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

- Model-based measures of upstream market structure (number of 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**
  - This paper: (i) two-sided firm heterogeneity and (iii) imperfect competition

- **Trade with imperfect competition**
  - This paper: (ii) matching frictions

- **Production networks**
  - This paper: amplification due to (i)-(iii)
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
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) $\ln(\text{sales})$ French importers

(b) $\ln(\text{VA per worker})$ 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) \( \ln(\text{sales}) \) Chinese exporters

(d) \( \ln(\text{VA per worker}) \) 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

- Final demand in J countries:
  - nested Cobb-Douglas/CES preferences
    \[ U_i = Q_i^{1-\alpha} \left[ \int_{\omega \in \Omega_i} q(\omega) \frac{\sigma-1}{\sigma} d\omega \right]^{\frac{\alpha \sigma}{\sigma-1}}, \sigma > 1 \]
  - demand for variety \( \omega \):
    \[ q_i(\omega) = E_i P_i^{\sigma-1} p_i(\omega)^{-\sigma} \]

- Heterogeneous final-good producers source from heterogeneous input suppliers
  - oligopolistic competition upstream, monopolistic competition downstream
  - matching frictions and endogenous production network

- Free entry conditions in industry and general equilibrium
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

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

\(\varphi\): core productivity from distribution \(G_i(\varphi), [\varphi_i, \infty)\)

\(\eta\): elasticity of substitution across countries \(j \in J\) and sectors \(k \in K\)

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

- Input cost index across varieties \(\nu\) of \(jk\) inputs for firm \(\varphi\)

\[
c_{ijk}(\varphi) = \left( \int_{0}^{1} z_{ijk}(\varphi, \nu)^{1-\lambda} \, d\nu \right)^{\frac{1}{1-\lambda}}, \quad \lambda > 1
\]

\(\lambda\): elasticity of substitution across \(jk\) input varieties
Downstream Input Prices

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

\[ z_{ijk}(\varphi, v) = \min_{s \in S_{ijk}(\varphi)} \{ \tau_{ijk} p_{ijks}(S_{ijk}(\varphi)) \xi_{ijks}(\varphi, v) \} \]

- $\tau_{ijk}$: iceberg trade cost
- $S_{ijk}(\varphi)$: set of discrete $jk$ suppliers to firm $\varphi$
- $p_{ijks}(S_{ijk}(\varphi))$: price $jk$ supplier $s$ offers to firm $\varphi$
- $\xi_{ijks}(\varphi, v)$: Fréchet match-specific cost shock

\[ \Pr(\xi_{ijks}(\varphi, v) \geq t) = e^{-t^\theta}, \quad \theta > 0 \]
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 $s \in S_{ijk}(\phi)$ matched to buyer $\phi$ from country $i$
- Suppliers set match-specific prices $p_{ijks}(\phi)$ to maximize profits

$$\max_{p_{ijks}(\phi)} \pi^{U}_{ijks}(\phi) = Q_{ijks}(\phi)(p_{ijks}(\phi) - c_{jks})$$

$Q_{ijks}(\phi)$: residual demand by buyers in country $i$ with productivity $\phi$
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 & Itskhoiki 2016)
- Buyers choose (1) set $I_i(\phi)$ of $jk$ country-sectors, (2) set $S_i(\phi)$ of suppliers in each $jk$, (3) sourcing across suppliers $S_{ijk}(\phi)$ in each $jk$
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 \( \varepsilon_{ijks}(\varphi) = [\sigma \delta_{ijk}(\varphi) + \eta (1 - \delta_{ijk}(\varphi))] \chi_{ijks}(\varphi) + \theta [1 - \chi_{ijks}(\varphi)] \) is the elasticity of residual demand, and \( \delta_{ijk}(\varphi) \) is the share of country-j sector-k inputs in buyer \( \varphi \)'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 \( \chi_{ijks} \)) and less elastic final demand (lower \( \sigma \))
- inputs are less substitutable across and within country-sectors (lower \( \eta \) and \( \theta \))
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 $c_{ijk}(\varphi)$.

