Summary of facts: rise of markups

Understanding Causes and Consequences:

1. Causes:
   - Market Structure: M&A, antitrust enforcement (e.g. ABInbev)
   - Technology: fixed cost and productivity shocks (Amazon Paradox)

2. Consequences: secular trends
   - Wage Stagnation & Labor Force Participation decline
   - Labor Share decline
   - Decline in Business Dynamism
   - Superstar firms: reallocation of sales towards high markup, large firms
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⇒ General Equilibrium framework w/ Imperfect competition output mkt
Facts about Market Power
Estimating markups

- Cost based method
- Use accounting data 1955–2016
- Estimate production function (output elasticity):
  - From firm’s FOC for cost minimization:
    \[ \mu_{it} = \theta_{it} \frac{P_{it} Q_{it}}{P_{it} V_{it}}. \]
- Individual Markup ⇒ distribution for markups
- Average markup, weighted by \( m_{it} \) (sales, costs, employment,...):
  \[ \mu_t = \sum_i m_{it} \mu_{it} \]
- With fixed costs: calculate profit rate (distribution)
1. HETEROGENEITY

No Change... in median markup
1. HETEROGENEITY

INCREASE IN AVERAGE Markup SINCE 1980
1. HETEROGENEITY

ALL ACTION IN UPPER HALF DISTRIBUTION
1. Heterogeneity

Facts

1. Heterogeneity: sharp rise for few firms; no rise for most
2. Reallocation

Weighting Matters: Input Weight

- See Edmond, Midrigan and Xu (2018)
2. **Reallocation**

\[ \Delta \mu_t = \sum_i m_{i,t-1} \Delta \mu_{it} + \sum_i \mu_{i,t-1} \Delta m_{i,t} + \sum_i \Delta \mu_{i,t} \Delta m_{i,t} \]

- **Δ within**
  - Δ market share
  - Δ cross-term

+ \[ \sum_{i \in \text{Entry}} \mu_{i,t} m_{i,t} - \sum_{i \in \text{Exit}} \mu_{i,t-1} m_{i,t-1} \]

**net entry**

See also Superstar Firms (Autor, Dorn, Katz, Patterson, Van Reenen (2018))
2. Reallocation

\[ \Delta \mu_t = \sum_i m_{i,t-1} \Delta \mu_{it} + \sum_i \mu_{i,t-1} \Delta m_{i,t} + \sum_i \Delta \mu_{i,t} \Delta m_{i,t} + \sum_{i \in \text{Entry}} \mu_{i,t} m_{i,t} - \sum_{i \in \text{Exit}} \mu_{i,t-1} m_{i,t-1} \]

- \( \Delta \) within
- \( \Delta \) market share
- \( \Delta \) cross-term
- \( \Delta \) net entry

See also Superstar Firms (Autor, Dorn, Katz, Patterson, Van Reen (2018))
1. Heterogeneity: sharp rise for few firms; no rise for most
2. Reallocation of sales from low to high markup firms (2/3)
3. Technology Matters
Rise in Overhead (SG&A)
### 3. Technology Matters

**Markups, Profits and SG&A**

<table>
<thead>
<tr>
<th></th>
<th>Markup (log)</th>
<th>Profit Rate (log)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
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<td>N</td>
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</tbody>
</table>
Facts

1. Heterogeneity: sharp rise for few firms; no rise for most
2. Reallocation of sales from low to high markup firms (2/3)
3. Technology Matters: Overhead cost (SG&A) ↑
4. Magnitude of Increase

a. Aggregation: Industry Averages: +20 points

- See also Hall (2018)
4. Magnitude of Increase

b. Profit Rate: +7-8 ppt

[Graph showing profit rate from 1960 to 2010]
4. Magnitude of Increase

b. Profit Rate: +7-8 ppt

- Profits/Value Added: +15%
- Similar for operating profits (measure by James Traina (2018))
4. Magnitude of Increase
Profit Rate vs Markup

- The profit rate:

\[ \pi = \frac{PQ - C(Q)}{PQ} = 1 - \frac{1}{\mu} \frac{AC}{MC} \]

\[ \Rightarrow \text{With } \mu = 1.6 \text{ in 2016, implied profit rate is } \pi = 1 - \frac{1}{1.61} = 0.38!! \]
The profit rate:

\[
\pi = \frac{PQ - C(Q)}{PQ} = 1 - \frac{1}{\mu} \frac{AC}{MC}
\]

