Market Power in Input Markets:
Theory and Evidence from French Manufacturing

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A Growing Concern: Market Power of *Buyers*

- Market power of firms is a largely debated topic, yet little is known about input markets

- However, large buyers dominate many sectors of the economy, and could potentially engage in anti-competitive practices
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- **This Paper:** market power in *imported* input markets
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- Market power of firms is a largely debated topic, yet little is known about input markets.

- However, large buyers dominate many sectors of the economy, and could potentially engage in anti-competitive practices.

- This Paper: market power in imported input markets.

- Why Input Trade?
  - Large buyers major players in international markets... (Bernard et al., 2007)
  - ... characterized by large formal/informal barriers to entry (Allen, 2014; Startz, 2017)
This Paper

1. Estimating Input Market Imperfections from Micro Data
   - "Production" Approach: Infer distortions from *wedges* in FOC
   - Estimation: Input market power in PF estimation
     - I/O price indices to control for unobserved differences in market power
This Paper

1. Estimating Input Market Imperfections from Micro Data
   - "Production" Approach: Infer distortions from *wedges* in FOC
   - Estimation: Input market power in PF estimation
     - I/O price indices to control for unobserved differences in market power

2. Buyer Power and the Aggregate Economy
   - Buyer power in an heterogeneous firms model of production
   - Mapping BP distortions (*wedges*) to losses in aggregate variables
Empirical Framework
De Loecker, Warzynski (AER, 2012)

- Assume that firm $i$:
  1. minimizes costs in producing output $Q_i$, and sells it at $P_i$
  2. buys at least one static input ($M_i$), taking its price ($W^M$) as given

- First Order Condition for $M_i$:
  \[
  \frac{\beta_i^m}{\alpha_i^m} = \frac{P_i}{MC_i} \equiv \mu_i
  \]

- Empirical strategy:
  1. $\alpha_i^m \equiv \frac{W_i^m M_i}{P_i Q_i}$ is observed;
  2. get $\beta_i^m = \frac{\partial Q_i}{\partial M_i} \frac{M_i}{Q_i}$ from PF estimation
Allowing for *Input* Market Power

- Assume that firm *i*:
  
  1. minimizes costs in producing output *Q*<sub>*i*</sub>, and sells it at *P*<sub>*i*</sub>
  
  2B. buys at least one static input (*X*<sub>*i*</sub>), *at some unit price* *W*<sub>*i*</sub>*<sub>*</sub> <sub>*X*<sub> = *W*<sub>*i*</sub>(*X*<sub>*i*</sub>)

- First Order Condition for *X*<sub>*i*</sub>:

\[
\frac{\beta_x^x}{\alpha_i^x} = \mu_i \psi_i^x,
\]

- Imperfect Competition upstream generates an *input efficiency* wedge:

\[
\psi_i^x \equiv \left(1 + \frac{\partial W_i^x}{\partial X_i} \frac{X_i}{W_i^x}\right) = \frac{MFC_i^x}{W_i^x}
\]
Allowing for *Input* Market Power

- Assume that firm $i$:
  1. minimizes costs in producing output $Q_i$, and sells it at $P_i$
  2. buys at least one *static* input $(X_i)$, at some unit price $W_i^X = W_i(X_i)$

- First Order Condition for $X_i$:
  \[
  \frac{\beta_x}{\alpha_i^X} = \mu_i \psi_i^X ,
  \]

- Imperfect Competition upstream generates an *input efficiency* wedge:
  \[
  \psi_i^X = \left(1 + \frac{\partial W_i^X}{\partial X_i} \frac{X_i}{W_i^X} \right) = \frac{MFC_i^X}{W_i^X}
  \]

- $\psi^X > 1 \iff \frac{\partial W_i^X}{\partial X_i} > 0$ consistent with firm $i$ exercising oligopsony power
Measuring Input Market Power: This Paper

Assume that firm $i$ minimizes costs in producing output $Q_i$ and:

1. buys at least one static input ($M_i$), taking its price ($W^M_i$) as given
2. buys at least one static input ($X_i$), at unit price $W^X_i = W_i(X_i)$

