The Rise of Market Power and the Macroeconomic Implications

De Loecker, Eeckhout and Unger
Presenter:Tokuma Suzuki

May 13, 2019

UTGSE M2

Introduction

Outline

Motivation

In the absense of competition, firms obtain market power.

- higher prices
- decreasing investment, labor demand
- decline in business dynamics and innovation

Thus such power affects monetary policy and income redistribution.
However, market power's patterns are almost unknown.

Contributions

1. Using firm level data, uncover the evolution of market power for US economy since 1950s.
    - Utilize IO technique for macroeconomic analysis.
2. Given the fact, discuss the macroeconomic implications of rise in market power and GE effect.
    - Rise in market power is consistent with decline in labor/capital share.

Empirical Findings

1. Average markup
    - $1.2 \sim 1.3$ in $1950 \sim 1980$
    - Increase starts in 1980 reaching 1.61 in 2016.
2. Markup distribution
    - Increases in the top percentiles of the sales-weighted dist
    - Flat or even decreasing below the median
3. No strong compotitional effects.
    - The increase occurs mainly within industry.

Estimation technique

Estimating Markup?

The potential problem is the availability of marginal cost data.

We need the economic structure to uncover marginal costs.

- Explicitly assume the production function

By exploiting the cost minimization, we can estimate markups.

Cost Minimization Problem

N firms are in the economy.They are heterogenous in their productivity.

Each firm i minimizes their cost at every period t.

- Q_{it}: Quantity of output
- $Q_{it}(\Omega_{it}, V_{it}, K_{it})$: Production technology
- Ω_{it}: Firm-specific Hicks-neutral productivity
- V_{it}: Bundle of variable inputs
- K_{it}: Capital stock

Cost Minimization Problem cont.

Lagrangian associated with the firm's cost minimization can be written as

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

where

- P_{it}^{V}: Price of the variable input
- r_{it}: User cost of capital
- F_{it}: Fixed cost
- λ_{it}: Lagrange multiplier
- $\bar{Q}_{it}$: Given amount of output

Direct measure of marginal costs

The first order condition w.r.t. V is

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

The output elasticity of input is

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

Notice that the Lagrange multiplier λ is a direct meature of marginal cost. This is the value of objective function as we relax the output constraints.

Simple expression for the markup

Let P be the price of output. We define the markup as $\mu = \frac{P}{\lambda}$.

Using this expression and output elasticity, we obtain

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

From this expression, two ingredients needed to measure the markup.

1. The output elasticity of the variable input(Crucial).
2. The revenue share of the variable output

Estimating the output elasticity

There are two way to estimate the output elasticity of the variable input.

1. Parametric production function estimation
2. Non-parametric estimation

1. Production Function Estimation

Assume parameters are time-varing and sector-specific.

Given industry s, we estimate the following production function.

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

where lower cases denote logs.

The potential problem is firm-specific technology shock is unobservable.

Unobserved productivity

We use control function approach to deal with this.

Suppose $\omega_{it} = h_{st}(v_{it}, k_{it})$, inverting input demand equation.

Let firm-specific productivity follows Markov process i.e. $\omega_{it} = g(\omega_{it-1}) + \xi_{it}$.

By the productivity process, we have the following moment condition.

$$\mathrm{E}\left(\xi_{it}(\theta_{st})\begin{pmatrix} v_{it-1} \\ k_{it} \end{pmatrix}\right) = 0$$

Unobserved productivity cont.

1. Use non-parametric projection of output

$$\begin{aligned} q_{it} &= \phi_t(v_{it}, k_{it}) + \epsilon_{it} \\ &= \theta^V_{st} v_{it} + \theta^K_{st} k_{it} + h_{st}(v_{it}, k_{it}) + \epsilon_{it} \end{aligned}$$

2. Using $\hat{\phi}_{it}$, we obtain $\omega_{it}(\theta^V_{st}) = \hat{\phi}_{it} - \theta^V_{st} v_{it} - \theta^K_{st} k_{it}$.
3. Projecting ω_{it} on its lag, we obtain $\xi_{it}(\theta_{st})$
4. Using moment conditions, θ^V_{st} is identified.

Empirical Results

Data sets

To estimate markups, they use Compustat which covers publicly traded firms.

- Concern: Missing small firms.

This selection leads to biased results. They deal with it in two ways.