⇒ With \( \mu = 1.6 \) in 2016, implied profit rate is \( \pi = 1 - \frac{1}{1.61} = 0.38!! \)

This logic uses:
1. Representative Firm Economy: but Aggregation (Jensen’s Inequality)
2. Unchanged economies of scale (\( AC = MC \)): but \( \frac{AC}{MC} \uparrow \) (Overhead \( \uparrow \))
4. Magnitude of Increase
Profit Rate vs Markup

![Graph showing the magnitude of increase in profit rate vs markup over the years 1980 to 2010. The graph compares Avg, No FC, Avg, FC, Aggr, No FC, Aggr, FC (PF1), and Profit Rate. The y-axis represents the profit rate on a scale from 0 to 0.4, while the x-axis represents the years from 1980 to 2010. Each line represents a different category, with Avg, FC showing a steady increase, Avg, No FC also increasing, Aggr, No FC showing a slight decrease, Aggr, FC (PF1) with fluctuations, and Profit Rate with a significant increase.]
Facts

1. Heterogeneity: sharp rise for few firms; no rise for most
2. Reallocation of sales from low to high markup firms (2/3)
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4. Magnitude of the Increase?
   A. Weighting and Aggregation is crucial
   B. Profit rate (+7-8 ppts) ≠ Markup (+30-40 points)
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∴ Only publicly traded firms (40% of GDP)
Robustness: US Censuses

Manufacturing


Mw90
Mw75
Mw50
Global Markup
134 countries; 70,000 firms; 1980-2016
Global Markup
134 countries; 70,000 firms; 1980-2016
Market Power in GE:
Causes and Consequences
GE Model of Market Power

1. Model
   - Build on Atekson Burstein (2008)
   - **New**: Overhead, shocks, endogenous market structure and free entry

2. Causes
   - Technology: Fixed costs, Dispersion of shocks (Amazon paradox)
   - Market Structure: Potential entrants (M&A and antitrust)

3. Estimate SMM
   - Match Moments: Markups, Profit rates, Reallocation
   - Non-targeted Moments: Wages, LF participation, Labor Share, TFPR

4. Experiments
   - Match time series of non-targeted moments
   - Decompose changes: Technology vs. Market Structure
Model Setup

- $J$ sectors; $N_j$ firms in each sector; $M$ potential entrants
- Household Pref.: nested CES, elasticity $\eta$ within sector, $\theta$ between
- Market Structure:
  1. Cournot (or differentiated Bertrand) within sector
  2. Entry at fixed cost $\phi$ ("sequential"; Berry (1982))
- Firm’s (static) optimization:
  1. Draw random productivity: fixed and variable component $a + z$
  2. Entry decision $b_{ijt}$
  3. Choose employment $l_{ijt}$
Model Limitations

Our model does not have:

- Dynamic pricing: Edmond, Midrigan, Xu (2018); Mongey (2018)
- Skill/Consumer heterogeneity
- Monopsony: Berger, Herkenhoff, Mongey (2019); Azar, Marinescu, Steinbaum (2018)
- Change in preferences/demand/globalization: Jaimovic, Rebelo, Wang (2018); Bornstein (2019)
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- Change in preferences/demand/globalization: Jaimovic, Rebelo, Wang (2018); Bornstein (2019) – globalization $\approx$ technological change
**Model Setup**

**Households**

\[
\max_{\{c_{ijt}, l_{ijt}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t U \left( \left( \frac{1}{J_t} \right)^{\frac{1}{\theta-1}} \left[ \sum_{j=1}^{J} \left( \frac{c_{jt}^{\theta-1}}{\theta-1} \right) \right]^{\frac{\theta}{\theta-1}} \right)
\]

where \( c_{jt} = \left( \frac{1}{N_{jt}} \right)^{\frac{1}{\eta-1}} \left[ \sum_{i=1}^{M} b_{ijt} c_{ijt}^{\eta-1} \right]^{\frac{\eta}{\eta-1}} \)

s.t. \[ \sum_{j=1}^{J} \sum_{i=1}^{M} b_{ijt} p_{ijt} c_{ijt} = W_t L_t + \Pi_t \]

\[ L_t = \sum_{j=1}^{J} \sum_{i=1}^{M} b_{ijt} l_{ijt} + \sum_{j=1}^{J} N_{jt} \phi \]

\[ N_{jt} = \sum_{i=1}^{M} b_{ijt} \quad \text{and} \quad J_t = \sum_{j=1}^{J} N_{jt} \]
**Model Setup**