Then:

$$\psi^x_i = \left( \frac{\beta^x_i}{\beta^m_i} \right) \left( \frac{\alpha^m_i}{\alpha^x_i} \right),$$

i.e. market imperfections in market $X$ can be estimated at the firm-level.
Measuring Input Market Power: This Paper

▸ Assume that firm \( i \) minimizes costs in producing output \( Q_i \) and:

1. buys at least one static input \((M_i)\), taking its price \((W^M_i)\) as given
2. buys at least one static input \((X_i)\), at unit price \(W^X_i = W_i(X_i)\)

▸ Then:

\[
\psi^x_i = \left( \frac{\beta^x_i}{\beta^m_i} \right) \left( \frac{\alpha^m_i}{\alpha^x_i} \right),
\]

i.e. market imperfections in market \( X \) can be estimated at the firm-level.

▸ This Paper:

▸ \( X_i \) is total imported intermediate inputs

▸ \( M_i \) is total intermediate inputs purchased domestically
Estimation of Output Elasticities
Production Function Estimation

- Firms in each industry have the same CD technology

\[ q_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_x x_{it} + \omega_{it} \]  

(1)

- Challenges:
  - Lack of data on input and output prices can generate important biases (De Loecker, Goldberg 2014)

- This Paper:
  - Measures of \( p_{it} \) and \( w_{it} \) *sufficient* to address biases while allowing for market power in output and foreign input markets
  - Construct measures of \( p_{it} \) and \( w_{it} \) using export/import unit values at firm-product-country level

- Estimation: 2-stages GMM procedure in Ackerberg et al., 2015
Data, Results
Data: French Manufacturing Importers

Production Data (FICUS) -

▶ Firm-year *nominal* data on total production, value added, labor, capital and material expenditures, wages etc.

Custom Data (DOUANES) -

▶ Value and quantity of imports/exports at firm-CN8-country level;

Time Frame: Annual data, from 1996 to 2007

Sample:

▶ Manufacturing firms that *both* imports and exports

▶ 8% of firms, but account for ~60% of total manuf. value added
# Market Imperfections Across Sectors

## Table V. Input Market Power, by Sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>( \psi_{it} )</th>
<th>Mean</th>
<th>Median</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Food and Beverages</td>
<td>2.63</td>
<td>1.43</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>17 Textiles</td>
<td>2.00</td>
<td>1.21</td>
<td>2.20</td>
<td></td>
</tr>
<tr>
<td>18 Wearing Apparel</td>
<td>3.19</td>
<td>1.78</td>
<td>3.83</td>
<td></td>
</tr>
<tr>
<td>19 Leather Products</td>
<td>1.72</td>
<td>1.17</td>
<td>1.58</td>
<td></td>
</tr>
<tr>
<td>20 Products of Wood</td>
<td>3.92</td>
<td>2.12</td>
<td>4.43</td>
<td></td>
</tr>
<tr>
<td>21 Pulp and Paper Products</td>
<td>1.44</td>
<td>0.82</td>
<td>1.57</td>
<td></td>
</tr>
<tr>
<td>22 Printing and Publishing</td>
<td>3.71</td>
<td>2.31</td>
<td>3.73</td>
<td></td>
</tr>
<tr>
<td>24 Chemical Products</td>
<td>2.17</td>
<td>1.32</td>
<td>2.26</td>
<td></td>
</tr>
<tr>
<td>25 Rubber Products</td>
<td>2.58</td>
<td>1.58</td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td>26 Non-metallic minerals</td>
<td>3.15</td>
<td>1.94</td>
<td>3.22</td>
<td></td>
</tr>
<tr>
<td>27 Basic Metals</td>
<td>2.75</td>
<td>1.72</td>
<td>2.84</td>
<td></td>
</tr>
<tr>
<td>28 Fabricated Metal Products</td>
<td>2.15</td>
<td>1.27</td>
<td>2.29</td>
<td></td>
</tr>
<tr>
<td>29 Machinery and Equipment</td>
<td>2.24</td>
<td>1.35</td>
<td>2.33</td>
<td></td>
</tr>
<tr>
<td>31 Electrical Machinery</td>
<td>2.63</td>
<td>1.43</td>
<td>3.01</td>
<td></td>
</tr>
<tr>
<td>32 Radio and Communication</td>
<td>2.49</td>
<td>1.61</td>
<td>2.46</td>
<td></td>
</tr>
<tr>
<td>33 Medical Instruments</td>
<td>2.12</td>
<td>1.26</td>
<td>2.27</td>
<td></td>
</tr>
<tr>
<td>34 Motor Vehicles, Trailers</td>
<td>2.84</td>
<td>1.78</td>
<td>2.94</td>
<td></td>
</tr>
<tr>
<td>35 Other Equipment</td>
<td>4.41</td>
<td>2.32</td>
<td>5.11</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>2.65</td>
<td>1.56</td>
<td>2.85</td>
<td></td>
</tr>
</tbody>
</table>
Market Imperfections Across Sectors
Market Imperfections Across Firms: Theory

