The views in this presentation are those of the author and do not represent the views of his employer or any other party.
Markups

Recent papers examining behavior of markup = price/MC

- De Loecker and Eeckhout [2017] “The rise of market power”
- De Loecker and Eeckhout [2018] “Global market power”
- Karabarbounis and Neiman [2013], “The global decline of the labor share”
- Calligaris, Criscuolo, and Marcolin: “Markups in the digital era”
- Traina [2018], “Is aggregate market power increasing?”
- Hall [2018] “New evidence on the markup of prices over marginal cost”
**The Rise of Market Power**
I have posted the draft of J. De Leecker, J. Eeckhout, "The Rise of Market Power and the Macroeconomic Implications".

**Media coverage:**
The Economist · The Wall Street Journal · Financial Times · NY Times · Bloomberg · Reuters · Quartz · Harvard Business Review · Pro Market · Noahpinion · Marginal Revolution · Growth Economics · The Weeds · Vox Podcast

**New paper: Global Market Power**
This paper documents the evolution of markups for 134 countries around the world.

**Sabbatical at Princeton**
This academic year 2017-2018 I am the Louis A. Simpson visiting fellow and visiting professor at the Department of Economics at Princeton University.

**Upcoming Seminars**
This semester I give talks at ASU, Columbia, Yale, IMF, UPenn, McGill, Northwestern, Saint Louis Fed, Philadelphia Fed, UCLA, Banque de France, SED Mexico, Singapore (NUS and SMU).

**Video:** A funny take on Market Power by John Oliver
DeLoecker and Eeckhout equation

\[
\min \sum_i w_{it} x_{it} \quad \text{s.t.} \quad y_t = A_t f(x_t)
\]

**FOC:** \( w_{it} = \lambda_t A_t \frac{\partial f(x_t)}{\partial x_{it}} \)

Multiply by \( x_{it}/p_t y_t \):

\[
\frac{w_{it} x_{it}}{p_t y_t} = \frac{\lambda_t}{p_t} \frac{\partial f(x_t)}{\partial x_{it}} \frac{x_{it}}{f(x_t)}
\]

Define terms:

\( r_{it} = \frac{\lambda_t}{p_t} \theta_{it} \)

Rearrange:

\[
\frac{p_t}{\lambda_t} = \frac{\theta_{it}}{r_{it}}
\]

In words: markup\( _t = \frac{\theta_{it}}{\text{revenue share}_{it}} \)
DeLoecker and Eeckhout equation

\[
\min \sum_{i} w_{it} x_{it} \text{ s.t. } y_{t} = A_{t} f(x_{t})
\]

FOC: \[ w_{it} = \lambda_{t} A_{t} \frac{\partial f(x_{t})}{\partial x_{it}} \]

Multiply by \[ x_{it}/p_{ty_{t}} \] :

\[
\frac{w_{it} x_{it}}{p_{ty_{t}}} = \frac{\lambda_{t}}{p_{t}} \frac{\partial f(x_{t})}{\partial x_{it}} \frac{x_{it}}{f(x_{t})}
\]

define terms: \[ r_{it} = \frac{\lambda_{t}}{p_{t}} \theta_{it} \]

rearrange: \[ \frac{p_{t}}{\lambda_{t}} = \frac{\theta_{it}}{r_{it}} \]

in words: markup_{t} = \[ \frac{\theta_{it}}{\text{revenue share}_{it}} \]
DeLoecker and Eeckhout equation

\[
\min \sum_i w_{it} x_{it} \text{ s.t. } y_t = A_t f(x_t)
\]

FOC: \( w_{it} = \lambda_t A_t \frac{\partial f(x_t)}{\partial x_{it}} \)

Multiply by \( x_{it}/p_t y_t \):

\[
\frac{w_{it} x_{it}}{p_t y_t} = \lambda_t \frac{\partial f(x_t)}{p_t} \frac{x_{it}}{\partial x_{it}} f(x_t)
\]

define terms: \( r_{it} = \frac{\lambda_t}{p_t} \theta_{it} \)

rearrange: \( \frac{p_t}{\lambda_t} = \frac{\theta_{it}}{r_{it}} \)

in words: markup\(_t = \frac{\theta_{it}}{\text{revenue share}_{it}} \)
DeLoecker and Eeckhout equation

