The Rise of Market Power and the Macroeconomic Implications

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Time trend of markups

1. Markups increase from 1980-2016.
2. The increase occurs mainly in the top of the markup distribution.
3. There is no strong compositional pattern across industries and the increase occurs mainly within industry.
4. The rise in average weighted markups is due to an increase in the upper tail of the unweighted markups (roughly $\frac{1}{3}$), combined with the reallocation of market share from low to high markup firms (about $\frac{2}{3}$).

Outline

1. Estimation methods
2. Results on markups
3. Market power
4. Macro implications

Estimation of markups: production approach

Production function:

$$Q_{it} = Q_{it}\left(\Omega_{it}, \boldsymbol{V}_{it}, K_{it}\right)$$

where

- $\boldsymbol{V} = \left(V^1, \ldots, V^J\right)$: vector of variable inputs of production.
- K_{it}: capital stock.
- Ω_{it}: Hicks-neutral productivity term that is firm-specific.

Cost minimization:

$$\mathcal{L}\left(V_{it}, K_{it}, \lambda_{it}\right) = P_{it}^V V_{it} + r_{it} K_{it} + F_{it} - \lambda_{it}\left(Q(\cdot) - \overline{Q}_{it}\right)$$

FOC:

$$\frac{\partial \mathcal{L}_{it}}{\partial V_{it}} = P_{it}^V - \lambda_{it} \frac{\partial Q(\cdot)}{\partial V_{it}} = 0$$

Estimation of markups: production approach

Output elasticity of input V:

$$\theta_{it}^{v} \equiv \frac{\partial Q(\cdot)}{\partial V_{it}} \frac{V_{it}}{Q_{it}} = \frac{1}{\lambda_{it}} \frac{P_{it}^{V} V_{it}}{Q_{it}}$$

Define the markup as $\mu = \frac{P}{\lambda}$, we have

$$\mu_{it} = \theta_{it}^{v} \frac{P_{it} Q_{it}}{P_{it}^{V} V_{it}}$$

- the revenue share of the variable input: $\frac{P_{it} Q_{it}}{P_{it}^{V} V_{it}}$.
- the output elasticity of a variable input of production: θ_{it}^{v}.
    - Estimate a parametric production function for each sector.
    - Non-parametrically estimate the output elasticity using (constructed) cost shares.

Output Elasticities: Production Function Estimation

Production function (taking log):

$$q_{it} = \theta_{st}^{V} v_{it} + \theta_{st}^{K} k_{it} + \omega_{it} + \varepsilon_{it}$$

where θ_{st}^{V} and θ_{st}^{K} are sector specific and time varying.

Challenges:

1. unobserved productivity shocks: ω_{it}.
2. extracting units of output and inputs from expenditure data.

Unobserved productivity

Standard production function estimation in IO.
Control function:

$$\omega_{it} = h_{st}\left(d_{it}, k_{it}\right)$$

Non-parametric projection of output on the inputs and the control variable:

$$q_{it} = \phi_t\left(v_{it}, k_{it}, d_{it}\right) + \varepsilon_{it}$$

where $\phi = \theta^V_{st} v_{it} + \theta^K_{st} k_{it} + h_{st}\left(d_{it}, k_{it}\right)$. We have $\hat{\phi}_t$.
Question: if only want θ^V_{st}, semiparametric regression is enough.

The productivity process:

$$\omega_{it} = g\left(\omega_{it-1}\right) + \xi_{it}$$

Moment condition:

$$\mathbb{E}\left(\xi_{it}(\theta^V_{st}, \theta^K_{st}) v_{it-1}\right) = 0$$

Units

We fail to observe physical output and input (q, v, k). Instead we observe sales and expenditures on the various inputs.

$$q_{it} + p_{it} = \theta_{st}^{V} \tilde{v}_{it} + \theta_{st}^{K} \tilde{k}_{it} + \omega_{it} + p_{it} - \sum_{j} \theta_{st}^{j} p_{it}^{j} + \varepsilon_{it}$$

