Firm Heterogeneity and Imperfect Competition in Global Production Networks

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Motivation: Two phenomena

1. Global value chains have transformed international trade and firm operations in recent decades

2. Rise of firm heterogeneity and superstar firms has ushered in higher mark-ups and industry concentration

- Interaction of these phenomena raises important policy questions
  - optimal trade and industrial policy
  - micro and macro effects of globalization

- This paper: role of firm heterogeneity and imperfect competition for global production networks and gains from trade

Contribution I: Theory

Quantifiable GE model of global sourcing with (i) two-sided firm heterogeneity, (ii) buyer-supplier matching frictions, (iii) oligopolistic competition upstream and monopolistic competition downstream

- Matching with more suppliers is more costly, but reduces input prices via greater variety, better matches and lower mark-ups

- More productive firms source higher quantities, from more suppliers, at lower prices

- Lower entry barriers upstream improve sourcing outcomes downstream, esp. for most productive firms

- Lower trade or matching costs also benefit downstream buyers, esp. mid-productivity firms

Contribution II: Empirics

Consistent evidence for causal impact of upstream market structure in China on downstream sourcing behavior in France

- Firm-level production data and transaction-level customs data for universe of French and Chinese firms, 2000-2006

- Model-based measures of upstream market structure (# actual and potential suppliers, export reform IV) and buyer/seller heterogeneity (productivity, size)

- Entry upstream increases import quantities and purchases and reduces import prices within downstream firms over time

- Bigger effects for more productive firms downstream and when more heterogeneous firms upstream

Contribution III: Quantification (in progress)

Quantify impact of industrial policy, trade policy and network technology on sourcing behavior and gains from trade

- Solution method for GE model with high-dimensional, discrete-choice optimization problem

- Parameters tractably estimated from trade gravity expressions

- Lower entry barriers upstream, trade costs and matching costs increase firm productivity, size dispersion and welfare downstream

- Non-trivial contribution of (i) two-sided firm heterogeneity, (ii) matching frictions, (iii) imperfect competition

Literature

- Global value chains
  - ▶ trade in intermediates: Goldberg et al (2010), Blaum et al (2015), Halpern et al (2015), Boler et al (2015), Manova et al (2015), Antràs et al (2017), Boehm & Oberfield (2018) etc.
  - ▶ buyer-seller networks: Chaney (2014), Eaton et al (2018), Bernard et al (2018), Bernard & Moxnes (2018), Lim (2018), Oberfield (2018), Bernard et al (2019), Kikkawa et al (2019), Bernard et al (2020) etc.
  - ▶ This paper: (i) two-sided firm heterogeneity and (iii) imperfect competition

- Trade with imperfect competition
  - ▶ Bernard et al (2003), Atkeson & Burstein (2008), Neary (2010), Edmond et al (2015), Morlacco (2018), Head & Mayer (2019) etc.
  - ▶ This paper: (ii) matching frictions

- Production networks
  - ▶ size dispersion: Gaubert & Itskhoki (2018), Bernard et al (2019) etc.
  - ▶ shocks: Acemoglu et al (2012), Carvalho et al (2016), Tintelnot et al (2017), Magerman et al (2016), Baqaee (2018), Boehm et al (2019) etc.
  - ▶ This paper: amplification due to (i)-(iii)

Outline

- Data & Stylized facts

- Theorical framework

- Empirical evidence

- (Estimation & counterfactuals)

Data

- Chinese CCTS customs data, 2000-2006

- Chinese ASIE industrial survey, 2000-2006

- French customs data, 2000-2006

- French FICUS administrative survey, 2000-2006

Summary Statistics

|	2000				2006			
	N	Mean	St Dev	Median	N	Mean	St Dev	Median
Panel A. Importer Characteristics (Firm)								
employment	10,691	210	2,673	19	20,896	171	2,816	16
sales (EUR 1,000)	11,319	59,600	609,900	4,000	22,790	48,400	574,300	3,200
sales / worker (EUR 1,000)	10,679	460	2,854	215	20,860	466	3,530	222
VA / worker (EUR 1,000)	10,634	63	477	44	20,822	64	661	51
total imports (EUR 1,000)	12,571	785	7,088	43	25,737	864	7,631	32
Panel B. Market Structure (HS-6 product)								
# CHN exporters to FRA	2,139	16.9	38.3	5	2,954	37.7	92.3	9
C4 CHN exporters to FRA	2,139	0.87	0.19	0.99	2,954	0.82	0.23	0.94
HHI CHN exporters to FRA	2,139	0.52	0.34	0.46	2,954	0.45	0.33	0.36
# CHN exporters to ROW w/o FRA	2,865	272	426	124	3,695	729	1,452	231
C4 CHN exporters to ROW w/o FRA	2,865	0.53	0.25	0.51	3,695	0.48	0.25	0.44
HHI CHN exporters to ROW w/o FRA	2,865	0.16	0.19	0.09	3,695	0.14	0.18	0.07
# FRA importers from CHN	2,863	28.6	72.1	6	3,671	56.6	142.1	9
# FRA importers from ROW w/o CHN	2,903	374.1	652.8	195	3,711	355	562	169

Number of observations vary due to missing values.

