The Micro–Agregated Profit Share

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Motivation

Growing interest in evolution of market power, aggregate profits, and their connection

- Important for antitrust, taxation, and redistribution
- Important for understanding evolution of income shares

Substantial debate on whether firms increased their market power and profits

1. Measurement
2. Aggregation
3. No link between indicators of aggregate market power and profit share

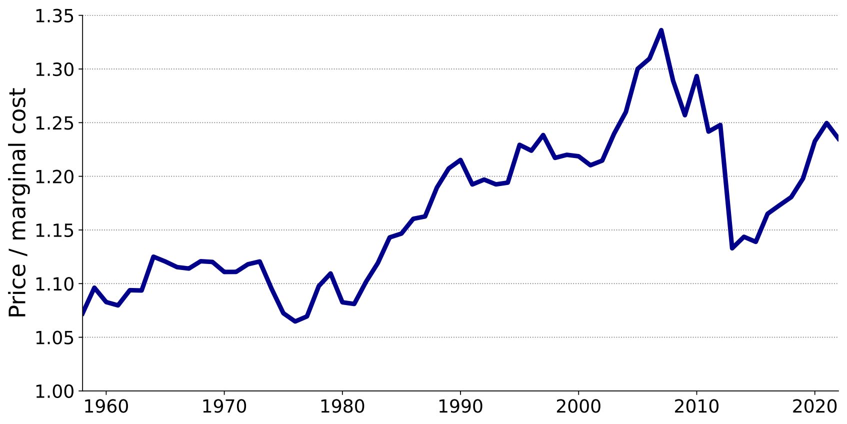
This Paper

1. Theory: **Provide this connection, resolve aggregation issues, measurement progress**
2. Empirics: **New estimates for the US** (Compustat + Census of Manufactures)

Questions & Main Findings

How much has market power increased in the US in the last 60 years?

1. Agg. markup increased from 10% of price over marginal cost in 1960 to 25% in 2020



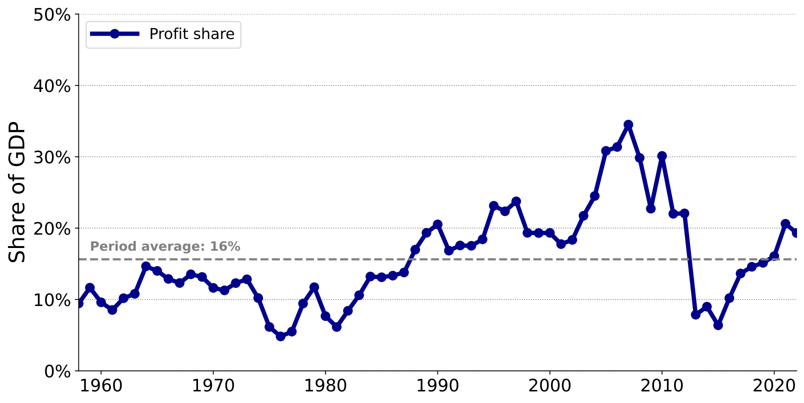
▸ DEU comparison

Questions & Main Findings

What happened to aggregate profits? (Profits = Revenues — Opportunity costs — Other costs)

2. Profit share constant at 16% of GDP despite rise in market power

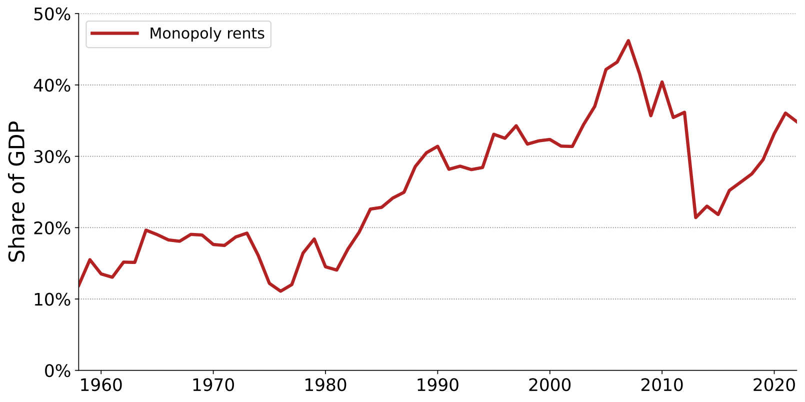
Reason: Increase in monopoly rents offset by rising fixed costs and changing technology



Questions & Main Findings

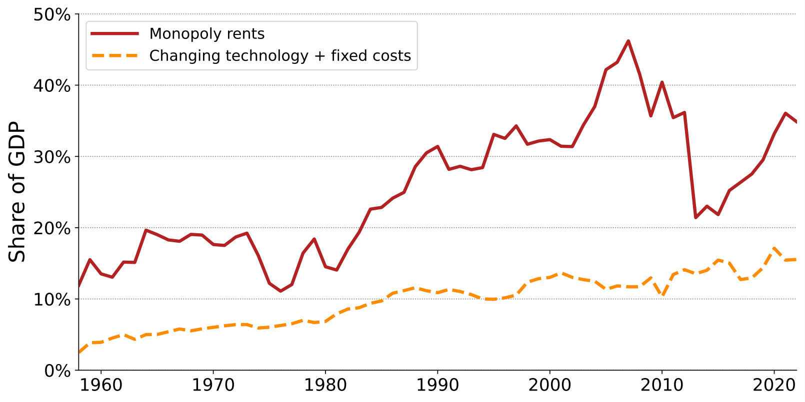
What happened to aggregate profits?

2. Profit share constant at 16% of GDP despite rise in market power
   - How is this possible?: Monopoly rents increased because of rising markups



What happened to aggregate profits?

2. Profit share constant at 18% of GDP despite rise in market power
   - Simultaneously, fixed costs increased and technology changed



Questions & Main Findings

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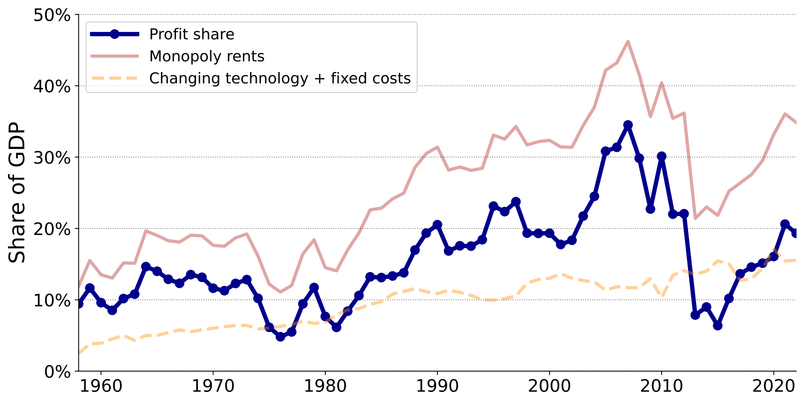
   - Reason: Increase in monopoly rents offset by rising fixed costs and changing technology



Contributions: Theory + Empirics

1. New method to construct profit share from micro-level data
   (Profit share = share of GDP not used to compensate production factors or cover fixed costs)
   - How? Economic theory + Aggregation result
   - Micro vs. Macro (standard) approach
2. Link profit share to indicators of aggregate market power. What for?
   - Understand determinants of profit share (market power vs. technology + fixed costs)
   - Assess origins of profits (monopoly vs. monopsony) at desired level of aggregation
   - Implies aggregate measures of markup, markdowns, returns to scale
   - Do sanity checks on micro estimates of markups, markdowns, returns to scale

Related Literature

- **Functional Distribution of Income.** Elsby Hobijn Sahin 2013; Karabarbounis Neiman 2014, 2019; Barkai 2020; Kehrig Vincent 2021; Eggertson Robbins Wold 2021; ...
  - \+ New method to construct profit share
- **Market Power & Macroeconomics.** Basu 2019; De Ridder 2019, 2024; De Loecker Eeckhout Unger 2020; Gutierrez Jones Philippon 2021; Edmond Midrigan Xu 2023; Hsieh Rossi-Hansberg 2023; ...
  - \+ Provide link between aggregate indicators of market power and profit share (allowing for arbitrary IO networks, returns to scale, fixed costs, monopsony)
- **Production Networks.** Quesnay 1758; Leontief 1951, 1966; Hulten 1978; Long Ploser 1983; Acemoglu Akcigit Kerr 2016; Grassi 2017; Baqaee Farhi 2019, 2020, 2022, 2024; ...
  - \+ Clarify role of production networks in profit share

Rest of the Talk

1. Theory
   - Constructing the Profit Share (Macro vs. Micro Approach)
   - The Micro Approach
     - Obtaining profit rates
     - Aggregating profit rates
     - Linking the profit share to indicators of aggregate market power
2. Empirics
   - Economy-Wide Evidence (US Compustat)
   - Evidence from US Manufacturing (Compustat + CMF)
3. Conclusion

Theory

The Macro Approach

- **Macro approach backs out profit share from National Accounts:**

$$\underbrace{\text{GDP}}_{\text{Value added}} = \underbrace{WL}_{\text{Labor income}} + \underbrace{RK}_{\text{Capital income}} + \text{Wedge income}$$

- Assuming only source of wedges is profit income, we can write:

$$\underbrace{\text{GDP}}_{\text{Value added}} = \underbrace{WL}_{\text{Labor income}} + \underbrace{RK}_{\text{Capital income}} + \underbrace{\Pi}_{\text{Profits}}$$

- It then follows:

$$\underbrace{\Lambda_{\Pi}^{\text{Macro}}}_{\text{Profit share}} = 1 - \underbrace{\Lambda_L}_{\text{Labor share}} - \underbrace{\Lambda_K}_{\text{Capital share}}$$

- **Profit share calculated residually by imputing/estimating user cost of capital,** R

The Micro Approach

- Micro approach computes micro-level profit rates and aggregates:

$$\Lambda_{\Pi}^{\text{Micro}} = \sum_{i \in \mathcal{I}} \underbrace{\omega_i}_{i\text{'s weight}} \times \underbrace{s_{\pi_i}}_{i\text{'s profit } \textit{rate}}$$

- To obtain profit *share* (= total profits / GDP):
    - Need to measure *economic* profits
        - Economic profits = Revenues − Opportunity cost(production factors) − Other costs
    - Need to use Domar weights (= producer sales / GDP) if profit rate defined in terms of sales
        - Sufficient statistics for production networks that capture double marginalization

Network Example

Obtaining Profit Rates: Economic vs. Accounting Profits

- Economic profits are not observable
  - Economic vs. accounting profits [Fisher McGowan 1983]

$$\pi_t^{\text{accounting}} = \underbrace{p_t y_t}_{\text{revenue}} - \underbrace{\sum_{j \in \mathcal{N}} w_{jt} x_{jt}}_{\substack{\text{cost of employing} \\ \text{variable inputs}}} - \underbrace{\sum_{k \in \mathcal{Z}} \delta_{kt}^{\text{accounting}} z_{kt}}_{\substack{\text{accounting cost of} \\ \text{installed inputs}}} - \underbrace{\text{FC}_t}_{\text{fixed costs}} \qquad \text{(Accounting profits)}$$

$$\pi_t^{\text{economic}} = p_t y_t - \sum_{j \in \mathcal{N}} w_{jt} x_{jt} - \underbrace{\sum_{k \in \mathcal{Z}} r_{kt} z_{kt}}_{\substack{\text{opportunity cost of} \\ \text{installed inputs}}} - \text{FC}_t \qquad \text{(Economic profits)}$$

- To make progress, assumptions on producer behavior & technology required

Obtaining Profit Rates: Economic Environment

- Economy populated by producers $i \in \mathcal{I} = \{1, \ldots, I\}$
- **A1. Producers choose variable inputs to minimize current-period costs subject to output constraint $\overline{y}_i$ and availability of installed inputs $\boldsymbol{z}$**
  - Output $\overline{y}_i$ possibly determined through complex strategic interactions (Abreu 1986)

$$\min_{\mathbf{x}_i \geq 0} \quad \mathsf{C}_i(\overline{y}; \boldsymbol{z}, A) \equiv \sum_{j \in \mathcal{N}} w_j(x_{ij}) x_{ij} + \mathsf{FC}_i$$

$$\text{s.t.} \quad y_i = F_i\left(\{x_{ij}\}_{j \in \mathcal{N}}, \{z_{ik}\}_{k \in \mathcal{Z}}; A_i\right) \geq \overline{y}_i$$

$w_j(x_{ij})$: rental rate of input j which depends on quantity demanded by i, x_{ij} FC: fixed costs
F: prod. function $\mathcal{N}$: Set of variable inputs $\mathcal{Z}$: Set of installed inputs A: productivity $\overline{y}$: min output

- **A2. Production technologies are differentiable, quasi-concave, satisfy Inada**
- **Producers set prices:** $p_i = \mu_i \times \mathsf{mc}_i$ and $w_{ij} = \nu_{ij} \times MRP_{ij}$ ($\mu_i, \{\nu_{ij}\}_j$: exogenous wedges)
- **Markets clear**

