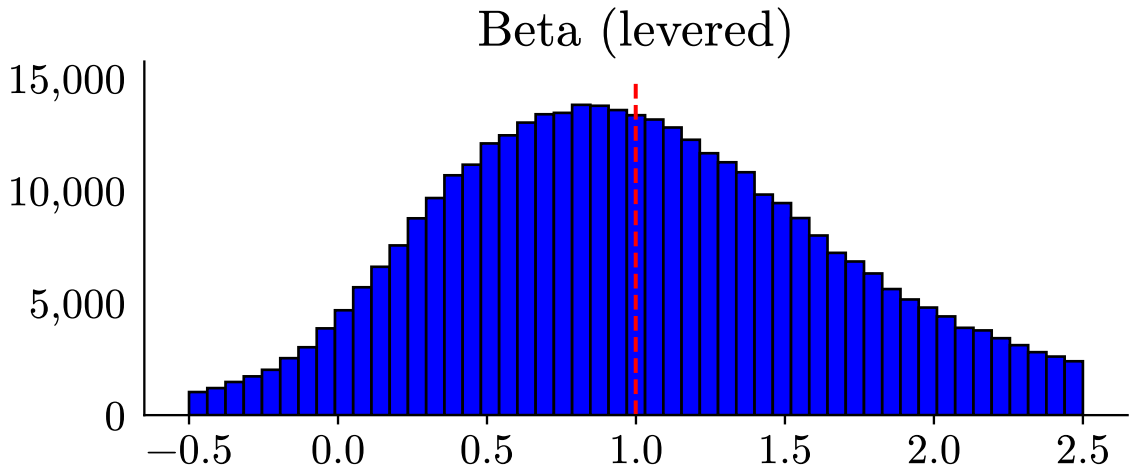
Dataset	Firms	Observations
Unfiltered 1981-2022	11,879	419,238
Unfiltered Current Public	3,737	206,040
Filtered 1981-2022	2,433	46,437
Filtered Current Public	1,555	35,619

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	419,238
Mean	4.16
Std. Dev	471.21
Minimum	-8.68E+04
25th Percentile	0.52
Median	1.00
75th Percentile	1.57
Maximum	1.18E+05

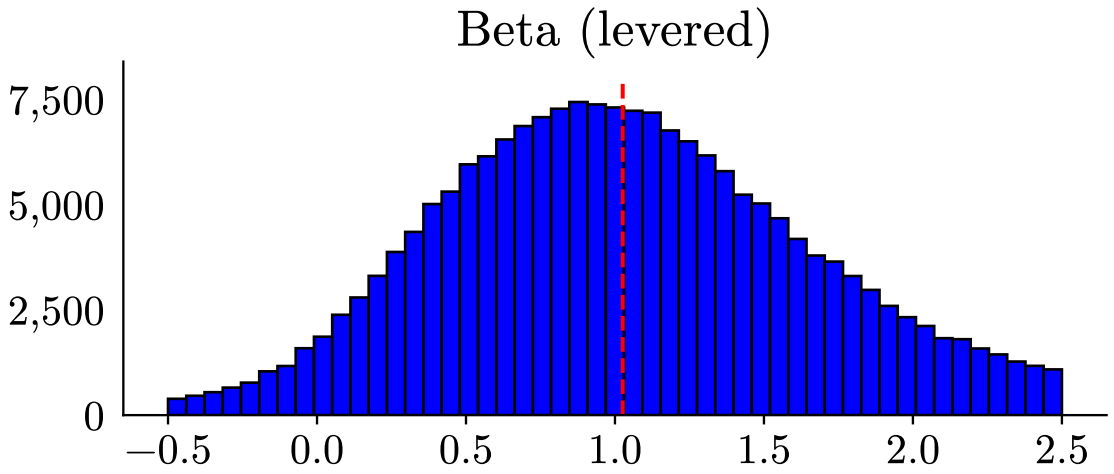


Unfiltered 1981-2022

Calculating Beta

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

Levered Beta	
Count	206,040
Mean	4.92
Std. Dev	520.75
Minimum	-6.89E+03
25th Percentile	0.58
Median	1.03
75th Percentile	1.53
Maximum	1.01E+05

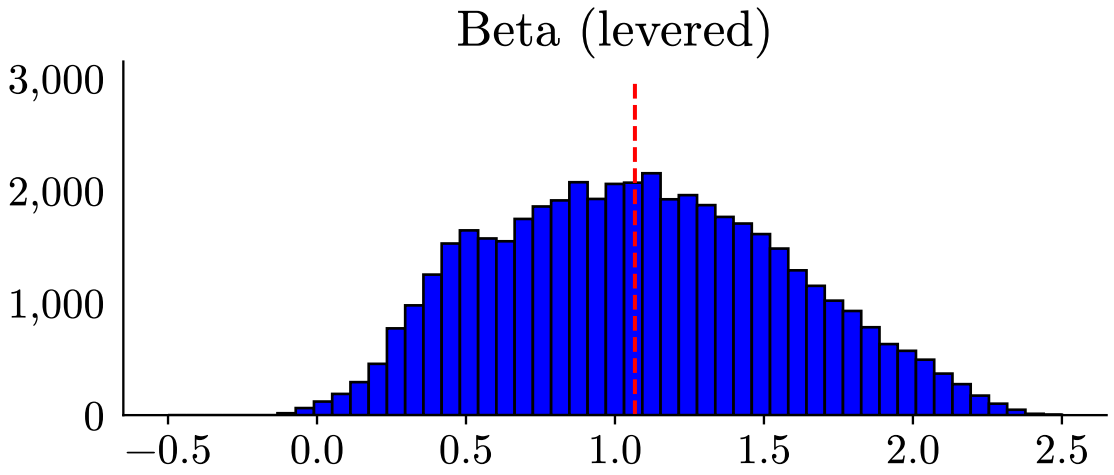


Unfiltered Current

Calculating Beta

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

Levered Beta	
Count	46,437
Mean	1.08
Std. Dev	0.49
Minimum	(0.12)
25th Percentile	0.70
Median	1.07
75th Percentile	1.44
Maximum	3.06

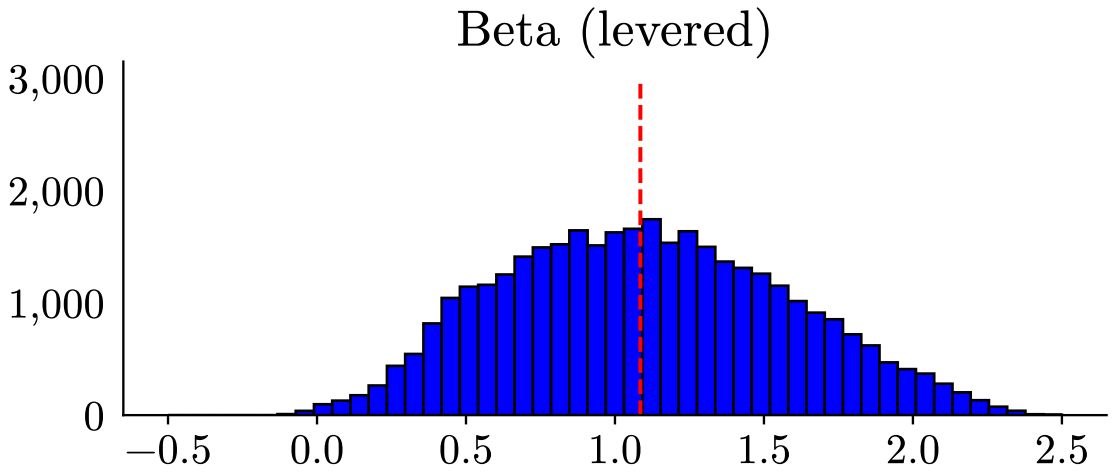


Filtered 1981-2022

Calculating Beta

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

Levered Beta	
Count	35,619
Mean	1.10
Std. Dev	0.48
Minimum	(0.12)
25th Percentile	0.74
Median	1.09
75th Percentile	1.44
Maximum	3.06



Filtered Current

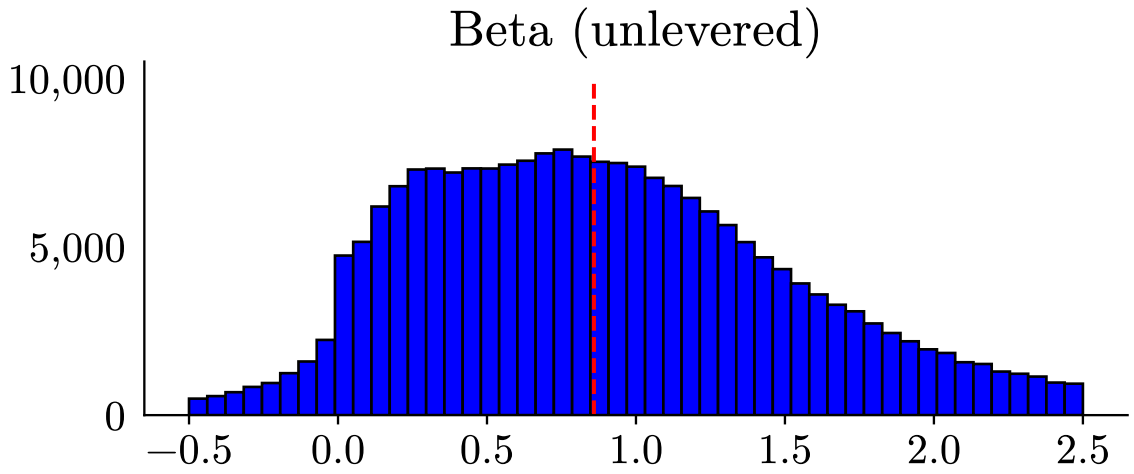
Unlevered Beta

- 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
  - Manuel & Stevens, 1987

Unlevered Beta

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

Unlevered Beta	
Count	233,661
Mean	3.42
Std. Dev	973.91
Minimum	-3.46E+05
25th Percentile	0.38
Median	0.86
75th Percentile	1.40
Maximum	1.18E+05



Unfiltered 1981-2022

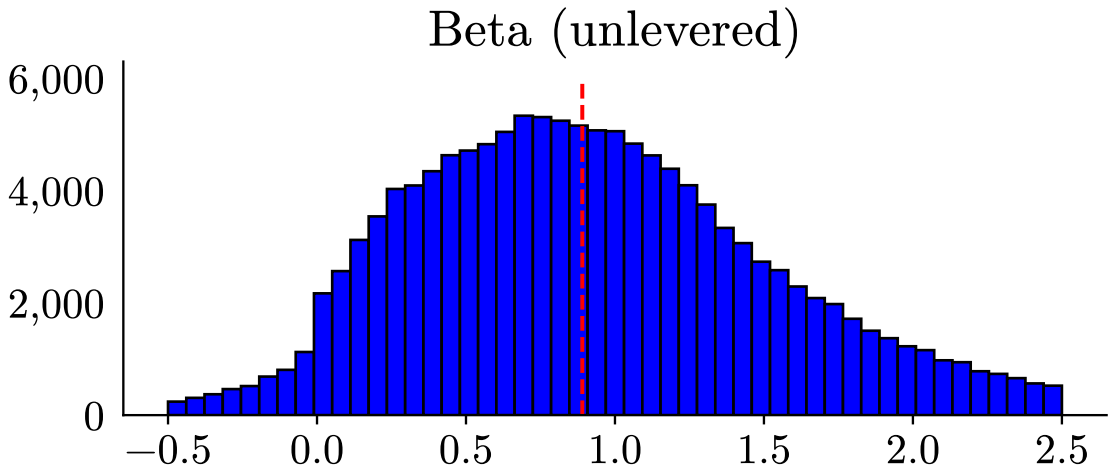
Unlevered Beta

- 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
  - Manuel & Stevens, 1987

Unlevered Beta

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

Unlevered Beta	
Count	144,297
Mean	3.27
Std. Dev	1,071.27
Minimum	-3.46E+05
25th Percentile	0.45
Median	0.89
75th Percentile	1.39
Maximum	9.79E+04



Unfiltered Current

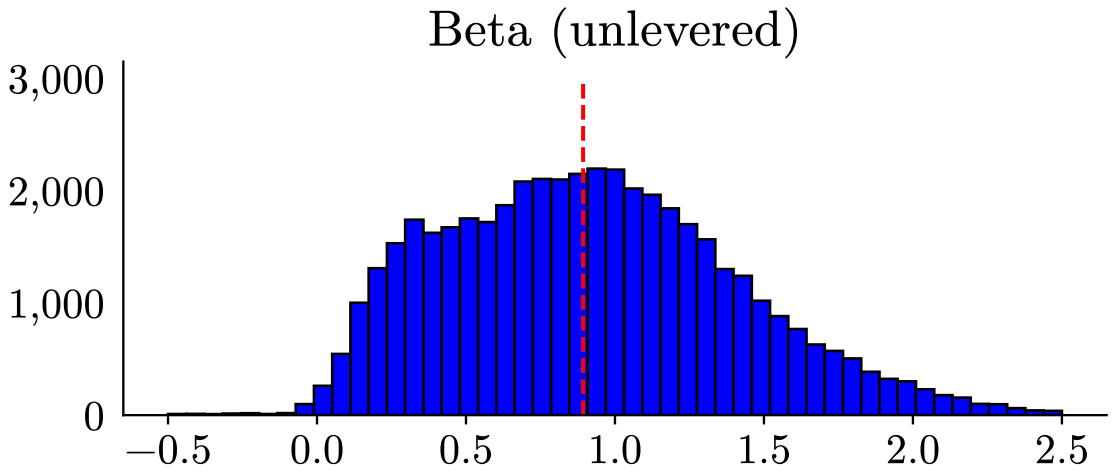
Unlevered Beta

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

Unlevered Beta

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

Unlevered Beta	
Count	46,437
Mean	0.94
Std. Dev	1.81
Minimum	(13.17)
25th Percentile	0.54
Median	0.89
75th Percentile	1.24
Maximum	343.35