Summary Statistics

|	2000				2006			
	N	Mean	St Dev	Median	N	Mean	St Dev	Median
Panel C. Control Variables (HS-6 product)								
applied EU import tariff (%)	2,899	3.9	7.5	1.5	3,600	2.8	7.1	0
mean VA / worker CHN exporters (log)	2,699	4.16	0.82	4.09	3,576	5.01	0.88	4.94
variance VA / worker CHN exporters (log)	2,546	7.23	2.23	7.31	3,454	9.30	2.27	9.35
mean TFP CHN exporters (log)	2,699	6.93	0.89	6.85	3,576	7.57	0.97	7.50
variance TFP CHN exporters (log)	2,546	13	2.22	13.2	3,454	14.7	2.25	14.7
mean input unit value CHN exporters (log)	2,863	1.6	1.1	1.46	3,689	1.69	1.25	1.71
mean input unit value CHN exporters (log), de-meaned	2,863	4.17	1.4	4.22	3,689	4.29	1.48	4.30
share CHN processing trade	2,865	0.36	0.32	0.29	3,695	0.26	0.27	0.16
share CHN trade intermediares	2,865	0.41	0.24	0.40	3,695	0.43	0.22	0.44
share CHN foreign-owned exporters	2,865	0.17	0.12	0.15	3,695	0.17	0.12	0.14
share CHN multi-product exporters	2,865	0.95	0.11	0.99	3,695	0.94	0.11	0.99

Number of observations vary due to missing values.

Stylized Fact I: Two-sided firm heterogeneity

- Significant dispersion in size and productivity across French firms importing a given HS6 product from China (or ROW)
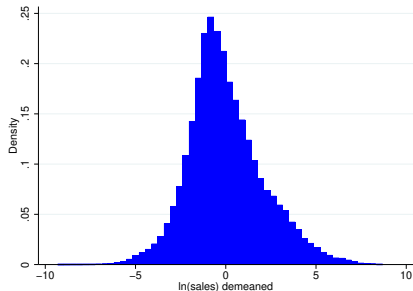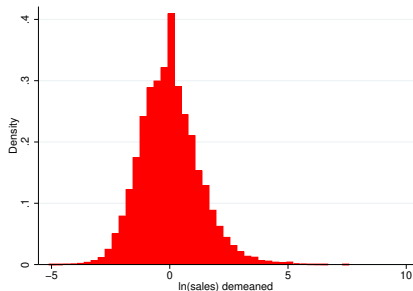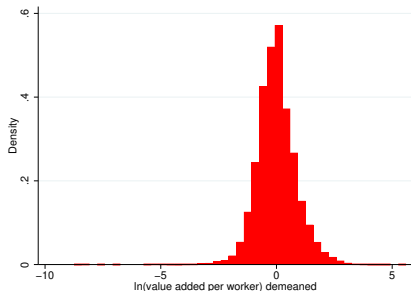

(a) ln(sales) French importers
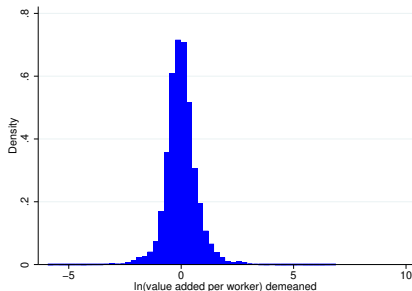
(b) ln(VA per worker) French importers

Stylized Fact I: Two-sided firm heterogeneity

- Significant dispersion in size and productivity across Chinese firms exporting a given HS6 product to France (or ROW)
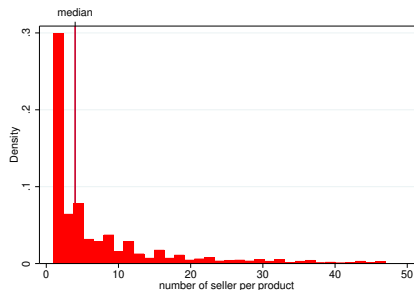

(c) ln(sales) Chinese exporters

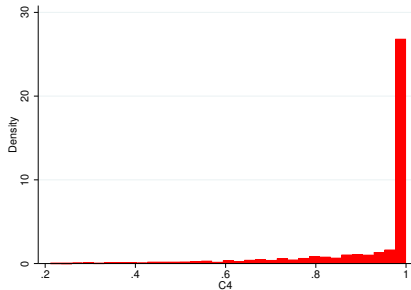(d) ln(VA per worker) Chinese exporters

Stylized Fact 2: Imperfect competition upstream

- Market concentration among Chinese exporters of a given HS6 product to France (or ROW)
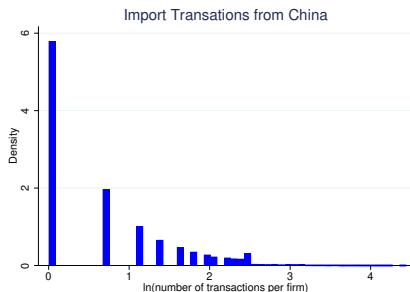

(e) number of sellers

(f) C4

Stylized Fact 3: Matching frictions

- Skewed distribution of transactions across French importers and across Chinese exporters of a given HS6 product (bilateral or global)

Theoretical Framework

- Stylized facts motivate a quantifiable GE model of global sourcing with 3 key ingredients

  - Fact 1 => heterogeneous buyers source from heterogeneous suppliers

  - Fact 2 => oligopolistic competition upstream and monopolistic competition downstream

  - Fact 3 => matching frictions and endogenous matching costs

- Goals:

  - characterize endogenous production network

  - evaluate impact of upstream entry, matching frictions and trade costs on sourcing behavior and welfare downstream

Final Demand

- Consumers in J countries have nested Cobb-Douglas/CES preferences over a tradable CRS homogeneous good and non-tradable differentiated varieties

$$U_i = Q_0^{1-\alpha} \left[\int_{\omega \in \Omega_i} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\alpha\sigma}{\sigma-1}}, \ \sigma > 1$$

- Demand for variety $\omega \in \Omega_i$:

$$q_i(\omega) = E_i P_i^{\sigma-1} p_i(\omega)^{-\sigma}$$

Downstream Production

- Downstream firms assemble intermediates to manufacture final goods and engage in monopolistic competition

$$\max_{p_i(\omega)} (p_i(\omega) - c_i(\omega)) q_i(\omega) \Rightarrow p_i(\omega) = \frac{\sigma}{\sigma - 1} c_i(\omega)$$

- Marginal production costs

$$c_i(\varphi) = \frac{1}{\varphi} \left(\sum_{j=1}^{J} \sum_{k=1}^{K} I_{ijk}(\varphi) c_{ijk}(\varphi)^{1-\eta} \right)^{\frac{1}{1-\eta}}, \ \eta > 1$$

φ: core productivity from distribution $G_i(\varphi)$, $[\overline{\varphi}_i, \infty)$

η: elasticity of substitution across countries $j \in J$ and sectors $k \in K$

$I_{ijk}(\varphi) = 1$ if sourcing jk inputs

- Input cost index across varieties v of jk inputs for firm φ

$$c_{ijk}(\varphi) = \left(\int_0^1 z_{ijk}(\varphi, v)^{1-\lambda} \, dv \right)^{\frac{1}{1-\lambda}}, \ \lambda > 1$$

λ: elasticity of substitution across jk input varieties

Downstream Input Prices

- Conditional on sourcing jk inputs, firm φ buys variety v from lowest-cost supplier it has matched with
- Cost of input v depends on seller, buyer and match characteristics

$$z_{ijk}(\varphi, v) = \min_{s \in \mathscr{S}_{ijk}(\varphi)} \left\{ \tau_{ijk} p_{ijks} \left(\mathscr{S}_{ijk}(\varphi) \right) \xi_{ijks}(\varphi, v) \right\}$$

τ_{ijk}: iceberg trade cost
$\mathscr{S}_{ijk}(\varphi)$: set of discrete jk suppliers to firm φ
$p_{ijks} \left(\mathscr{S}_{ijk}(\varphi) \right)$: price jk supplier s offers to firm φ
$\xi_{ijks}(\varphi, v)$: Fréchet match-specific cost shock

$$\Pr(\xi_{ijks}(\varphi, v) \geq t) = e^{-t^{\theta}}, \ \theta > 0$$

Upstream Production

- Discrete number S_{jk} of upstream suppliers s produce differentiated inputs in country j and sector k at constant marginal cost c_{jks}

- Oligopolistic competition among suppliers $s \in \mathscr{S}_{ijk}(\varphi)$ matched to buyer φ from country i

- Suppliers set match-specific prices $p_{ijks}(\varphi)$ to maximize profits

$$\max_{p_{ijks}(\varphi)} \pi_{ijks}^{U}(\varphi) = Q_{ijks}(\varphi)(p_{ijks}(\varphi) - c_{jks})$$

$Q_{ijks}(\varphi)$: residual demand by buyers in country i with productivity φ

Buyer-Supplier Matching

- Buyers and suppliers meet in bidding rooms of varying sizes at a trade fair between countries i and j
- Upstream suppliers must pay fixed cost $w_j f_{ijk}^U$ to attend the trade fair
    - e.g. registration fee
- Downstream buyers must pay higher fixed cost $w_i f_{ijk}^D(S_{ijk})$ to hold a bidding game in a room with more suppliers
    - e.g. registration fee + sourcing managers
- Sellers enter a room sequentially in increasing order of marginal cost (Eaton et al 2012, Gaubert & Itskhoki 2016)

Sourcing Conditional on Supplier Set

Buyers choose (1) set $\mathbb{I}_i(\varphi)$ of jk country-sectors, (2) set $\mathbb{S}_i(\varphi)$ of suppliers in each jk, (3) sourcing across suppliers $\mathscr{S}_{ijk}(\varphi)$ in each jk

- Market share of supplier s in buyer φ's expenditure on jk inputs

$$\chi_{ijks}(\varphi) = \frac{p_{ijks}(S_{ijk}(\varphi))^{-\theta}}{\sum_{s=1}^{S_{ijk}(\varphi)} p_{ijks}(S_{ijk}(\varphi))^{-\theta}}$$

- Buyer φ's input cost index and quantity of jk inputs

$$c_{ijk}(\varphi) = \gamma \tau_{ijk} \left[\sum_{s=1}^{S_{ijk}(\varphi)} p_{ijks}(\varphi)^{-\theta} \right]^{-1/\theta}$$

$$Q_{ijk}(\varphi) = (\frac{\sigma-1}{\sigma})^{\sigma} E_i P_i^{\sigma-1} \varphi^{\eta-1} c_i(\varphi)^{\eta-\sigma} c_{ijk}(\varphi)^{-\eta}$$