\[
\log \hat{c}_{ijk}(\varphi)^{-\theta} = \log \left( \sum_{s=1}^{S_{ijk}(\varphi)} \chi_{ijks}(\varphi)\hat{\mu}_{ijks}(\varphi)^{-\theta} \right) - \log \left( 1 - \sum_{s=S_{ijk}(\varphi)+1}^{\infty} \chi_{ijks}(\varphi)^{'} \right).
\]

- extensive margin: + variety gains, + better matches, - less productive marginal suppliers
- intensive margin: + lower mark-ups
Proposition 3

Downstream buyers’ optimal sourcing strategy is such that:

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

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

- $\sigma > \eta$: sourcing complementarity (Antràs et al 2017)
- $\rho_{ijk}(\varphi) > 0$: new pro-competitive effect (strategic complementarity among suppliers, Amiti et al 2019)
- 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)
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 \( c_{ijk}(\phi) \) and weakly increases input quantities \( Q_{ijk}(\phi) \) and purchases \( X_{ijk}(\phi) \) 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

$S_{ijk}(\varphi)$

$S_{ijk}$
Impact of Entry Upstream on Sourcing Downstream

\[ S_{ijk}(\varphi) \]

\[ S'_{ijk} \]

\[ S_{ijk} \]
Impact of Trade Policy and Matching Technology

Proposition 5

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

(a) weakly expands buyers’ sourcing strategy $I_i(\phi)$ and $S_i(\phi)$;

(b) weakly reduces buyers’ input cost index $c_{ijk}(\phi)$ and weakly increases input purchases $X_{ijk}(\phi)$ of $jk$ inputs.

(c) exerts bigger effects on mid-productivity firms

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

- lower input costs $c_{ijk}(\phi)$ translate into lower marginal cost $c_i(\phi)$ for downstream firms
Impact of Lower Trade and Matching Costs on Sourcing Downstream

\[ S_{ijk}(\varphi) \]

\[ S_{ijk} \]
Impact of Lower Trade and Matching Costs on Sourcing Downstream

\[ S_{ijk}(\varphi) \]

\[ S_{ijk} \]
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 input supplier to France (3.2% → 5.7%)
  - France not a key export market for China (1.5% → 1.4%)
Chinese Market Structure Over Time

truncated CDF of firm number across HS6

Cumulative Probability

Firm Number

c.d.f. of 2000  c.d.f. of 2006

[Graph showing cumulative distribution functions for firm numbers in 2000 and 2006]
Empirical Specification

\[
\{\ln X_{fpt}, \ln Q_{fpt}, \ln c_{fpt}\} = \alpha + \beta \ln S_{CHN\rightarrow ROW, pt} + \Gamma \Omega_{CHN, pt} + \\
+ \delta_f + \delta_p + \delta_t + t \delta_p + \varepsilon_{fpt}
\]

- \(\{\ln X_{fpt}, \ln Q_{fpt}, \ln c_{fpt}\}\): Chinese import activity by French firm \(f\), HS-6 product \(p\), year \(t\)
- \(\ln S_{CHN\rightarrow ROW, pt}\): 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
  - $\ln S_{CHN\rightarrow ROW, pt}$: potential suppliers, not firms’ endogenous supplier set
  - Robust to $\ln S_{CHN\rightarrow FRA, pt}$, IV reforms to Chinese export restrictions

- **Omitted variable bias, common trends, spurious correlation**
  - $\delta_f$: 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
Instrumental Variables

- Direct export restrictions (DER) (Bai, Krishna, and Ma, 2017)
  - size restriction that varies across industries, regions, ownership
  - gradually eliminated by 2004 as part of WTO accession