Obtaining Profit Rates

Proposition 1': Economic Profit Rate (No Monopsony) ▸ RS & FC

Suppose A1–A2 hold. Then, the profit rate (defined as profits over sales) of a *monopolist* producer can be written as

$$s_\pi = 1 - \underbrace{\frac{\mathsf{RS}}{\mu}}_{\text{monopoly term}},$$

where $\mu := p/\mathrm{mc}$ is the markup, and $\mathrm{RS} := \mathrm{ac}/\mathrm{mc}$ are returns to scale, which are given by

$$\mathrm{RS} = \underbrace{SE}_{\text{scale elasticity}} \times \underbrace{\left(\frac{\text{Total Costs}}{\text{Total Costs} - \text{Fixed Costs}}\right)}_{\text{fixed-costs adjustment factor}} \equiv \mathrm{SE}^{\mathrm{adj}}.$$

- Generalizes Basu–Fernald allowing for fixed costs

Obtaining Profit Rates

Proposition 1: Economic Profit Rate

▸ Proof ▸ Markdowns ▸ $\mathsf{RS} = \mathsf{SE}^{\mathrm{adj}} - \mathcal{M}$

Suppose A1–A2 hold. Then, the profit rate of a producer (defined as profits over sales) can be written as

$$s_\pi = 1 - \underbrace{\frac{\mathsf{SE}^{\mathrm{adj}}}{\mu}}_{\text{monopoly term}} + \underbrace{\frac{\mathcal{M}}{\mu}}_{\text{monopsony term}},$$

where μ is the markup, SE^{adj} is the scale elasticity adjusted for fixed costs, and $\mathcal{M}$ is a monopsony term capturing market power in input markets ($\nu_j := w_j / MRP_j \in (0, 1]$ is markdown in input j)

$$SE^{\mathrm{adj}} = \underbrace{SE}_{\text{scale elasticity}} \times \underbrace{\left(\frac{\text{Total Costs}}{\text{Total Costs} - \text{Fixed Costs}}\right),}_{\text{fixed-costs adjustment factor}} \qquad \mathcal{M} = \left(\frac{\mathrm{TC}}{\mathrm{TC} - \mathrm{FC}}\right) \sum_j \theta_j (1 - \nu_j).$$

- Generalizes Basu–Fernald allowing for fixed costs + market power in factor markets

Aggregating Profit Rates

Lemma

If individual profit rates (defined as profits over sales) are aggregated using Domar weights (defined as sales over GDP), then Micro and Macro approaches both yield the profit share.

▸ Alternative aggregation scheme ▸ Intuition for Domar weights ▸ Math behind Domar weights

Proof.

$$\Lambda_{\Pi}^{\text{Macro}} = \frac{\Pi}{\text{GDP}} = \frac{\sum_{i\in\mathcal{I}} \pi_i}{\text{GDP}} = \frac{\sum_i s_{\pi_i} p_i y_i}{\text{GDP}} = \sum_{i\in\mathcal{I}} \underbrace{\frac{p_i y_i}{\text{GDP}}}_{\text{Domar weight}} \times s_{\pi_i} \equiv \Lambda_{\Pi}^{\text{Micro, DW}}.$$

Π: total profits π_i: producer i's profits s_π: profit rate (profits over sales) py: sales

Main Theoretical Result

Theorem: The Profit Share & Market-Power Indicators

With cost-minimizer producers, each of which operates a production function that satisfies standard regularity conditions, the profit share (defined as profits over aggregate value added) can be expressed as

$$\Lambda_\Pi = \underbrace{\chi}_{\substack{\text{sufficient statistic}\\ \text{production networks}}} \times \underbrace{\left(1 - \underbrace{\frac{\overline{\mathrm{SE}}^{\mathrm{adj}}}{\overline{\mu}_{\mathrm{hsw}}} - \mathrm{Cov}_\omega\left[\mathrm{SE}^{\mathrm{adj}}, \frac{1}{\mu}\right]}_{\text{aggregate monopoly term}} + \underbrace{\frac{\overline{\mathcal{M}}}{\overline{\mu}_{\mathrm{hsw}}} + \mathrm{Cov}_\omega\left[\mathcal{M}, \frac{1}{\mu}\right]}_{\text{aggregate monopsony term}}\right)}_{\text{sales-weighted average profit rate}},$$

where $\chi = \text{Sales/GDP}$ is the input-output multiplier

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where $\chi = \text{Sales/GDP}$ is the input-output multiplier, $\overline{\mathsf{SE}}^{\text{adj}}$ is the sales-weighted scale elasticity (adjusted for fixed costs)

$$\overline{\mathsf{SE}}^{\text{adj}} = \sum_i \frac{p_i y_i}{\sum_j p_j y_j} \left\{ \mathsf{SE}_i \left(\frac{\mathsf{TC}_i}{\mathsf{TC}_i - \mathsf{FC}_i} \right) \right\}$$

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where $\chi = \text{Sales/GDP}$ is the input-output multiplier, $\overline{\text{SE}}^{\text{adj}}$ is the sales-weighted scale elasticity (adjusted for fixed costs), $\overline{\mu}_{\text{hsw}}$ is the harmonic sales-weighted markup (Baqaee Farhi 2020; Edmond Midrigan Xu 2023)

$$\overline{\mu}_{\text{hsw}} = \left(\sum_i \frac{p_i y_i}{\sum_j p_j y_j} \times \frac{1}{\mu_i}\right)^{-1}$$

Main Theoretical Result

Theorem: The Profit Share & Market-Power Indicators

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Main Theoretical Result

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$$\overline{\mathcal{M}} = \sum_i \frac{p_i y_i}{\sum_j p_j y_j}\left\{\left(\frac{\mathrm{TC}_i}{\mathrm{TC}_i - \mathrm{FC}_i}\right)\sum_j \theta_{ij}(1-\nu_{ij})\right\}$$

Main Theoretical Result

Theorem: The Profit Share & Market-Power Indicators [Proof]

With cost-minimizer producers, each of which operates a production function that satisfies standard regularity conditions, the profit share (defined as profits over aggregate value added) can be expressed as

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- Special cases: [No Monopsony ($\text{RS} = \overline{\text{SE}}^{\text{adj}}$)] [No Monopsony, No fixed costs, CRS]

Why Is This Theorem Useful?

1. Leverage high-quality micro data to estimate profit share
2. Understand determinants of profit share (market power vs. technology + fixed costs)
3. Assess origins of market power (monopoly vs. monopsony) at desired level of aggregation
4. Implies aggregate measures of markup, markdowns, returns to scale
   - Harmonic sales-weighted markup
   - Sales-weighted markdown
   - Sales-weighted returns to scale
5. Do sanity checks on micro estimates of markups, markdowns, returns to scale
   - Elucidates discussion between Basu 2019 and DEU 2020, and others

▸ Details

Empirics

Economy-Wide Evidence from US Compustat

Firm-level data from US Compustat:

- Publicly traded firms
- Annual data from 1960–2020 for 20 industries (2-digit NAICS)
- Data on:
  - Sales (SALE)
  - Cost of goods sold $(\mathrm{COGS}$ = labor compensation + materials) $\rightarrow$ no markdowns!
  - Selling, general, and administrative expenses $(\mathrm{SG\&A})$
  - Physical capital (PPEGT)
  - Investment in physical capital (CAPX)
  - Intangible capital $(\mathrm{K\_INT})$ following Peters and Taylor 2017
  - Investment in intangible capital $(\mathrm{R\&D} + 30\% \text{ of } \mathrm{SG\&A} \text{ net of } \mathrm{R\&D})$

Cost Minimization (No Monopsony)

$$\min \quad \mathrm{TC}_{it} \equiv \underbrace{p^v_{it} v_{it} + r_{it} k_{it}}_{\text{production-related costs}} + \underbrace{\mathrm{FC}_{it}}_{\text{non-production costs}}$$

$$\text{s.t.} \quad y_{it} = F_i\left(v_{it}, k_{it}; \omega_{it}\right) \geq \overline{y}_{it}$$

FOC for variable input yields markup:

$$\mu_{it} \equiv \frac{p_{it}}{\mathrm{mc}_{it}} = \theta^v_{it} \times \frac{p_{it} y_{it}}{p^v_{it} v_{it}}$$

- Output price over marginal cost
- Output elasticity wrt variable input
- Inverse revenue share of variable cost

Returns to scale: $\mathrm{RS}_{it} = \underbrace{\left(\theta^v_{it} + \theta^k_{it}\right)}_{\substack{\equiv \mathrm{SE}_{it} \\ \text{(scale elasticity)}}} \times \underbrace{\left(\frac{\mathrm{TC}_{it}}{\mathrm{TC}_{it} - \mathrm{FC}_{it}}\right)}_{\text{fixed-cost adjustment factor}}$

Methodology: Producer Function Estimation

- Use control function approach to get output elasticities

  (Olley and Pakes 1996, Levinsohn Petrin 2003, De Loecker Warzynski 2012, Ackerberg Caves Frazer 2015,...)

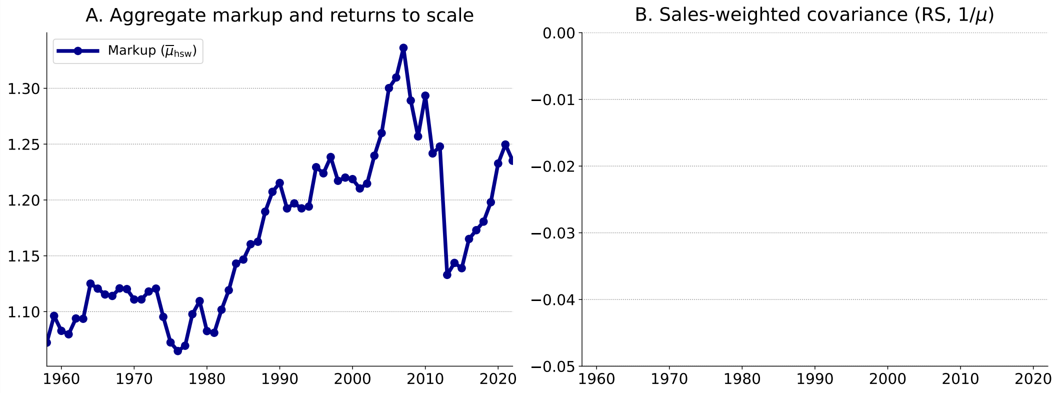
- Mapping theory to data:
  - Variable input ($\text{OPEX} := \text{COGS} + 35\%$ of SG&A net of R&D)
  - Physical + Intangible capital ($= \text{PPEGT} + \text{K\_INT}$)
  - Fixed costs ($= 35\%$ of SG&A net of R&D)

- Estimation at industry level (2-digit NAICS), allowing for time-varying technologies so that elasticities and returns to scale can vary over time
  1. Get *revenue* elasticities $\{\hat{\theta}^v_{jt}, \hat{\theta}^k_{jt}\}$ for each industry j
  2. Compute markups and returns to scale $\{\mu_{it}, \text{RS}_{it}\}$ for each firm i

PFE Details | Biases: Revenue vs. Output Elasticities

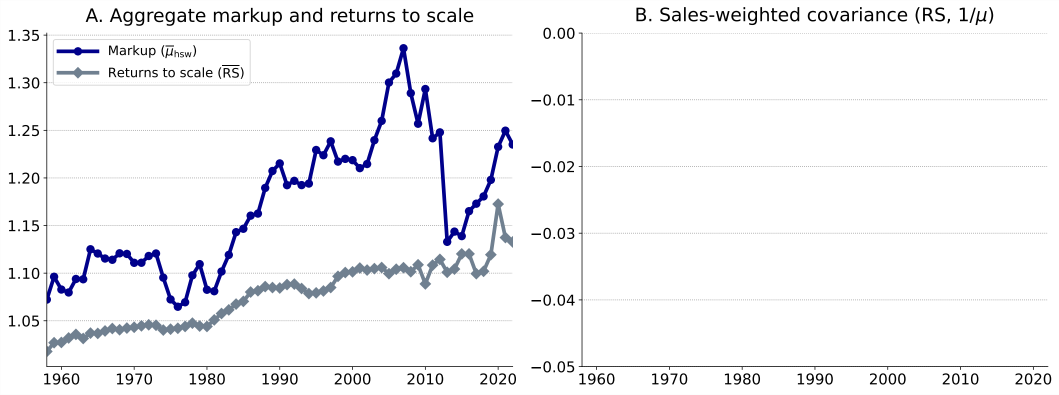
▶ Harmonic sales-weighted markup increasing since 1970

▸ Decomposition ▸ Distribution ▸ DEU



Markups, RS, & Profit Shares: $\Lambda_\Pi = \chi\left(1 - \frac{\overline{\text{RS}}}{\overline{\mu}_{\text{hsw}}} - \text{Cov}_\omega\left[\text{RS}, \frac{1}{\mu}\right]\right)$