Filtered 1981-2022

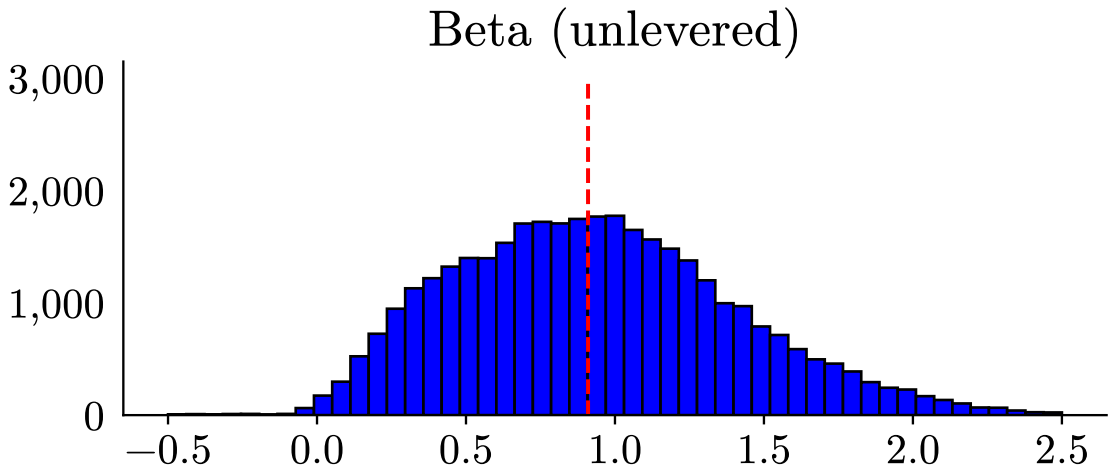
Unlevered Beta

- 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
  - Manuel & Stevens, 1987

Unlevered Beta

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

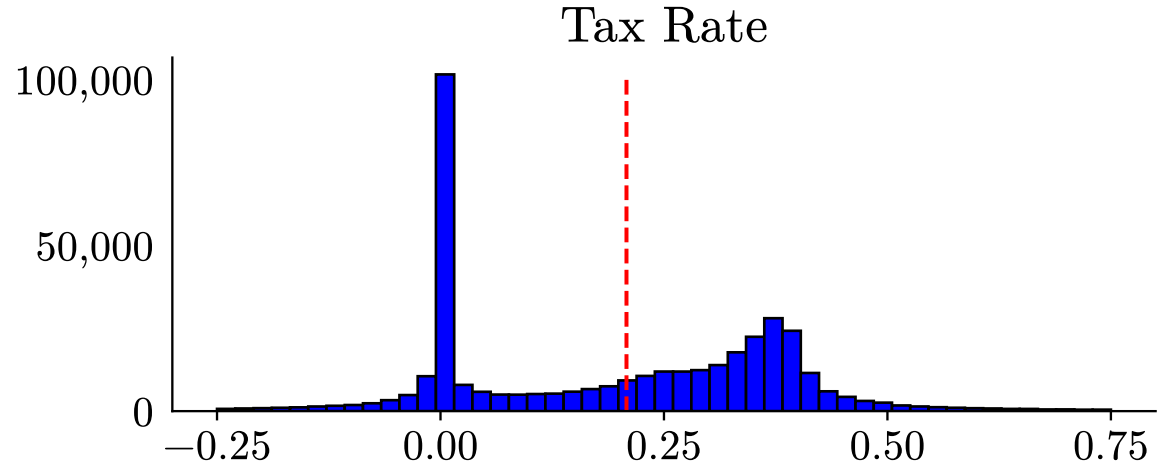
Unlevered Beta	
Count	35,619
Mean	0.95
Std. Dev	0.82
Minimum	(13.17)
25th Percentile	0.58
Median	0.91
75th Percentile	1.24
Maximum	59.99



Taxes and Tax Rate

- Last year, I applied a tax rate of 25% for all firms
- This was arbitrary, so when I computed statistics for the full WRDS database, I used the *effective* tax rate to unlever the beta
  - Taxes / Taxable Income
  - Better to use marginal tax rate but that is hard to identify for many firms
- This is part of my endogenous variable, unlevered beta

Tax Rate	
Count	414,209
Mean	15.1%
Std. Dev	771.6%
Minimum	-1.77E+03
25th Percentile	– %
Median	20.8%
75th Percentile	36.0%
Maximum	1.24E+03

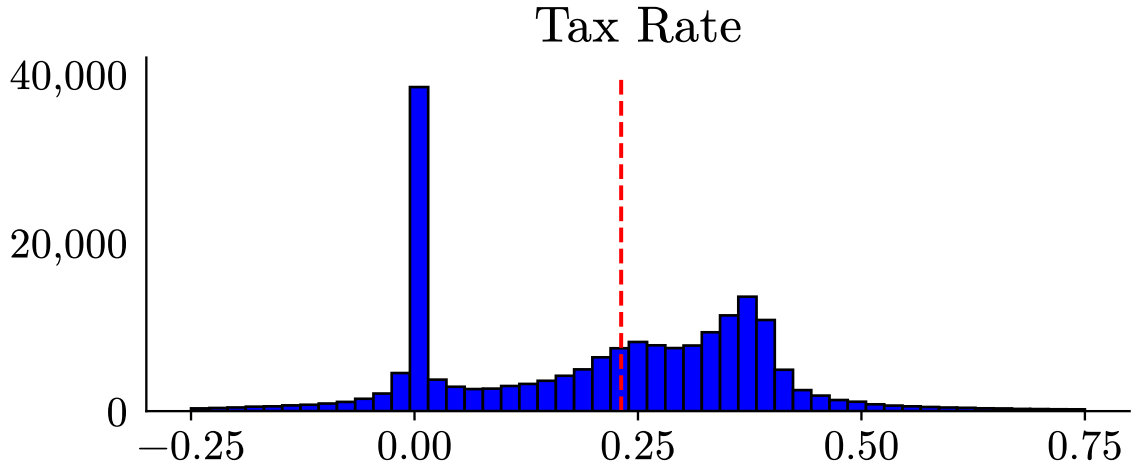


Unfiltered 1981-2022

Taxes and Tax Rate

- Last year, I applied a tax rate of 25% for all firms
- This was arbitrary, so when I computed statistics for the full WRDS database, I used the *effective* tax rate to unlever the beta
  - Taxes / Taxable Income
  - Better to use marginal tax rate but that is hard to identify for many firms
- This is part of my endogenous variable, unlevered beta

Tax Rate	
Count	203,818
Mean	18.6%
Std. Dev	722.7%
Minimum	-1.47E+03
25th Percentile	– %
Median	23.1%
75th Percentile	35.5%
Maximum	1.24E+03

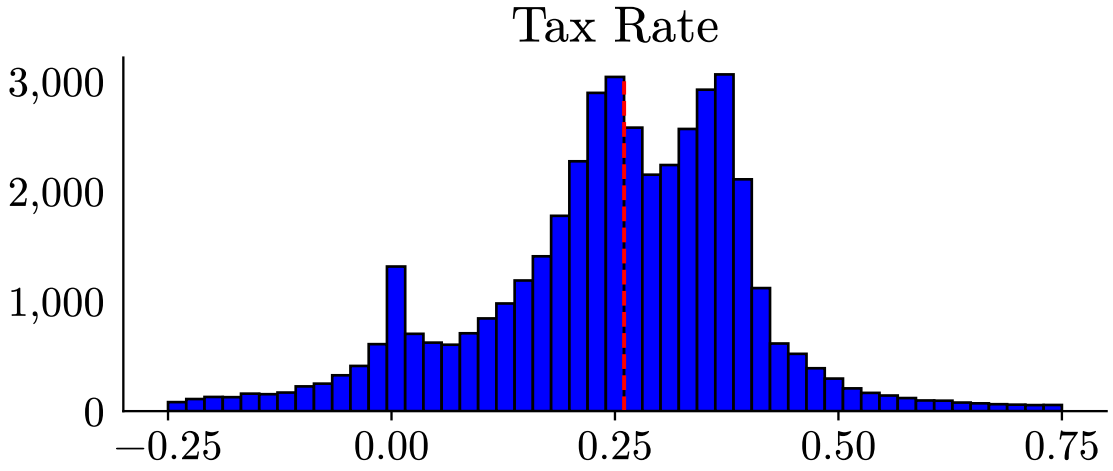


Unfiltered Current

Taxes and Tax Rate

- Last year, I applied a tax rate of 25% for all firms
- This was arbitrary, so when I computed statistics for the full WRDS database, I used the *effective* tax rate to unlever the beta
  - Taxes / Taxable Income
  - Better to use marginal tax rate but that is hard to identify for many firms
- This is part of my endogenous variable, unlevered beta

Tax Rate	
Count	46,437
Mean	22.5%
Std. Dev	230.5%
Minimum	-7.51E+01
25th Percentile	15.5%
Median	26.0%
75th Percentile	35.6%
Maximum	1.91E+02

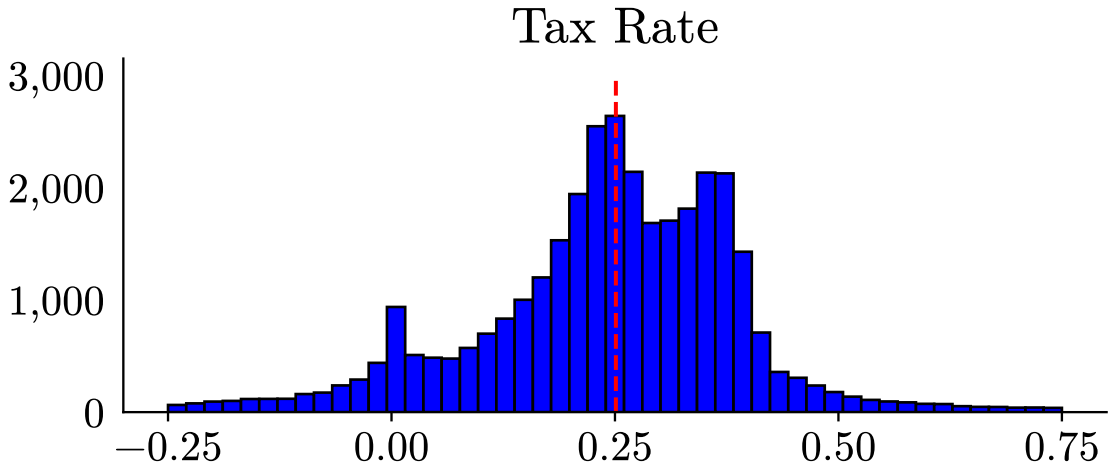


Filtered 1981-2022

Taxes and Tax Rate

- Last year, I applied a tax rate of 25% for all firms
- This was arbitrary, so when I computed statistics for the full WRDS database, I used the *effective* tax rate to unlever the beta
  - Taxes / Taxable Income
  - Better to use marginal tax rate but that is hard to identify for many firms
- This is part of my endogenous variable, unlevered beta

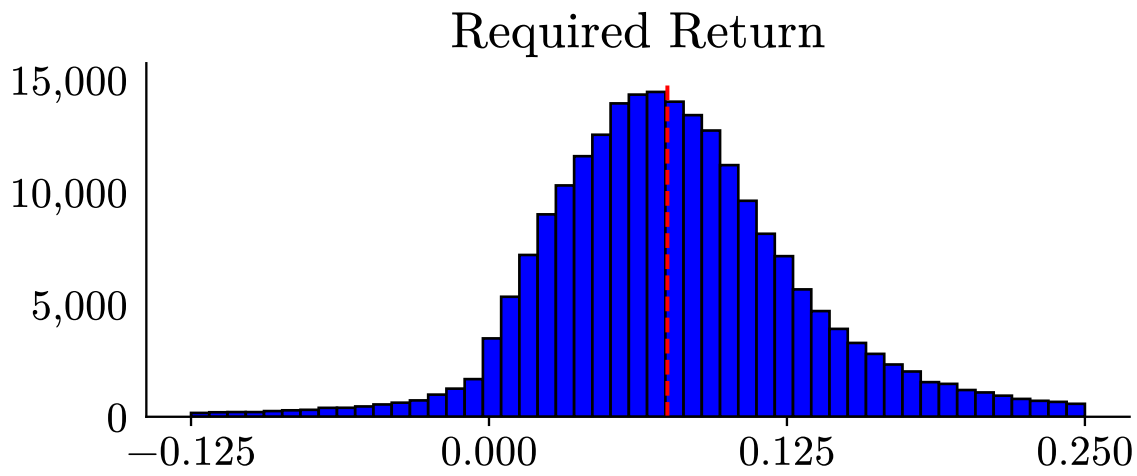
Tax Rate	
Count	35,619
Mean	22.1%
Std. Dev	234.7%
Minimum	-7.51E+01
25th Percentile	15.6%
Median	25.1%
75th Percentile	34.6%
Maximum	1.91E+02

