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
- 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
   - Data: Panel of French manufacturing importers, 1996-2007.

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   - Estimation: Input market power in PF estimation
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   - Data: Panel of French manufacturing importers, 1996-2007.
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_i, and sells it at P_i

  2B. 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:

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

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

$$\psi_i^x \equiv \left(1 + \frac{\partial W_i^x}{\partial X_i} \frac{X_i}{W_i^x}\right) = \frac{MFC_i^x}{W_i^x}$$

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- $\psi^x > 1 \iff \frac{\partial W_i^x}{\partial X_i} > 0$ 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) as given
  2. buys at least one *static* input (X_i), at unit price $W_i^X = W_i(X_i)$

- Then:

$$\psi_i^x = \left(\frac{\beta_i^x}{\beta_i^m}\right)\left(\frac{\alpha_i^m}{\alpha_i^x}\right),$$

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

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- 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

$$q_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_x x_{it} + \omega_{it} \quad (1)$$

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

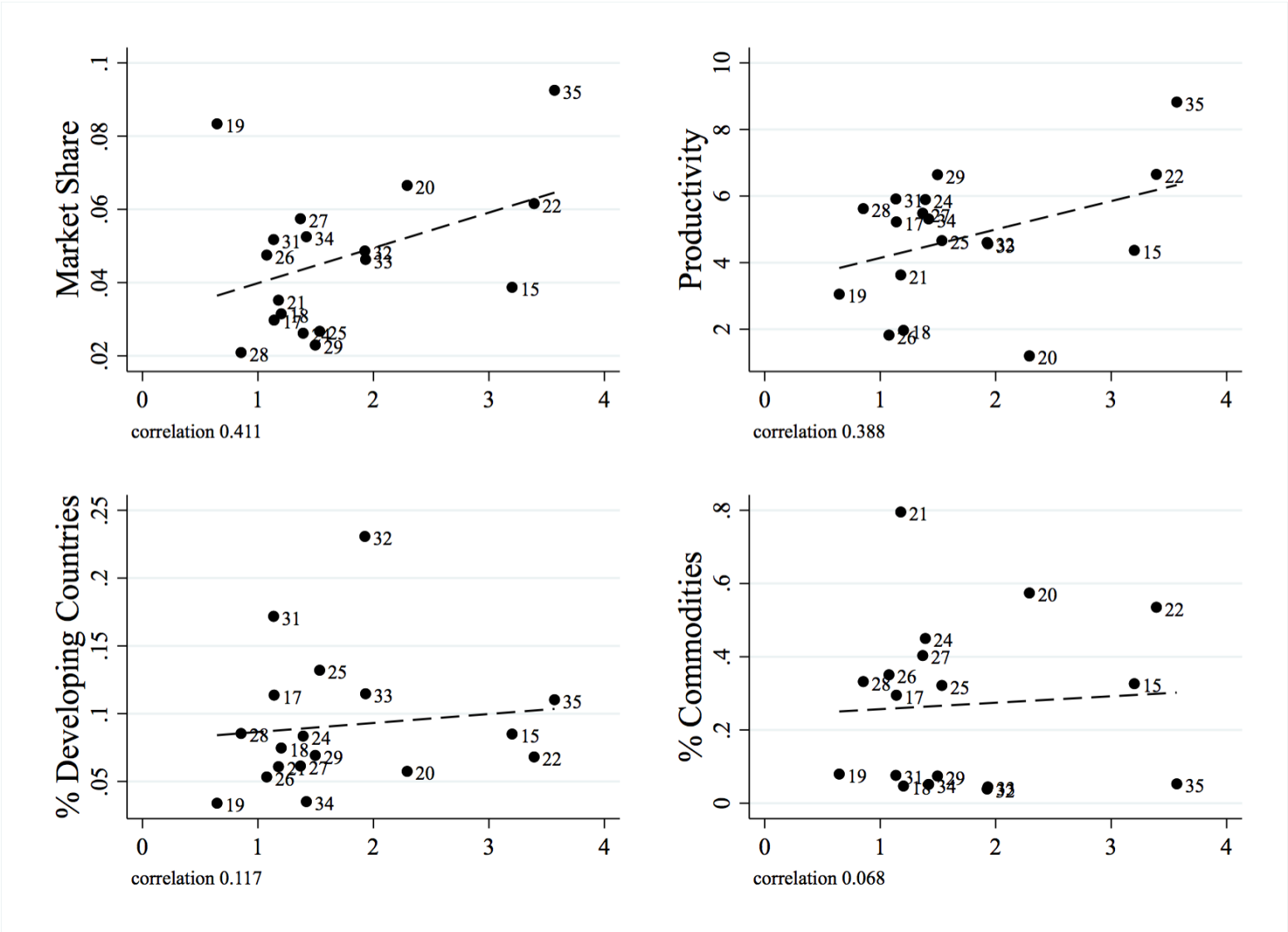
- Manufacturing firms that *both* imports and exports
- 8% of firms, but account for ∼60% of total manuf. value added

Market Imperfections Across Sectors

TABLE V. INPUT MARKET POWER, BY SECTOR

SECTOR	$\psi^x{}_{it}$		
	MEAN	MEDIAN	STD DEV
15 Food and Beverages	2.63	1.43	3.00
17 Textiles	2.00	1.21	2.20
18 Wearing Apparel	3.19	1.78	3.83
19 Leather Products	1.72	1.17	1.58
20 Products of Wood	3.92	2.12	4.43
21 Pulp and Paper Products	1.44	0.82	1.57
22 Printing and Publishing	3.71	2.31	3.73
24 Chemical Products	2.17	1.32	2.26
25 Rubber Products	2.58	1.58	2.60
26 Non-metallic minerals	3.15	1.94	3.22
27 Basic Metals	2.75	1.72	2.84
28 Fabricated Metal Products	2.15	1.27	2.29
29 Machinery and Equipment	2.24	1.35	2.33
31 Electrical Machinery	2.63	1.43	3.01
32 Radio and Communication	2.49	1.61	2.46
33 Medical Instruments	2.12	1.26	2.27
34 Motor Vehicles, Trailers	2.84	1.78	2.94
35 Other Equipment	4.41	2.32	5.11
Average	2.65	1.56	2.85