**Firms**

- Firm $i \in \{1, \ldots, M\}$ in sector $j \in \{1, \ldots, J\}$;  
  $b \in \{0, 1\}$ entry decision $\Rightarrow N_j \leq M$

\[
\pi_{ijt} = \max_{b_{ijt}, y_{ijt}} b_{ijt} \left[ p(y_{ijt}, y_{-ijt}, Y_t) y_{ijt} - W_t l_{ijt} - W_t \phi \right]
\]

\[
\log y_{ijt} = \log z_{ijt} + \alpha \log l_{ijt}
\]

\[
\log z_{ijt+1} = \rho_z \log z_{ijt} + \varepsilon_{ijt}, \quad \varepsilon_{ijt} \sim \mathcal{N}\left(-\frac{1}{2} \frac{\sigma^2_\varepsilon}{1 + \rho_z}, \sigma^2_\varepsilon \right)
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**Model Setup**

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\]

- Demand

\[
p_{ijt} = \left( \frac{1}{J_t} \right)^{\frac{1}{\eta}} \left( \frac{1}{N_{jt}} \right)^{\frac{1}{\theta}} \left( \frac{y_{ijt}}{Y_t} \right)^{-\frac{1}{\eta}} \left( \frac{y_{jt}}{Y_t} \right)^{-\frac{1}{\theta}}, \quad y_{jt} = \left( \frac{1}{N_{jt}} \right)^{\frac{1}{\eta-1}} \left[ \sum_{i=1}^{N} b_{ijt} y_{ijt} \right]^\frac{n-1}{n}
\]

- Labor Supply

\[
\log L_t = \log \bar{\phi} + \phi \log W_t
\]
**Firm optimality**

- Equilibrium demand elasticity

\[
- \frac{d \log p_{ijt}}{d \log y_{ijt}} = \frac{1}{\eta} + \left( \frac{1}{\theta} - \frac{1}{\eta} \right) \frac{d \log y_{jt}}{d \log y_{ijt}}
\]

\[
\frac{1}{\epsilon_{ijt}} = \frac{1}{\eta} + \left( \frac{1}{\theta} - \frac{1}{\eta} \right) s_{ijt}
\]

- Markups

\[
\mu(s_{ijt}) = \frac{\epsilon(s_{ijt})}{\epsilon(s_{ijt}) - 1}
\]

- Prices

\[
p_{ijt} = \left[ \mu(s_{ijt}) \frac{W}{z_{ijt}} s_{ijt}^{\frac{\eta-\theta}{\eta-1}} Y^{\frac{1-\alpha}{\alpha}} \right]^{\frac{1}{1+\theta \frac{1-\alpha}{\alpha}}}
\]
1. General Equilibrium: \( W^*, L^*, Y^* \)

- Input markets are competitive, no monopsony power
1. General Equilibrium: $W^*, L^*, Y^*$
2. Decline in Labor Share

*Stylized Fact no more?*

- At the firm level: effect of markups

\[
\mu_i = \theta_i \frac{P_i Q_i}{P_i V_i} \quad \Rightarrow \quad \frac{W L_i}{S_i} = \frac{\theta_i^L}{\mu_i}
\]
2. Decline in Labor Share

*Stylized Fact no more?

- At the firm level: effect of markups

\[ \mu_i = \theta_i \frac{P_i Q_i}{P_i^V V_i} \quad \Rightarrow \quad \frac{W L_i}{S_i} = \theta_i^L \mu_i \]

<table>
<thead>
<tr>
<th>Markup (log)</th>
<th>Labor Share (log)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>(-0.24)</td>
<td>-0.23</td>
</tr>
<tr>
<td>(0.03)</td>
<td>(0.03)</td>
</tr>
</tbody>
</table>

| Year F.E.   | X      | X      | X      |
| Industry F. E. | X      |        |        |
| Firm F.E.   |        |        | X      |

| R²          | 0.02   | 0.08   | 0.21   | 0.88   |
3. Decline in labor dynamism

\[ P_{\mu > 1}(\bar{z}) \]

\[ P_{\mu > 1}(\bar{z}) \]

\[ \frac{w}{z} \]

\[ \frac{w}{z} \]

\[ \Delta l_{\mu > 1} \]

\[ \Delta l_{\mu = 1} \]

\[ l_{\mu = 1} \]
3. **Decline in labor dynamism**

\[
\log l_{ijt} = \log y_{ijt} - \log z_{ijt}
\]

\[
d \log l_{ijt} = \left( \varepsilon(s_{ijt}) \times \Omega(s_{ijt}; \eta, \theta) - 1 \right) d \log z_{ijt}
\]