- Buyer φ's total input costs $C_i(\varphi) = (\frac{\sigma-1}{\sigma})^{\sigma} E_i P_i^{\sigma-1} c_i(\varphi)^{1-\sigma}$
- Residual demand by buyer φ for supplier s $Q_{ijks}(\varphi) = Q_{ijk}(\varphi)\chi_{ijks}(\varphi)$

Oligopolistic Pricing Upstream

Proposition 1

There exists a unique Nash Equilibrium with supplier s prices

$$p_{ijks}(\varphi) = \frac{\varepsilon_{ijks}(\varphi)}{\varepsilon_{ijks}(\varphi) - 1} c_{jks},$$

where $\varepsilon_{ijks}(\varphi) = \left[\sigma \delta_{ijk}(\varphi) + \eta \left(1 - \delta_{ijk}(\varphi)\right)\right] \chi_{ijks}(\varphi) + \theta \left[1 - \chi_{ijks}(\varphi)\right]$ is the elasticity of residual demand, and $\delta_{ijk}(\varphi)$ is the share of country-j sector-k inputs in buyer φ's input purchases.

Higher mark-ups if:

- supplier has bigger market share $\chi_{ijks}(\varphi)$ and
  $\rho_{ijs}(\varphi) \equiv \theta - \eta + (\eta - \sigma)\delta_{ijs}(\varphi) > 0$ (Kikkawa et al 2019)
- buyer has less diversified sourcing (higher avg χ_{ijks}) and less elastic final demand (lower σ)
- inputs are less substitutable across and within country-sectors (lower η and θ)

Pro-Competitive Effect

Proposition 2

An increase in number of country-j sector-k suppliers to a buyer $S_{ijk}(\varphi)$

(a) reduces the market shares $\chi_{ijks}(\varphi)$, mark-ups $\mu_{ijks}(\varphi)$ and prices $p_{ijks}(\varphi)$ of all inframarginal jk suppliers to the buyer;

(b) lowers the buyer's input cost index across jk inputs $c_{ijk}(\varphi)$.

$$\log \widehat{c}_{ijk}(\varphi)^{-\theta} = \underbrace{\log \left(\sum_{s=1}^{S_{ijk}(\varphi)} \chi_{ijks}(\varphi) \widehat{\mu}_{ijks}(\varphi)^{-\theta} \right)}_{\textit{intensive margin}} - \underbrace{\log \left(1 - \sum_{s=S_{ijk}(\varphi)+1}^{S_{ijk}(\varphi)'} \chi_{ijks}(\varphi)' \right)}_{\textit{extensive margin}}.$$

- extensive margin: + variety gains, + better matches, - less productive marginal suppliers
- intensive margin: + lower mark-ups

Optimal Supplier Set

Buyers choose their set $\mathbb{I}_i(\varphi)$ of jk country-sector origins and set $\mathbb{S}_i(\varphi)$ of suppliers by maximizing total profits

$$\max_{\substack{I_{ijk}(\varphi)\in\{0,1\}_{j=1,k=1}^{J,K} \\ S_{ijk}(\varphi)\in\{0,1,2,\dots,S_{ijk}\}_{j=1,k=1}^{J,K}}} \pi_i^D(\varphi) = B_i c_i(\varphi)^{1-\sigma} - \sum_{j=1}^{J}\sum_{k=1}^{K} I_{ijk}(\varphi) w_i f_{ijk}^D(S_{ijk}(\varphi)),$$

- Final demand shifter: B_i

- Marginal cost: $c_i(\varphi) = \frac{\gamma}{\varphi}\Theta_i(\varphi)^{\frac{1}{1-\eta}}$

- Sourcing capability:
  $$\Theta_i(\varphi) \equiv \sum_{j=1}^{J}\sum_{k=1}^{K} I_{ijk}(\varphi)\tau_{ijk}^{1-\eta}\left[\sum_{s=1}^{S_{ijk}(\varphi)} p_{ijks}(\varphi)^{-\theta}\right]^{-\frac{1-\eta}{\theta}}$$

Optimal Sourcing Strategy

Proposition 3

Downstream buyers' optimal sourcing strategy is such that:

(a) set of input suppliers $I_{ijk}(\varphi)$ and $S_{ijk}(\varphi)$ is non-contracting in φ under sourcing complementarity $\sigma > \eta$ and $\rho_{ijk}(\varphi) > 0$;

(b) sourcing capability $\Theta_i(\varphi)$ is non-decreasing in φ.

- $\sigma > \eta$: sourcing complementarity (Antràs et al 2017)
- $\rho_{ijk}(\varphi) > 0$: new pro-competitive effect (strategic complementarity among suppliers)
- pecking order of country-sectors and suppliers $\Rightarrow$ negative degree assortativity along extensive margin (Bernard & Moxnes 2018)
- endogenous sourcing amplifies downstream firm's productivity advantage (Bernard et al 2019)

Trade Flows

- Firm-to-firm sales

$$X_{ijks}(\varphi) = X_{ijk}(\varphi)\chi_{ijks}(\varphi)$$

  - two-sided heterogeneity & imperfect competition $\Rightarrow$ ambiguous assortativity along intensive margin
  - more productive firms buy more from more productive suppliers if scale effect (higher quantity) dominates competition effect (lower mark-up) (Sugita et al 2014, Benguria 2015, Bernard & Moxnes 2018)