1. Repeat the estimation on the US Censuses.
2. Use the population weights of each sector to adjust the weights

Variables in Compustat

These are important and contraversial for the estimation.

- Variable input: ”Cost of Goods Sold”
- Overhead cost: ”Selling, General and Adiministrative Expenses”(SGA)

If firms have overhead costs, they charge price to offset the overhead.

Markup $\neq$ Market power

Average markup

Recall that the markup of firm *i* in sector *s* at time *t* is

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

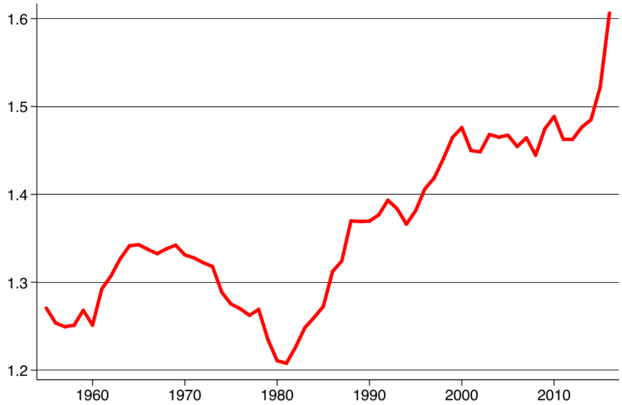
We define the average markup as

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

where

- $m_{it} = \frac{S_{it}}{S_t}$: Market share of sales in the sample
- $S_t = \sum_i S_{it}$: Total sales at time t

Evolution of average markup



Source: De Loecker, Eeckhout and Unger (2018)

Cause of increasing markup

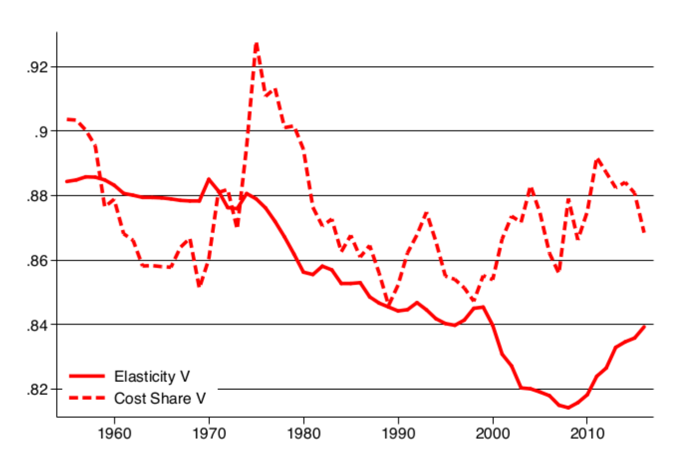
Recall that markup can be written as follows.

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

From this equation, the rise in the markup are attributed to two sources.

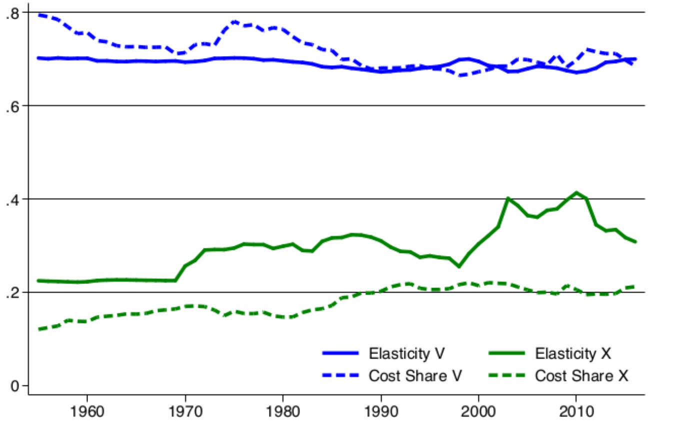
1. Increase in the output elasticity
2. Increase in the ratio of sales to expenditure on variable inputs

Output elasticity and Cost share



Source: De Loecker, Eeckhout and Unger (2018)

Cost share of overhead



Source: De Loecker, Eeckhout and Unger (2018)

Overhead as a Factor of Production

Higher expenditure on better sales people $\rightarrow$ increase in the units sold.

- Overhead costs are non-Variable
- Qualitatively, similar pattern
- Average markup shows moderate increase (30 points)

Since θ^V is slightly decreasing, average markup is smaller.