1. Incomplete pass-through reduces volatility \( \Omega(s_{ijt}) < 1 \)

2. Small firms have higher reallocation rates
   (i) Higher \( \varepsilon(s_{ijt}) \), (ii) Higher pass-through \( \Omega(s_{ijt}) \)

3. If shares increase, reallocation falls by more for small firms
   (i) Greater fall in \( \varepsilon(s_{ijt}) \), (ii) Greater decline in \( \Omega(s_{ijt}) \)

→ As in Amiti, Itskhoki, Konings (2018)
3. Decline in labor dynamism

\[ RR_t = \sum_{g \in \{Sm, Lg\}} s^L_{gt} RR_{gt} \]
\[ RR_{gt} = \frac{JC_{gt} + JD_{gt}}{L_{gt}} \]

- 98 percent of \( \Delta RR_t \) due to \( \{ \Delta RR_{gt} \} \), 3 percent due to \( \{ \Delta s^L_{gt} \} \)
- 65 percent of \( \Delta RR_t \) due to smaller firms
4. Reallocation and Superstar Firms

2/3 of rise in average markup
### Calibration - Annual

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Across sector elasticity $\theta$</td>
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<tr>
<td>Within sector elasticity $\eta$</td>
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<td>Returns to scale $\alpha$</td>
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<tr>
<td>Elasticity labor supply $\varphi$</td>
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<td>Markups $\mu$</td>
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<td>1.20</td>
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<td></td>
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<tr>
<td>Markup - P90 $P90(\mu)$</td>
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<td>1.45</td>
<td></td>
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<tr>
<td>Gross Profit Rate $\pi$</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
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<tr>
<td>Overhead Labor Share $\frac{L^{OH}}{L}$</td>
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<td>0.08</td>
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<tr>
<td>Reallocation Rate $RR$</td>
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<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
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<tr>
<td>Potential entrants $M$</td>
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<tr>
<td>Fixed Cost $W\phi$</td>
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<tr>
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<tr>
<td>Welfare $C$</td>
<td>1</td>
<td></td>
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</tr>
</tbody>
</table>
COMPARATIVE STATICS

TECHNOLOGY: $W\phi \uparrow$
Comparative Statics

Technology: $\sigma_e \uparrow$
COMPARATIVE STATICS

MARKET STRUCTURE: $\sigma_a \uparrow$
Comparative Statics

Market Structure: $M \downarrow$
<table>
<thead>
<tr>
<th>Moment</th>
<th>1980 Model</th>
<th>1980 Data</th>
<th>2016 Model</th>
<th>2016 Data</th>
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<td>Markup - P90</td>
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<td>Gross Profit Rate</td>
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<table>
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<tr>
<th>Estimated Parameter</th>
<th>1980</th>
<th>2016</th>
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<tr>
<td>Potential entrants</td>
<td>M</td>
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<tr>
<td>Fixed Cost</td>
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</tr>
<tr>
<td>Productivity shock: temp</td>
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<td>Productivity shock: perm</td>
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### 1980 – 2016

<table>
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<th>2016</th>
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<td>Potential entrants $M$</td>
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<td>Productivity shock: temp $\sigma_\varepsilon$</td>
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<tr>
<td>Welfare $C$</td>
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<td>0.81</td>
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</tbody>
</table>

- Alternative Model: Dynamic adjustment costs (magnitude; profits?)
## Non-targeted Moments

<table>
<thead>
<tr>
<th>Moment</th>
<th>1980 Model</th>
<th>1980 Data</th>
<th>2016 Model</th>
<th>2016 Data</th>
<th>% Change Model</th>
<th>% Change Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>( W )</td>
<td>1.00</td>
<td>1.00</td>
<td>0.81</td>
<td>0.78</td>
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<td>-22</td>
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<td>( L )</td>
<td>0.876</td>
<td>0.68</td>
<td>0.789</td>
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<td>-9</td>
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<tr>
<td>Labor Share</td>
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<td>0.62</td>
<td>0.69</td>
<td>0.56</td>
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<tr>
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<td>0.12</td>
<td>0.091</td>
<td>0.08</td>
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<td>-33</td>
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# Experiments