Bias of the productivity residual: $\omega_{it} + p_{it} - \sum_{j} \theta_{st}^{j} p_{it}^{j}$.
Under a constant returns to scale production function:

$$\ln \lambda_{it} = \sum_{j} \theta_{st}^{j} p_{it}^{j} - \omega_{it}$$

We have

$$q_{it} + p_{it} = \theta_{st}^{V} \tilde{v}_{it} + \theta_{st}^{K} \tilde{k}_{it} + \ln \mu_{it} + \varepsilon_{it}$$

This paper assumes markup depends linearly on market share (can we use more flexible specifications?)

$$\ln \mu_{it} = \mu(m_{it}) + \omega_{it}$$

Cost Shares

Estimate output elasticity by the share of expenditures on the variable input bundle in total cost.

Assumes

1. Each input of production to be variable.
2. Production to occur under constant returns to scale.

When consider firm-time specific cost shares, measure of the markup is simply the ratio of sales-to-total costs

Caveats for the estimation methods

Focus on single product firm, while most firms have multi-products, even across sectors. Multinationals is a typical example.

In this paper, the rising markup is driven by the top tier of firms, where the multi-product problem is quite severe.

How to deal with different products? Estimating PPF?

Data

Data: Compustat (Publicly traded firms, 1950-2015)

- Sales.
- Input expenditure (Cost of Goods Sold: input bundle).
- Capital stock.
- Profitability.
- Stock market performance.
- Overhead (Selling, General and Administrative Expenses).

Census: 1960s - 2012. Every 5 years.

- The Census of Manufactures: establishment-level data on sales, and very comprehensive data on inputs (the total labor wage bill, capital, materials, and so on).
- Most of the other sector censuses (retail, wholesale, etc.) only contain data on establishment-level sales and wage bill, and not other non-labor inputs.

Production Function

Firm i's markup:

$$\mu_{it} = \theta^V_{st} \frac{P_{it} Q_{it}}{P^V_{it} V_{it}}$$

Average markup (weighted by the share of sales):

$$\mu_t = \sum_i m_{it} \mu_{it}$$

1. PF1: Traditional Production Function with Fixed Costs.
2. PF2: Production Function with Overhead as a Factor of Production.

Results on markups

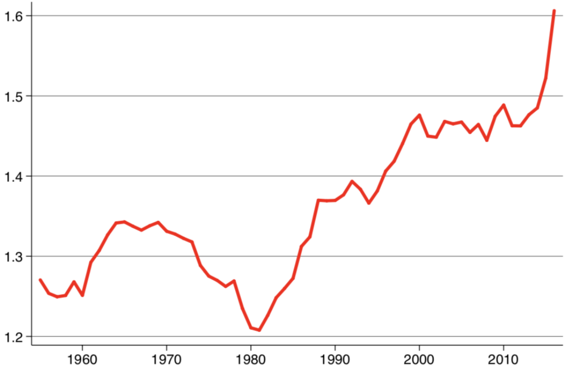
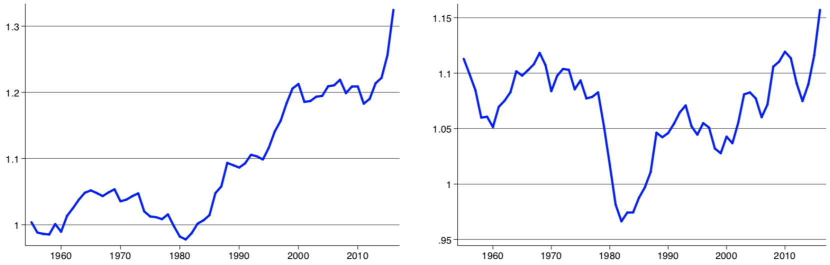


Figure 1: Average Markups for Conventional Production Function. Output elasticities θ_{st} from estimated PF1 are time-varying and sector-specific (2 digit). Average is sales weighted. Evolution 1955-2016.