- Returns to scale increased from 1.03 to 1.15



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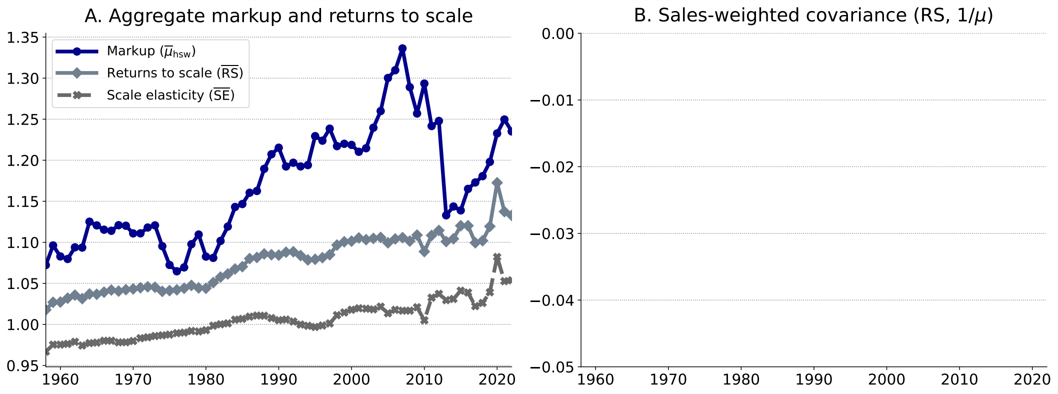
- Scale elasticity increased from around 0.97 to 1.05 (RS $=$ SE $\times$ FC adj. factor)

▸ RS & FC



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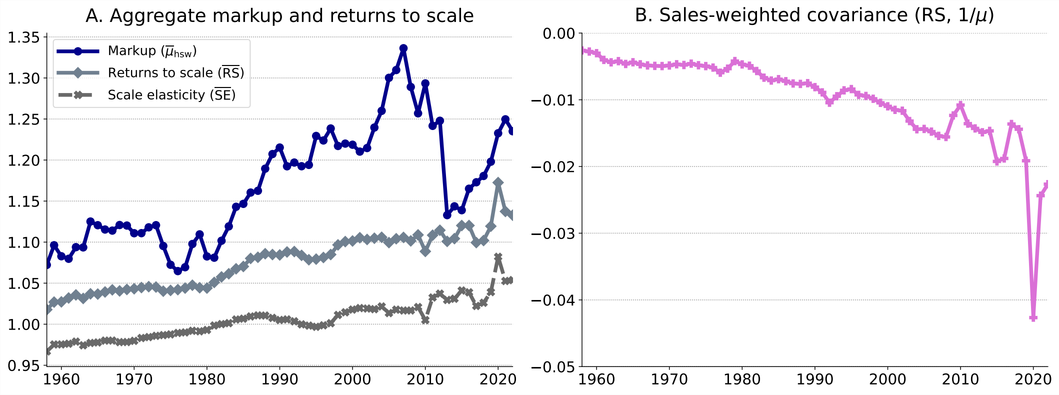
- Small negative correlation between returns to scale and inverse markups

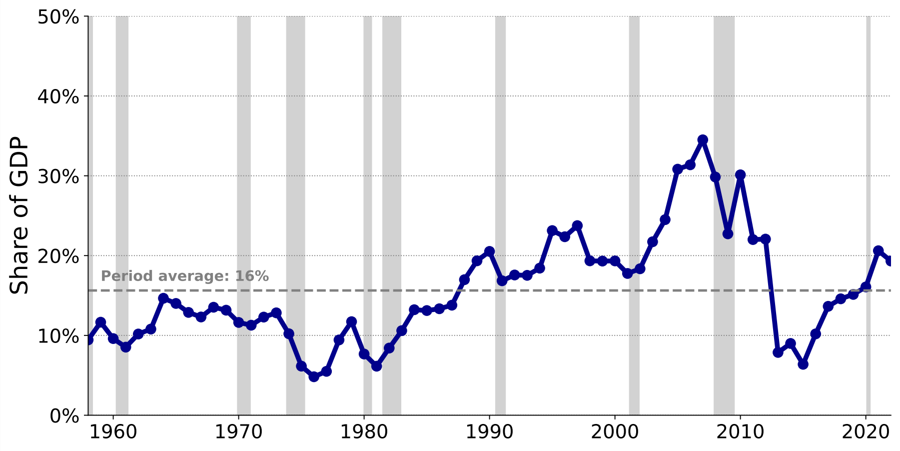
IO term



Markups, RS, & Profit Shares: $\Lambda_\Pi = \chi\left(1 - \frac{\overline{\text{RS}}}{\overline{\mu}_{\text{hsw}}} - \text{Cov}_\omega\left[\text{RS}, \frac{1}{\mu}\right]\right)$

Profit share in the US has been roughly constant at around 16%

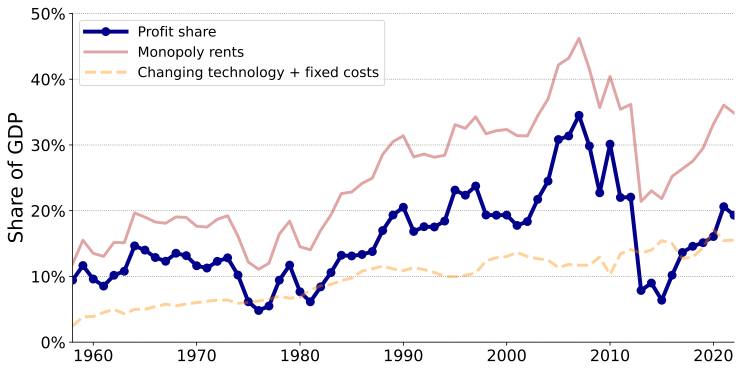
(consistent with average profit rate of 8% because of double marginalization)



Profit Share Decomposition: $\Lambda_\Pi = \chi\left(1 - \frac{\overline{\mathrm{RS}}}{\overline{\mu}_{\mathrm{hsw}}} - \mathrm{Cov}_\omega\left[\mathrm{RS}, \frac{1}{\mu}\right]\right)$

- We can decompose profit share into several sources of market power:

$$\Lambda_\Pi = \underbrace{\underbrace{\chi\left(1-\frac{1}{\overline{\mu}_{\mathrm{hsw}}}\right)}_{\text{Monopoly rents}} + \underbrace{\chi\left\{\left(\frac{1}{\overline{\mu}_{\mathrm{hsw}}}-1\right)(1-\mathrm{RS}) - \mathrm{Cov}_\omega\left[\mathrm{RS}, \frac{1}{\mu}\right]\right\}}_{\text{Non-linearities}}}_{\text{Monopoly rents (broad)}} - \underbrace{\chi(\mathrm{RS}-1)}_{\substack{\text{Fixed costs \&} \\ \text{Changing technology}}}$$



Evidence from US Manufacturing

- We zoom into US manufacturing for two reasons:
  1. To compare results from US Compustat with US Census of manufactures
     - → Get some reassurance that Compustat captures broad time-series movements
  2. To assess the origins of profits
     - → Estimate contributions of both monopoly and monopsony to profits using CMF data

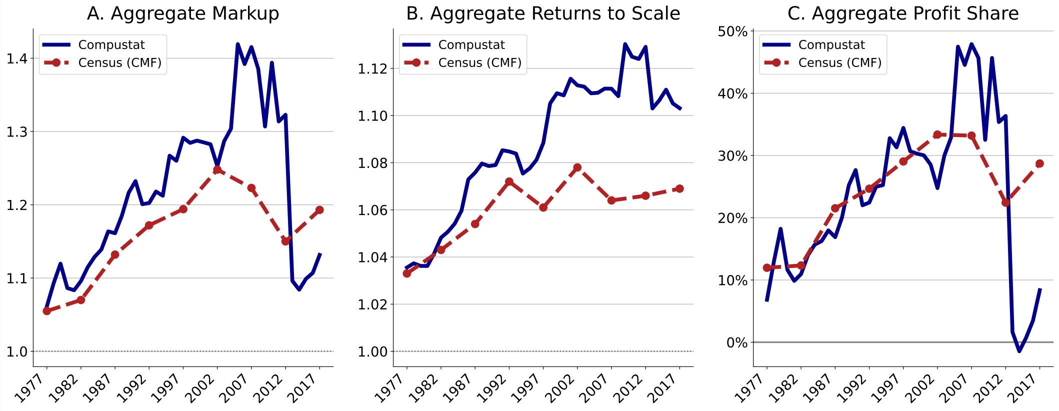
- Results from US manufacturing similar to those for US economy
  - Rising markups and returns to scale, profit share constant at around 20% ▸ See

- Labor-market monopsony important source of manufacturing profits
  - Aggregate markdown ≈ 0.65; ie, marginal worker takes home 60% of MRP ▸ See
    [Corresponds to labor supply elasticity of $\approx$2]

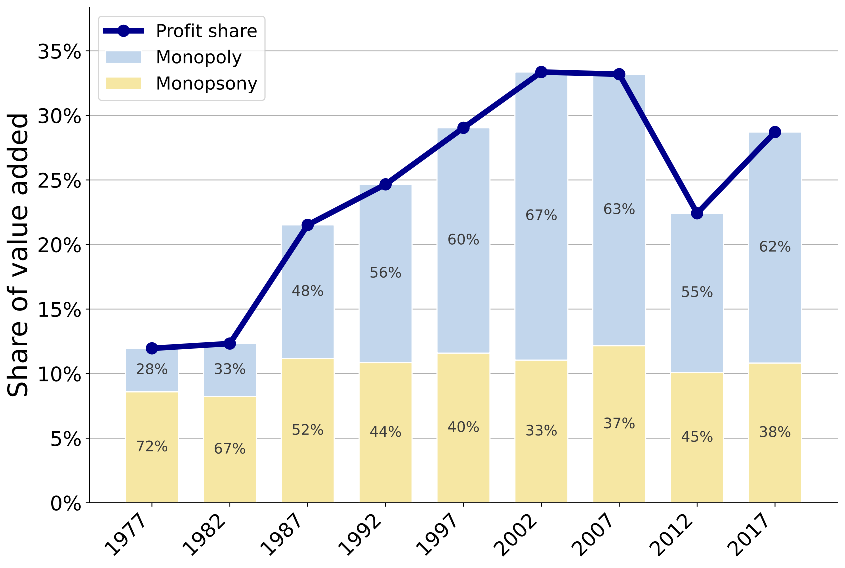
Manufacturing Aggregates: US Compustat vs Census of Manufactures

Publicly traded firms have greater market power and more capital-intensive technologies.

Similar time trends provide some reassurance on Compustat results



The Origins of Profits (CMF)



Additional Results

1. Industry-level Heterogeneity: ▸ 2022 Scatter plot ▸ Markups ▸ Returns to scale
2. Markup Heterogeneity: ▸ Distributions & Percentiles ▸ Decomposition
3. Robustness: ▸ Treatment of variable inputs ▸ DEU (2020) Replication
4. Benchmarking: ▸ Micro vs. Macro Approach ▸ DEU (2020) markup comparison
5. Implications for Income Shares: ▸ Aggregate Economy ▸ Manufacturing
6. Basu–DEU Controversy: ▸ See
7. Profit Share and the User Cost of Capital: ▸ Details

Conclusion

Conclusion

- We develop a micro approach to the profit share that, unlike the standard macro approach treating profits as a residual, constructs it from producer-level data
  - Links aggregate profitability to market power, returns to scale, and production networks

- Using micro-data for the United States, we document that from 1960 to 2020:
  1. Several indicators of market power have increased
     - Aggregate markup has increased from 10% of price over marginal cost to 25%
     - Aggregate returns to scale have risen from 1.03 to 1.15
  2. Despite the rise in market power, profit share stable at around 16% of GDP
     - Increase in monopoly rents offset by rising fixed costs and changes in technology
  3. Monopsony power in labor markets important source of profits in US manufacturing

- To make these points, we need our theoretical results + micro data

Questions?

Thank You!

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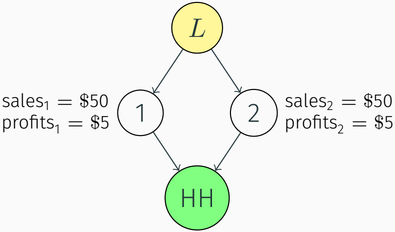
Appendix

Simple Example: Profit Share and Production Networks

- Two producers, $i \in \{1,2\}$, each with profit rate $s_{\pi_i} = 0.10$

No Networks

Labor compensation $= \$90$



consumption $= \$100$

$$\Lambda_{\Pi}^{\text{Macro}} = \frac{\text{Profits}}{\text{Value added}} = 0.10$$

$$\Lambda_{\Pi}^{\text{Micro, SW}} = \sum_i \frac{\text{sales}_i}{\text{total sales}} s_{\pi_i} = 0.10$$

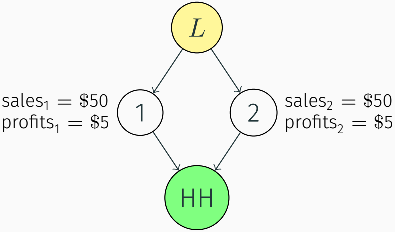
Simple Example: Profit Share and Production Networks

Back to Micro Approach Back to Lemma

- Two producers, $i \in \{1, 2\}$, each with profit rate $s_{\pi_i} = 0.10$

No Networks

Labor compensation $= \$90$



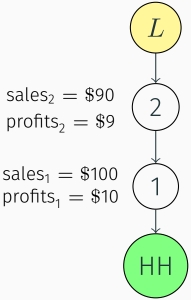
consumption $= \$100$

$$\Lambda_{\Pi}^{\text{Macro}} = \frac{\text{Profits}}{\text{Value added}} = 0.10$$

$$\Lambda_{\Pi}^{\text{Micro, SW}} = \sum_i \frac{\text{sales}_i}{\text{total sales}} s_{\pi_i} = 0.10$$

Networks

Labor compensation $= \$81$



consumption $= \$100$

$$\Lambda_{\Pi}^{\text{Macro}} = \frac{\text{Profits}}{\text{Value added}} = 0.19$$

$$\Lambda_{\Pi}^{\text{Micro, SW}} = \sum_i \frac{\text{sales}_i}{\text{total sales}} s_{\pi_i} = 0.10$$

$$\Lambda_{\Pi}^{\text{Micro, DW}} = \sum_i \frac{\text{sales}_i}{\text{Value added}} s_{\pi_i} = 0.19$$

Other weights do not generally work

(cost shares, VA shares, etc.)