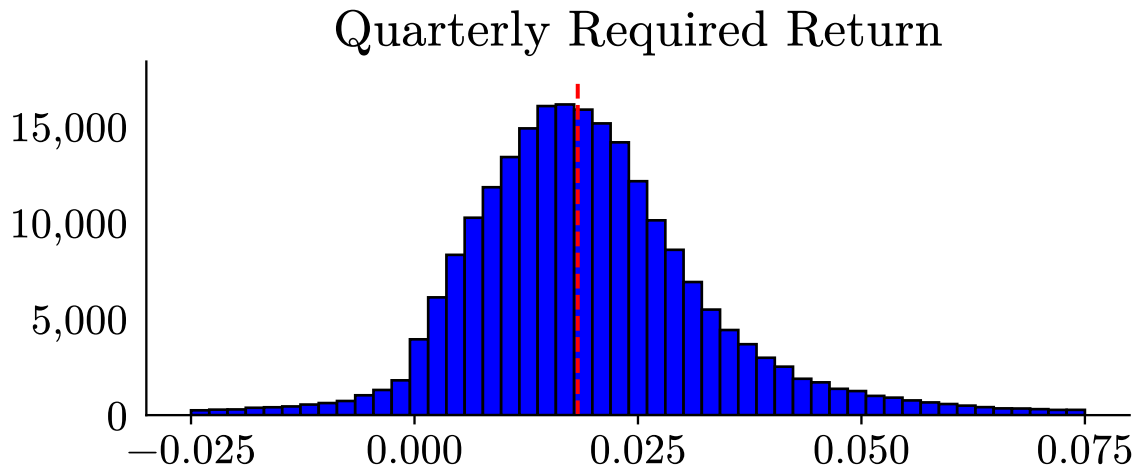


Filtered Current

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

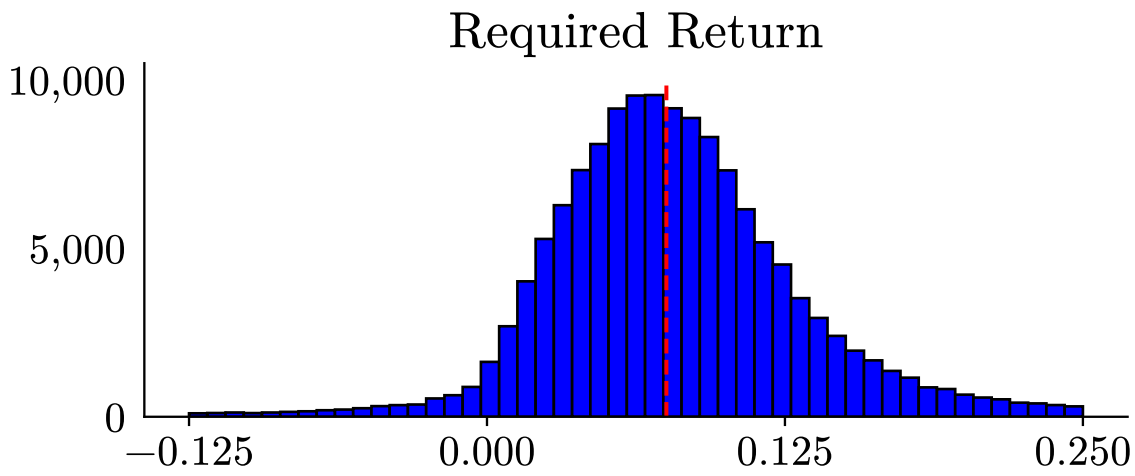


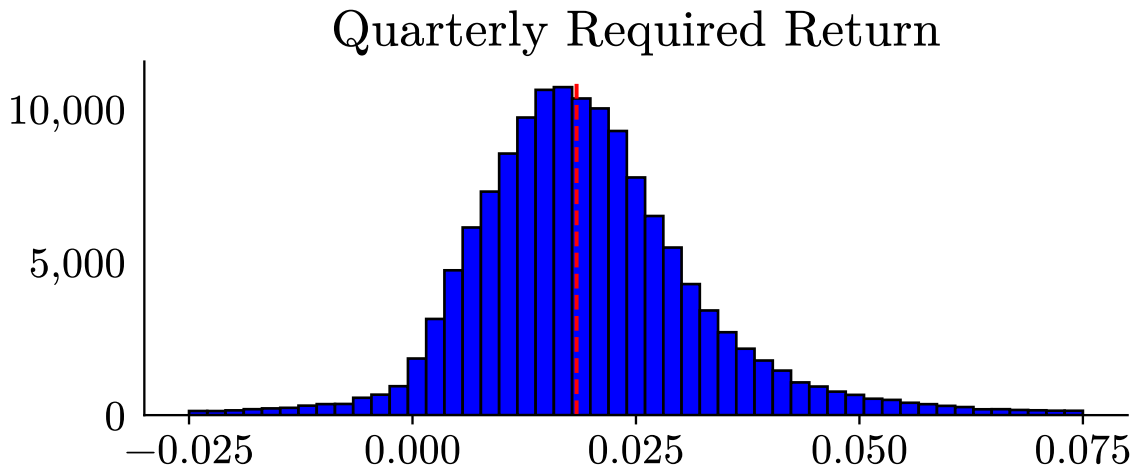


Unfiltered 1981-2022

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

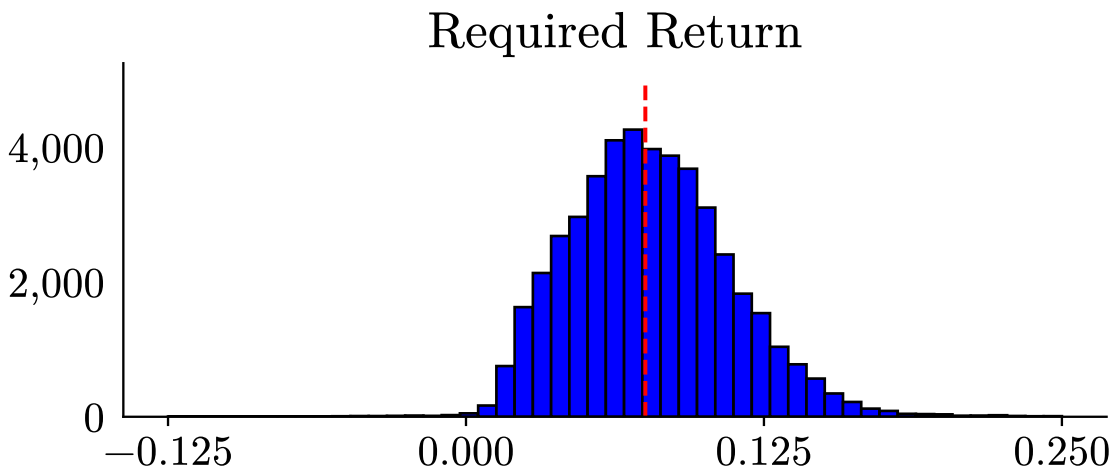


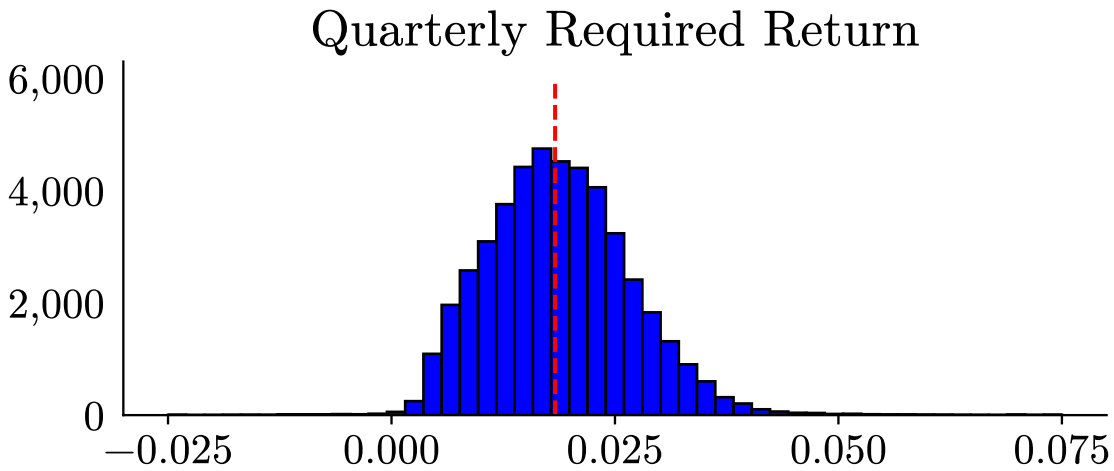


Unfiltered Current

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

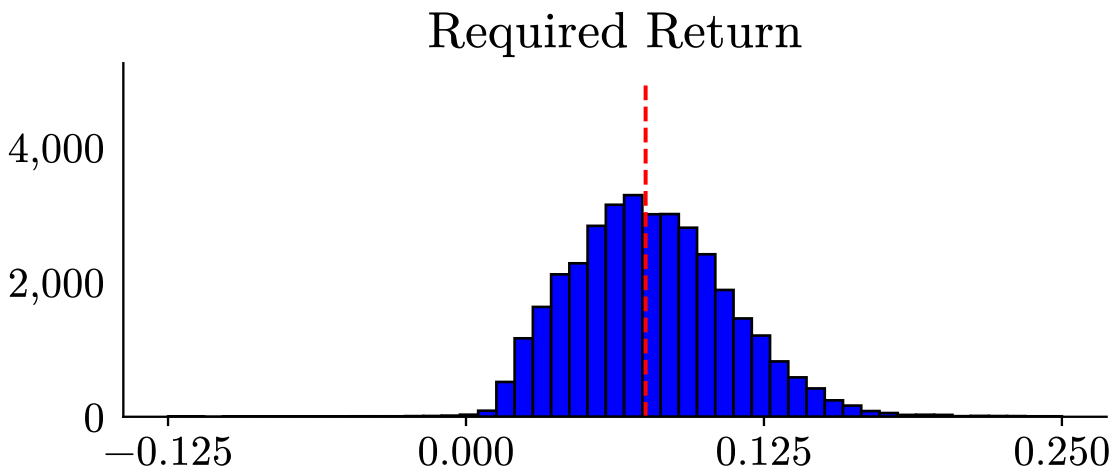


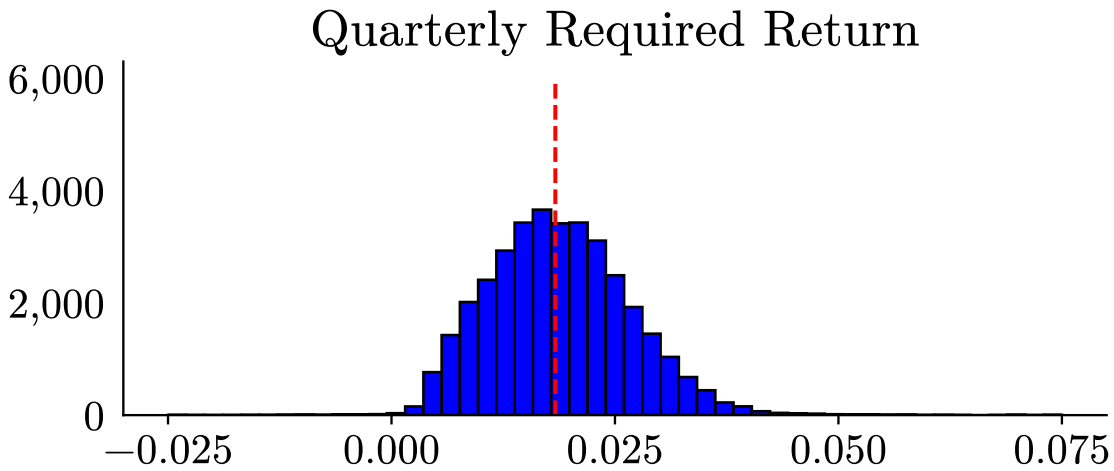


Filtered 1981-2022

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





Filtered Current

Measures of Power

Measures Include

- Profit metrics
  - Lerner index*
  - Hay-Liu-Boone index*
  - Accounting profit margins*
  - Marginal ROIC or ROA
- Concentration
  - ~~k-Firm concentration index~~
  - Herfindahl-Hirshman index
- Time Series
  - ~~Industry Churn~~
  - ~~Profits Autoregression~~
- Elasticity
  - ~~Rothschild-Bresnahan~~
  - ~~Panzar-Rosse H-Statistic~~
- Valuation
  - Tobin's q

Lerner Index

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

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

Estimate Lerner with

$$(\text{EBIT} - \text{RR}) = \beta_0 + \beta_1(\text{Revenue})$$

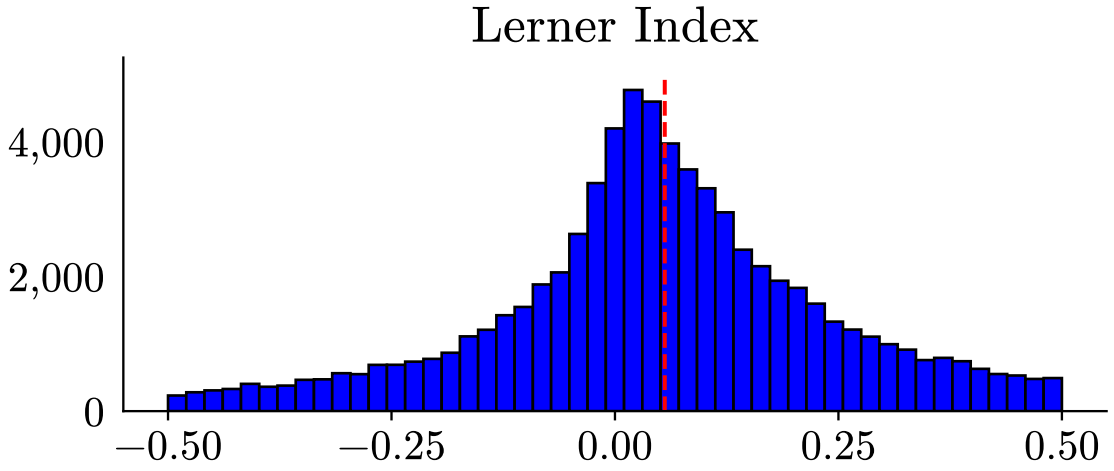
Calculate Required Return with

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

Lerner Index

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

Lerner Index	
Count	96,030
Mean	-0.960
Std. Dev	255.41
Minimum	-61,974.741
25th Percentile	-0.087
Median	0.056
75th Percentile	0.253
Maximum	16,181.083