Returns to Scale

With two technologies, we estimate returns to scale over time.

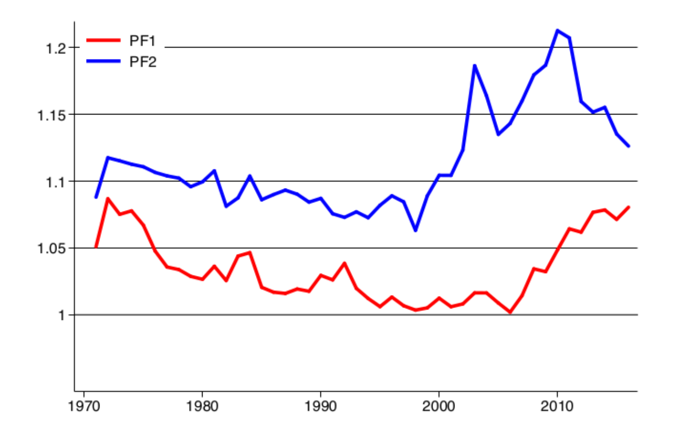
Recall that technology is Cobb-Douglas.

RTS is measured by the sum of the output elasticities.

- PF1: $\theta^V + \theta^K$
- PF2: $\theta^V + \theta^K + \theta^X$

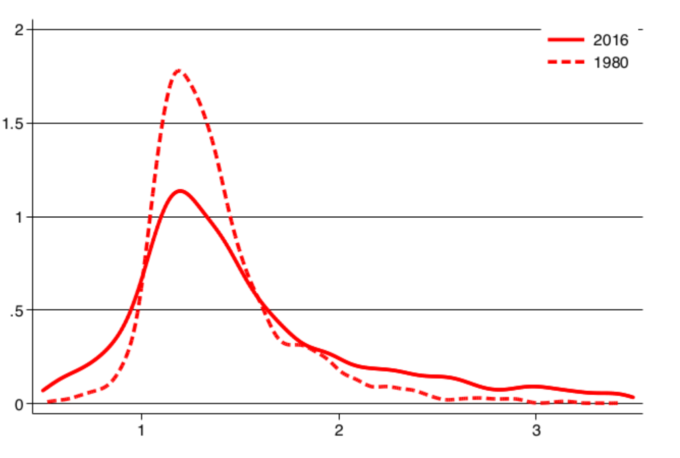
Since overhead cost is in part a fixed cost, PF2 shows higher RTS.

Returns to Scale Result



Source: De Loecker, Eeckhout and Unger (2018)

The Distribution of Markups



Source: De Loecker, Eeckhout and Unger (2018)

Sales-weighted markup

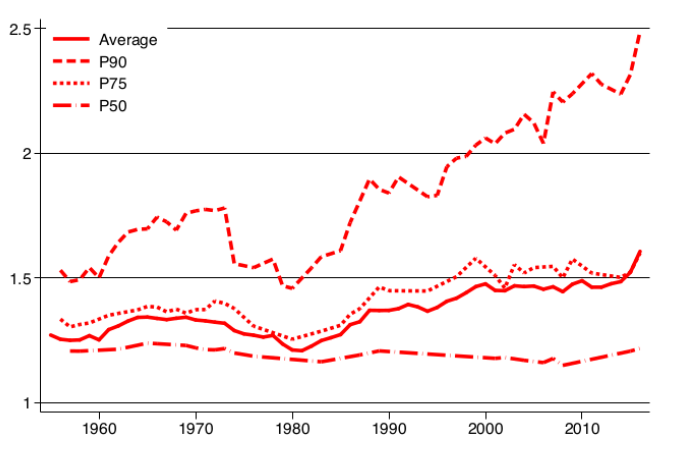
We want to know which firms increase markups.

- Rank the firms by markup
- Obtain the percentiles we weigh each firm by its market share

For the 90th percentile, the increase is sharpest.

Increase in average markup is driven by a few firms.