Using the definition (w/ general PF):

\[
\log \psi_{it}^x = \log \left( \frac{\beta_{it}^x}{\beta_{it}^m} \right) + \log \left( \frac{\alpha_{it}^m}{\alpha_{it}^x} \right)
\]

Estimating equation:

\[
\log \left( \frac{\alpha_{it}^m}{\alpha_{it}^x} \right) = \beta_0 + \beta_1 \log \text{size}_{it} + \beta_2 \log \hat{\omega}_{it} + z_{it} + \text{ind} + \epsilon_{it},
\]

- \(z_{it}\) controls for differences in technology across firms, e.g. extensive margin of imports, group dummies,..
- Note: under Cobb-Douglas, technology is captured by industry fixed effects
Market Imperfections Across Firms: Evidence

<table>
<thead>
<tr>
<th>TABLE VI. MARKET POWER AND FIRM CHARACTERISTICS</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log size$_{it}$</td>
<td>-0.09***</td>
<td>0.16***</td>
<td>0.16***</td>
<td>0.21***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>log ω$_{it}$</td>
<td>0.112***</td>
<td>0.06***</td>
<td>0.06**</td>
<td>0.033***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.013)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTROLS</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FIXED EFFECTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry (2 digits) -Time</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry (3 digits)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.12</td>
<td>0.12</td>
<td>0.24</td>
<td>0.20</td>
<td>0.24</td>
<td>0.26</td>
</tr>
<tr>
<td>No. Observations</td>
<td>71,284</td>
<td>71,284</td>
<td>71,284</td>
<td>71,284</td>
<td>71,284</td>
<td>46,459</td>
</tr>
</tbody>
</table>
Market Imperfections in Foreign Input Markets: Summary

- Input efficiency wedges are large across firms and sectors
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- Conditional on technology, larger and more productive firms seem to spend a lower-than-optimal amount on foreign intermediates
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- Conditional on technology, larger and more productive firms seem to spend a lower-than-optimal amount on foreign intermediates.
- This is particularly true in sectors:
  - highly concentrated
  - with high economies of scale
  - with a large % of imports coming from developing countries.

Results are robust to using a CES PF, where the elasticity of substitution is higher.
Market Imperfections in Foreign Input Markets: Summary

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  - highly concentrated
  - w/ high economies of scale
  - w/ a large % of imports coming from developing countries
- Results are robust to using a CES PF, where $M$ and $X$ are related by a higher elasticity of substitution
- Input efficiency wedges in imported input markets are consistent with monopsony/oligopsony power of importers
Theory
Buyer Power in General Equilibrium: Overview

- **Demand Side:**
  - MC + CES demand over differentiated varieties $q_i$ (e.g. Melitz, 2003)

- **Supply Side:**
  - Technology is a CRS Cobb-Douglas in a (i) domestic input $l_i$ and a (ii) foreign *firm-specific* input $x_i$
  
  - $x_i$ is supplied *elastically* from competitive foreign sellers

- In foreign market, firm $i$ competes with an *exogenous* no. of (foreign) competitors, of size $X_{-i}$. 
Buyer Power in Theoretical Model

- Foreign input supply

\[ W_i^x = \left( \frac{x_i + X_{-i}}{a + X_{-i}} \right)^\eta \]
Buyer Power in Theoretical Model