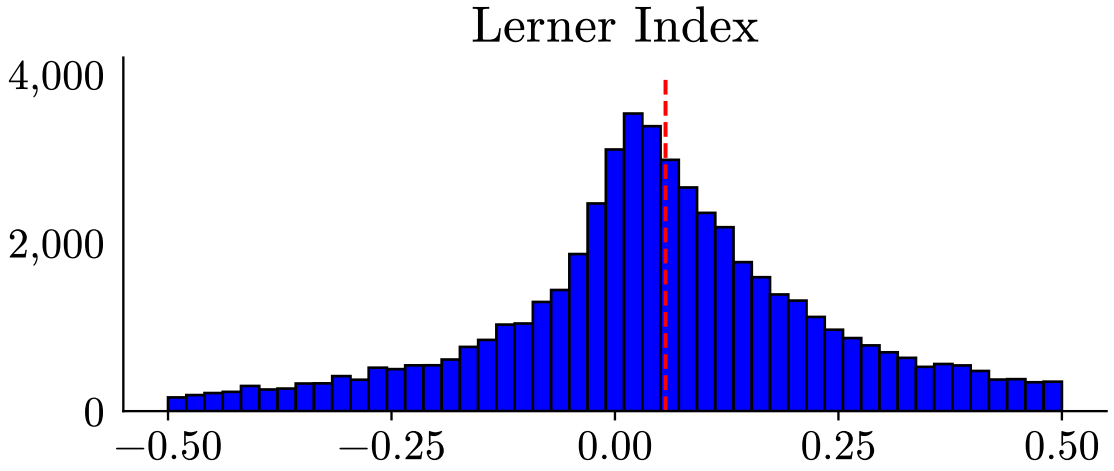


Unfiltered 1981-2022

Lerner Index

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

Lerner Index	
Count	68,410
Mean	-1.050
Std. Dev	259.947
Minimum	-61,974.741
25th Percentile	-0.077
Median	0.057
75th Percentile	0.247
Maximum	16,181.083

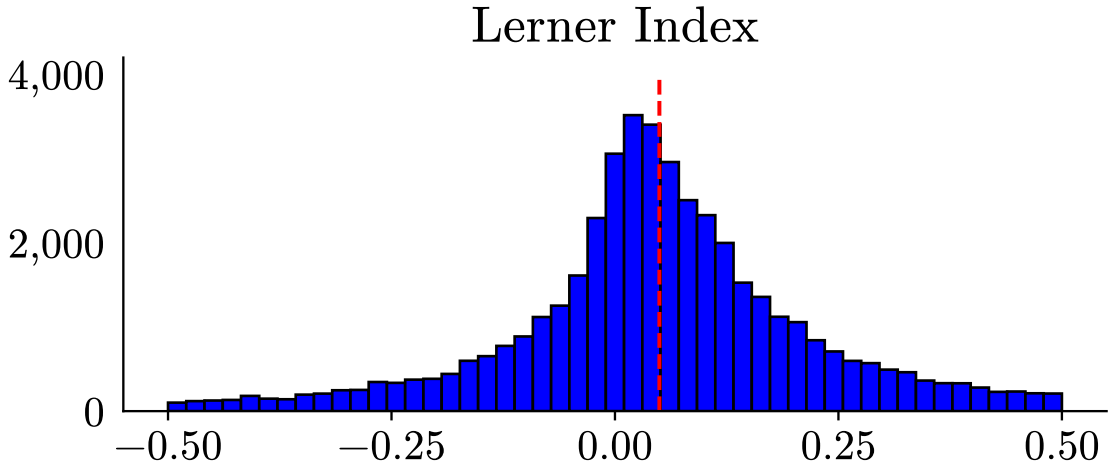


Unfiltered Current

Lerner Index

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

Lerner Index	
Count	46,437
Mean	0.071
Std. Dev	0.227
Minimum	-1.506
25th Percentile	-0.026
Median	0.050
75th Percentile	0.154
Maximum	1.858

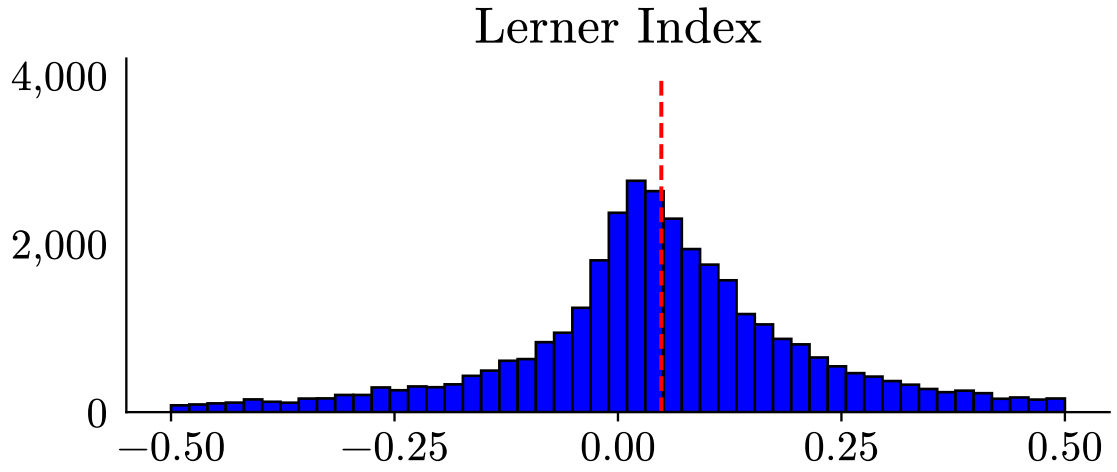


Filtered 1981-2022

Lerner Index

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

Lerner Index	
Count	35,619
Mean	0.068
Std. Dev	0.223
Minimum	-1.491
25th Percentile	-0.026
Median	0.049
75th Percentile	0.151
Maximum	1.858

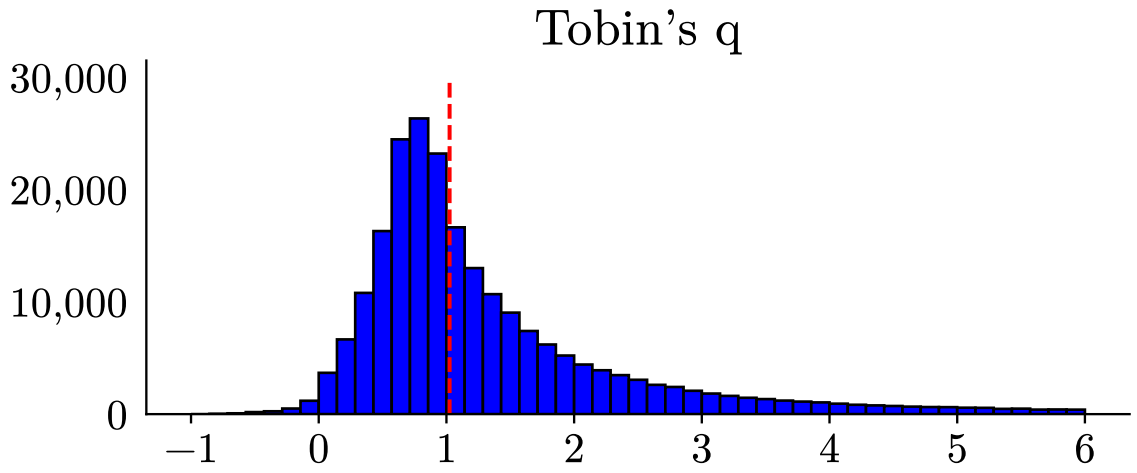


Filtered Current

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	233,862
Mean	6.260
Std. Dev	334.538
Minimum	-0.843
25th Percentile	0.685
Median	1.025
75th Percentile	1.825
Maximum	98,030.435



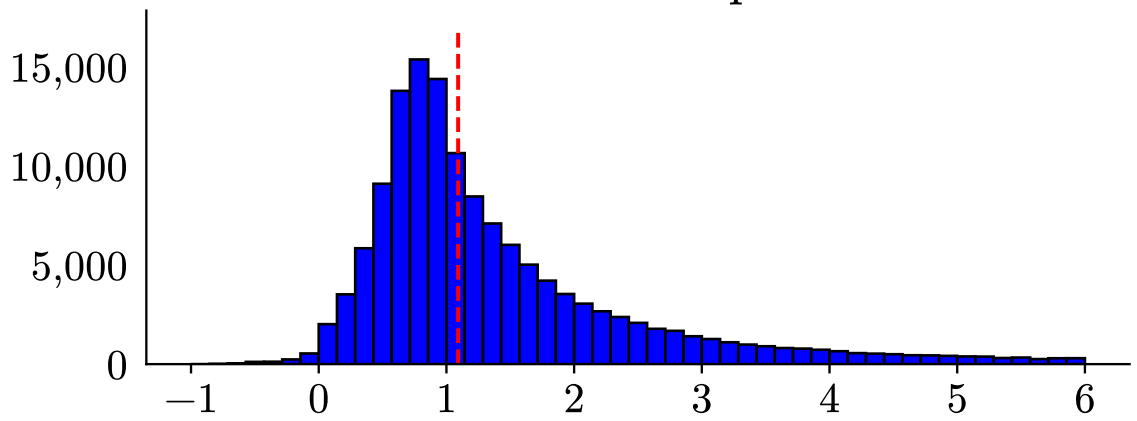
Unfiltered 1981-2022

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	144,408
Mean	5.585
Std. Dev	297.926
Minimum	-0.843
25th Percentile	0.722
Median	1.092
75th Percentile	1.923
Maximum	88,722.496

Tobin's q

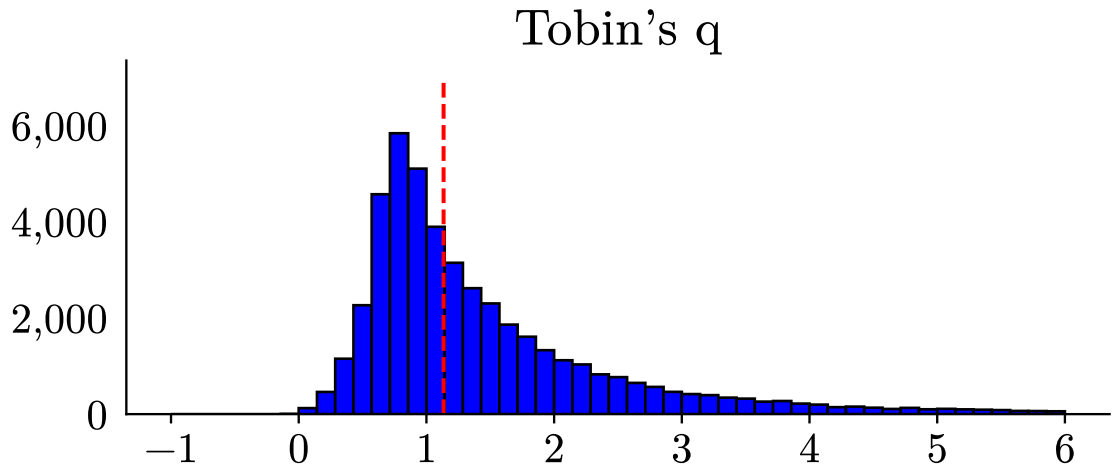


Unfiltered Current

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	46,437
Mean	1.606
Std. Dev	1.590
Minimum	-0.059
25th Percentile	0.790
Median	1.134
75th Percentile	1.845
Maximum	31.660

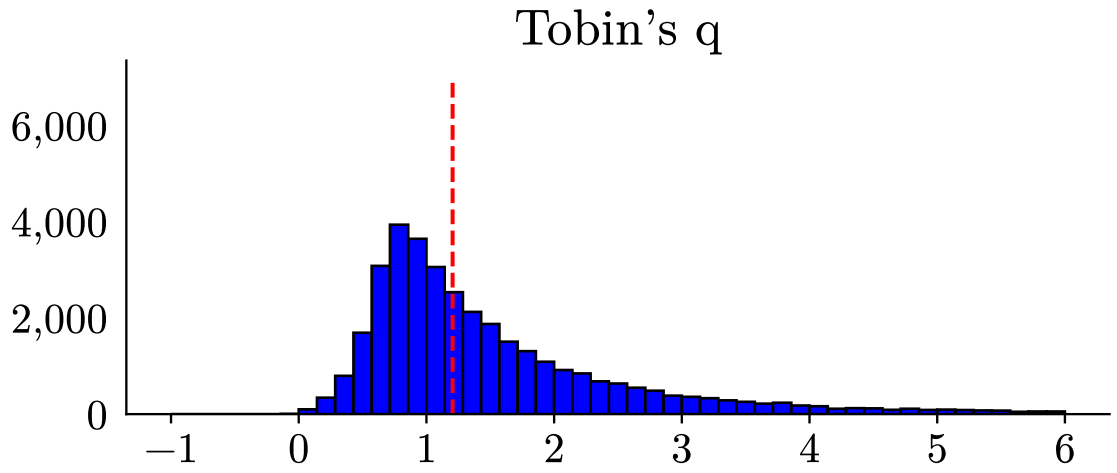


Filtered 1981-2022

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	35,619
Mean	1.694
Std. Dev	1.691
Minimum	-0.059
25th Percentile	0.820
Median	1.205
75th Percentile	1.948
Maximum	31.660