Results on markups



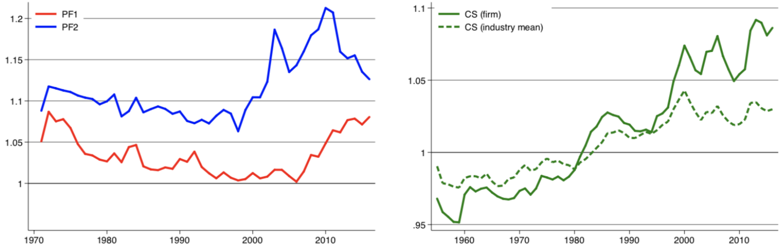
(a) Markup with θ_{st} from PF2 (b) Markup with θ_{st} from CS2

Figure 4: Average Markups for Production Function with Overhead as a factor. Output elasticities from estimated PF2 and from CS2: time-varying, sector-specific (2 digit) output elasticity θ_{st} (sales weighted average).

1. PF1: $\theta^V + \theta^K$
2. PF2: $\theta^V + \theta^K + \theta^X$

Cost share based on Syverson (2004):

$$q = \gamma\left[\alpha_V v + \alpha_K k + \alpha_X x\right] + \omega$$



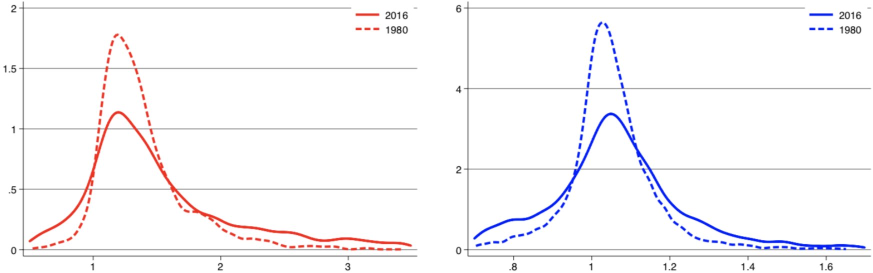
(a) RTS (sum of output elasticities) of Estimated PF1 and PF2; sales weighted

(b) Estimated RTS of Cost Shares: firm CS and sector average CS

Figure 5: Returns to Scale

The Distribution of Markups

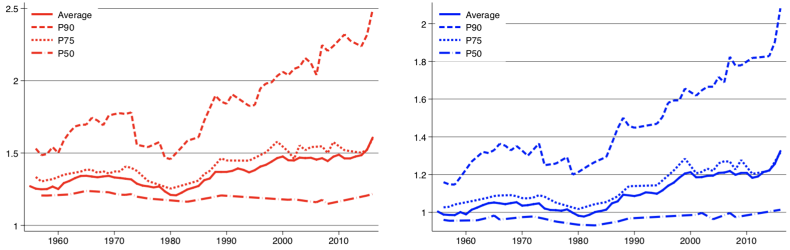
Kernel density of the unweighted markups for 1980 and 2016



(a) Production Function PF1 (b) Production Function PF2

Figure 7: Distribution of Markups μ_{it}: Kernel Density Plots (unweighted)

The Distribution of Markups



(a) Production Function PF1

(b) Production Function PF2

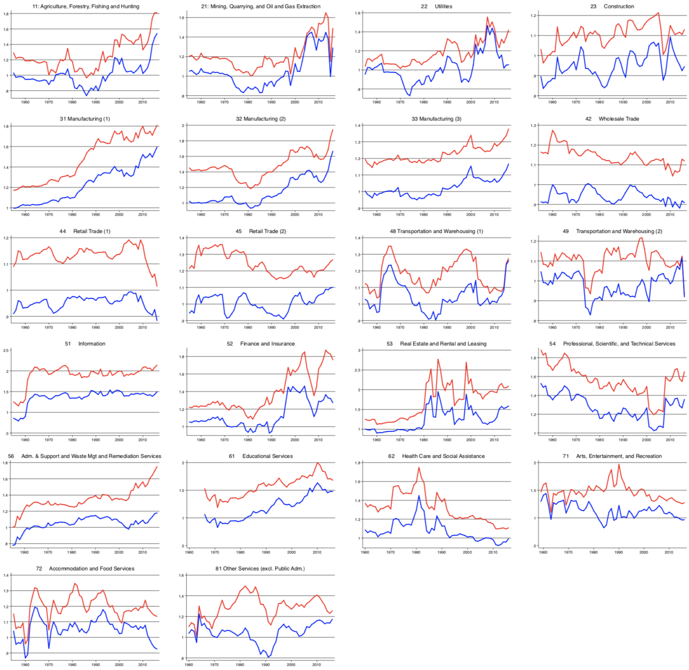
Figure 8: Percentiles of the Markup Distribution. (The percentiles of the Markup distribution are weighted by marketshare of sales in the sample.)