More about the DER IV
## Baseline Results

<table>
<thead>
<tr>
<th>Panel</th>
<th>(log) Import Value (fpt)</th>
<th>(log) # CHN  →  ROW Exporters (pt)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A. (log) Import Value (fpt)</td>
<td>(log) # CHN  →  ROW Exporters (pt)</td>
<td>0.085***</td>
<td>0.118**</td>
<td>0.206***</td>
<td>0.220***</td>
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<tr>
<td></td>
<td></td>
<td>(0.024)</td>
<td>(0.058)</td>
<td>(0.036)</td>
<td>(0.039)</td>
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</tr>
<tr>
<td></td>
<td>N</td>
<td>897,091</td>
<td>897,091</td>
<td>897,091</td>
<td>897,091</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R2</td>
<td>0.008</td>
<td>0.163</td>
<td>0.585</td>
<td>0.585</td>
<td></td>
</tr>
<tr>
<td>Panel B. (log) Import Quantity (fpt)</td>
<td>(log) # CHN  →  ROW Exporters (pt)</td>
<td>0.141***</td>
<td>0.233***</td>
<td>0.269***</td>
<td>0.274***</td>
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<tr>
<td></td>
<td></td>
<td>(0.030)</td>
<td>(0.063)</td>
<td>(0.040)</td>
<td>(0.043)</td>
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</tr>
<tr>
<td></td>
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<td>897,091</td>
<td>897,091</td>
<td>897,091</td>
<td>897,091</td>
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<tr>
<td></td>
<td>R2</td>
<td>0.006</td>
<td>0.170</td>
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<td>0.605</td>
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<tr>
<td>Panel C. (log) Import Unit Value (fpt)</td>
<td>(log) # CHN  →  ROW Exporters (pt)</td>
<td>-0.056**</td>
<td>-0.115***</td>
<td>-0.063***</td>
<td>-0.055***</td>
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<tr>
<td></td>
<td></td>
<td>(0.025)</td>
<td>(0.022)</td>
<td>(0.018)</td>
<td>(0.019)</td>
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<tr>
<td></td>
<td>N</td>
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<td>897,091</td>
<td>897,091</td>
<td>897,091</td>
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</tr>
<tr>
<td></td>
<td>R2</td>
<td>0.005</td>
<td>0.505</td>
<td>0.714</td>
<td>0.714</td>
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<td>Year FE</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>HS-6 Product FE</td>
<td></td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>HS-6 Product Trend</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td></td>
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<tr>
<td>Firm FE</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Product × Year Controls</td>
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<td>YES</td>
<td>YES</td>
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## Robustness

<table>
<thead>
<tr>
<th></th>
<th>Balanced Sample</th>
<th>No Wholesalers</th>
<th>CES Import Price Index (4)</th>
<th>Natural Quantity Units (5)</th>
<th>CHN→FRA Exporters OLS (6)</th>
<th>IV: Export Restrictions (7)</th>
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</thead>
<tbody>
<tr>
<td><strong>Panel A. (log) Import Value</strong>&lt;sub&gt;fpt&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(log) # CHN→ROW Exporters&lt;sub&gt;pt&lt;/sub&gt;</td>
<td>0.152*** (0.041)</td>
<td>0.123*** (0.029)</td>
<td>0.115 (0.072)</td>
<td>0.281*** (0.054)</td>
<td>0.195*** (0.017)</td>
<td>0.271 (0.226)</td>
</tr>
<tr>
<td>N</td>
<td>486,849</td>
<td>897,091</td>
<td>134,482</td>
<td>308,718</td>
<td>811,958</td>
<td>811,958</td>
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<tr>
<td>R2</td>
<td>0.481</td>
<td>0.585</td>
<td>0.446</td>
<td>0.592</td>
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<td>0.580</td>
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<tr>
<td><strong>Panel B. (log) Import Quantity</strong>&lt;sub&gt;fpt&lt;/sub&gt;</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(log) # CHN→ROW Exporters&lt;sub&gt;pt&lt;/sub&gt;</td>
<td>0.196*** (0.046)</td>
<td>0.112*** (0.034)</td>
<td>0.159** (0.079)</td>
<td>0.285*** (0.044)</td>
<td>0.359*** (0.062)</td>
<td>0.212*** (0.019)</td>
</tr>
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<tr>
<td>R2</td>
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<td>0.534</td>
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<td><strong>Panel C. (log) Import Unit Value</strong>&lt;sub&gt;fpt&lt;/sub&gt;</td>
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</tr>
<tr>
<td>(log) # CHN→ROW Exporters&lt;sub&gt;pt&lt;/sub&gt;</td>
<td>-0.043** (0.020)</td>
<td>0.011 (0.015)</td>
<td>-0.041 (0.032)</td>
<td>-0.072*** (0.020)</td>
<td>-0.078*** (0.029)</td>
<td>-0.017** (0.008)</td>
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<tr>
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<td>134,482</td>
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<tr>
<td>R2</td>
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<tr>
<td>Firm, Year, HS-6 Product FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>HS-6 Product Trend</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<td>Product × Year Controls</td>
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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