Filtered Current

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

Compute EBIT Margin with

$$\text{EBIT Margin \%} = \frac{\text{EBIT}}{\text{Revenue}}$$

Estimate Price-Cost Margin with

$$\text{EBIT} = \beta_0 + \beta_1(\text{Revenue})$$

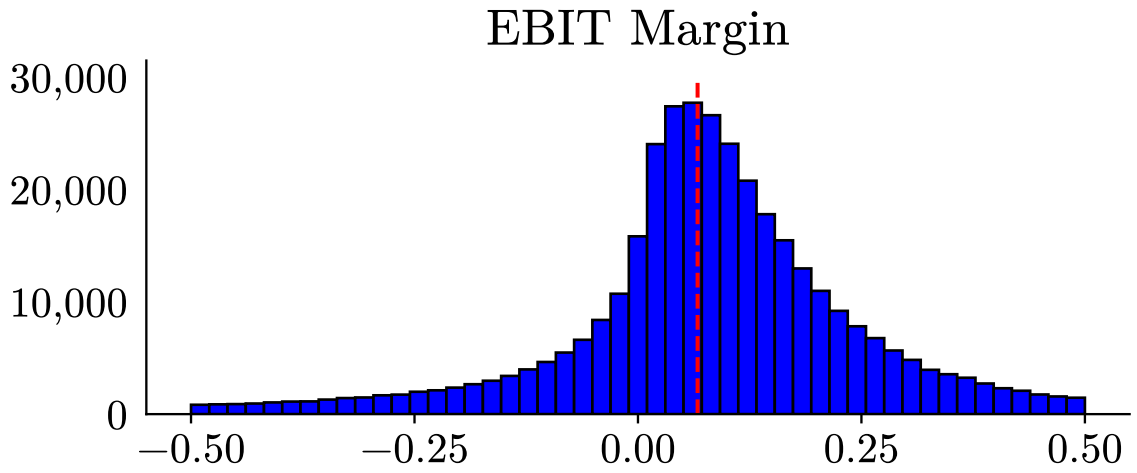
Compute ROIC with

$$\text{ROIC} = \frac{\text{EBIT}(1-\tau)}{\text{Invested Capital}}$$

EBIT Margin

- Percent profit on earnings before interest and tax
- Common financial metric

EBIT Margin	
Count	412,691
Mean	-5.136
Std. Dev	138.919
Minimum	-3.95E+04
25th Percentile	-0.039
Median	0.067
75th Percentile	0.162
Maximum	7.43E+02

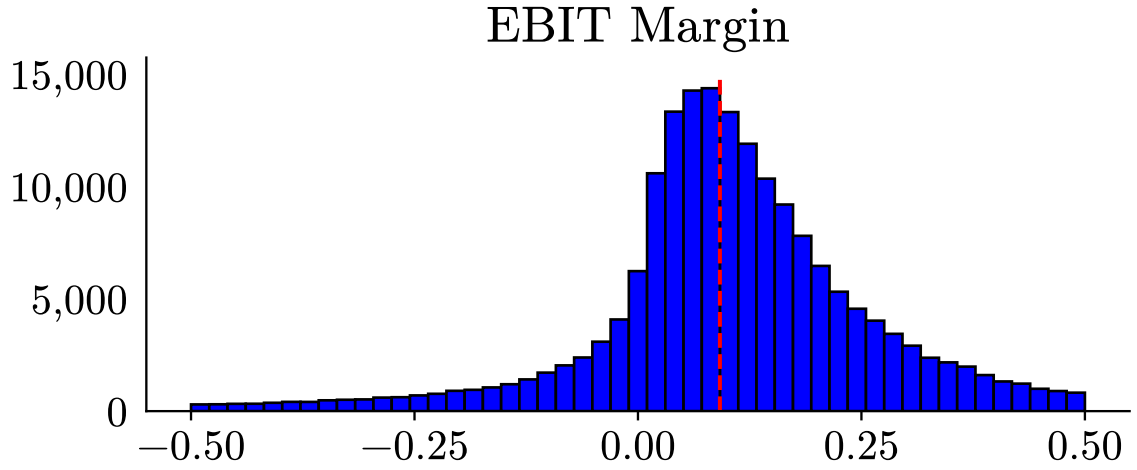


Unfiltered 1981-2022

EBIT Margin

- Percent profit on earnings before interest and tax
- Common financial metric

EBIT Margin	
Count	203,413
Mean	-4.011
Std. Dev	143.618
Minimum	-3.95E+04
25th Percentile	0.014
Median	0.092
75th Percentile	0.189
Maximum	7.43E+02

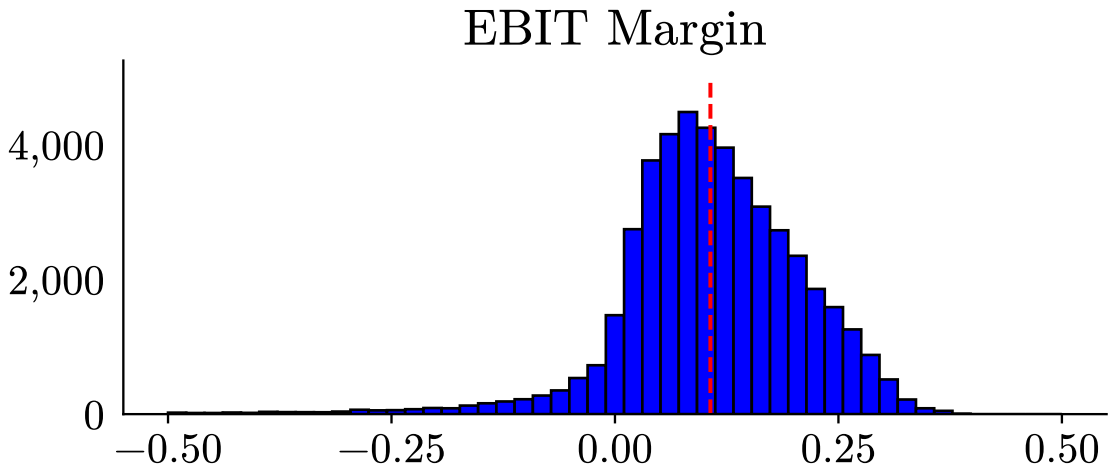


Unfiltered Current

EBIT Margin

- Percent profit on earnings before interest and tax
- Common financial metric

EBIT Margin	
Count	46,437
Mean	0.105
Std. Dev	0.114
Minimum	-1.498
25th Percentile	0.052
Median	0.107
75th Percentile	0.173
Maximum	0.387

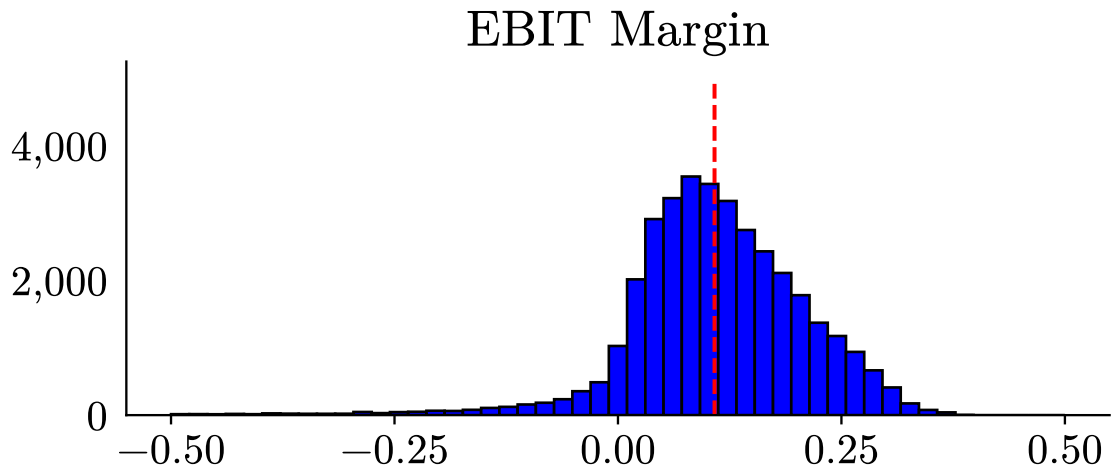


Filtered 1981-2022

EBIT Margin

- Percent profit on earnings before interest and tax
- Common financial metric

EBIT Margin	
Count	35,619
Mean	0.107
Std. Dev	0.112
Minimum	-1.498
25th Percentile	0.055
Median	0.108
75th Percentile	0.172
Maximum	0.387

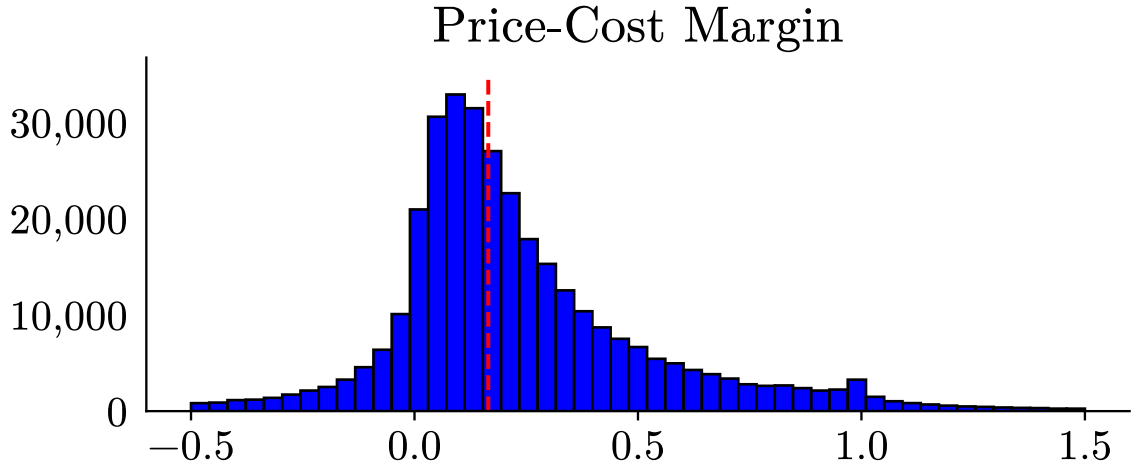


Filtered Current

Price-Cost Margin

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

Price Cost Margin	
Count	348,074
Mean	0.097
Std. Dev	18.923
Minimum	-6,487.639
25th Percentile	0.053
Median	0.165
75th Percentile	0.357
Maximum	3,431.453

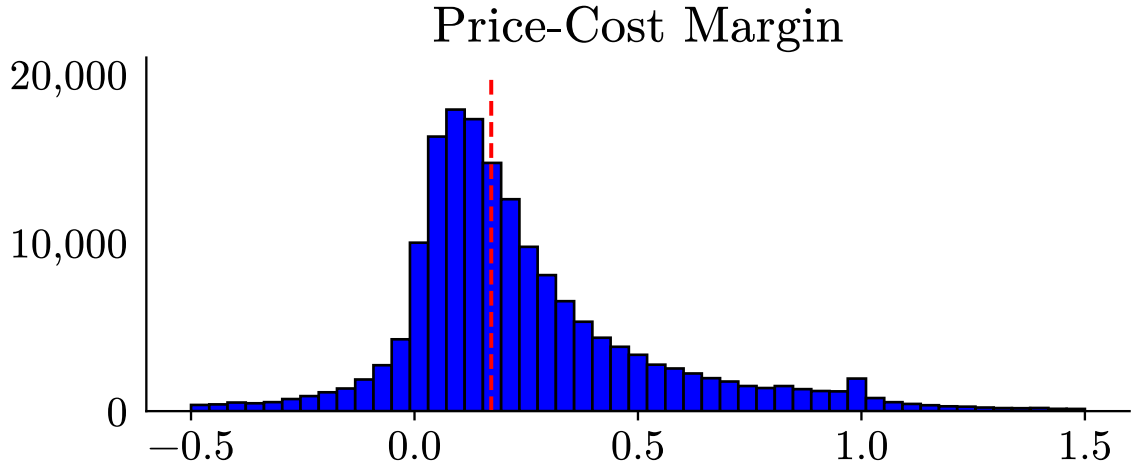


Unfiltered 1981-2022

Price-Cost Margin

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

Price Cost Margin	
Count	179,427
Mean	0.010
Std. Dev	24.659
Minimum	-6,487.639
25th Percentile	0.065
Median	0.172
75th Percentile	0.357
Maximum	3,431.453