Alternative Aggregation Scheme

- Use of Domar weights crucially relies on employed notion of profit rate
- If profit rate defined as profits divided by value added (instead of sales), then aggregation calls for value-added weights:

$$\begin{aligned}\Lambda_{\Pi}^{\text{Macro}} &= \frac{\Pi}{\text{GDP}} \\ &= \frac{\sum_i \pi_i}{\text{GDP}} \\ &= \sum_i \underbrace{\frac{\text{VA}_i}{\text{GDP}}}_{\text{VA shares}} \times \underbrace{\frac{\pi_i}{\text{VA}_i}}_{\equiv s_{\pi_i}^{\text{VA}}} \equiv \Lambda_{\Pi}^{\text{Micro,VA}}\end{aligned}$$

Π: total profits $\quad$ π_i: producer i's profits $\quad$ s_{π}^{VA}: profit rate (profits over value added)

Back

Math behind Domar Weights

Back

- Market clearing requires:

$$
\begin{aligned}
y_i &= \sum_{j \in \mathcal{N}/\mathcal{F}} x_{ji} + c_i \\
\iff \qquad p_i y_i &= \sum_j p_i x_{ji} + p_i c_i \\
&= \sum_j \underbrace{\frac{p_i x_{ji}}{p_j y_j}}_{\equiv \Omega_{ji}} \times p_j y_j + p_i c_i
\end{aligned}
$$

i, j: producer indices $\quad$ y: gross output $\quad$ x_{ji}: producer j's demand of i $\quad$ c: final demand $\quad$ p: price

- Divide by GDP and write in matrix form:

$$
\lambda_i = \sum_j \Omega_{ji} \underbrace{\frac{p_j y_j}{\text{GDP}}}_{\equiv \lambda_j} + \underbrace{\frac{p_i c_i}{\text{GDP}}}_{\equiv b_i} \qquad \Longrightarrow \qquad \lambda' = b'(I - \Omega)^{-1} = b' + b'\Omega + b'\Omega^2 + \cdots
$$

Link Between Increasing Returns and Fixed Costs

- We think of firms as facing two types of fixed costs:

  1. Non-production related (eg, R&D, licensing and regulatory costs)

     $\Longrightarrow$ Need to interact scale elasticity with fixed-cost adjustment factor to get returns to scale (RS)

$$\text{RS} = \text{SE} \times \left(\frac{\text{TC}}{\text{TC} - \text{FC}} \right)$$

  2. Production-related (eg, minimum amount of grids needed to provide electricity)

     $\Longrightarrow$ Will be captured by scale elasticity if corresponding expenditures cannot be told apart

- Example illustrates how production-related FC may be captured by scale elasticity:

  - For simplicity, assume there are *only* production-related fixed costs, so that $\text{RS} = \text{SE}$

Link Between Increasing Returns and Fixed Costs

- Suppose there is a firm that produces according to

$$y = \begin{cases} A(k-\overline{k})^{\alpha}, & k > \overline{k} > 0 \\ 0, & \text{otherwise} \end{cases}$$

A: productivity $\quad$ k: capital $\quad$ $\overline{k}$: minimum capital requirement $\quad$ α: governs returns to scale

- Under standard regularity conditions, the scale elasticity given by

$$\text{SE} := \frac{\mathrm{d}y}{\mathrm{d}k}\frac{k}{y} = \alpha\frac{k}{k-\overline{k}} > \alpha$$

- RS $=$ SE *if and only if* there are only production-related fixed costs

- Thus, if $\alpha = 1$ and $k > \overline{k} > 0$, there are IRS because of fixed costs

Back to Profit Rates Back to Empirics

Proof of Proposition 1

- Cost minimization problem of producer i:

$$\min_{\mathbf{x}_i \geq 0} \quad \mathsf{C}_i \equiv \sum_{j \in \mathcal{N}} w_j(x_{ij})x_{ij} + \mathsf{FC}_i$$

$$\text{s.t.} \quad y_i = F_i\left(\{x_{ij}\}_{j \in \mathcal{N}}, \{z_{ik}\}_{k \in \mathcal{Z}}; A_i\right) \geq \overline{y}_i$$

$w_j(x_{ij})$: rental rate of input j which depends on quantity demanded by i, x_{ij} FC: fixed costs F: prod. function

$\mathcal{N}$: Set of variable inputs $\mathcal{Z}$: Set of installed inputs A: productivity parameter $\overline{y}$: min output requirement

- Generic FOC for variable input + Envelope Theorem + Duality:

$$w_j(x_{ij})x_{ij} = \mathsf{MC}_i y_i \theta_{ij} \nu_{ij}$$

MC: marginal cost $\theta_{ij} \equiv \frac{\partial F_i}{\partial x_{ij}} \frac{x_{ij}}{y_i}$: elasticity of output wrt input j $\nu_{ij} \equiv \frac{w_j}{\mathsf{MRP}_{ij}}$: markdown of producer i on j

- Envelope Theorem for installed inputs gives user cost:

$$r_{ik} z_{ik} = \mathsf{MC}_i y_i \theta_{ik}$$

Proof of Proposition 1

- Define total economic cost by:

$$
\begin{aligned}
\mathsf{TC}_i &= \sum_{j\in\mathcal{N}} w_j(x_{ij})x_{ij} + \sum_{k\in\mathcal{Z}} r_{ik}z_{ik} + \mathsf{FC}_i \\
\implies \qquad \mathsf{TC}_i - \mathsf{FC}_i &= \sum_{j\in\mathcal{N}} w_j(x_{ij})x_{ij} + \sum_{k\in\mathcal{Z}} r_{ik}z_{ik} \\
&= \mathsf{MC}_i y_i \left(\sum_{j\in\mathcal{N}} \theta_j \nu_j + \sum_{k\in\mathcal{Z}} \theta_k \right)
\end{aligned}
$$

- With monopsony distortions only in factors markets $\mathcal{F} \subseteq \mathcal{N} \cup \mathcal{Z}$:

$$
\mathsf{TC}_i - \mathsf{FC}_i = \mathsf{MC}_i y_i \left(\mathsf{SE}_i - \sum_{j\in\mathcal{F}} \theta_j (1-\nu_j) \right), \qquad \mathsf{SE}_i = \sum_{j\in\mathcal{N}} \theta_j + \sum_{k\in\mathcal{Z}} \theta_k
$$

Proof of Proposition 1

- Doing some algebraic manipulations:

$$\mathrm{RS}_i := \frac{\mathrm{AC}_i}{\mathrm{MC}_i} = \underbrace{\mathrm{SE}_i \left(\frac{\mathrm{TC}_i}{\mathrm{TC}_i - \mathrm{FC}_i} \right)}_{\equiv \mathrm{SE}_i^{\mathrm{adj}}} - \underbrace{\left(\frac{\mathrm{TC}_i}{\mathrm{TC}_i - \mathrm{FC}_i} \right) \sum_{j \in \mathcal{F}} \theta_j (1 - \nu_j)}_{\equiv \mathcal{M}_i}$$

- Using the definitions of profit rate, returns to scale, and markup:

$$\begin{aligned} s_{\pi_i} &:= \frac{\pi_i}{p_i y_i} \\ &= 1 - \frac{\mathrm{RS}_i}{\mu_i} \\ &= 1 - \frac{\mathrm{SE}_i^{\mathrm{adj}}}{\mu_i} + \frac{\mathcal{M}_i}{\mu_i} \end{aligned}$$

Back

Production Function Approach

- Focus on input whose markdown we want to obtain—say, labor ℓ
- Write conditional cost-minimization problem for that input:

$$\begin{aligned} \min_{\ell_t \geq 0} \quad & w_t(\ell_t)\ell_t \\ \text{s.t.} \quad & y_t = F(\ell_t, \mathbf{X}^*_{-\ell,t}; \omega_t) \geq \overline{y}_t, \end{aligned} \tag{1}$$

  where $w_t(\ell_t)$ is the wage, which depends on quantity demanded, and $\mathbf{X}^*_{-\ell,t}$ is vector of optimized inputs other than ℓ_t

- Let λ_t be the Lagrange multiplier associated with the constraint and take FOC:

$$\left[1 + \frac{w'_t(\ell_t)\ell_t}{w_t(\ell_t)}\right] = \lambda_t \times \frac{\partial F(\ell_t, \mathbf{X}^*_{-\ell,t})/\partial \ell_t}{w_t(\ell_t)} \tag{2}$$

Production Function Approach: Markdowns

- Letting

$$\varepsilon_{St}^{-1} = \frac{w_t'(\ell_t)\ell_t}{w_t(\ell_t)}\Big|_{\ell=\ell^*} \tag{3}$$

denote the firm's perceived (inverse) elasticity of labor supply, we can write FOC (2) as

$$1 + \varepsilon_{St}^{-1} = \frac{\lambda_t}{p_t} \times \frac{\partial F(\ell_t, \mathbf{X}^*_{-\ell,t})}{\partial \ell_t} \frac{\ell_t}{y_t} \times \frac{p_t y_t}{w_t(\ell_t)\ell_t}$$

- Using duality arguments, we can write the labor markdown $\nu \equiv (1 + \varepsilon_S^{-1})^{-1}$. Hence,

$$\frac{1}{\nu_t} = \underbrace{\mu_t^{-1}}_{\substack{\text{inverse} \\ \text{markup}}} \times \underbrace{\frac{\theta_t^\ell}{\alpha_t^\ell}}_{\substack{\text{labor's output elasticity} \\ \text{divided by its revenue share}}}$$

Duality Back

Markdowns and Duality

- Conditional profit-maximization problem:

$$\max_{\ell_t \geq 0} \quad R_t(\ell_t) - w_t(\ell_t)\ell_t,$$

where $R_t(\ell_t) \equiv \mathrm{rev}(\ell_t, \mathbf{X}^*_{-\ell,t}(\ell))$ is revenue function with all inputs other than labor at optimum

- FOC:

$$R'_t(\ell^*_t) = \left[1 + \underbrace{\frac{w'_t(\ell^*_t)\ell^*_t}{w_t(\ell^*_t)}}_{\equiv \varepsilon^{-1}_{St}}\right] w_t(\ell^*_t)$$

- Defining markdown ν as ratio of rental rate to MRPL, we have

$$\nu_t := \frac{w_t(\ell^*_t)}{R'_t(\ell^*_t)} = (1 + \varepsilon^{-1}_{St})^{-1}$$

Back

Returns to Scale

- Recall cost-minimization problem:

$$\min_{\mathbf{x}_i \geq 0} \quad \mathsf{C}_i \equiv \sum_{j \in \mathcal{N}} w_j(x_{ij})x_{ij} + \mathsf{FC}_i$$

$$\text{s.t.} \quad y_i = F_i\left(\boldsymbol{x}_i, \boldsymbol{z}_i; A_i\right) \geq \overline{y}_i$$

- Optimality implies:

$$\underbrace{\sum_{j} w_{ij}(x_{ij})x_{ij} + \sum_{k \in \mathcal{Z}} r_{ik} z_{ik}}_{\equiv \mathsf{TC}_i - \mathsf{FC}_i} = \mathsf{MC}_i y_i \left(\mathsf{SE}_i - \sum_{j \in \mathcal{F}} \theta_{ij} \{1 - \nu_{ij}\} \right)$$

- Doing simple algebraic manipulations:

$$\underbrace{\frac{\mathsf{AC}_i}{\mathsf{MC}_i}}_{\equiv \mathsf{RS}_i} \frac{\mathsf{TC}_i - \mathsf{FC}_i}{\underbrace{\mathsf{AC}_i y_i}_{\equiv \mathsf{TC}_i}} = \mathsf{SE}_i - \sum_{j \in \mathcal{F}} \theta_{ij} \{1 - \nu_{ij}\}$$

Returns to Scale

- Hence,

$$\mathrm{RS}_i = \underbrace{\mathrm{SE}_i \left(\frac{\mathrm{TC}_i}{\mathrm{TC}_i - \mathrm{FC}_i} \right)}_{\equiv \mathrm{SE}_i^{\mathrm{adj}}} - \underbrace{\left(\frac{\mathrm{TC}_i}{\mathrm{TC}_i - \mathrm{FC}_i} \right) \sum_j \theta_{ij} \{1 - \nu_{ij}\}}_{\equiv \mathcal{M}_i}$$