Decomposition Within Versus Between Sectors

$$\Delta\mu_t = \underbrace{\sum_s m_{s,t-1}\Delta\mu_{st}}_{\Delta \text{ within}} + \underbrace{\sum_s \mu_{s,t-1}\Delta m_{s,t}}_{\Delta \text{ between}} + \underbrace{\sum_s \Delta\mu_{s,t}\Delta m_{s,t}}_{\Delta \text{ cross term}}$$

Production Function PF1					
	Markup	Δ Markup	Δ Within	Δ Between	Δ Cross
1966	1.337	0.083	0.057	-0.017	0.041
1976	1.270	-0.067	-0.055	0.002	-0.014
1986	1.312	0.042	0.035	0.010	-0.003
1996	1.406	0.094	0.098	0.004	-0.008
2006	1.455	0.049	0.046	0.007	-0.005
2016	1.610	0.154	0.133	0.014	0.007
Production Function PF2					
	Markup	Δ Markup	Δ Within	Δ Between	Δ Cross
1966	1.051	0.061	0.044	-0.012	0.028
1976	1.014	-0.037	-0.030	-0.004	-0.003
1986	1.048	0.035	0.028	0.008	-0.001
1996	1.141	0.093	0.096	0.002	-0.006
2006	1.211	0.070	0.068	0.004	-0.002
2016	1.329	0.118	0.106	0.004	0.008

Table 1: Decomposition of 10 year change in Markup.


11: Agriculture, Forestry, Fishing and Hunting
21: Mining, Quarrying, and Oil and Gas Extraction
22 Utilities
23 Construction
31 Manufacturing (1)
32 Manufacturing (2)
33 Manufacturing (3)
42 Wholesale Trade
44 Retail Trade (1)
45 Retail Trade (2)
48 Transportation and Warehousing (1)
49 Transportation and Warehousing (2)
51 Information
52 Finance and Insurance
53 Real Estate and Rental and Leasing
54 Professional, Scientific, and Technical Services
56 Adm. & Support and Waste Mgt and Remediation Services
61 Educational Services
62 Health Care and Social Assistance
71 Arts, Entertainment, and Recreation
72 Accommodation and Food Services
81 Other Services (excl. Public Adm.)

Decomposition at the Firm Level

$$\Delta\mu_t = \underbrace{\sum_i m_{i,t-1}\Delta\mu_{it}}_{\Delta \text{ within}} + \underbrace{\underbrace{\sum_i \tilde{\mu}_{i,t-1}\Delta m_{i,t}}_{\Delta \text{ market share}} + \underbrace{\sum_i \Delta\mu_{i,t}\Delta m_{i,t}}_{\Delta \text{ cross term}}}_{\text{Reallocation}}$$

$$+ \underbrace{\sum_{i\in \text{Entry}} \tilde{\mu}_{i,t} m_{i,t} - \sum_{i\in \text{ Exit}} \tilde{\mu}_{i,t-1} m_{i,t-1}}_{\text{net entry}}$$