\[
\begin{align*}
\min & \quad \sum_{i} w_{it} x_{it} \text{ s.t. } y_t = A_t f(x_t) \\
\text{FOC: } w_{it} &= \lambda_t A_t \frac{\partial f(x_t)}{\partial x_{it}} \\
\text{Multiply by } x_{it}/p_t y_t: & \quad \frac{w_{it} x_{it}}{p_t y_t} = \frac{\lambda_t}{p_t} \frac{\partial f(x_t)}{\partial x_{it}} \frac{x_{it}}{f(x_t)} \\
\text{define terms: } r_{it} &= \frac{\lambda_t}{p_t} \theta_{it} \\
\text{rearrange: } & \quad \frac{p_t}{\lambda_t} = \frac{\theta_{it}}{r_{it}} \\
\text{in words: markup}_t &= \frac{\theta_{it}}{\text{revenue share}_{it}}
\end{align*}
\]
DeLoecker and Eeckhout assumption

\[
\frac{\text{price}_t}{\text{marginal cost}_t} = \frac{p_t}{\lambda_t} = \frac{\theta_{it}}{w_{it}x_{it}/p_t y_t} = \frac{\text{output elasticity of labor}_t}{\text{revenue share of labor}_t}
\]
De Loecker and Eeckhout equation

\[
\frac{\text{price}_t}{\text{marginal cost}_t} = \frac{p_t}{\lambda_t} = \frac{\theta_{it}}{w_{it}x_{it}/p_t y_t} = \frac{\text{output elasticity of labor}_t}{\text{revenue share of labor}_t}
\]

Assume Cobb-Douglas, making \( \theta_{it} \textbf{constant} \) over time!

If you only care about about growth, don’t need to estimate anything.
Labor share in US

Source: FRED
The evolution of average markups (1960 - 2014)

Source: DeLoecker and Eeckhout
Facts about labor share

- Labor share fell in essentially all OECD countries and all industries starting around 1980.
- Which is more plausible?
  - All OECD countries decided to relax antitrust policy in all industries in 1980 and subsequently prices went up.
  - There was a technological shock starting in 1980 and subsequently cost went down (among adopters).
- Of course, price and marginal cost can *both* fall while markup increases.
  - I’ll present some evidence on this in a minute.
One equation, two unknowns

De Loecker and Eeckhout assume $\theta_{it}$ is constant, so margin is inversely proportional to revenue share. But you could just as well assume the margin is constant so $\theta_{it}$ equals revenue share.

$$\frac{\text{price}_t}{\text{marginal cost}_t} = \frac{p_t}{\lambda_t} = \frac{\theta_{it}}{w_{it}x_{it}/p_ty_t} = \frac{\text{output elasticity of labor}_t}{\text{revenue share of labor}_t}$$

Is it plausible that in the last 35 years...

1. H1: Technology has been constant, markup has changed?
2. H2: Markup has been constant, technology has changed?
3. H3: Or has there been a mix of the two?
What could the 1980 technological shock be?
Cost reduction

**Cost per Million Standard Operations per Second**

(in constant $1985)


**Price of Local Storage $/Gb**


**Internet Transit Pricing**

Source: Dr. Peering (http://peering.net/stats/IMPLP/Internet-Transmission/Internet-Transmission/Prices.html)

**Cloud Price Indices**

Source: Derived from Byrne, Corrado, and Schel 2017
Simple model of diffusion

- DE model: $\theta_{it}$ constant, markup changes.
- HV model: markup, constant, $\theta_{it}$ changes.
- Blended model: $\theta_{it}$ is a k-year moving average of revenue share. Need k=40 to get something close to the constant $\theta_{it}$ model.
Easy to estimate marginal cost separately

\[ \text{FOC: } w_{it} = \lambda_t A_t \frac{\partial f(x_t)}{\partial x_{it}} \]

multiply by \( x_{it}/y_t \):

\[ \frac{w_{it}x_{it}}{y_t} = \lambda_t \frac{\partial f(x_t)}{\partial x_{it}} \frac{x_{it}}{f(x_t)} \]

rewrite: \( \lambda_t = s_{it}/\theta_{it} \)

in words: marginal cost = labor share of output/labor elasticity
But you can add price if you want...

\[
\text{FOC: } w_{it} = \lambda_t A_t \frac{\partial f(x_t)}{\partial x_{it}}
\]

multiply by \( x_{it}/y_t \):

\[
\frac{w_{it}x_{it}}{y_t p_t} = \frac{\lambda_t}{p_t} \frac{\partial f(x_t)}{\partial x_{it}} \frac{x_{it}}{f(x_t)}
\]

If you assume elasticity is constant, then you can estimate marginal cost. Or you can just multiply markup by price.
How does marginal cost change?