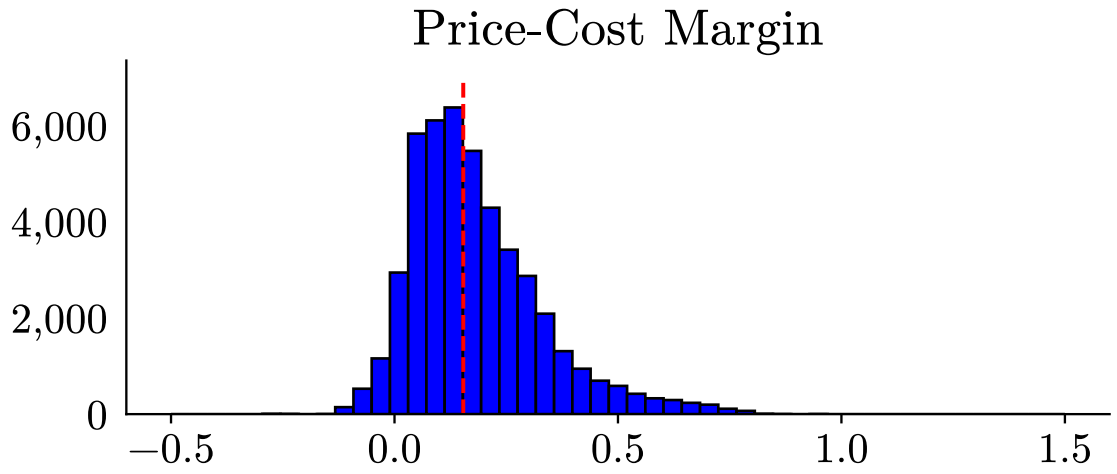


Unfiltered Current

Price-Cost Margin

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

Price Cost Margin	
Count	46,437
Mean	0.182
Std. Dev	0.147
Minimum	-0.288
25th Percentile	0.078
Median	0.154
75th Percentile	0.256
Maximum	0.945

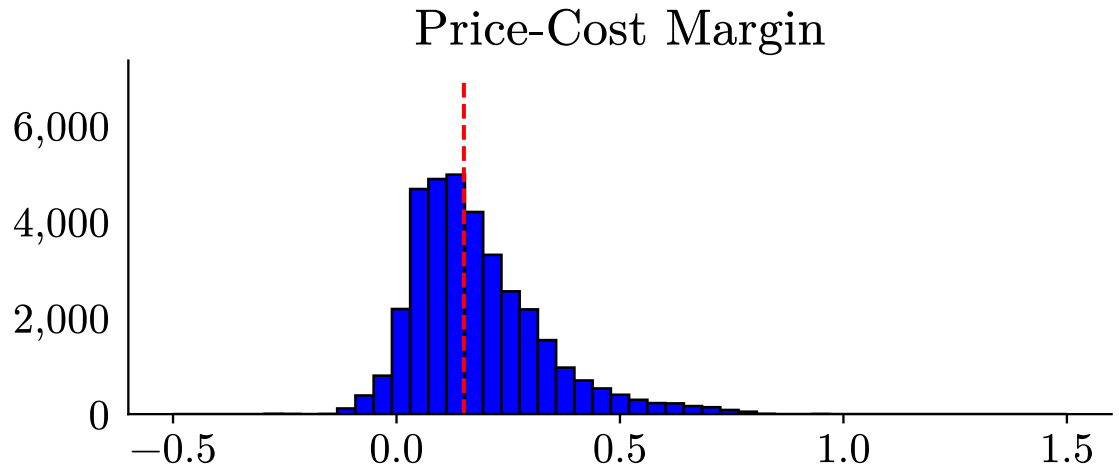


Filtered 1981-2022

Price-Cost Margin

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

Price Cost Margin	
Count	35,619
Mean	0.180
Std. Dev	0.145
Minimum	-0.288
25th Percentile	0.077
Median	0.151
75th Percentile	0.251
Maximum	0.945

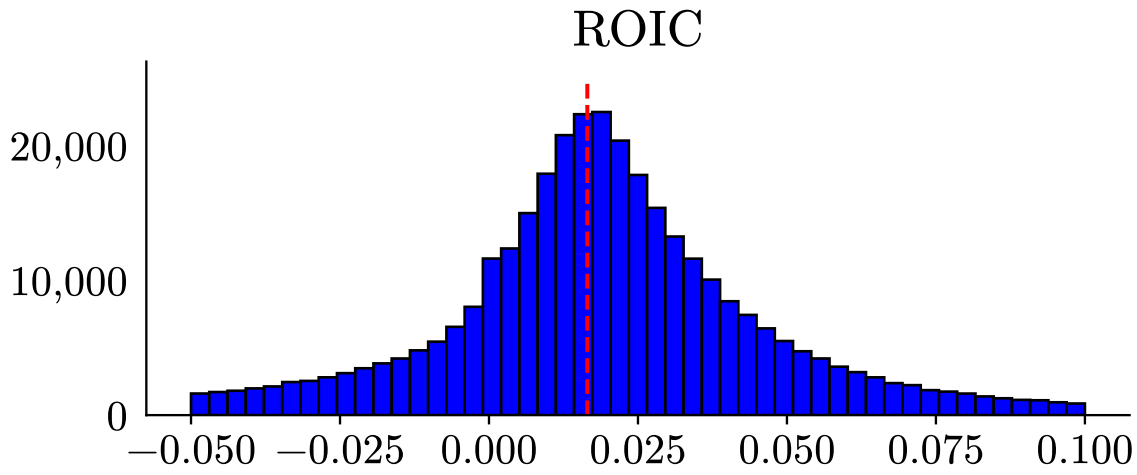


Filtered Current

Return on Invested Capital

- Profit divided by the resources the company has
- Used to assess performance
- Quarterly shown here

ROIC	
Count	410,035
Mean	0.042
Std. Dev	10.760
Minimum	-1,809.000
25th Percentile	-0.004
Median	0.017
75th Percentile	0.034
Maximum	5,348.000

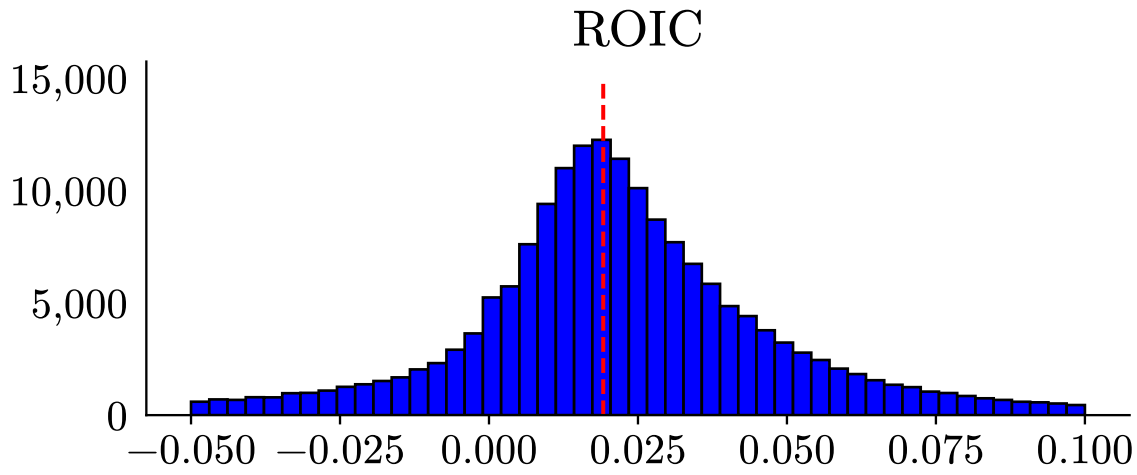


Unfiltered 1981-2022

Return on Invested Capital

- Profit divided by the resources the company has
- Used to assess performance
- Quarterly shown here

ROIC	
Count	202,335
Mean	0.100
Std. Dev	13.069
Minimum	-1,168.000
25th Percentile	0.003
Median	0.019
75th Percentile	0.036
Maximum	5,348.000

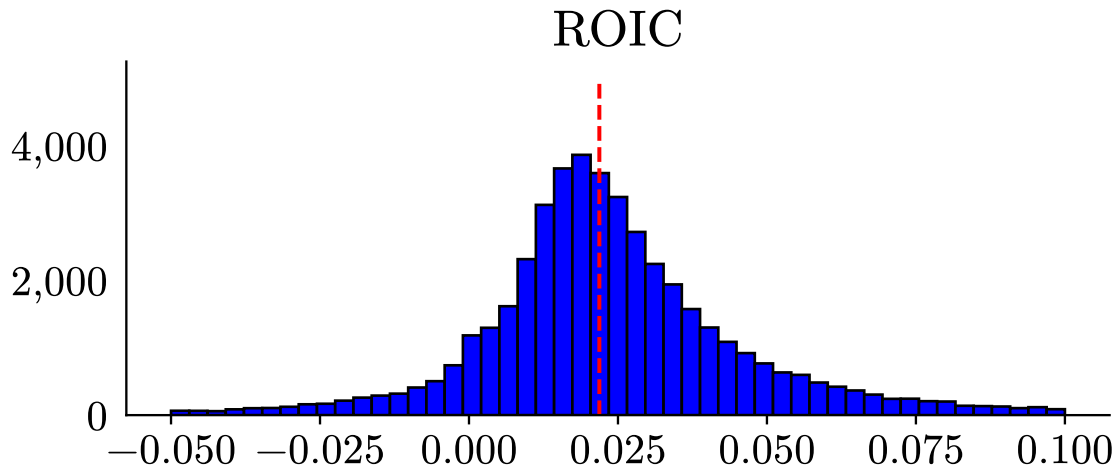


Unfiltered Current

Return on Invested Capital

- Profit divided by the resources the company has
- Used to assess performance
- Quarterly shown here

ROIC	
Count	46,437
Mean	0.025
Std. Dev	0.080
Minimum	-4.720
25th Percentile	0.012
Median	0.022
75th Percentile	0.035
Maximum	6.932

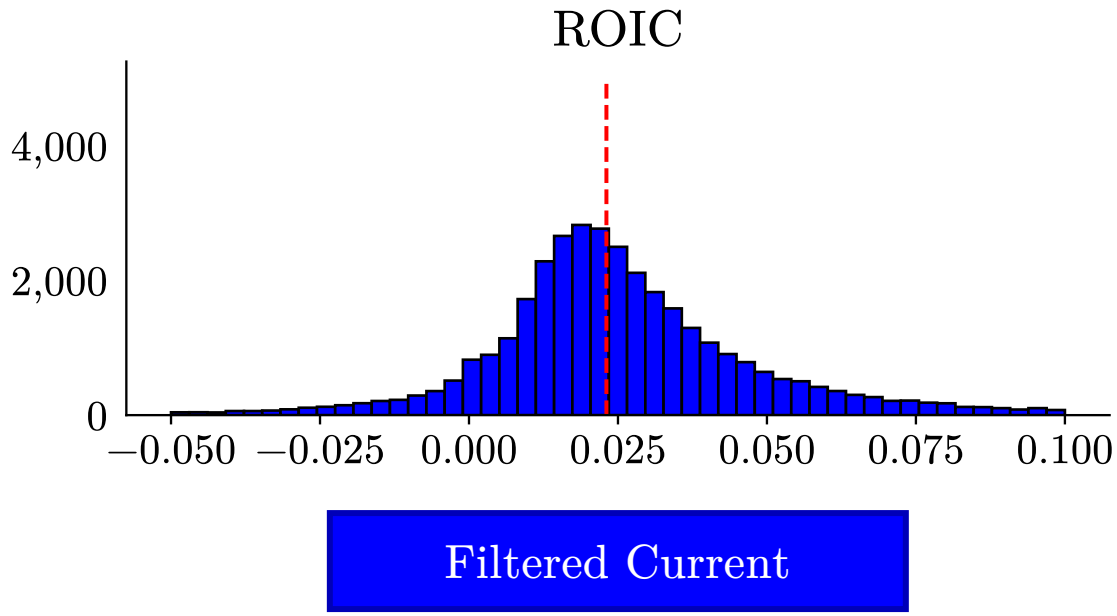


Filtered 1981-2022

Return on Invested Capital

- Profit divided by the resources the company has
- Used to assess performance
- Quarterly shown here

ROIC	
Count	35,619
Mean	0.027
Std. Dev	0.073
Minimum	-4.720
25th Percentile	0.013
Median	0.023
75th Percentile	0.037
Maximum	6.538