Percentiles of the Distribution



Source: De Loecker, Eeckhout and Unger (2018)

Decomposition at the Sector Level

Increase in markup can be decomposed by

1. within: a change of markup at the industry level
2. between: a change in the composition of sectors
3. cross term: joint change in markup and the firm composition

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

Sector Level Decomposition

	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

Source: De Loecker, Eeckhout and Unger (2018)

Decomposition at the Firm Level

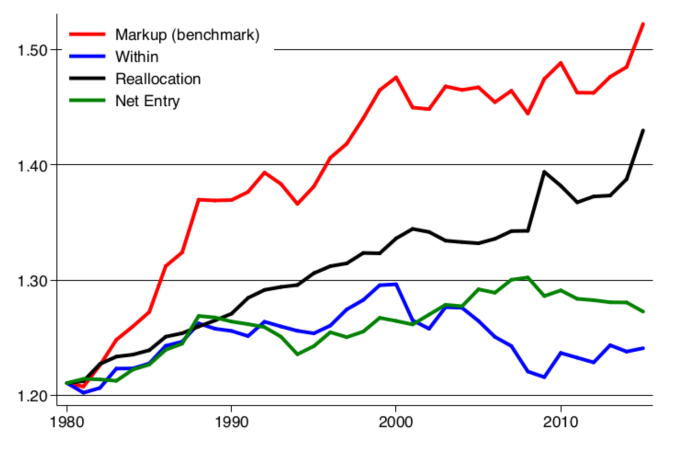
High markup firms increase their market share $\rightarrow$ an increase in the average weighted markup.

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

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

where $\tilde{\mu}_{it-1} = \mu_{it} - \mu_{t-1}$

Counterfactual Experiments



Source: De Loecker, Eeckhout and Unger (2018)

Measure of Market Power

High markup rate $\neq$ High market power

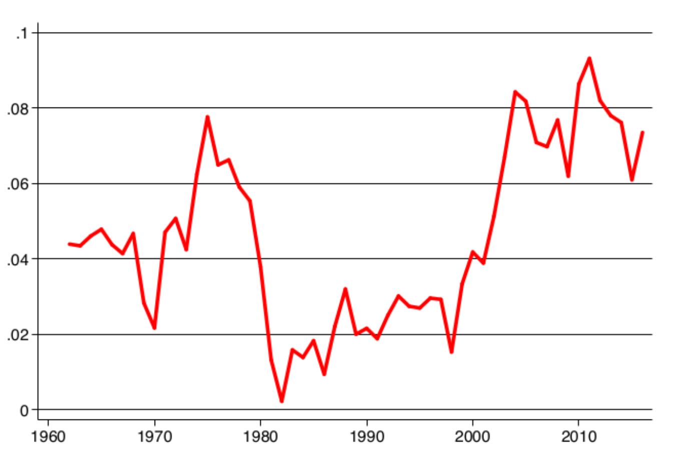
Economic profit rate as a measure of market power.

Profit rate is computed by

$$\Pi_{it} = S_{it} - P_t^V V_{it} - r_t K_{it} - P_t^X X_{it} \text{ (Net Profit)}$$

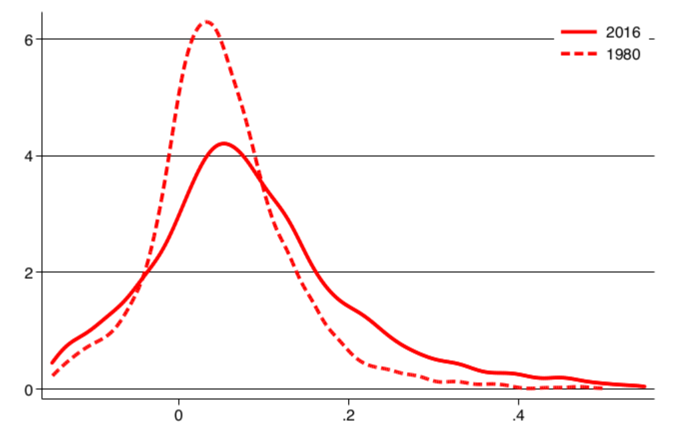
$$\pi_{it} = 1 - \frac{\theta_{st}}{\mu_{it}} - \frac{r_t K_{it}}{S_{it}} - \frac{P_t^X X_{it}}{S_{it}} \text{ (Profit Rate)}$$

Average Profit Rate



Source: De Loecker, Eeckhout and Unger (2018)

Profit Rate Distribution



Source: De Loecker, Eeckhout and Unger (2018)

Summary of Facts

1. Sharp increase in markup since 1980: 42%
2. High markup firms increase markups
3. Increase in markup mostly within industry
4. Markup indicates Market Power