**1980 Economy with 2016 Variables**

<table>
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<tr>
<th></th>
<th>$\mu$</th>
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<th>$\pi$</th>
<th>RR</th>
<th>W</th>
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<td>+67</td>
<td>+50</td>
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<td>+22</td>
<td>+58</td>
<td>-29</td>
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<td>-11</td>
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<td>$\sigma_\epsilon$</td>
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<td>+23</td>
<td>+58</td>
<td>-26</td>
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<td>-11</td>
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<tr>
<td>$\sigma_a$</td>
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<td>+26</td>
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</tbody>
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Conclusions

1. Facts: Rise of Market Power since 1980
   - **Heterogeneity**: sharp rise for some, constant for most firms
   - Markups (20-40 points) ≠ Profit Rate (7-8 ppt’s)

2. Quantifying Market Power in GE
   1. Causes: need both
      - Market Structure: to get labor reallocation down
      - Technology (mainly fixed cost): to get enough markup increase
   2. Consequences: macroeconomic implications
      - Wage Stagnation & LF Participation decline: *equilibrium* effect
      - Labor Share decline: at firm level
      - Decline in Business Dynamism: *incomplete passthrough*
      - Superstar firms: *reallocation* of sales towards high markup, large firms
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Cannot use Representative Agent framework to study Market Power: HA!!
Quantifying Market Power

Jan De Loecker\textsuperscript{1}  Jan Eeckhout\textsuperscript{2}  Simon Mongey\textsuperscript{3}

\textsuperscript{1}University of Leuven\textsuperscript{2}\textsuperscript{}UPF Barcelona and UCL\textsuperscript{3}\textsuperscript{Chicago}

Richmond Fed
May 16, 2019
Future Work

1. Higher permanent heterogeneity in firm productivity
2. Correlation Entry Cost – Productivity
Data

- Accounting data on publicly listed firms:
  - Broad Cross Section: average 5,000 firms per year
- Selection?
  - Large firms; miss many small firms
  - Small subset of all firms
  - Publicly traded ≠ privately held firms
- But:
  - Covers all sectors and industries (contrast: Cens. of Manuf.)
  - 30% of US employment (Cens. of Manuf. 8.8%)

⇒ Allow for markup variation across producers and time; heterogeneity has substantial economic implications
Estimating Markups

- Two steps:
  1. Estimate Production Function: different models
  2. Derive Markup

- Important Caveats about the method:
  1. Frictionless adjustment (variable inputs) – ideally, e.g. electricity
  2. Use ‘Cost of Goods Sold’ as a variable input bundle
  3. Construct ‘User Cost of Capital’
  4. Markup = Market Power?

- Cost vs. Demand approach: De Loecker-Scott (2016)
  Beer industry $\rightarrow$ similar estimates $\mu \approx 1.5$
**Producer Behavior**

- Production technology
  \[ Q_{it}(V_{it}, K_{it}, \Omega_{it}) = F_{it}(V_{it}, K_{it})\Omega_{it}, \]
  - \( V_{it} \): variable inputs (labor, intermediate inputs)
  - \( K_{it} \): capital stock
  - \( \Omega_{it} \): Hicks-neutral productivity term (TFP)
- Associated Lagrangian function (with one composite input):
  \[ \mathcal{L}(V_{it}, K_{it}, \lambda_{it}) = P_{it}^V V_{it} + r_{it}K_{it} - \lambda_{it}(Q_{it}(\cdot) - Q_{it}) \]
- Consider FOC wrt the variable input \( V \):
  \[ \frac{\partial \mathcal{L}_{it}}{\partial V_{it}} = P_{it}^V - \lambda_{it} \frac{\partial Q_{it}(\cdot)}{\partial V_{it}} = 0 \]
- Rearranging \( \Rightarrow \) expression of output elasticity of input \( V_{it} \):
  \[ \theta_{it}^V \equiv \frac{\partial Q_{it}(\cdot)}{\partial V_{it}} \frac{V_{it}}{Q_{it}} = \frac{1}{\lambda_{it}} \frac{P_{it}^V V_{it}}{Q_{it}} \]
Producer Behavior

- Lagrangian multiplier $\lambda$ is a direct measure of marginal cost
- Define markup $\mu = \frac{P}{\lambda}$ or

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

depending on Sales $S_{it} = P_{it} Q_{it}$ and expenditure share $\theta^V_{it}$, which is specific to technology