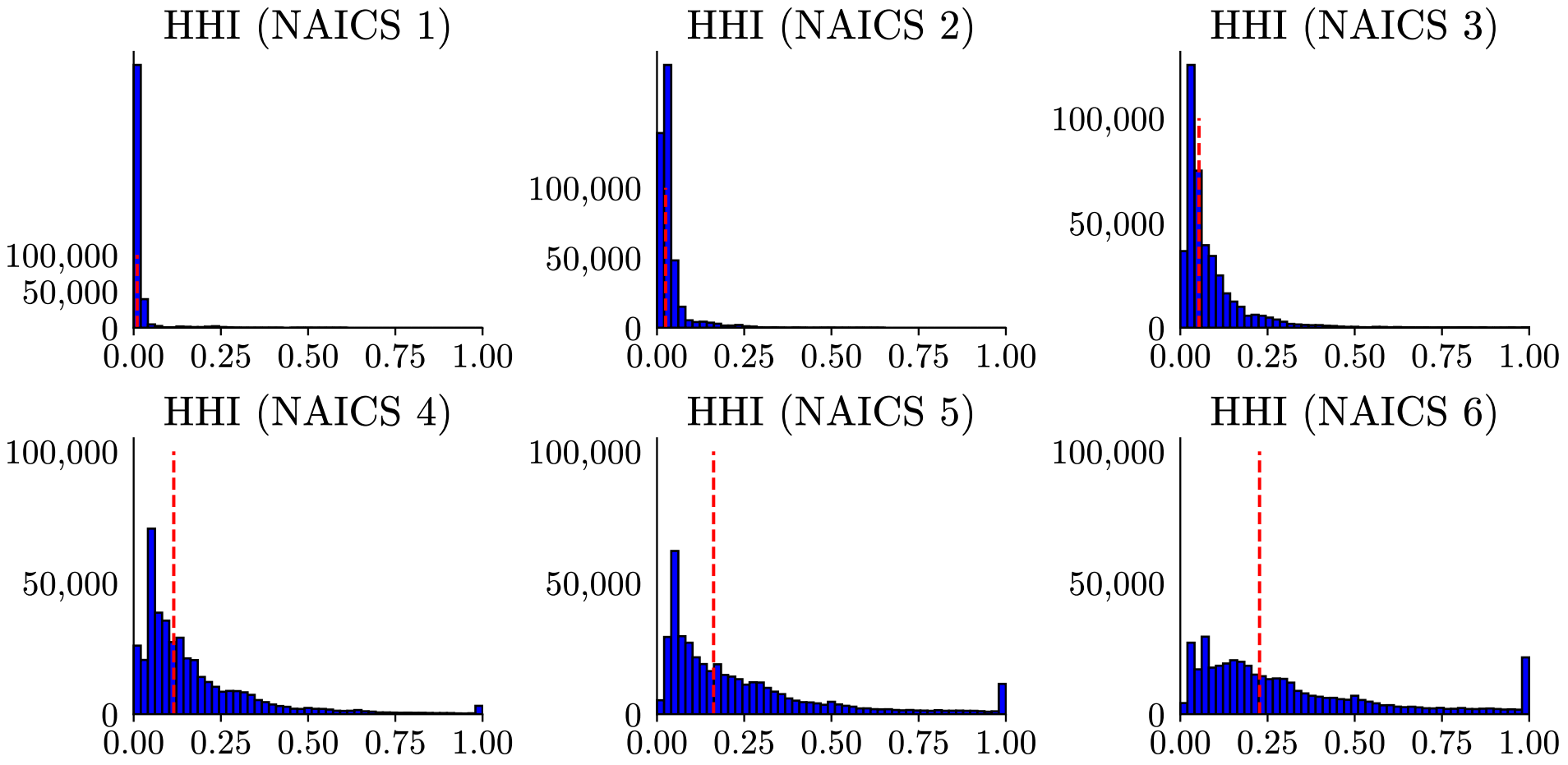
Hirschman-Herfindahl Index

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

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

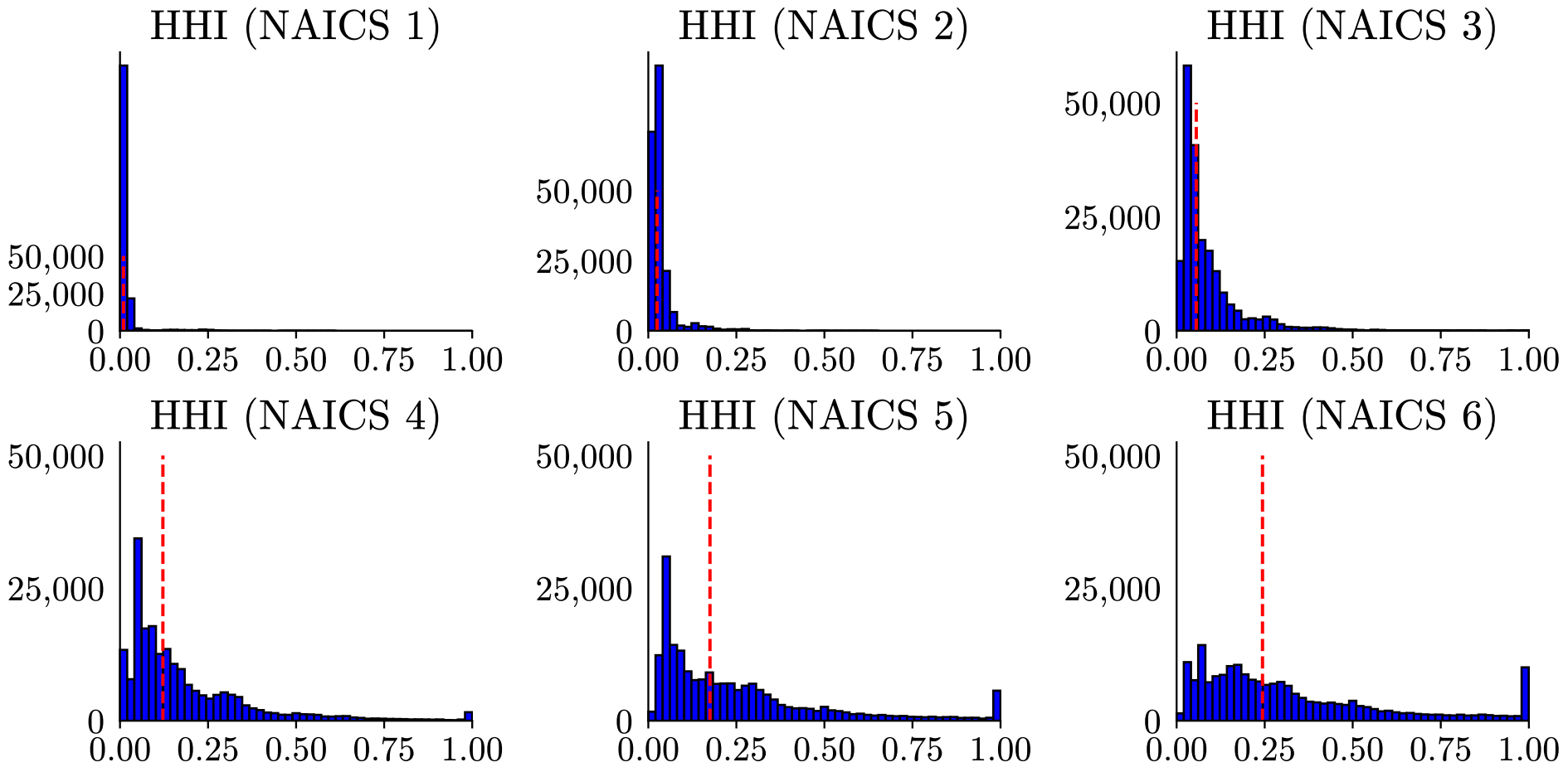
I compute market share and HHI before any filtering.

Hirschman-Herfindahl Index



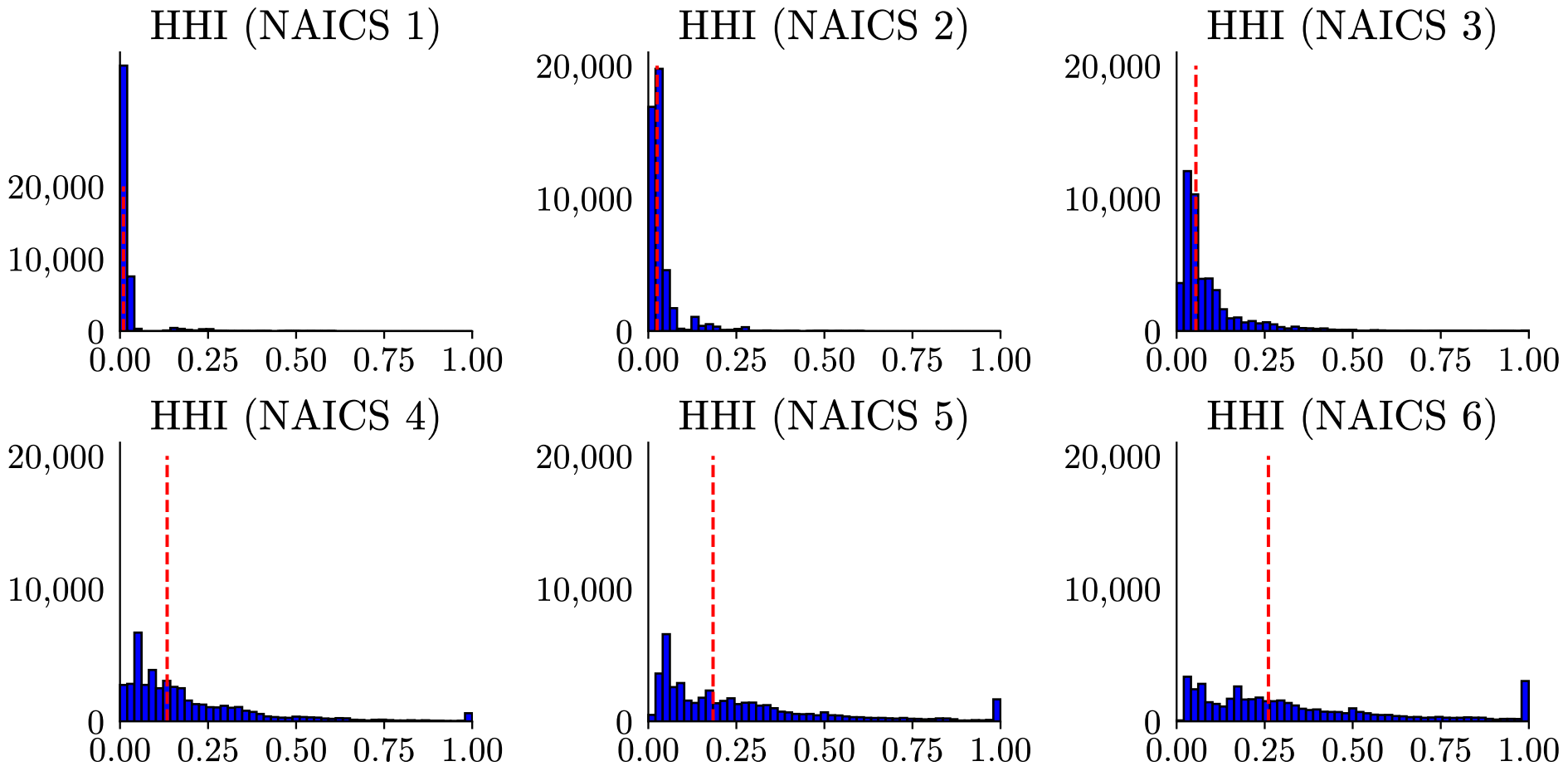
Unfiltered 1981-2022

Hirschman-Herfindahl Index



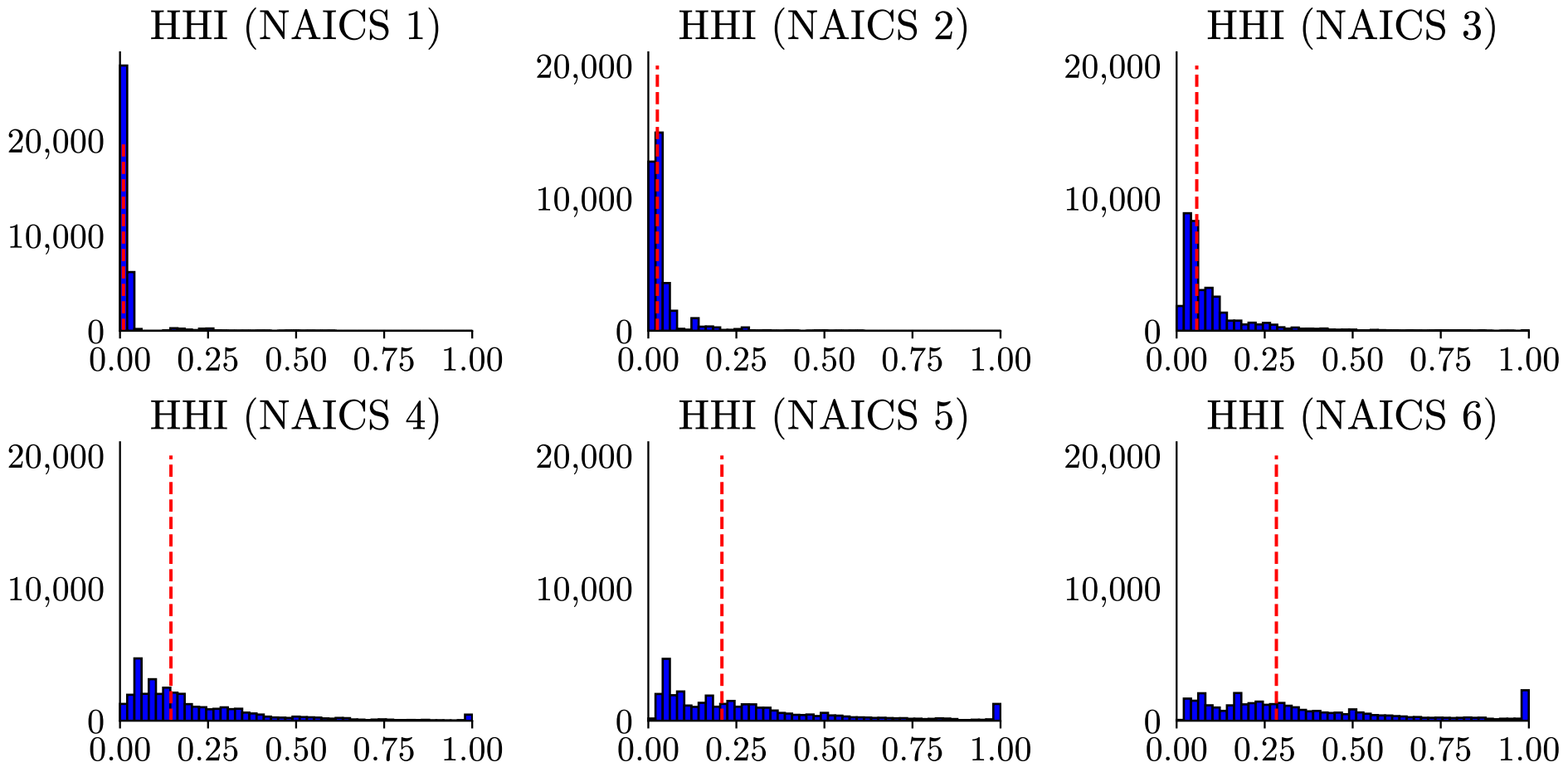
Unfiltered Current

Hirschman-Herfindahl Index



Filtered 1981-2022

Hirschman-Herfindahl Index



Filtered Current

Regressions

Regressions

- All Heteroskedastic
- Run them for all four subsets of the data
- Mostly small, insignificant coefficients
- Endogenous variable is **Unlevered Beta**

Regressions

1. UL Beta vs Lerner
2. UL Beta vs Monopoly Stat + Controls & FEs
   - Lerner, PCM, Tobin's q, HHI_4
3. UL Beta vs Monopoly Stat $\times$ Revenue + Controls & FEs
   - Lerner, PCM, HHI_4

8 Specifications $\times$ 4 Subsets $=$ 32 Regressions

(This is a fraction of the regressions I actually ran, of course.)