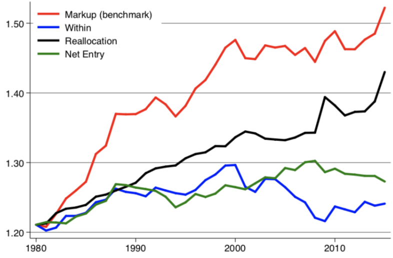
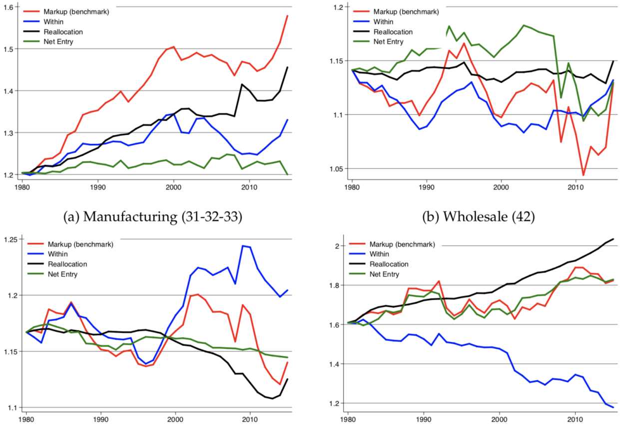


Figure 10: Decomposition of markup growth at the firm level.

Firm Level Decomposition by Sectors



(a) Manufacturing (31-32-33)

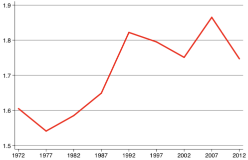
(b) Wholesale (42)

(c) Retail (44-45)

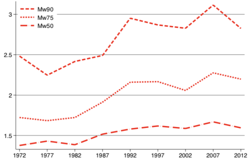
(d) Services (54-56-61-62-71-72-81)

Sectors where "within component" dominates: Wholesale, FIRE(finance, insurance, and real estate), Agriculture, Mining and Utilities.

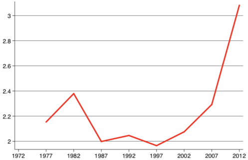
Results from the US Censuses



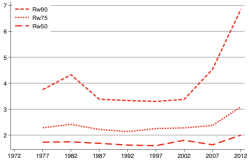
(a) Manufacturing: average



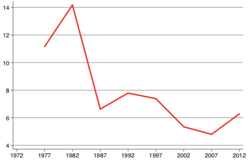
(b) Manufacturing: percentiles



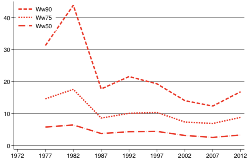
(c) Retail: average



(d) Retail: percentiles



(e) Wholesale: average



(f) Wholesale: percentiles

Market Power

Rising markups could be caused by:

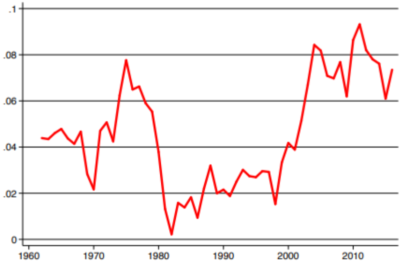
- Decrease in marginal costs
- Increase in demand or its elasticity
- Change in market structure

But does this correspond to higher market power? Not necessarily.
$\rightarrow$ do higher markups lead to higher profits?

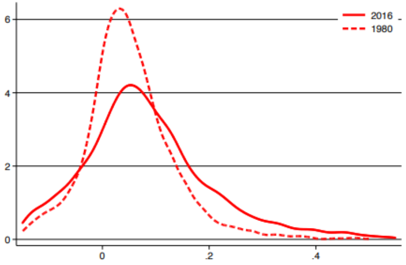
Profits

Implied net economic profit as share of sales:

$$\pi_{it} = 1 - \underbrace{\frac{\theta_{st}}{\mu_{it}}}_{\text{variable}} - \underbrace{\frac{r_t K_{it}}{S_{it}}}_{\text{capital}} - \underbrace{\frac{P_t^X X_{it}}{S_{it}}}_{\text{overhead}} \tag{1}$$



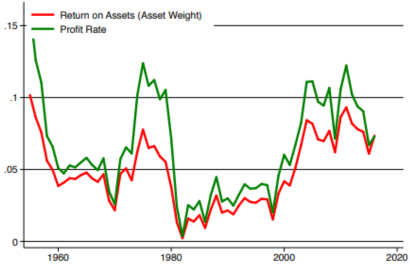
(a) Average Profit Rate (sales weighted)



(b) Kernel Density Profit Rate (unweighted)

Figure 14: Average Profit Rate and Profit Rate Distribution.