- Firm-level imports

$$X_{ijk}(\varphi) = (\frac{\sigma - 1}{\sigma})^{\sigma} E_i P_i^{\sigma-1} \varphi^{\eta-1} c_i(\varphi)^{\eta-\sigma} c_{ijk}(\varphi)^{1-\eta}$$

  - matching frictions & imperfect competition $\Rightarrow$ supplier set & mark-ups

Industry and General Equilibrium

- Free entry $\Rightarrow$ threshold downstream firm productivity $\overline{\varphi}_i$

$$\int_{\overline{\varphi}_i}^{+\infty} \pi_i^D(\varphi)dG(\varphi) = w_i f_{ei}$$

- Non-negative profits of marginal supplier $\overline{s}_{ijk} \Rightarrow \#$ suppliers S_{ijk}

$$\Pi_{\overline{s}_{ijk}, S_{ijk}}^{U} = \Delta_i \int_{\overline{\varphi}_{ijk\overline{s}}}^{\infty} \pi_{\overline{s}_{ijk}, S_{ijk}}^{U}(\varphi)dG_i(\varphi),\ \Pi_{\overline{s}_{ijk}, S_{ijk}}^{U} \geq w_j f_{ijk}^{U},\ \Pi_{\overline{s}_{ijk}+1, S_{ijk}}^{U} < w_j f_{ijk}^{U}$$

  - $\overline{\varphi}_{ijk\overline{s}}$: least productive country-i buyer that buys sector-k inputs from marginal country-j supplier to i

Impact of Market Structure

Proposition 4

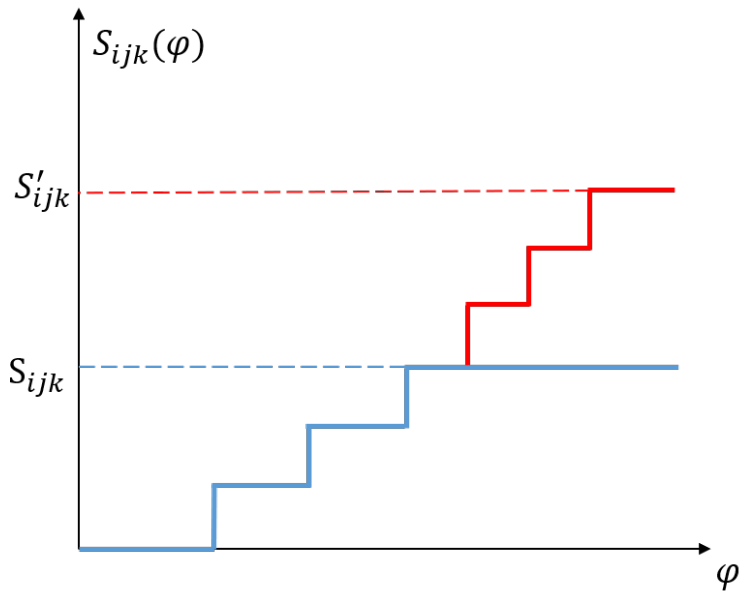*Under sourcing complementarity, a rise in the number of country-j sector-k suppliers S_{ijk}*

(a) weakly increases the number of jk suppliers to a buyer;

(b) weakly reduces buyers' input cost index $c_{ijk}(\varphi)$ and weakly increases input quantities $Q_{ijk}(\varphi)$ and purchases $X_{ijk}(\varphi)$ of jk inputs;

(c) exerts bigger effects on more productive buyers.

- positive input variety and pro-competitive mark-up effects dominate negative supplier selection effect

- more productive downstream firms more likely to enter a bigger bidding room and expand supplier set

Input Sourcing with Concentrated Market Upstream
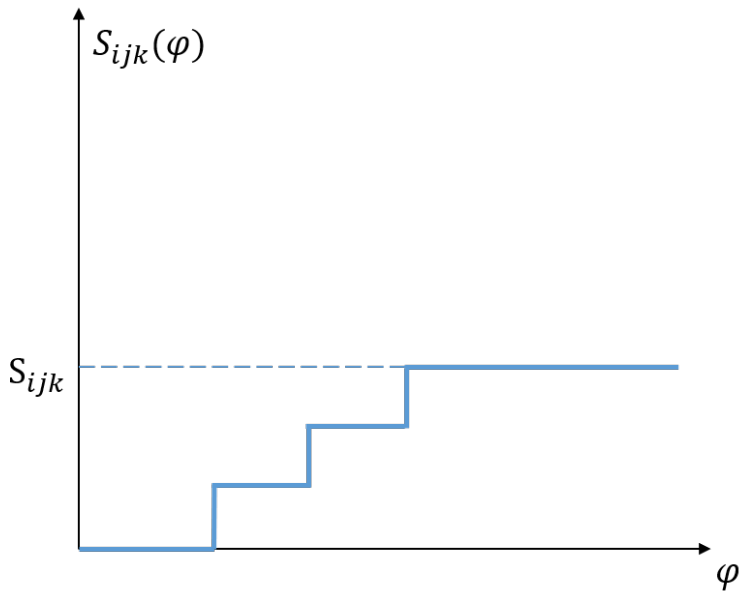
Impact of Entry Upstream on Sourcing Downstream

Impact of Trade Policy and Matching Technology

Proposition 5

Under sourcing complementarity and fixed final demand B_i, a fall in trade costs τ_{ijk} or matching costs $f_{ijk}^D(S_{ijk})$