- **Limiting cases**:
  - No monopsony (ie, $\nu_{ij} := w_j / \mathrm{MRP}_j \to 1, \forall j$):

$$\mathrm{RS}_i = \mathrm{SE}_i \left(\frac{\mathrm{TC}_i}{\mathrm{TC}_i - \mathrm{FC}_i} \right) \equiv \mathrm{SE}_i^{\mathrm{adj}}$$

  - No monopsony + No fixed costs (ie, $\mathrm{FC}_i \to 0$)

$$\mathrm{RS}_i = \mathrm{SE}_i$$

Back

Proof Aggregation Theorem

- By Lemma 1, the aggregate profit share can be computed as

$$\Lambda_\Pi = \sum_i \frac{p_i y_i}{\text{GDP}} \times s_{\pi_i}$$

- By Proposition 1,

$$s_{\pi_i} = 1 - \frac{\text{SE}_i^{\text{adj}}}{\mu_i} + \frac{\mathcal{M}_i}{\mu_i}$$

Proof of Aggregation Theorem (cont'd)

- Hence,

$$
\begin{aligned}
\Lambda_\Pi &= \sum_i \frac{p_i y_i}{\text{GDP}} \left(1 - \frac{\text{SE}_i^{\text{adj}}}{\mu_i} + \frac{\mathcal{M}_i}{\mu_i}\right) \\
&= \underbrace{\left(\sum_k \frac{p_k y_k}{\text{GDP}}\right)}_{\equiv \chi} \sum_i \underbrace{\frac{p_i y_i}{\sum_k p_k y_k}}_{\equiv \omega_i} \left(1 - \frac{\text{SE}_i^{\text{adj}}}{\mu_i} + \frac{\mathcal{M}_i}{\mu_i}\right) \\
&= \chi \left(1 - \mathbb{E}_\omega \left[\frac{\text{SE}^{\text{adj}}}{\mu}\right] + \mathbb{E}_\omega \left[\frac{\mathcal{M}}{\mu}\right]\right) \\
&= \chi \left(1 - \frac{\overline{\text{SE}}^{\text{adj}}}{\overline{\mu}_{hsw}} + \frac{\overline{\mathcal{M}}}{\overline{\mu}_{hsw}} - \text{Cov}_\omega \left[\text{SE}^{\text{adj}}, \frac{1}{\mu}\right] + \text{Cov}_\omega \left[\mathcal{M}, \frac{1}{\mu}\right]\right)
\end{aligned}
$$

Back

Special Case I: No Monopsony

Theorem 1'

With cost-minimizer producers, arbitrary returns to scale, fixed costs, and no market power in input markets, the profit share can be computed as

$$\Lambda_\Pi = \chi\left(1 - \mathbb{E}_\omega\left[\frac{\mathsf{SE}^{\mathsf{adj}}}{\mu}\right]\right)$$
$$= \chi\left(1 - \frac{\overline{\mathsf{SE}}^{\mathsf{adj}}}{\overline{\mu}_{hsw}} - \mathsf{Cov}_\omega\left[\mathsf{SE}^{\mathsf{adj}}, \frac{1}{\mu}\right]\right),$$

where $\chi = \sum_{i\in\mathcal{I}} \frac{p_i y_i}{\mathsf{GDP}}$ is IO multiplier, $\mathbb{E}_\omega\left[\frac{\mathsf{SE}^{\mathsf{adj}}}{\mu}\right]$ is the sales-weighted expected value of individual scale elasticities (adjusted for fixed costs) over markups, $\overline{\mathsf{SE}}^{\mathsf{adj}}$ is the sales-weighted scale elasticity adjusted for fixed costs, and $\overline{\mu}_{hsw}$ is the harmonic sales-weighted markup.

- Elucidates discussion between Basu 2019, DEU 2020, and others Details Back to Theorem

Special Case II: No Monopsony, No Fixed Costs, CRS

Theorem 1”

With cost-minimizer producers, constant returns to scale, no fixed costs, and no market power in input markets, the profit share can be computed as

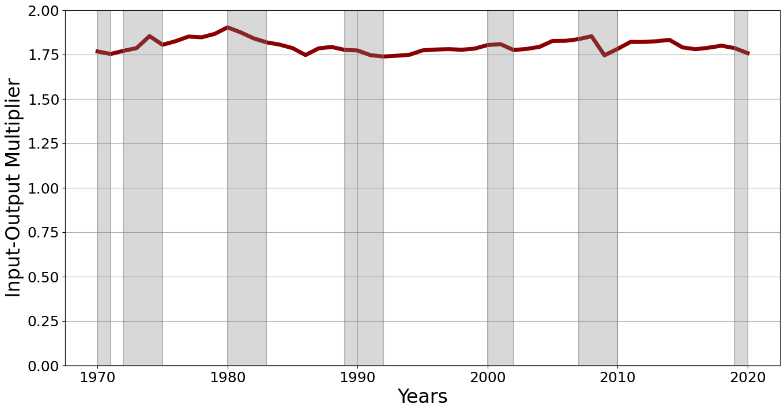
$$\Lambda_{\Pi} = \chi \left(1 - \frac{1}{\overline{\mu}_{hsw}}\right)$$

where $\chi = \sum_{i \in \mathcal{I}} \frac{p_i y_i}{\text{GDP}}$ is the input-output multiplier, and $\overline{\mu}_{hsw}$ is the harmonic sales-weighted markup.

- Permits backing out profit share or aggregate markup under strong assumptions
  - Makes clear the role of production networks in computing profit share ▸ Networks & Inference
- This profit share would attain in Baqaee and Farhi (2020)’s IO framework ▸ Back to Theorem

IO Multiplier

- Input-output multiplier: $\chi = \frac{\text{Sales}}{\text{Value added}}$
- In US data, IO multiplier stable (≈ 1.8) and mildly procyclical ▸ Back to Empirics



Methodology: Production Function Estimation

- One of the standard approaches in IO literature to get output elasticities
  (Olley Pakes 1996, Levinsohn Petrin 2003, De Loecker Warzynski 2012, Ackerberg Caves Frazer 2015,...)
- Informal discussion:
  - Specify production function and take log transformation:
  $$y_{it} = f_i\left(v_i, k_i; \beta\right) + \omega_{it} + \varepsilon_{it},$$
  where ω is productivity and ε is an unanticipated shock/measurement error
  - Impose assumptions on technology, timing, and productivity process
  - Estimate production function parameters in **two-step procedure**:
    1. First-stage (non-parametric) regression to obtain output free of measurement error
    2. Construct productivity estimates, obtain productivity shocks, and estimate PF parameters in a second stage through GMM using appropriate moment conditions
  - Calculate elasticities (θ^v, θ^k)

Methodology: Production Function Estimation

- PFE at the industry level (2-digit NAICS), allowing for time-varying technologies so that input elasticities and returns to scale can vary over time

Table 1: Estimation Details in the Application of the Control Function Approach

Technology	Cobb–Douglas
Elasticities	Time-varying, 5-year rolling windows
Method	Olley and Pakes (1996)
Productivity process	AR(1)
Degree of polynomial	3rd
Ackerberg-Caves-Frazer correction	✓
Deflated variables	✓
Outcome, y	SALE
State, k	PPEGT + K_INT
Free, ℓ	OPEX ($=$ COGS $+$ 35% of SG&A net of R&D)
Proxy, x	CAPX + R&D + 30% of SG&A net of R&D

Back

Biases Associated with Revenue Elasticities

- We estimate *revenue*- rather than *output* elasticities because of data limitations
- **Biases associated with revenue elasticities**:
  - Bond et al 2021: when revenue elasticity used in place of output elasticity, estimated markup of a firm that max static profits equals 1 and not informative of true markup
    - Key to this argument: static profit maximization
    - In more general environments in which firms maximize discounted sum of profits, static profit maximization need not apply, although firms may minimize costs statically (eg, Abreu 1986)
    - Imposing cost minimization only, the use of revenue elasticities results in downward-biased markups when firms face downward-sloping demand curves

Biases Associated with Revenue Elasticities

- **Biases associated with revenue elasticities** (cont'd):
  - **Revenue-based markups understate true markups w/ monopolistic competition; $\mu^R \leq \mu$**
    - Cost minimization implies true markup $\mu = \theta_\ell \alpha_\ell^{-1}$, where $\theta_\ell := \frac{\mathrm{d}y}{\mathrm{d}\ell}\frac{\ell}{y}$ is output elasticity
    - Revenue-based markup uses revenue elasticity, ie, $\mu^R = \theta_\ell^R \alpha_\ell^{-1}$, where $\theta_\ell^R := \frac{\mathrm{d}R}{\mathrm{d}\ell}\frac{\ell}{R}$
    - We show that $\mu^R = \theta_y^R \mu$, where $\theta_y^R := \frac{\mathrm{d}R}{\mathrm{d}y}\frac{y}{R}$ is revenue elasticity of output
    - When firms face-downward sloping demand curves and can influence prices, $\theta_y^R \leq 1$
    - Hence, $\mu^R \leq \mu$
    - Similar argument in: Klette Griliches 1996, Bond et al 2021, De Ridder et al 2022

Biases Associated with Revenue Elasticities

- **Biases associated with revenue elasticities** (cont'd):
  - Profit rates unbiased when using revenue elasticity in place of output elasticity; $s_\pi^R = s_\pi$
    - Output-based profit rate $s_\pi = 1 - \frac{\text{RS}}{\mu}$
    - Revenue-based profit rate $s_\pi^R = 1 - \frac{\text{RS}^R}{\mu^R}$
    - We show that RS^R and μ^R both biased by same factor θ^{Ry}, so biases cancel and $s_\pi^R = s_\pi$

Back

Controversy with DEU 2020's Markup Estimates

- Basu 2019 notes:

  "Markups as large as those reported by De Loecker, Eeckhout, and Unger (...) have some implausible implications"

- He goes on to say:

  "Because the authors report that average returns to scale are about 1.05 in 2016, but that the average markup is 1.61, the relationship (...) between markups, returns to scale, and economic profits suggests that (...) about 70 percent of GDP is pure economic profit!"

- DEU 2020 point two problems with **Basu's back-of-envelope calculation**:

  1. Assumes no fixed costs
  2. Incorrect aggregation (representative-firm assumption)

- **We clarify Basu–DEU discussion by providing an exact (and more general) mapping from micro to macro data, which nests Basu's BoE calculation as a special case**

Basu's Back-of-Envelope Calculation

- Assume representative firm, no fixed costs, and no market power in input markets
- Basu's back-of-envelope calculation

$$\Lambda_{\Pi}^{\text{Basu}} = \chi \left(1 - \frac{\overline{\text{SE}}}{\overline{\mu}}\right)$$

$\overline{SE}$: sales-weighted scale elasticity $\quad$ $\overline{\mu}$: sales-weighted markup

is a "rough" guess at implied profit share from micro data

- Both DEU and Basu use RS to refer to the scale elasticity (SE), but $\text{RS} = \text{SE}^{\text{adj}}$
- **Our theorem provides an "exact" mapping from micro do macro data**:

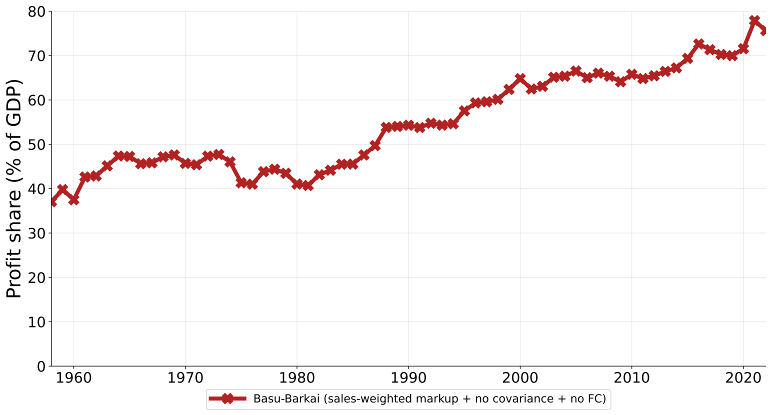
$$\Lambda_{\Pi} = \chi \left(1 - \frac{\overline{\text{SE}^{\text{adj}}}}{\overline{\mu}_{hsw}} - \text{Cov}_{\omega}\left[\text{SE}^{\text{adj}}, \frac{1}{\mu}\right]\right)$$

$\overline{\mu}_{hsw}$: harmonic sales-weighted markup $\quad$ Cov_{ω}: sales-weighted covariance

... And boils down to Basu's BOE calculation *if* no fixed costs and no heterogeneity