Return on Assets

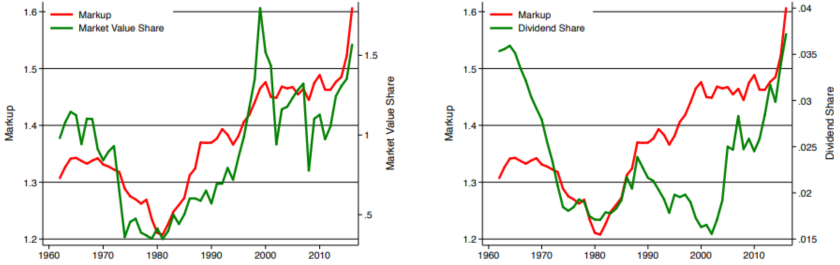


(a) Return on Assets (asset weight) and Profit Rate.

(b) Return on Assets (sales weight).

Figure 7.1: Average Return on Assets.

Market value and dividends



(a) Average Market Value (share of Sales), Markup (b) Average Dividends (share of Sales), Markup

Figure 15: Market Value and Dividends.

Fi

level: firms with higher markups have higher market values and dividends.

Overheads, R&D and Advertising

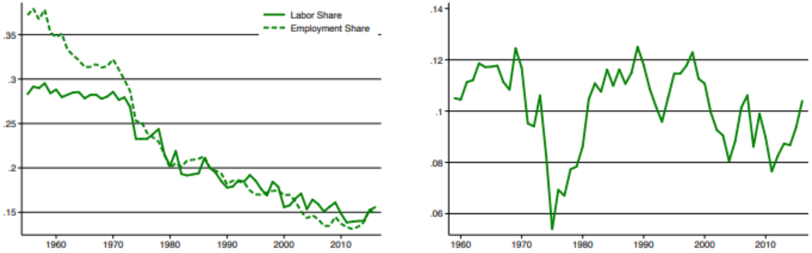
	Markup (log)			Profit Rate (log)	
	(1)	(2)	(3)	(4)	(5)
SG&A (log)	0.56			0.15	
	(0.01)			(0.03)	
R&D Exp. (log)		0.16			0.10
		(0.01)			(0.01)
Advertising Exp. (log)		0.05			0.03
		(0.00)			(0.01)
R&D dummy			0.06		
			(0.01)		
Advertising dummy			-0.00		
			(0.03)		
R^2	0.61	0.07	0.43	0.04	0.05
N	26,743		247,615	26,743	

Table 3: Regressions: effect of SG&A, R&D Expenditure and Advertising Expenditure on markups and Profit Rate; Extensive margin effect of R&D and Advertising.

Labor Share

Direct (inverse) relationship between the labor share and the markup:
Rewriting the firm-level First Order Condition:

$$\frac{w_t L_{it}}{P_t Q_{it}} = \frac{\theta_{it}}{\mu_{it}} \tag{2}$$



(a) Average Labor and Employment Shares (= Employees/Sales; normalized to 0.2 in 1980).

(b) The Evolution of the Average Capital Share in our sample of firms.

Figure 21: Labor and Capital Shares.