(a) weakly expands buyers' sourcing strategy $\mathbb{I}_i(\varphi)$ and $\mathbb{S}_i(\varphi)$;

(b) weakly reduces buyers' input cost index $c_{ijk}(\varphi)$ and weakly increases input purchases $X_{ijk}(\varphi)$ of jk inputs.
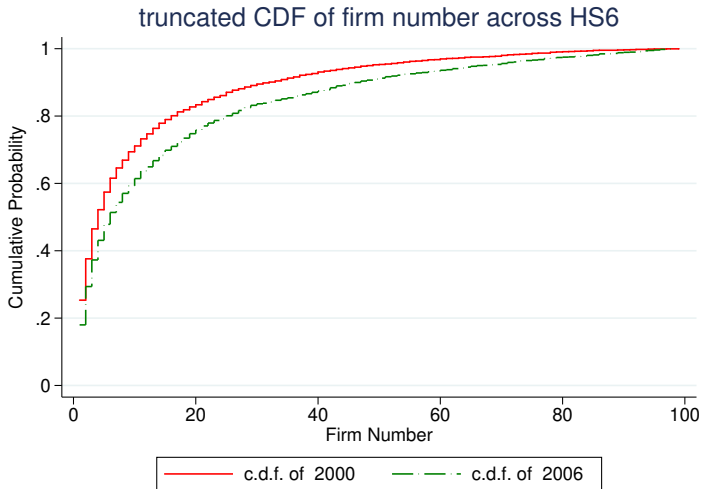
(c) exerts bigger effects on mid-productivity firms

- trade liberalization and technological progress improve countries' supply potential $\phi_{ijk}(\varphi) = \tau_{ijk}^{1-\eta} \left[\sum_{s=1}^{S_{ijk}(\varphi)} p_{ijks}(\varphi)^{-\theta} \right]^{-\frac{1-\eta}{\theta}}$

- lower input costs $c_{ijk}(\varphi)$ translate into lower marginal cost $c_i(\varphi)$ for downstream firms

Empirical Design

Impact of upstream market structure in China on downstream sourcing behavior in France, 2000-2006

- Two large open economies at different GVC segments

- China experienced dramatic export growth after joining WTO in 2001
  - relaxation of barriers to entry, development of trade-oriented SEZs, expansion of physical and institutional infrastructure

- Large, exogenous upstream supply shock to downstream firms
  - China an important new input supplier to France
  - France not a key export market for China

Chinese Market Structure Over Time

truncated CDF of firm number across HS6

Cumulative Probability vs Firm Number

c.d.f. of 2000 —·— c.d.f. of 2006

Empirical Specification

$$\left\{\ln X_{fpt}, \ln Q_{fpt}, \ln c_{fpt}\right\} = \alpha + \beta \ln S_{CHN \to ROW, pt} + \Gamma \Omega_{CHN, pt} + \\ + \delta_f + \delta_p + \delta_t (+t\delta_p) + \varepsilon_{fpt}$$

- $\left\{\ln X_{fpt}, \ln Q_{fpt}, \ln c_{fpt}\right\}$: Chinese import activity by French firm f, HS-6 product p, year t
- $\ln S_{CHN \to ROW, pt}$: # Chinese exporters to ROW by product, year
- $\Omega_{CHN, pt}$: controls by product, year
- $\delta_f, \delta_p, \delta_t, t\delta_p$: firm, product, year FE; product time trends

Identification Strategy

- Reverse causality
  - market structure in China arguably does not respond to sourcing behavior of individual French firms
  - $\ln S_{CHN \to ROW, pt}$: potential suppliers, not firms' endogenous supplier set
  - robust to $\ln S_{CHN \to FRA, pt}$, IV reforms to Chinese export restrictions

- Omitted variable bias, common trends, spurious correlation
  - δ_f: unobserved buyer heterogeneity
  - $\delta_p, \delta_t, t\delta_p$: aggregate policy, technology, supply, demand shocks
  - $\Omega_{CHN, pt}$: EU import tariffs, # FRA importers from ROW; avg productivity, st dev productivity, avg quality of CHN exporters; CHN export share of processing, intermediaries, multinationals, multi-product

▸ the DER IV

Baseline Results

	(1)	(2)	(3)	(4)
Panel A. (log) Import Value$_{fpt}$				
(log) # CHN → ROW Exporters$_{pt}$	0.085***	0.141***	0.138***	0.220***
	(0.024)	(0.039)	(0.026)	(0.039)
N	897,091	897,091	897,091	897,091
R2	0.008	0.150	0.581	0.585
Panel B. (log) Import Quantity$_{fpt}$				
(log) # CHN → ROW Exporters$_{pt}$	0.141***	0.140***	0.127***	0.274***
	(0.030)	(0.043)	(0.028)	(0.043)
N	897,091	897,091	897,091	897,091
R2	0.006	0.158	0.601	0.605
Panel C. (log) Import Unit Value$_{fpt}$				
(log) # CHN → ROW Exporters$_{pt}$	-0.056**	0.001	0.011	-0.055***
	(0.025)	(0.016)	(0.012)	(0.019)
N	897,091	897,091	897,091	897,091
R2	0.005	0.498	0.709	0.714
Year FE	YES	YES	YES	YES
HS-6 Product FE		YES	YES	YES
Firm FE			YES	YES
HS-6 Product Trend				YES
Product × Year Controls				YES