- **Foreign input supply**

\[ W_{i}^{x} = \left( \frac{x_{i} + X_{-i}}{a + X_{-i}} \right)^{\eta} \]

- **Buyer power:**

\[ \psi_{i} = \frac{MFC_{i}}{W_{i}} = 1 + \eta \frac{x_{i}}{x_{i} + X_{-i}} \]

where \( \eta \equiv \frac{\partial \log W^{x}}{\log X_{i}} \).
Buyer Power in Theoretical Model

- Foreign input supply

\[ W_i^x = \left( \frac{x_i + X_{-i}}{a + X_{-i}} \right)^\eta \]

- Buyer power:

\[ \psi_i = \frac{MFC_i}{W_i} = 1 + \eta \frac{x_i}{x_i + X_{-i}} \]

where \( \eta \equiv \frac{\partial \log W^x}{\log X_i} \).

- Buyer power in foreign markets (i.e. \( \psi_i > 1 \)) emerges due to (cf. Atkenson, Burstein, 2008)

  - Elastic supply of the foreign good, i.e. \( \eta > 0 \).

  - Positive market share of buyer \( i \) in foreign market, i.e. \( \frac{x_i}{x_i + X_{-i}} > 0 \).
Buyer Power and the Aggregate Economy

- Compare aggregate variables in this economy to a counterfactual scenario where I remove all input market distortions
Buyer Power and the Aggregate Economy

- Compare aggregate variables in this economy to a counterfactual scenario where I remove all input market distortions

**Aggregate Efficiency:**

\[
\hat{TFP} = \sum_{s=1}^{S} \theta_s \hat{TFP}_s = - \sum_{s=1}^{S} \theta_s \kappa_{1s} \text{var log } \psi_s^x
\]

**Aggregate Output (Welfare)**

\[
\hat{Q} = \frac{1}{1 - \sum_{s=1}^{S} \theta_s \beta_s} \left[ - \sum_{s=1}^{S} \theta_s \kappa_{2s} \mathbb{E} \text{log } \psi_s + \sum_{s=1}^{S} \theta_s \kappa_{3s} \text{var log } \psi_s \right]
\]

- \[\Rightarrow\] First and second moment of distribution of \text{log } \psi \text{ sufficient statistics for effect of buyer power on aggregate variables}
How Much Does Market Power of *Importers* Cost to France?

### Table VI. Buyer Power and the Aggregate Economy

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>%ΔTFP</td>
<td>-0.4%</td>
<td>-0.89%</td>
<td>-0.25%</td>
<td>-0.05%</td>
<td>-0.13%</td>
</tr>
<tr>
<td>%ΔQ</td>
<td>-1.1%</td>
<td>-1.53%</td>
<td>-0.94%</td>
<td>-0.47%</td>
<td>-0.74%</td>
</tr>
</tbody>
</table>

*Notes:* The table reports the changes in aggregate output when going from an hypothetical competitive economy to the economy with buyer power. Alternative specifications differ in the value of the foreign supply elasticity \( \eta \). Aggregate variables are a weighted average of sector variables, with weights given by sector share in total manufacturing value added. (1) is baseline calibration; in (2) I choose \( \eta_s = \bar{\eta}|_{p60} - 1 \); in (2) I choose \( \eta_s = \bar{\eta}|_{p60} - 1 \); in (2) I choose \( \eta_s = \bar{\eta}|_{p60} - 1 \); in (5) I use the (cross-country) estimates of \( \eta_s \) in Broda, Limao, Weinstein (AER, 2008)
Conclusions

- **Evidence**: Market imperfections in foreign input markets seems large across many sectors, and consistent with monopsony/oligopsony power of importers

- **Theory**:
  - With MC + CES downstream and CRS production, 1\textsuperscript{st} and 2\textsuperscript{nd} moment of distribution of $\log \psi$ *sufficient statistics* for effect of buyer power on aggregate variables
  - Heterogeneity can be *positive* for aggregate output and welfare

- **Policy Implications**:
  - Trade policy as an antitrust policy?
  - Sources of foreign market segmentation?
Appendix