The output elasticity of labor is the percent change in output due to a 1% increase in labor. We would expect that over time this would increase (or at worst stay constant) due to technological progress.

\[ s_{it} = \lambda_t \theta_{it} \]

\[ \log \lambda_t = \log s_{it} - \log \theta_{it} \]

\[ \frac{s_{it}}{\lambda_t} = \frac{\dot{s}_{it}}{s_{it}} - \frac{\dot{\theta}_{it}}{\theta_{it}} \]

(-) (--) (+)
What price index should you use?

- Of course nominal prices have increased.
- Want to measure price normalized by income
  - \( p_1 x_1 + p_2 x_2 = m \)
  - \( (p_1/m) x_1 + (p_2/m) x_2 = 1 \)
  - \( p_1 (x_1/m) + p_2 (x_2/m) = 1 \)
- But we know real output has increased in most industries so normalized price has decreased
Marginal cost (KLEMS data)
Price index (from KLEMS)
Summary

1. Labor share has decreased in virtually every country and every industry.
   a. Constant output elasticity of labor implies markups have increased.
   b. Constant markup implies output elasticity of labor has increased.
2. Both price and marginal cost have fallen over estimation period.
3. Heterogeneity in productivity is large and persistent. Why? Perhaps because it takes time to adopt new technology.
Calligaris, Criscuolo and Marcolin (CCM)

- Firm level data for 2.5 million firms, 26 countries, 2001-2014
- Intermediate factor share, rather than labor share
- Translog as well as Cobb-Douglas
  - More flexible but still production function is constant except for Hicks neutral technological change
- Findings
  - Heterogeneity: top markups got bigger
  - Digital intensity: markups were bigger in digital industries
### Possible interpretations of findings

<table>
<thead>
<tr>
<th>Finding</th>
<th>Interpretation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markups have increased</td>
<td>Marginal costs have decreased</td>
</tr>
<tr>
<td>Driven by firms at top of distribution</td>
<td>Those who adopted digital tech saw significant cost reduction</td>
</tr>
<tr>
<td>Markups are higher in digital industries</td>
<td>Digital tech can lower costs</td>
</tr>
<tr>
<td>Markups in digital industries have increased</td>
<td>Internet has reduced costs the most</td>
</tr>
</tbody>
</table>

Important to recognize that increasing markups may not be due to “market power”. They can just as easily be due to “lower cost”. Same point holds for “concentration”: is this due to more market power or more efficiency?
Monopoly power or competitive quasi-rent?

A barrel of oil cost $2 to produce in Saudi Arabia but $50 to produce in the North Sea. The low cost producer faces a market price of $50 but has capacity constraints.

Result: market price is $50 = the marginal cost of extraction of the most inefficient producer. Producers with lower cost earn a competitive quasi-rents.

Example: Diffusion of technology is remarkably slow; see Comin & Hobijn [2018].
Simple model of technology diffusion

\[ p = c_2 \]

Demand: In long run price = marginal cost in competitive industry with CRS.
Initial adoption of technology w capacity constraint

A single firm adopts, but it is a price taker and earns (competitive) quasi-rents.
More adopters...

More firms adopt, but marginal supplier still uses the inefficient technology.
A substantial amount of industry has adopted, but marginal output is provided by high cost firm, so price remains constant.
Long run equilibrium

Now everyone has adopted and price (finally) falls.
Producer surplus and cost heterogeneity

Many firms each with one plant

Producer surplus = integral of \( p - MC \)

Heterogeneous costs imply existence of rent or quasi-rent.
Producer surplus and monopoly surplus

This doesn’t preclude monopoly rents as well.

One firm with many plants
Summary
What did we learn?

- Empirical observation: labor share of revenue has decreased everywhere
- Cost minimization implies markup = \( \frac{p_t}{mc_t} = \frac{\theta_{it}}{r_{it}} \)
  - One equation, two unknowns (\( \theta_{it} \) and markup)
    - Constant \( \theta_{it} \) -> markups increase
    - Constant markup -> \( \theta_{it} \) decreases
- Markup (\( \frac{p_t}{mc_t} \)) can increase when both \( p_t \) and \( mc_t \) decrease
- Technology adoption takes time and cost heterogeneity is persistent
- Market price can be above cost of capacity constrained, inframarginal firms which implies competitive quasi-rents can be earned
The End
Calligaris, Criscuolo, and Marcolin (CCM)

- Firm level data for 2.5 million firms, 26 countries, 2001-2014
- Intermediate good share, rather than labor share
- Translog as well as Cobb-Douglas
  - However, function is still time invariant.
- Findings
  - Heterogeneity in cost
  - Digital intensity associated with higher margins