Robustness

	Balanced Sample	No Wholesalers		CES Import Price Index	Natural Quantity Units	CHN→FRA Exporters	
		Upstream	Downstream			OLS	IV: Export Restrictions
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. (log) Import Value$_{fpt}$							
(log) # CHN→ROW Exporters$_{pt}$	0.152***	0.123***	0.115		0.281***	0.195***	0.271
	(0.041)	(0.029)	(0.072)		(0.054)	(0.017)	(0.226)
N	486,849	897,091	134,482		308,718	811,958	811,958
R2	0.481	0.585	0.446		0.592	0.581	0.580
Panel B. (log) Import Quantity$_{fpt}$							
(log) # CHN→ROW Exporters$_{pt}$	0.196***	0.112***	0.159**	0.285***	0.359***	0.212***	0.648**
	(0.046)	(0.034)	(0.079)	(0.044)	(0.062)	(0.019)	(0.281)
N	486,849	897,091	134,482	897,091	308,718	811,958	811,958
R2	0.525	0.605	0.534	0.596	0.635	0.600	0.598
Panel C. (log) Import Unit Value$_{fpt}$							
(log) # CHN→ROW Exporters$_{pt}$	-0.043**	0.011	-0.041	-0.072***	-0.078***	-0.017**	-0.378*
	(0.020)	(0.015)	(0.032)	(0.020)	(0.029)	(0.008)	(0.194)
N	486,849	897,091	134,482	897,091	308,718	811,958	811,958
R2	0.696	0.714	0.740	0.694	0.791	0.707	0.701
KP Stage 1							10.95
Firm, Year, HS-6 Product FE	YES	YES	YES	YES	YES	YES	YES
HS-6 Product Trend	YES	YES	YES	YES	YES	YES	YES
Product × Year Controls	YES	YES	YES	YES	YES	YES	YES

Downstream Heterogeneity

Importer Size Measure	Employment	Sales	Total Imports		
			Baseline	CES Index	Interacted Controls
	(1)	(2)	(3)	(4)	(5)
Panel A. (log) Import Value$_{fpt}$					
(log) # CHN→ROW Exporters$_{pt}$	0.206***	0.205***	0.131***		0.123***
× 2nd Down Size Tercile Dummy	0.011	0.009	0.029***		0.035***
× 3rd Down Size Tercile Dummy	0.033**	0.041**	0.110***		0.122***
N	811,373	811,373	811,373	811,373	811,373
R2	0.589	0.589	0.594		0.594
Panel B. (log) Import Quantity$_{fpt}$					
(log) # CHN→ROW Exporters$_{pt}$	0.272***	0.267***	0.179***	0.175***	0.170***
× 2nd Down Size Tercile Dummy	0.010	0.005	0.039***	0.048***	0.047***
× 3rd Down Size Tercile Dummy	0.033**	0.039**	0.124***	0.142***	0.135***
N	811,373	811,373	811,373	811,373	811,373
R2	0.607	0.607	0.610	0.602	0.611
Panel C. (log) Import Unit Value$_{fpt}$					
(log) # CHN→ROW Exporters$_{pt}$	-0.060***	-0.062***	-0.048**	-0.043**	-0.047**
× 2nd Down Size Tercile Dummy	0.001	0.004	-0.010**	-0.022***	-0.013***
× 3rd Down Size Tercile Dummy	0.001	0.002	-0.013**	-0.040***	-0.013**
N	811,373	811,373	811,373	811,373	811,373
R2	0.713	0.713	0.713	0.693	0.713
Firm, Year, HS-6 Product FE	YES	YES	YES	YES	YES
HS-6 Product Trend	YES	YES	YES	YES	YES
Product × Year Controls	YES	YES	YES	YES	YES

Upstream Heterogeneity

Upstream Dispersion Measure	Sales per Worker (1)	VA per Worker (2)	Import Share (3)	Export Price (4)
Panel A. (log) Import Value$_{fpt}$				
(log) # CHN→ROW Exporters$_{pt}$	0.212***	0.155***	0.253***	0.280***
	(0.055)	(0.049)	(0.049)	(0.050)
× 2nd Up Dispersion Tercile Dummy	-0.029	0.048	-0.012	-0.073*
	(0.052)	(0.036)	(0.044)	(0.043)
× 3rd Up Dispersion Tercile Dummy	0.024	0.097**	-0.113*	-0.094*
	(0.055)	(0.042)	(0.064)	(0.048)
R2	0.585	0.585	0.585	0.585
Panel B. (log) Import Quantity$_{fpt}$				
(log) # CHN→ROW Exporters$_{pt}$	0.210***	0.160***	0.276***	0.335***
	(0.059)	(0.055)	(0.054)	(0.061)
× 2nd Up Dispersion Tercile Dummy	0.034	0.119**	0.017	-0.064
	(0.057)	(0.047)	(0.055)	(0.058)
× 3rd Up Dispersion Tercile Dummy	0.101*	0.152***	-0.034	-0.109*
	(0.060)	(0.052)	(0.074)	(0.061)
R2	0.605	0.605	0.605	0.605
Panel C. (log) Import Unit Value$_{fpt}$				
(log) # CHN→ROW Exporters$_{pt}$	0.002	-0.006	-0.023	-0.055**
	(0.025)	(0.027)	(0.025)	(0.025)
× 2nd Up Dispersion Tercile Dummy	-0.062***	-0.072***	-0.029	-0.009
	(0.021)	(0.025)	(0.025)	(0.025)
× 3rd Up Dispersion Tercile Dummy	-0.077***	-0.055**	-0.079***	0.014
	(0.024)	(0.027)	(0.031)	(0.026)
R2	0.714	0.714	0.714	0.714
Firm, Year, HS-6 Product FE	YES	YES	YES	YES
HS-6 Product Trend	YES	YES	YES	YES
Product × Year Controls	YES	YES	YES	YES
N	897,082	897,082	897,082	897,082