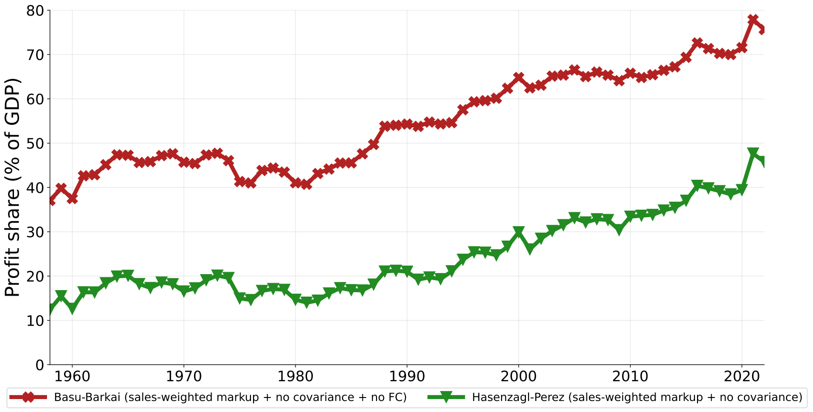
Mapping Micro-Level Estimates to the Profit Share: $\Lambda_\Pi = \chi \left(1 - \frac{\overline{\text{SE}^{\text{adj}}}}{\overline{\mu}_{\text{hsw}}} - \text{Cov}_\omega\left[\text{SE}^{\text{adj}}, \frac{1}{\mu}\right]\right)$

- Map DEU 2020's estimates to profit share using different formulas



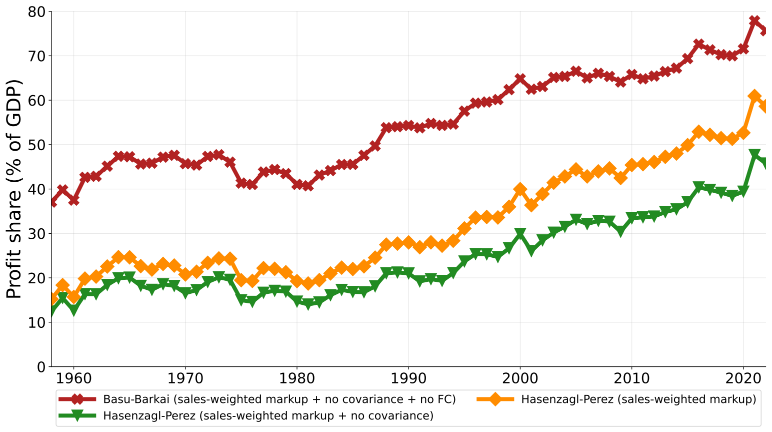
Mapping Micro-Level Estimates to the Profit Share: $\Lambda_\Pi = \chi\left(1 - \frac{\overline{\text{SE}^{\text{adj}}}}{\overline{\mu}_{\text{hsw}}} - \text{Cov}_\omega\left[\text{SE}^{\text{adj}}, \frac{1}{\mu}\right]\right)$

- Map DEU 2020's estimates to profit share using different formulas



Mapping Micro-Level Estimates to the Profit Share: $\Lambda_\Pi = \chi\left(1 - \frac{\overline{\text{SE}^{\text{adj}}}}{\overline{\mu}_{\text{hsw}}} - \text{Cov}_\omega\left[\text{SE}^{\text{adj}}, \frac{1}{\mu}\right]\right)$

- Map DEU 2020's estimates to profit share using different formulas



Mapping Micro-Level Estimates to the Profit Share: $\Lambda_\Pi = \chi\left(1 - \frac{\overline{\text{SE}^{\text{adj}}}}{\overline{\mu}_{\text{hsw}}} - \text{Cov}_\omega\left[\text{SE}^{\text{adj}}, \frac{1}{\mu}\right]\right)$

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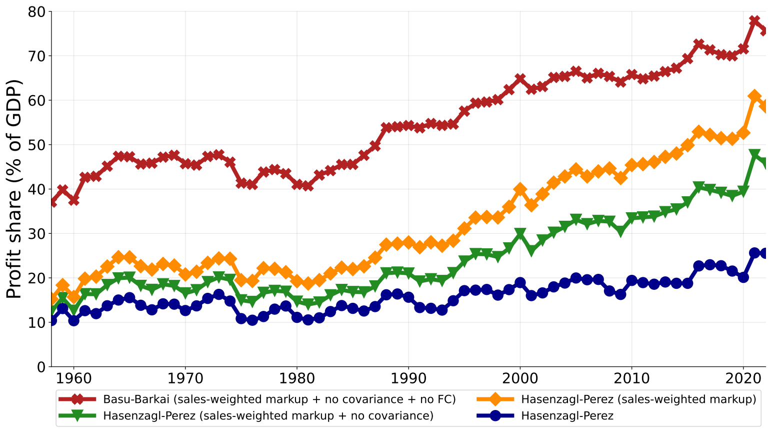


Back to Theorem
Back to Additional Results

Shift-Share Analysis of Aggregate Markup

- We provide a statistical decomposition for the harmonic sales-weighted markup

Proposition: Markup Decomposition

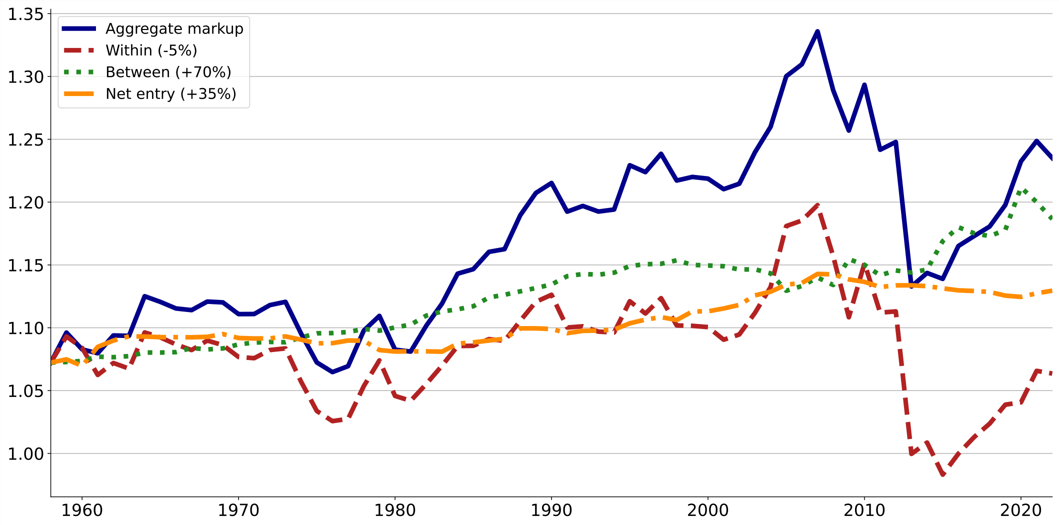
$$\Delta\overline{\mu}_{\text{hsw}} = -\overline{\mu}_t^{\text{hsw}}\overline{\mu}_{t-1}^{\text{hsw}}\left\{\underbrace{\sum_{i\in\mathcal{C}_t}\overline{\omega}_i\Delta\mu_i^{-1}}_{\text{within}} + \underbrace{\sum_{i\in\mathcal{C}_t}\Delta\omega_i\left(\overline{\mu_i^{-1}} - \overline{\mu^{-1}}^*\right)}_{\text{between}}\right\}$$
$$\underbrace{-\overline{\mu}_t^{\text{hsw}}\overline{\mu}_{t-1}^{\text{hsw}}\left\{\sum_{i\in\mathcal{E}_t}\omega_{it}\left(\mu_{it}^{-1} - \overline{\mu^{-1}}^*\right) - \sum_{i\in\mathcal{X}_t}\omega_{i,t-\tau}\left(\mu_{i,t-\tau}^{-1} - \overline{\mu^{-1}}^*\right),\right\}}_{\text{net entry}}$$

where t, τ index time, i index producers, μ are markups, ω are sales weights, $\overline{X}$ is the (arithmetic) mean of X, and $\Delta X = X_t - X_{t-1}$.

Shift-Share Analysis of Aggregate Markup

Back to Empirics
Back to Additional Results

Aggregate markup increased mostly due to reallocation toward higher-markup firms



Snapshots of Markup Distribution

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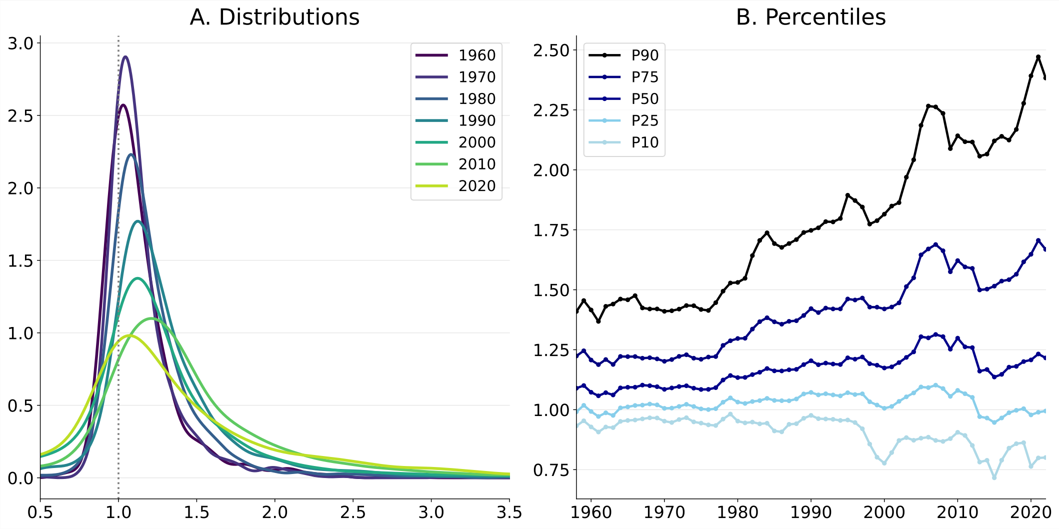
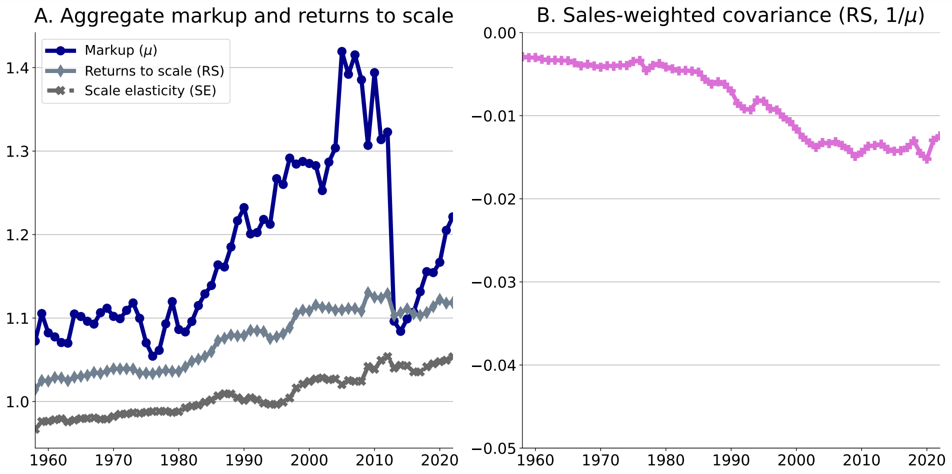


Markups and Returns to Scale in US Manufacturing (Compustat)

Rising markups and returns to scale (magnitudes similar to US economy)



Profit Share in US Manufacturing (Compustat)

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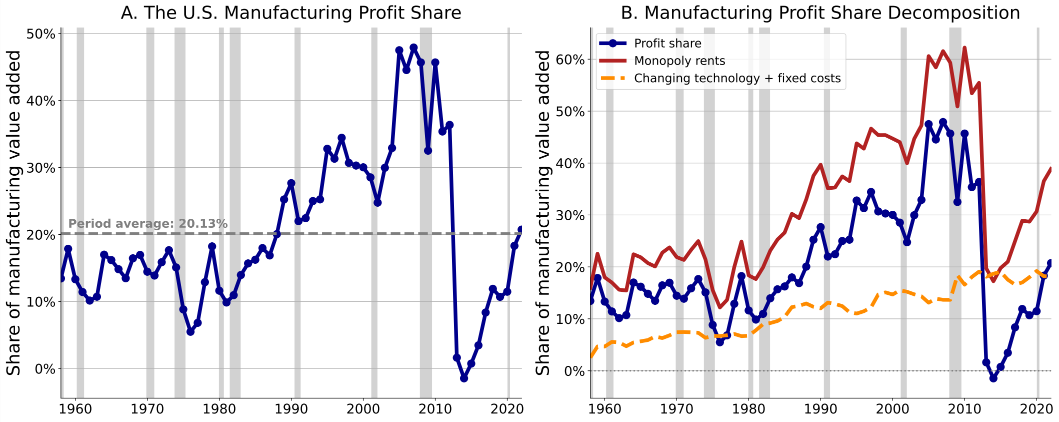
Profit share constant at around 20% (+ 4pp relative to aggregate economy)