1. Beta vs Lerner

Lerner – Unfiltered Data

$$\beta_{UL} = a_0 + b_1(\text{Lerner})$$

Unfiltered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.855	0.002	395.764	–
Lerner	-1.53E-05	8.43E-06	-1.817	0.069

Unfiltered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.893	0.002	357.718	–
Lerner	4.71E-06	9.58E-06	0.491	0.623

Lerner – Filtered Data

$$\beta_{UL} = a_0 + b_1(\text{Lerner})$$

Filtered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.903	0.003	361.040	–
Lerner	-0.068	0.011	-6.493	–

Filtered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.928	0.003	339.895	–
Lerner	-0.128	0.012	-10.929	–

2. Beta vs Monopoly Stats

Lerner – Unfiltered Data

$$\beta_{UL} = a_0 + b_1(\text{Lerner}) + b_2(\text{Market Cap}) + b_3(\ln(\text{Stock Price})) + \Gamma_{I,Y}$$

Unfiltered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.269	0.061	4.397	–
Lerner	-1.17E-05	7.13E-06	-1.634	0.102
Market Cap	-6.38E-07	3.46E-08	-18.432	–
ln(Stock Price)	0.062	0.001	60.188	–

Unfiltered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.342	0.095	3.617	–
Lerner	8.16E-06	8.32E-06	0.980	0.327
Market Cap	-4.73E-07	3.51E-08	-13.474	–
ln(Stock Price)	0.042	0.001	32.104	–

Lerner – Filtered Data

$$\beta_{UL} = a_0 + b_1(\text{Lerner}) + b_2(\text{Market Cap}) + b_3(\ln(\text{Stock Price})) + \Gamma_{I,Y}$$

Filtered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.368	0.067	5.488	–
Lerner	-0.133	0.008	-15.669	–
Market Cap	-3.32E-07	3.05E-08	-10.888	–
ln(Stock Price)	0.010	0.002	5.161	–

Filtered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.365	0.099	3.691	–
Lerner	-0.148	0.010	-15.113	–
Market Cap	-3.23E-07	3.06E-08	-10.550	–
ln(Stock Price)	0.014	0.002	6.415	–

PCM – Unfiltered Data

$$\beta_{UL} = a_0 + b_1(\text{PCM}) + b_2(\text{Market Cap}) + b_3(\ln(\text{Stock Price})) + \Gamma_{I,Y}$$

Unfiltered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.188	0.062	3.041	0.002
PCM	-1.00E-04	6.55E-05	-1.658	0.097
Market Cap	-8.43E-07	3.73E-08	-22.594	–
ln(Stock Price)	0.058	0.001	70.407	–

Unfiltered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.266	0.093	2.846	0.004
PCM	-5.00E-04	6.59E-05	-7.600	–
Market Cap	-5.45E-07	3.59E-08	-15.164	–
ln(Stock Price)	0.030	0.001	27.903	–

PCM – Filtered Data

$$\beta_{UL} = a_0 + b_1(\text{PCM}) + b_2(\text{Market Cap}) + b_3(\ln(\text{Stock Price})) + \Gamma_{I,Y}$$

Filtered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.286	0.067	4.256	–
PCM	0.149	0.013	11.012	–
Market Cap	-3.57E-07	3.05E-08	-11.706	–
ln(Stock Price)	0.008	0.002	4.284	–

Filtered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.310	0.099	3.130	0.002
PCM	0.149	0.016	9.542	–
Market Cap	-3.48E-07	3.06E-08	-11.371	–
ln(Stock Price)	0.012	0.002	5.274	–

HHI_4 – Unfiltered Data

$$\beta_{UL} = a_0 + b_1(\text{HHI}_4) + b_2(\text{Market Cap}) + b_3(\ln(\text{Stock Price})) + \Gamma_{I,Y}$$

Unfiltered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.265	0.025	10.643	–
HHI_4	-0.004	0.001	-3.585	–
Market Cap	-9.46E-07	3.74E-08	-25.253	–
ln(Stock Price)	0.059	0.001	79.569	–

Unfiltered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.382	0.036	10.630	–
HHI_4	-0.003	0.001	-2.324	0.020
Market Cap	-6.37E-07	3.60E-08	-17.727	–
ln(Stock Price)	0.032	0.001	32.442	–

HHI_4 – Filtered Data

$$\beta_{UL} = a_0 + b_1(\text{HHI}_4) + b_2(\text{Market Cap}) + b_3(\ln(\text{Stock Price})) + \Gamma_{I,Y}$$

Filtered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.269	0.068	3.970	–
HHI_4	0.082	0.012	7.004	–
Market Cap	-3.48E-07	3.05E-08	-11.404	–
ln(Stock Price)	0.010	0.002	4.919	–

Filtered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.238	0.100	2.389	0.017
HHI_4	0.121	0.013	9.268	–
Market Cap	-3.40E-07	3.06E-08	-11.102	–
ln(Stock Price)	0.014	0.002	6.161	–

Tobin's Q – Unfiltered Data

$$\beta_{UL} = a_0 + b_1(\text{Tobin's q}) + b_2(\text{Market Cap}) + b_3(\ln(\text{Share Price})) + \Gamma_{I,Y}$$

Unfiltered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.263	0.025	10.541	–
Tobin's q	-2.85E-05	4.42E-06	-6.452	–
Market Cap	-9.45E-07	3.74E-08	-25.222	–
ln(Stock Price)	0.059	0.001	79.388	–

Unfiltered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.380	0.036	10.582	–
Tobin's q	4.90E-06	5.73E-06	0.856	0.392
Market Cap	-6.37E-07	3.60E-08	-17.702	–
ln(Stock Price)	0.032	0.001	32.374	–

Tobin's Q – Filtered Data

$$\beta_{UL} = a_0 + b_1(\text{Tobin's q}) + b_2(\text{Market Cap}) + b_3(\ln(\text{Share Price})) + \Gamma_{I,Y}$$

Filtered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.345	0.067	5.148	–
Tobin's q	0.008	0.001	6.098	–
Market Cap	-3.46E-07	3.05E-08	-11.327	–
ln(Stock Price)	0.005	0.002	2.328	0.020

Filtered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.345	0.099	3.478	0.001
Tobin's q	0.009	0.001	6.167	–
Market Cap	-3.37E-07	3.07E-08	-10.998	–
ln(Stock Price)	0.008	0.002	3.283	0.001

3. Beta vs Monopoly Stats and Interaction

Lerner – Unfiltered Data

$$\beta_{UL} = a_0 + b_1(\text{Lerner}) + b_2(\text{Revenue}) + b_3(\text{Rev:Lerner}) + b_4(\text{Market Cap})\Gamma_{I,Y}$$

Unfiltered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.409	0.063	6.505	–
Lerner	-2.26E-05	7.36E-06	-3.074	0.002
Revenue	-4.61E-06	3.68E-07	-12.516	–
Lerner:Revenue	-3.05E-09	4.80E-09	-0.636	0.525
Market Cap	1.65E-07	4.37E-08	3.774	–

Unfiltered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.438	0.096	4.587	–
Lerner	1.17E-05	8.44E-06	1.392	0.164
Revenue	-5.51E-06	3.69E-07	-14.945	–
Lerner:Revenue	-4.58E-09	4.72E-09	-0.970	0.332
Market Cap	1.61E-07	4.32E-08	3.729	–

Lerner – Filtered Data

$$\beta_{UL} = a_0 + b_1(\text{Lerner}) + b_2(\text{Revenue}) + b_3(\text{Rev:Lerner}) + b_4(\text{Market Cap})\Gamma_{I,Y}$$

Filtered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.391	0.066	5.895	–
Lerner	-0.133	0.009	-14.867	–
Revenue	-5.89E-06	3.03E-07	-19.449	–
Lerner:Revenue	-7.30E-07	1.27E-06	-0.575	0.565
Market Cap	2.30E-07	3.80E-08	6.034	–

Filtered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.399	0.098	4.060	–
Lerner	-0.150	0.010	-14.399	–
Revenue	-6.12E-06	3.06E-07	-19.951	–
Lerner:Revenue	6.04E-07	1.29E-06	0.467	0.641
Market Cap	2.35E-07	3.80E-08	6.187	–

PCM – Unfiltered Data

$$\beta_{UL} = a_0 + b_1(\text{PCM}) + b_2(\text{Revenue}) + b_3(\text{Rev:PCM}) + b_4(\text{Market Cap})\Gamma_{I,Y}$$

Unfiltered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.300	0.063	4.753	–
PCM	-8.73E-05	6.75E-05	-1.293	0.196
Revenue	-5.19E-06	3.39E-07	-15.340	–
PCM:Revenue	1.29E-07	1.84E-07	0.700	0.484
Market Cap	1.80E-07	4.63E-08	3.899	–

Unfiltered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.333	0.094	3.541	–
PCM	-5.00E-04	6.67E-05	-7.289	–
Revenue	-6.02E-06	3.23E-07	-18.611	–
PCM:Revenue	1.59E-07	2.19E-07	0.727	0.467
Market Cap	1.59E-07	4.35E-08	3.660	–

PCM – Filtered Data

$$\beta_{UL} = a_0 + b_1(\text{PCM}) + b_2(\text{Revenue}) + b_3(\text{Rev:PCM}) + b_4(\text{Market Cap})\Gamma_{I,Y}$$

Filtered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.311	0.067	4.657	–
PCM	0.137	0.014	9.858	–
Revenue	-4.64E-06	3.42E-07	-13.560	–
PCM:Revenue	-1.13E-05	2.01E-06	-5.600	–
Market Cap	2.87E-07	4.22E-08	6.819	–

Filtered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.340	0.098	3.450	0.001
PCM	0.136	0.016	8.418	–
Revenue	-4.76E-06	3.46E-07	-13.739	–
PCM:Revenue	-1.20E-05	2.04E-06	-5.892	–
Market Cap	3.05E-07	4.22E-08	7.222	–

HHI_4 – Unfiltered Data

$$\beta_{UL} = a_0 + b_1(\text{HHI}_4) + b_2(\text{Revenue}) + b_3(\text{Rev:HHI}) + b_4(\text{Market Cap})\Gamma_{I,Y}$$

Unfiltered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.389	0.026	15.261	–
HHI_4	-0.004	0.001	-4.199	–
Revenue	-5.03E-06	4.03E-07	-12.458	–
HHI_4:Revenue	3.03E-06	9.63E-07	3.148	0.002
Market Cap	1.19E-07	4.62E-08	2.574	0.010

Unfiltered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.470	0.036	13.027	–
HHI_4	-0.004	0.001	-3.115	0.002
Revenue	-6.08E-06	3.84E-07	-15.821	–
HHI_4:Revenue	3.58E-06	9.09E-07	3.942	–
Market Cap	8.44E-08	4.31E-08	1.958	0.050

HHI_4 – Filtered Data

$$\beta_{UL} = a_0 + b_1(\text{HHI}_4) + b_2(\text{Revenue}) + b_3(\text{Rev:HHI}) + b_4(\text{Market Cap})\Gamma_{I,Y}$$

Filtered 1981-2022

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.306	0.067	4.543	–
HHI_4	0.063	0.012	5.237	–
Revenue	-6.88E-06	3.82E-07	-18.038	–
HHI_4:Revenue	4.37E-06	1.10E-06	3.977	–
Market Cap	1.77E-07	3.83E-08	4.634	–

Filtered Current

Item	Coefficient	Std. Error	Z	p-value
Intercept	0.286	0.099	2.891	0.004
HHI_4	0.097	0.013	7.294	–
Revenue	-6.92E-06	3.87E-07	-17.900	–
HHI_4:Revenue	4.05E-06	1.13E-06	3.591	–
Market Cap	1.86E-07	3.83E-08	4.846	–

Next Steps...

Next Steps

- Finalize Filtering
- Add Hay-Liu-Boone Statistic
- Improve theoretical model
- Review additional specifications

And possibly see if it is at all possible to cut down the number of slides...