Quantification (in progress)

- Goal: quantify model by using standard parameter values from the literature and structurally estimating key primitives from our data

- Estimation strategy

  - solution method for GE model with high-dimensional, discrete-choice optimization problem for firms' global sourcing (Antras et al. 2017, Arkolakis and Eckert 2017, Taschereau-Dumouchel 2019)

  - estimate each country's sourcing potential from French firms' import purchases

  - estimate matching frictions from gravity expressions for trade flows

Counterfactual Analysis (in progress)

- Goals:
  - assess impact of industrial policy, trade policy and technological progress on global sourcing and gains from trade
  - evaluate role of (i) two-sided firm heterogeneity, (ii) matching frictions, (iii) imperfect competition

- Preliminary results
  - lower entry barriers upstream, trade costs and matching costs increase firm productivity, size dispersion and welfare downstream
  - no (i): identical suppliers $=>$ gains from trade smaller and more unequal across firms
  - no (ii): ubiquitous sourcing $=>$ no pro-competitive effects or unequal gains across firms
  - no (iii): monopolistically or perfectly competitive suppliers $=>$ no pro-competitive effects, but still unequal gains across firms

Conclusion

- Two phenomena: global value chains, superstar firms

- Theoretical rational and empirical evidence that market structure upstream importantly affects sourcing downstream
  - two-sided firm heterogeneity and endogenous matching
  - oligopolistic competition and pro-competitive gains

- Open questions
  - optimal trade and industrial policy
  - cross-border policy spillovers
  - dynamic gains from global sourcing

Instrumental Variables

- Direct export restrictions (DER): the right to trade was restricted to certain types of Chinese firms (Bai, Krishna, and Ma, 2017)
  - It is mostly a size restriction which varies with industries, regions & ownership

- China gradually eliminated DER and totally abandoned it in 2004 as part of the WTO accession agreement

- We instrument the number of firms that actually export a HS6 product with the potential number of firms that can in principle export given the DER in place
  - Match each HS6 product to a CIC industry and count the number of firms in Chinese customs data that export a product p in $t_0 = 2000, NEXP_{p,t_0}$
  - Infer the potential number of firms that could have exported product p at time t_0 if there had been no DERs at the time as $N_{p,t_0} = NEXP_{p,t_0}/DER_{s,to}$ where p belongs to sector s.
  - Infer the potential number of firms that could export product p at time t as $N_{p,t}^{IV} = N_{p,t0}DER_{st}$ where p belongs to sector s.

Instrumental Variables

Time	1999 - 2000	1/2001 - 6/2001	7/2001 - 12/2001	1/2002 - 8/2003	9/2003 - 6/2004
SEZ	•Reg.K ≥ 2M	•Reg.K ≥ 2M	•Reg.K ≥2M	•Reg.K ≥2M	•Reg.K ≥0.5M
	•Register	•Register	Reg.K ≥1M if M&E	Reg.K ≥1M if M&E	•Register
			•Register	•Register	
Pudong New Area	No difference from the rest of China	No difference from the rest of China	No difference from the rest of China	•Reg.K≥0.5M •Register	•Reg.K ≥0.5M •Register
State or Public Owned Domestic Firm	•Reg.K ≥5M Reg.K ≥3M if MW Reg.K ≥2M if M&E Reg.K ≥2M if Inst. •Register	•Reg.K ≥5M Reg.K ≥3M if MW Reg.K ≥2M if M&E Reg.K ≥2M if Inst. •Register	•Reg.K ≥3M Reg.K ≥2M if MW Reg.K ≥1M if M&E Reg.K ≥1M if Inst. •Register	•Reg.K ≥3M Reg.K ≥2M if MW Reg.K ≥1M if M&E Reg.K ≥1M if Inst. •Register	•Reg.K ≥0.5M •Register
Private Owned Domestic Firm	•Reg.K ≥8.5M Net Assets ≥8.5M Sales ≥50M for 2 yrs Export≥1M USD Sales≥30M if M&E •Apply for Approval	•Reg.K ≥5M Reg.K ≥3M if MW Reg.K ≥2M if M&E Reg.K ≥2M if Inst. •Apply for Approval	•Reg.K ≥3M Reg.K ≥2M if MW Reg.K ≥1M if M&E Reg.K ≥1M if Inst. • Register	•Reg.K ≥3M Reg.K ≥2M if MW Reg.K ≥1M if M&E Reg.K ≥1M if Inst. • Register	•Reg.K ≥0.5M •Register

Source: Ministry of Commerce of China;

M: Million Chinese Yuan; SEZ: Special Economic Zones; Reg. K: Registered Capital; M&E: Mechanical and Electrical products; MW: Midwest; Inst.: Research Institution;

Figure source: Bai et al. (2017)

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Instrumental Variables

Share of firms subject to DER across sectors