Production Function Estimation: Approach

▪ Construct measures of $p_{it}$ and $w_{it}$ using export/import unit values:

$$\log (uv_{iknt}^j) = \theta_{it}^j + c_{knt}^j + \epsilon_{iknt},$$

▪ $i$: firm, $k$: NC8 digit products, $n$: country, $t$: years and $j = \{EX, IM\}$

▪ I define firm-level average input prices as $p_{it} = \hat{\theta}_{it}^{EX}$, and $w_{it} = \hat{\theta}_{it}^{IM}$
Robustness: CES technology

- If we assume a CES between $X_i$ and $M_i$ then:

\[
\frac{\beta_{x,i}}{\beta_{m,i}} = \left( \frac{X_i}{M_i} \right)^\rho
\]

and

\[
\log \psi_{it}^{x,CES} = \rho \log \left( \frac{X_i}{M_i} \right) + \log \left( \frac{\alpha_{it}^m}{\alpha_{it}^x} \right)
\]

- Estimating equation:

\[
\log \psi_{it}^{x,CES} = \beta_0 + \beta_1 \log \text{size}_{it} + \beta_2 \log \hat{\omega}_{it} + z_{it} + \text{ind} + \varepsilon_{it},
\]

- $z_{it}$ controls for observables that might affect technology of firms

- Take $\hat{\rho}$ from Blaum et al. (2018)
# Input Market Power: CES technology

## Table VII. Input Market Power, CES Technology

<table>
<thead>
<tr>
<th>Sector</th>
<th>$\psi^{x}_{it}$</th>
<th>Mean</th>
<th>Median</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Food Products and Beverages</td>
<td>1.79</td>
<td>1.51</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>17 Textiles</td>
<td>0.85</td>
<td>0.74</td>
<td>0.53</td>
<td></td>
</tr>
<tr>
<td>18 Wearing Apparel, Dressing</td>
<td>0.64</td>
<td>0.50</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>19 Leather, and Leather Products</td>
<td>0.80</td>
<td>0.70</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>20 Wood and Products of Wood</td>
<td>1.55</td>
<td>1.32</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>21 Pulp, Paper and Paper Products</td>
<td>1.05</td>
<td>0.91</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>22 Printing and Publishing</td>
<td>1.18</td>
<td>1.00</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>24 Chemicals and Chemical Products</td>
<td>1.02</td>
<td>0.92</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>25 Rubber and Plastic Products</td>
<td>1.21</td>
<td>1.08</td>
<td>0.67</td>
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<tr>
<td>26 Non-metallic mineral Products</td>
<td>1.11</td>
<td>0.94</td>
<td>0.75</td>
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</tr>
<tr>
<td>27 Basic Metals</td>
<td>1.15</td>
<td>1.03</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>28 Fabricated Metal Products</td>
<td>1.27</td>
<td>1.09</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>29 Machinery and Equipment</td>
<td>1.49</td>
<td>1.27</td>
<td>0.95</td>
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<tr>
<td>31 Electrical machinery and Apparatus</td>
<td>1.30</td>
<td>1.08</td>
<td>0.84</td>
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</tr>
<tr>
<td>32 Radio and Communication</td>
<td>1.17</td>
<td>1.01</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>33 Medical, Precision Instruments</td>
<td>0.99</td>
<td>0.81</td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td>34 Motor Vehicles, Trailers</td>
<td>1.38</td>
<td>1.24</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>35 Other Transport Equipment</td>
<td>1.09</td>
<td>0.83</td>
<td>0.85</td>
<td></td>
</tr>
</tbody>
</table>

Average (Weighted)                          | 1.29            | 1.11  | 0.82   |         |
## Buyer Power and Firm Size: CES technology

<table>
<thead>
<tr>
<th>Table VIII. Market Power and Firm Characteristics, CES Technology</th>
</tr>
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<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>log size$_{it}$</td>
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<td>log $\hat{\omega}_{it}$</td>
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<td><strong>CONTROLS</strong></td>
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<td><strong>FIXED EFFECTS</strong></td>
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<tr>
<td>Adj. $R^2$</td>
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<tr>
<td>No. Observations</td>
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