Macroeconomic Implications

Decline of Labor/Capital Share

Recall that markup can be written as

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

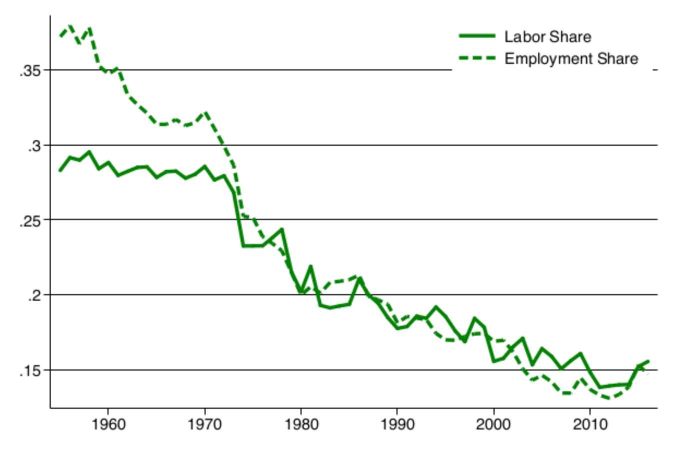
From this expression, we obtain the labor share at the firm level.

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

Since profit can be written as $\Pi = PQ - P^{V} V - rK - P^{X} X$, we have

$$\frac{P^{V} V}{PQ} + \frac{rK}{PQ} = 1 - \frac{P^{X} X}{PQ} - \frac{\Pi}{PQ}$$

Labor Share



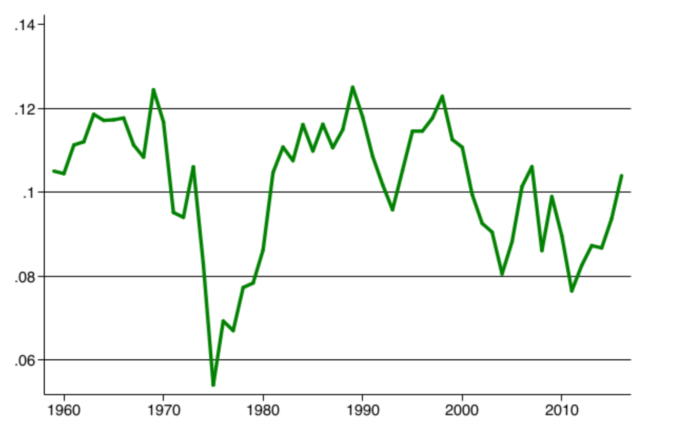
Source: De Loecker, Eeckhout and Unger (2018)

Regression result of Labor Share

	Labor Share (log)					
	(1)	(2)	(3)	(4)	(5)	(6)
Markup (log)	-0.24	-0.23	-0.20	-0.24	-0.68	- 0.73
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Cost Share (log)					0.91	0.96
					(0.01)	(0.01)
Year F.E.		X	X	X	X	X
Industry F. E.			X		X	
Firm F.E.				X		X
R^2	0.02	0.08	0.21	0.88	0.93	0.99
N	24,838					

Source: De Loecker, Eeckhout and Unger (2018)

Capital Share



Source: De Loecker, Eeckhout and Unger (2018)

Regression result of Capital Share

	Capital Share (log)					
	(1)	(2)	(3)	(4)	(5)	(6)
Markup (log)	0.03	0.03	-0.02	-0.14	-0.90	-0.86
	(0.02)	(0.02)	(0.01)	(0.02)	(0.00)	(0.00)
Cost Share (log)					1.13	1.11
					(0.00)	(0.00)
Year F.E.		X	X	X	X	X
Industry F. E.			X		X	
Firm F.E.				X		X
R^2	0.00	0.02	0.31	0.83	0.98	1.00
N	242,692					

Source: De Loecker, Eeckhout and Unger (2018)

Conclution

Contributions of this paper.

- provides new insights from IO for macroeconomics.
- documents evolution and distribution of markup.
- reveals relationship between labor/capital share and markup.

Many papers are based on this paper.

- Critics: Syverson(2019)
- Business Dynamics: Akcigit and Ates(2019)
- Welfare Costs: Edmond, Midrigan and Xu(2019)

Appendix

Absense of price

- In almost any dataset, we only observe sales and expenditures.
- No problem in this estimation.
- Only interested in the output elasticity of variable input.
- Under certain modeling restrictions, we can obtain consistent estimates. (But I couldn't understand why...)