Capital Share

Similar implications for the capital share:

$$\underbrace{\frac{w_t L_{it}}{P_t Q_{it}}}_{\text{labor}} + \underbrace{\frac{r_t K_{it}}{P_t Q_{it}}}_{\text{capital}} = 1 - \underbrace{\frac{P_t^X X_{it}}{P_t Q_{it}}}_{\text{overheads}} - \underbrace{\frac{\Pi_{it}}{P_t Q_{it}}}_{\text{profits}}$$

Labor Market

- Median wage stagnation
- Decline in labor force participation
- Decline in labor reallocation and migration

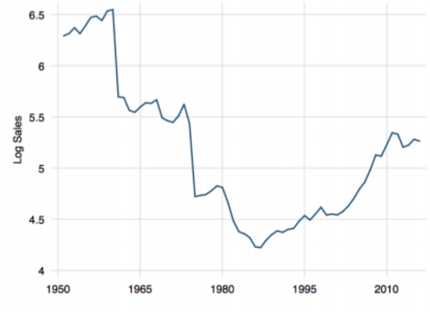
Discussion

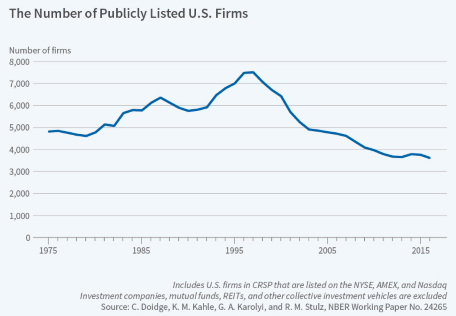
- To what extent have markups risen?
- To what extent does the rise in markups represent a rise in market power?

To what extent have markups risen? Measurement questions

Who are the Compustat firms?

Figure 8: Compustat Sample Firm Size





Traina critique

Same methodology, different measure of variable inputs
Traina variable inputs = OPEX = COGS + SGA (materials, labor, marketing, and management)
DEU variable inputs = COGS

Figure 2: COGS vs. OPEX Markups

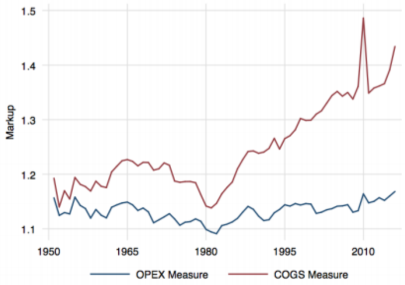
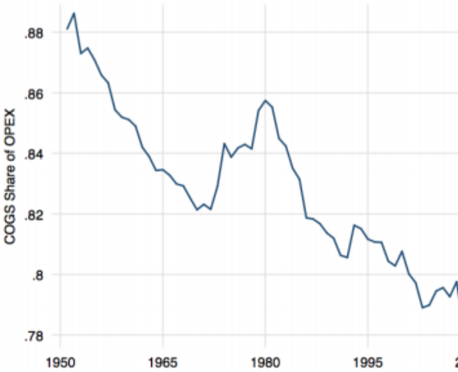


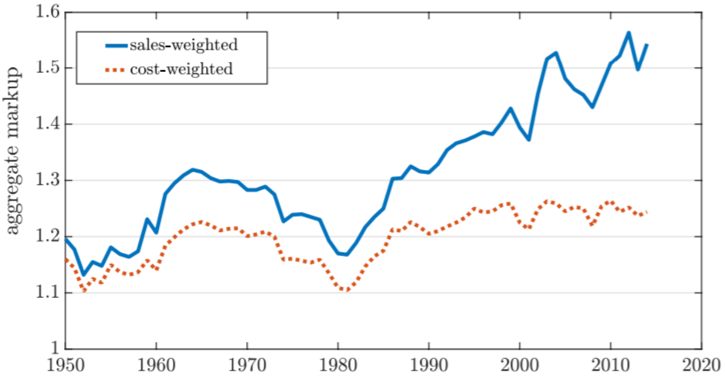
Figure 4: COGS Share of OPEX



To what extent does the rise in markups represent a rise in market power?