<table>
<thead>
<tr>
<th>Importer Size Measure</th>
<th>Employment</th>
<th>Sales</th>
<th>Total Imports</th>
<th>Baseline</th>
<th>CES Index</th>
<th>Interacted Controls</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td></td>
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<tr>
<td><strong>Panel A. (log) Import Value(f_{p,t})</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(log) # CHN→ROW Exporters(_{p,t})</td>
<td>0.206***</td>
<td>0.205***</td>
<td>0.131***</td>
<td>0.123***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>× 2nd Down Size Tercile Dummy</td>
<td>0.011</td>
<td>0.009</td>
<td>0.029***</td>
<td>0.035***</td>
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<td></td>
</tr>
<tr>
<td>× 3rd Down Size Tercile Dummy</td>
<td>0.033**</td>
<td>0.041**</td>
<td>0.110***</td>
<td>0.122***</td>
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<td>811,373</td>
<td>811,373</td>
<td>811,373</td>
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<tr>
<td>R2</td>
<td>0.589</td>
<td>0.589</td>
<td>0.594</td>
<td>0.594</td>
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<tr>
<td><strong>Panel B. (log) Import Quantity(f_{p,t})</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(log) # CHN→ROW Exporters(_{p,t})</td>
<td>0.272***</td>
<td>0.267***</td>
<td>0.179***</td>
<td>0.175***</td>
<td>0.170***</td>
<td></td>
</tr>
<tr>
<td>× 2nd Down Size Tercile Dummy</td>
<td>0.010</td>
<td>0.005</td>
<td>0.039***</td>
<td>0.048***</td>
<td>0.047***</td>
<td></td>
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<tr>
<td>× 3rd Down Size Tercile Dummy</td>
<td>0.033**</td>
<td>0.039**</td>
<td>0.124***</td>
<td>0.142***</td>
<td>0.135***</td>
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<tr>
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<tr>
<td>R2</td>
<td>0.607</td>
<td>0.607</td>
<td>0.610</td>
<td>0.602</td>
<td>0.611</td>
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<tr>
<td><strong>Panel C. (log) Import Unit Value(f_{p,t})</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>(log) # CHN→ROW Exporters(_{p,t})</td>
<td>-0.060***</td>
<td>-0.062***</td>
<td>-0.048**</td>
<td>-0.043**</td>
<td>-0.047**</td>
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<tr>
<td>× 2nd Down Size Tercile Dummy</td>
<td>0.001</td>
<td>0.004</td>
<td>-0.010**</td>
<td>-0.022***</td>
<td>-0.013***</td>
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<tr>
<td>× 3rd Down Size Tercile Dummy</td>
<td>0.001</td>
<td>0.002</td>
<td>-0.013**</td>
<td>-0.040***</td>
<td>-0.013**</td>
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<tr>
<td>R2</td>
<td>0.713</td>
<td>0.713</td>
<td>0.713</td>
<td>0.693</td>
<td>0.713</td>
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<td>Firm, Year, HS-6 Product FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>HS-6 Product Trend</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Product × Year Controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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</table>
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 $\Rightarrow$ gains from trade smaller and more unequal across firms

▶ no (ii): ubiquitous sourcing $\Rightarrow$ no pro-competitive effects or unequal gains across firms

▶ no (iii): monopolistically or perfectly competitive suppliers $\Rightarrow$ 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
### Summary Statistics