Market Imperfections Across Sectors



Market Imperfections Across Firms: Theory

- Using the definition (w/ general PF):

$$\log \psi_{it}^{x} = \underbrace{\log\left(\frac{\beta_{it}^{x}}{\beta_{it}^{m}}\right)}_{\text{technology component}} + \log\left(\frac{\alpha_{it}^{m}}{\alpha_{it}^{x}}\right)$$

- Estimating equation:

$$\log\left(\frac{\alpha_{it}^{m}}{\alpha_{it}^{x}}\right) = \beta_0 + \beta_1 \log size_{it} + \beta_2 \log \hat{\omega}_{it} + z_{it} + ind + \varepsilon_{it},$$

  - 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 VI. MARKET POWER AND FIRM CHARACTERISTICS

	(1)	(2)	(3)	(4)	(5)	(6)
$\log size_{it}$	-0.09***		0.16***		0.16***	0.21***
	(0.003)		(0.005)		(0.005)	(0.006)
$\log \hat{\omega}_{it}$		0.112***		0.06***	0.06**	0.033***
		(0.01)		(0.009)	(0.009)	(0.013)
CONTROLS	No	No	Yes	Yes	Yes	Yes
FIXED EFFECTS						
Industry (2 digits) -Time	Yes	Yes	Yes	Yes	Yes	Yes
Industry (3 digits)	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.12	0.12	0.24	0.20	0.24	0.26
No. Observations	71,284	71,284	71,284	71,284	71,284	46,459

Market Imperfections in Foreign Input Markets: Summary

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- Results are robust to using a CES PF, where M and X are related by a higher elasticity of substitution Robustness
- 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

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

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

  Aggregate Output (Welfare)

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

- $\Longrightarrow$ First and second moment of distribution of $\log \psi$ *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

	(1)	(2)	(3)	(4)	(5)
$\%\Delta$TFP	-0.4%	-0.89%	-0.25%	-0.05%	-0.13%
$\%\Delta Q$	-1.1%	-1.53%	-0.94%	-0.47%	-0.74%

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 η. 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 $\eta_s = \bar{\psi}|_{p60} - 1$; in (2) I choose $\eta_s = \bar{\psi}|_{p60} - 1$; in (2) I choose $\eta_s = \bar{\psi}|_{p60} - 1$; in (5) I use the (cross-country) estimates of η_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, 1st and 2nd 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?

Production Function Estimation: Approach

- Construct measures of p_{it} and w_{it}^x using export/import unit values:

$$\log\left(uv^j{}_{iknt}\right) = \theta_{it}^j + c_{knt}^j + \epsilon_{iknt},$$

  - 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 $w_{it}^x = \hat{\theta}_{it}^{IM}$ Back

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:

$$\log \psi_{it}^{x,CES} = \beta_0 + \beta_1 \log size_{it} + \beta_2 \log \hat{\omega}_{it} + z_{it} + ind + \varepsilon_{it},$$

  - 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

SECTOR	$\psi^x{}_{it}$		
	MEAN	MEDIAN	STD DEV
15 Food Products and Beverages	1.79	1.51	1.10
17 Textiles	0.85	0.74	0.53
18 Wearing Apparel, Dressing	0.64	0.50	0.49
19 Leather, and Leather Products	0.80	0.70	0.51
20 Wood and Products of Wood	1.55	1.32	0.92
21 Pulp, Paper and Paper Products	1.05	0.91	0.59
22 Printing and Publishing	1.18	1.00	0.80
24 Chemicals and Chemical Products	1.02	0.92	0.61
25 Rubber and Plastic Products	1.21	1.08	0.67
26 Non-metallic mineral Products	1.11	0.94	0.75
27 Basic Metals	1.15	1.03	0.67
28 Fabricated Metal Products	1.27	1.09	0.80
29 Machinery and Equipment	1.49	1.27	0.95
31 Electrical machinery and Apparatus	1.30	1.08	0.84
32 Radio and Communication	1.17	1.01	0.74
33 Medical, Precision Instruments	0.99	0.81	0.73
34 Motor Vehicles, Trailers	1.38	1.24	0.77
35 Other Transport Equipment	1.09	0.83	0.85
Average (Weighted)	1.29	1.11	0.82

Buyer Power and Firm Size: CES technology

TABLE VIII. MARKET POWER AND FIRM CHARACTERISTICS, CES TECHNOLOGY

	(1)	(2)	(3)	(4)	(5)	(6)
$\log size_{it}$	-0.08***		0.06***		0.06***	0.09***
	(0.003)		(0.004)		(0.004)	(0.005)
$\log \hat{\omega}_{it}$		0.197***		0.16***	0.155***	0.19***
		(0.008)		(0.007)	(0.007)	(0.011)
CONTROLS	No	No	Yes	Yes	Yes	Yes
FIXED EFFECTS						
Industry (2 digits) -Time	Yes	Yes	Yes	Yes	Yes	Yes
Industry (3 digits)	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.13	0.12	0.18	0.18	0.19	0.20
No. Observations	81,292	81,292	81,292	81,292	81,292	46,816

Back