CMF Aggregates

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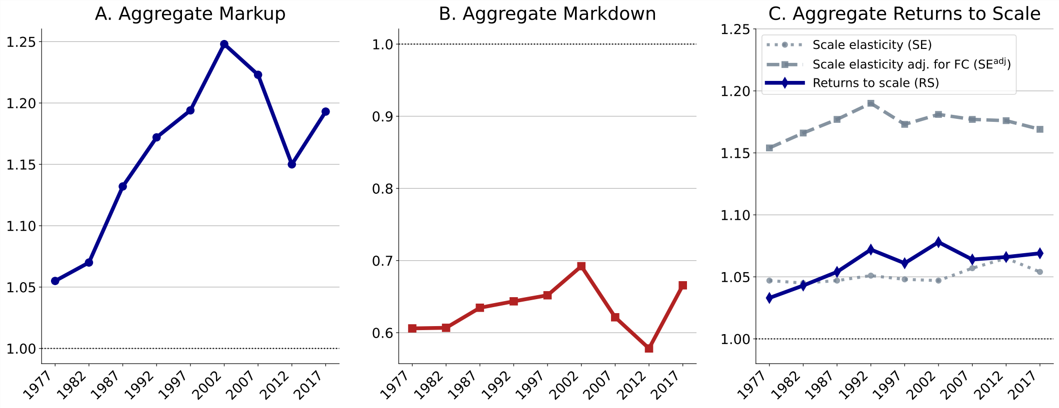
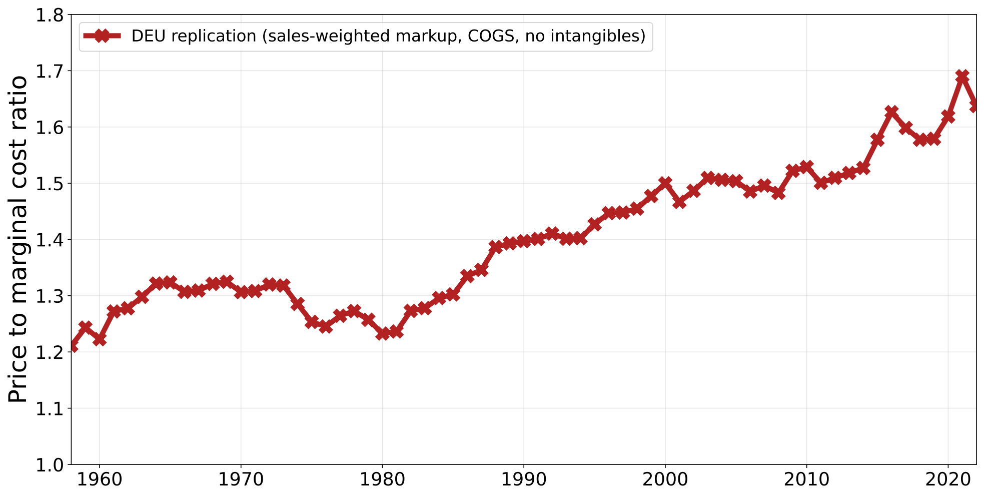
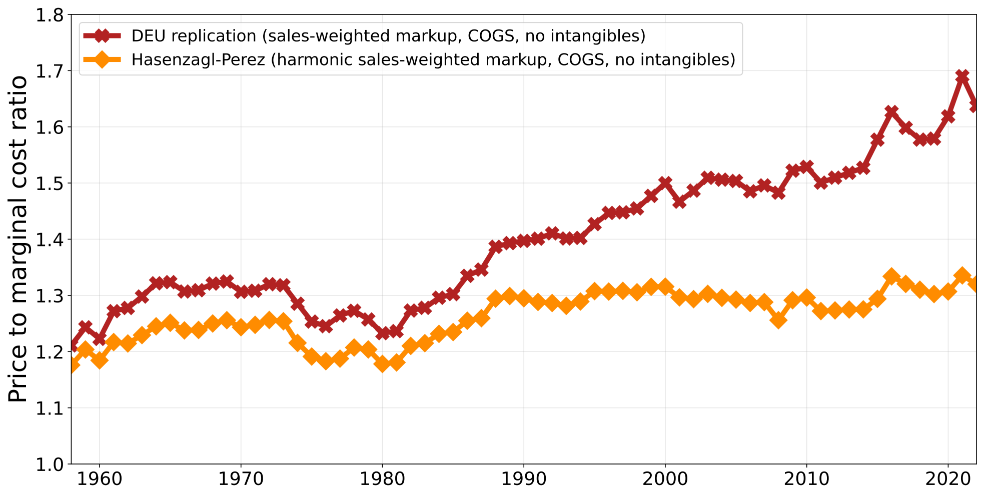


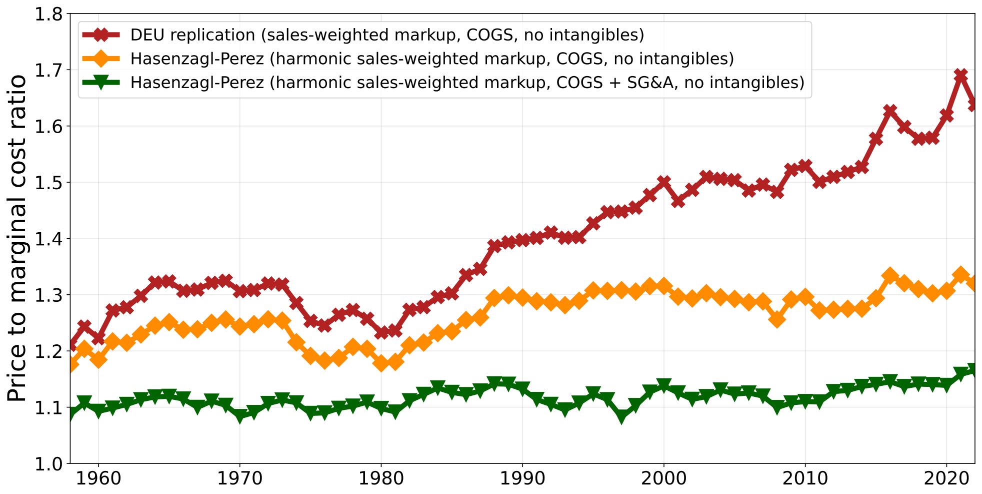
The Aggregate Markup: Comparison with DEU 2020



The Aggregate Markup: Comparison with DEU 2020



The Aggregate Markup: Comparison with DEU 2020



The Aggregate Markup: Comparison with DEU 2020

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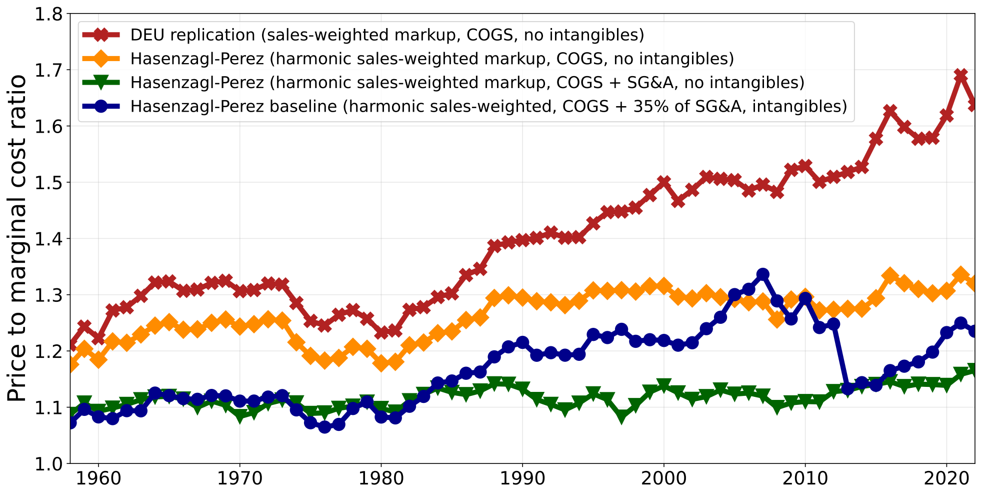
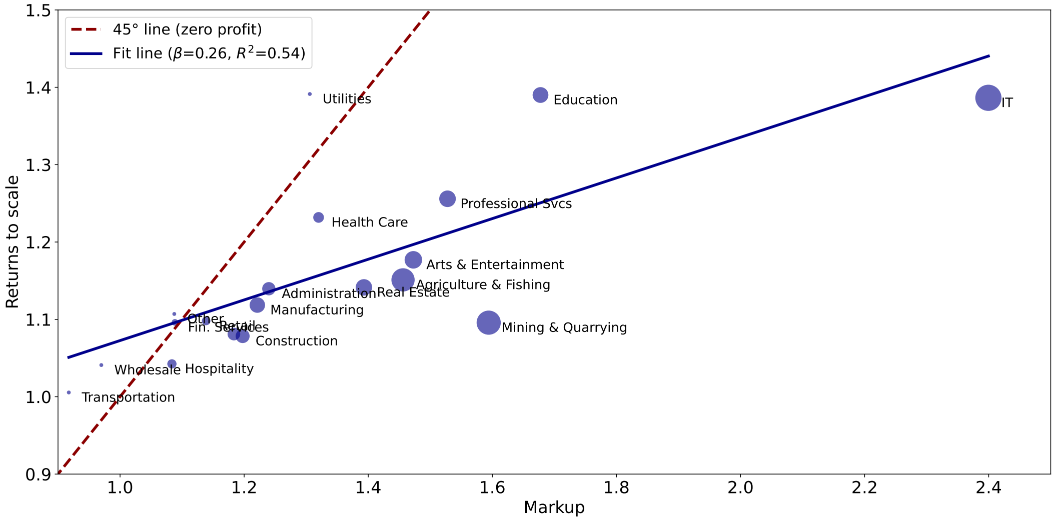


Industry-level Heterogeneity 2022: $\Lambda_{\Pi_i} = \hat{\chi}_i \left(1 - \frac{\overline{\text{RS}}_i}{\overline{\mu}_{i,\text{hsw}}} - \text{Cov}_\omega \left[\text{RS}_i, \frac{1}{\mu_i}\right]\right)$



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Markups Across Industries and Over Time

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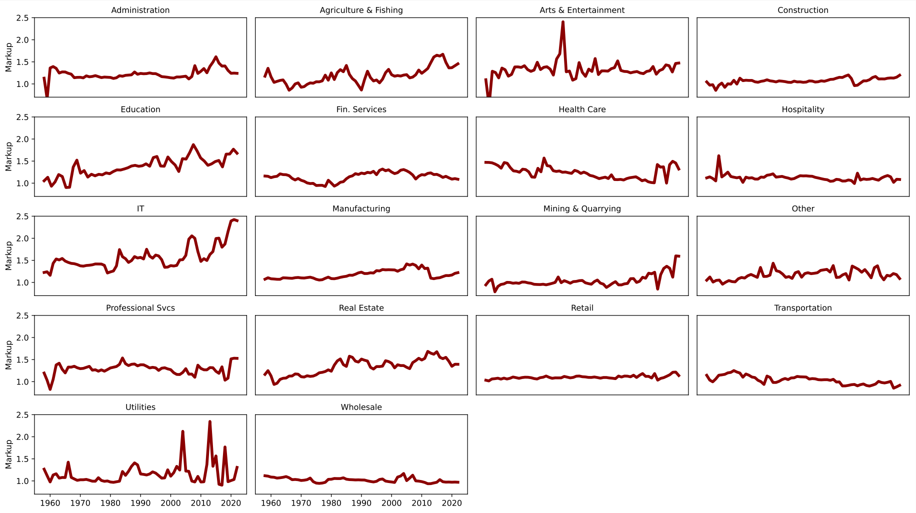

Returns to Scale Across Industries and Over Time

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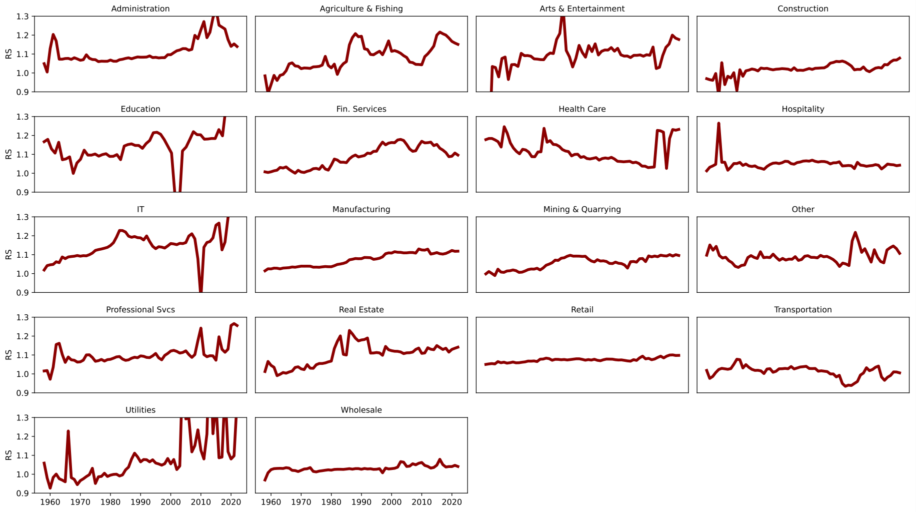