Edmond, Midrigan and Xu critique

Figure 8: Cost-weighted vs. sales-weighted average markups, Compustat data

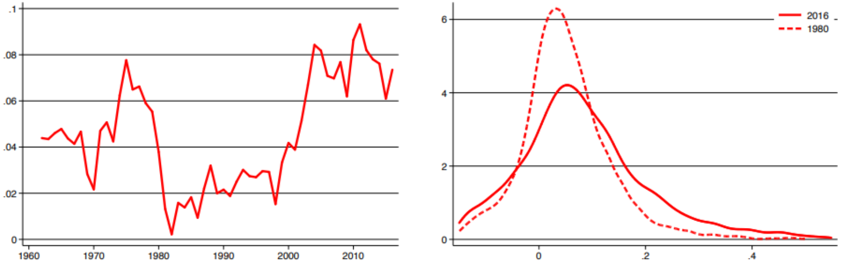


Solid blue line shows the sales-weighted average of firm-level markups, as in De Loecker and Eeckhout (2017). Dashed red line shows the cost-weighted average of firm-level markups. The former has increased by a larger amount, but the latter is the relevant measure of the aggregate distortion to first-order conditions that results in welfare losses.

Profits

Implied net economic profit as share of sales:

$$\pi_{it} = 1 - \underbrace{\frac{\theta_{st}}{\mu_{it}}}_{\text{variable}} - \underbrace{\frac{r_t K_{it}}{S_{it}}}_{\text{capital}} - \underbrace{\frac{P_t^X X_{it}}{S_{it}}}_{\text{overhead}} \tag{3}$$

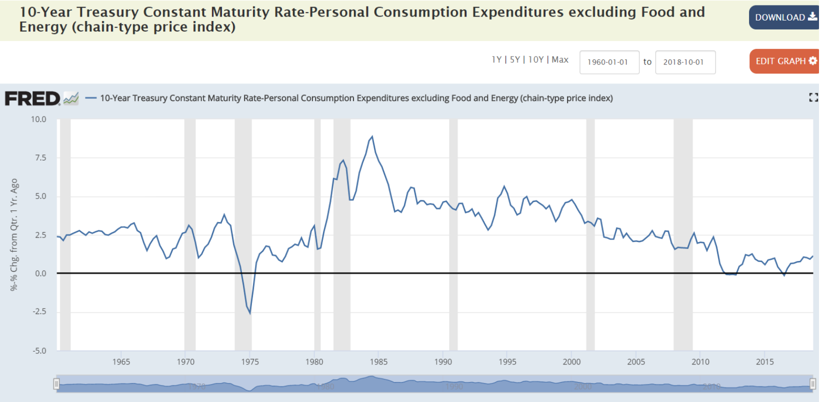


(a) Average Profit Rate (sales weighted)

(b) Kernel Density Profit Rate (unweighted)

Figure 14: Average Profit Rate and Profit Rate Distribution.

Income shares: variable, overhead, capital, profit



Karabarbounis and Neiman: Case R

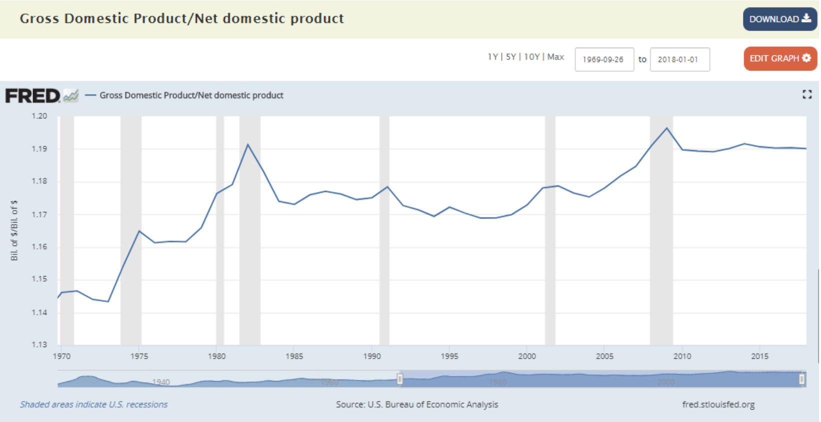
(a) Real Interest Rate

(b) IT Rental Rate

(c) Non-IT Rental Rate

(d) Housing Rental Rate

Depreciation



Labor share: corporate sector, net and gross (Bridgman 2018)

Discussion

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