- Method:
  - Hall (1988): aggregate data
  - De Loecker-Warzynski (2012): micro data
Estimating markups

\[ \mu_{it} = \theta_{it} \frac{P_{it} Q_{it}}{P_{it} V_{it}}. \]

- The method relies heavily on the data: sales/input expenditure
- Ratio is scaled by elasticity, \( \theta(\beta) \):
  1. Estimate production function (parametric):
     1.1 Benchmark: time, sector-varying Cobb-Douglas \((q_{it} = x\beta_{st} + \omega_{it})\)
     1.2 Constant by sector/year, \((q_{it} = x\beta + \omega_{it})\)
     1.3 Firm/time specific: Translog \((q_{it} = x\beta_{1,s} + x^2\beta_{2,s} + \omega_{it})\)

With correction for unanticipated shocks to output \((\xi)\)

2. Estimate cost-shares (“non-parametric”, but... CRTS CD)

- Average markup (weighted by sales share \(m_{it}\)):

\[ \mu_t = \sum_i m_{it} \mu_{it} \]
1. Income Statement:
   - R&D

2. Balance Sheet
   - Patents
   - Copyright, trademark
   - Goodwill
     But: Intangibles also measure profits (e.g. Goodwill)

   - 1996: $31 billion out of $410 billion in profits
   - 2011: $57 billion out of $983 billion in profits
Estimation Elasticities: Detail

• Translog production function for each industry:

\[ q_{it} = \beta_{v1} v_{it} + \beta_{k1} k_{it} + \beta_{v2} v_{it}^2 + \beta_{k2} k_{it}^2 + \omega_{it} + \epsilon_{it} \]

• Variation output elasticity over time and firms
• Output elasticity of the composite variable input:

\[ \theta_{it}^v = \beta_{v1} + 2\beta_{v2} v_{it} \]

• Preserves identification results, with two key ingredients:
  1. \( v = h(k, \omega) \)
  2. \( \omega = g(\omega) + \xi \)

• Moment conditions from static optimization of variable inputs:

\[ \mathbb{E}\left( \xi_{it}(\beta) \begin{bmatrix} v_{it-1} \\ v_{it-2}^2 \\ v_{it-1}^2 \end{bmatrix} \right) = 0 \]
Estimation Production Technology

- Cobb Douglas:
  \[ q_{it} = \beta_v v_{it} + \beta_k k_{it} + \omega_{it} + \epsilon_{it} \]

- Olley-Pakes (1996): productivity is function of inputs: \( \omega_{it} = h(v_{it}, k_{it}) \)

- Let:
  \[ q_{it} = \phi_t(v_{it}, k_{it}) + \epsilon_{it} \text{ where } \phi = \beta_v v_{it} + \beta_k k_{it} + h(v_{it}, k_{it}) \]

- Assume AR(1) productivity process: \( \omega_{it} = \rho \omega_{it-1} + \xi_{it} \)
  1. Regress deflated sales on variable inputs, capital and year dummies
  2. \( \xi_{it}(\beta_v) \): from \( \omega_{it}(\beta_v) \) on \( \omega_{it-1}(\beta_v) \), where \( \omega_{it} = \phi_{it} - \beta_v v_{it} + \beta_k k_{it} \)

- Identify output elasticities \( \mathbb{E}(\xi_{it}(\beta_v)v_{it-1}) = 0 \) under assumption:
  1. \( v_{it} \) responds to productivity shock
  2. \( v_{it-1} \) does not
Translog Production Technology

- Industry-specific, time-varying output elasticities
- Preserves identification results (De Loecker-Warzynski (2012))
- Moment conditions from static optimization of variable inputs:
  \[ \mathbb{E} \left( \xi_{it}(\beta) \begin{bmatrix} v_{it-1} \\ v_{it-1}^2 \end{bmatrix} \right) = 0, \]
- With translog production function for each industry:
  \[ q_{it} = \beta_v v_{it} + \beta_k k_{it} + \beta_v^2 v_{it}^2 + \beta_k k_{it}^2 + \omega_{it} + \epsilon_{it} \]
- Variation output elasticity over \( i, t \), no longer attributed to markup
- Output elasticity of the composite variable input:
  \[ \theta^v_{it} = \beta_v 1 + 2\beta_v v_{it} \]
- Markup defined as before; level difference, but normalization
**Markup = Market Power?**

**Profit Rate: No Capital**

![Graph showing profit rates with and without capital from 1960 to 2010. The graph compares profit rates (with and without capital) over time, illustrating the fluctuation in profit rates.](image-url)