The Profit Share & The User Cost of Capital

- The user cost of capital is a critical input for obtaining the profit share

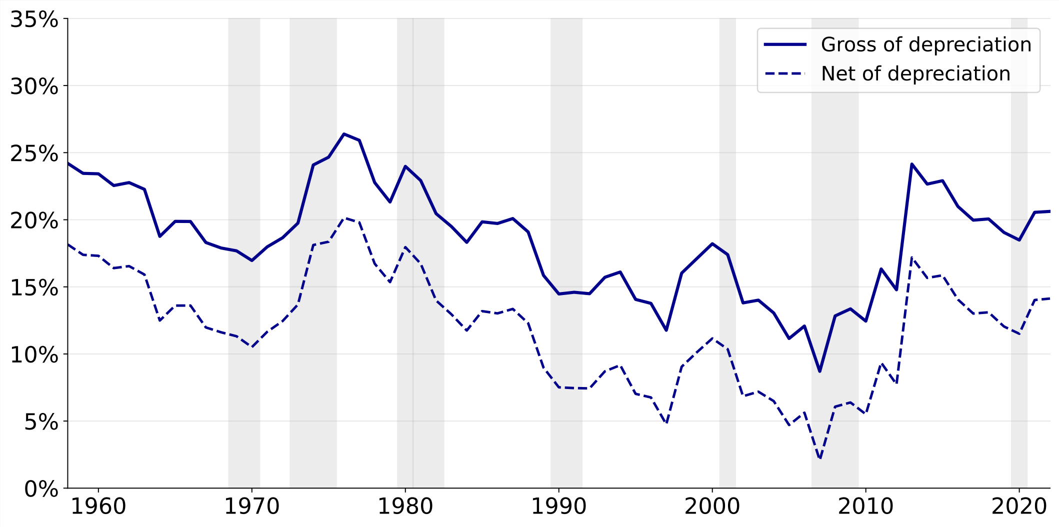
- **Our approach** (Hasenzagl–Perez) **backs out the user cost of capital for each producer i using optimality conditions**. That is,

$$r_{it} = \frac{\theta^k_{jt}}{\mu_{it}} \times \frac{p_{it} y_{it}}{k_{it}}$$

  where θ^k_j is the output elasticity of capital for the industry j in which producer i operates, μ is the markup, py are sales, and k is the capital stock

- Heterogeneous user costs of capital is an attractive feature of our method:
  - If composition of capital is different across producers and different types of capital generate heterogeneous returns, proudcers' user costs will be different
  - With financial frictions, risk premia and other wedges, rental rates differ across producers

Hasenzagl–Perez User Cost of Capital



The Profit Share & The User Cost of Capital

- DEU 2020's user cost of capital assumed to be homogeneous across producers:

$$r_t = i_t - \pi_t + \delta$$

i: nominal interest rate π: inflation rate δ: depreciation rate

- They compute the user cost of capital using:
  - Fed funds rate (FF) as a proxy for nominal interest rate i
  - GDP implicit price deflator (GDPDEF) as a proxy for inflation rate π
  - Exogenous depreciation rate $\delta = 0.12$

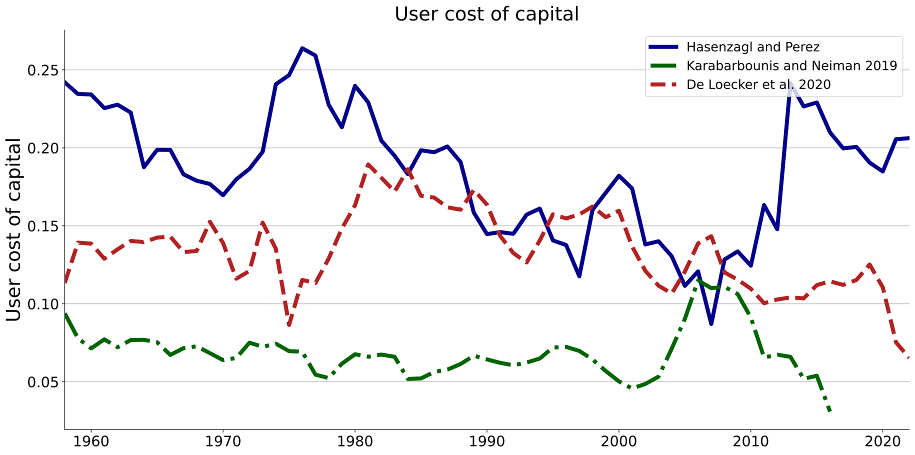
  $\rightarrow$ Return on capital driven by Federal Funds Rate, no role for financial frictions, homogeneous returns across producers, time-invariant deprec.

The Profit Share & The User Cost of Capital

- Karabarbounis and Neiman (2019) compute several user costs of capital
- Here, we focus on their "revised" series obtained under "Case R", which they estimate using a sophisticated econometric procedure
  - Previously showed implied profit share with "measured R", which has no role for risk-premia, financial frictions, adjustment costs
- **Their revised R is similar to ours** in that they allow for:
  - Time-varying risk premia, adjustment costs, financial frictions, ...
  - **Key difference**: homogeneous vs. heterogeneous R for individual producers
- We take this version of their R from their replication package

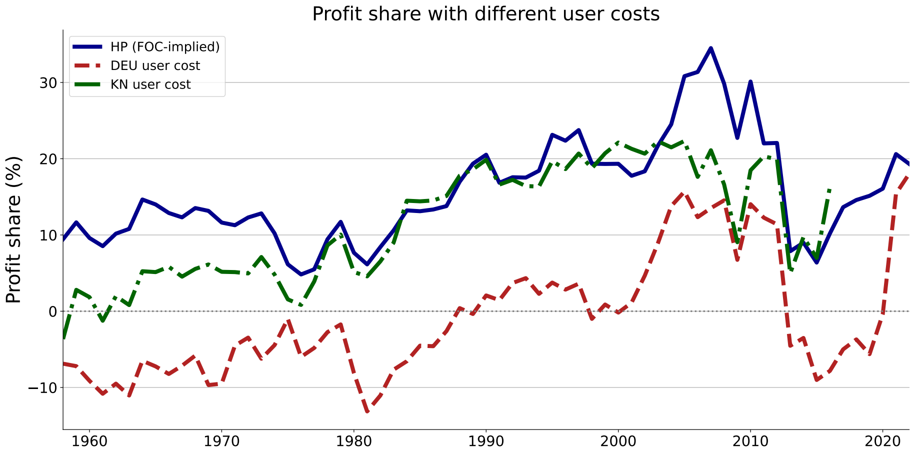
User Costs of Capital

- Our series registers abrupt jumps during financial crises (1973, 1980, 2000, 2007, 2012)
  - + Gilchrist and Zakrajšek 2012, Duarte Rosa 2015, Caballero et al 2017,...
  - − Brinca et al 2016, Chari et al 2007



Implied Profit Shares

- Profit share is sensitive to the user cost of capital
- Our series is more stable and aligns better with the Kaldor facts ▸ See ▸ Back



Implications for Income Shares

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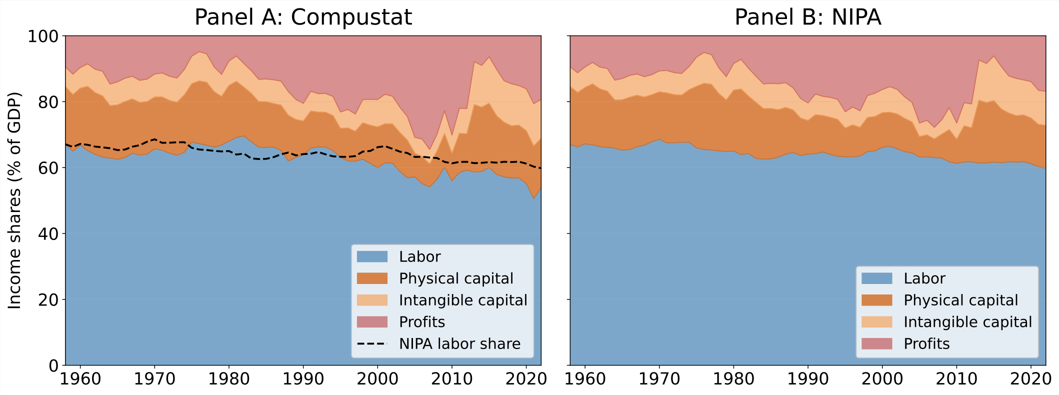

- **Panel B**: labor share from NIPA, (assuming labor share for proprietors same as for rest) and use our estimated capital-to-profit ratio to NIPA non-labor share

Income Shares in US Manufacturing

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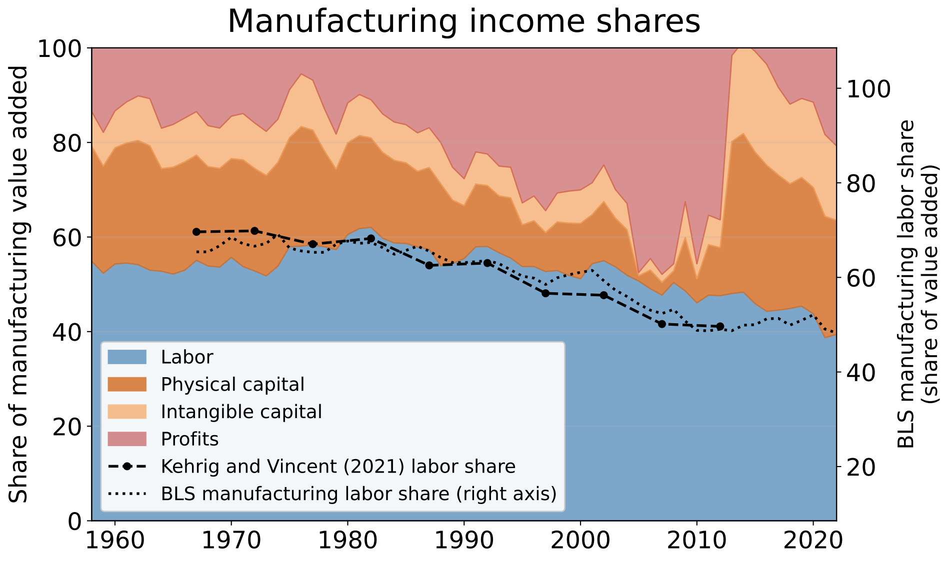

Robustness

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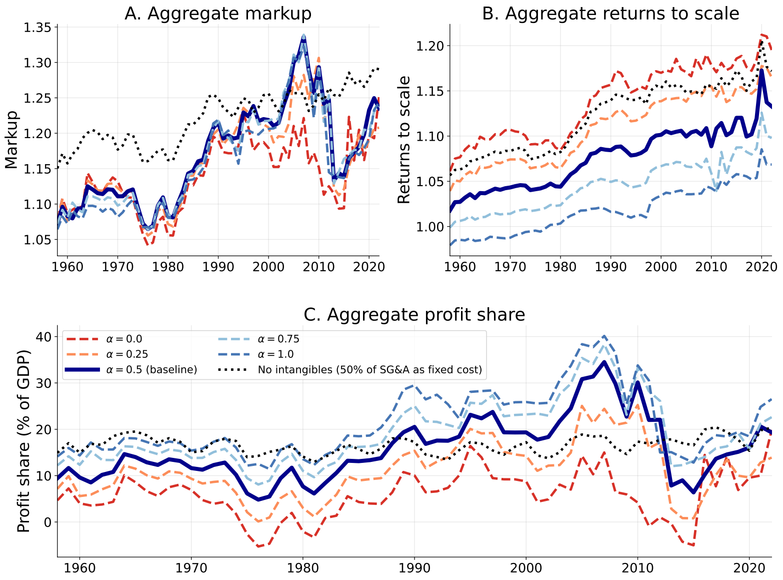
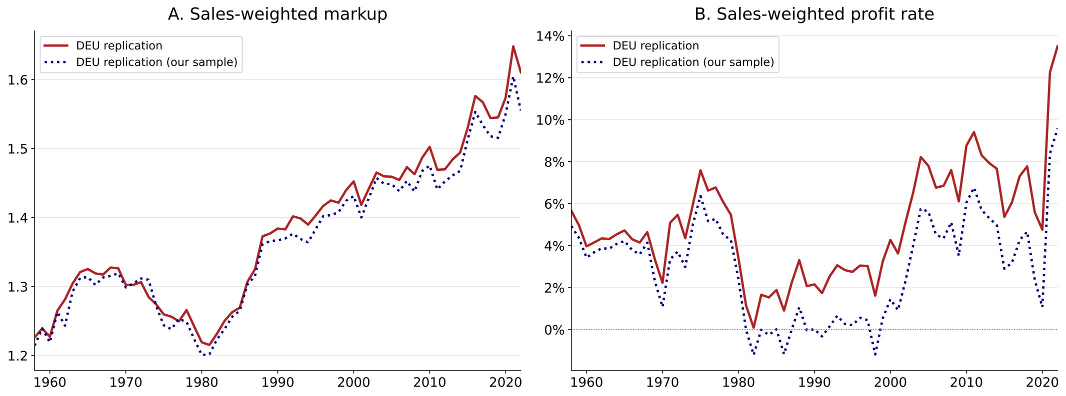


DEU 2020 Replication

- We replicate DEU 2020's sales-weighted markup and profit rate estimates using COGS as variable input, PPEGT as (physical) capital, and their imputed user cost of capital



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The Profit Share: Micro vs. Macro Approach

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