#### Panel A. Importer Characteristics (Firm)

<table>
<thead>
<tr>
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<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>St Dev</td>
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<tr>
<td>employment</td>
<td>10,691</td>
<td>210</td>
<td>2,673</td>
<td>19</td>
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<tr>
<td>sales (EUR 1,000)</td>
<td>11,319</td>
<td>59,600</td>
<td>609,900</td>
<td>4,000</td>
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<tr>
<td>sales / worker (EUR 1,000)</td>
<td>10,679</td>
<td>460</td>
<td>2,854</td>
<td>215</td>
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<td>VA / worker (EUR 1,000)</td>
<td>10,634</td>
<td>63</td>
<td>477</td>
<td>44</td>
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<tr>
<td>total imports (EUR 1,000)</td>
<td>12,571</td>
<td>785</td>
<td>7,088</td>
<td>43</td>
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#### Panel B. Market Structure (HS-6 product)

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<td>N</td>
<td>Mean</td>
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<tr>
<td># CHN exporters to FRA</td>
<td>2,139</td>
<td>16.9</td>
<td>38.3</td>
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<td>C4 CHN exporters to FRA</td>
<td>2,139</td>
<td>0.87</td>
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<td>HHI CHN exporters to FRA</td>
<td>2,139</td>
<td>0.52</td>
<td>0.34</td>
<td>0.46</td>
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<td># CHN exporters to ROW w/o FRA</td>
<td>2,865</td>
<td>272</td>
<td>426</td>
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<td>C4 CHN exporters to ROW w/o FRA</td>
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<td>0.25</td>
<td>0.51</td>
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<td>HHI CHN exporters to ROW w/o FRA</td>
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<td>0.16</td>
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<td>0.09</td>
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<tr>
<td># FRA importers from CHN</td>
<td>2,863</td>
<td>28.6</td>
<td>72.1</td>
<td>6</td>
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<tr>
<td># FRA importers from ROW w/o CHN</td>
<td>2,903</td>
<td>374.1</td>
<td>652.8</td>
<td>195</td>
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Number of observations vary due to missing values.
## Summary Statistics

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<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>St Dev</td>
<td>Median</td>
<td>N</td>
<td>Mean</td>
<td>St Dev</td>
<td>Median</td>
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<td>3.9</td>
<td>7.5</td>
<td>1.5</td>
<td>3,600</td>
<td>2.8</td>
<td>7.1</td>
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<td>mean VA / worker CHN exporters (log)</td>
<td>2,699</td>
<td>4.16</td>
<td>0.82</td>
<td>4.09</td>
<td>3,576</td>
<td>5.01</td>
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<td>variance VA / worker CHN exporters (log)</td>
<td>2,546</td>
<td>7.23</td>
<td>2.23</td>
<td>7.31</td>
<td>3,454</td>
<td>9.30</td>
<td>2.27</td>
<td>9.35</td>
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<td>mean TFP CHN exporters (log)</td>
<td>2,699</td>
<td>6.93</td>
<td>0.89</td>
<td>6.85</td>
<td>3,576</td>
<td>7.57</td>
<td>0.97</td>
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<tr>
<td>variance TFP CHN exporters (log)</td>
<td>2,546</td>
<td>13</td>
<td>2.22</td>
<td>13.2</td>
<td>3,454</td>
<td>14.7</td>
<td>2.25</td>
<td>14.7</td>
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<tr>
<td>mean input unit value CHN exporters (log)</td>
<td>2,863</td>
<td>1.6</td>
<td>1.1</td>
<td>1.46</td>
<td>3,689</td>
<td>1.69</td>
<td>1.25</td>
<td>1.71</td>
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<tr>
<td>mean input unit value CHN exporters (log), de-meaned</td>
<td>2,863</td>
<td>4.17</td>
<td>1.4</td>
<td>4.22</td>
<td>3,689</td>
<td>4.29</td>
<td>1.48</td>
<td>4.30</td>
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<tr>
<td>share CHN processing trade</td>
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<td>0.36</td>
<td>0.32</td>
<td>0.29</td>
<td>3,695</td>
<td>0.26</td>
<td>0.27</td>
<td>0.16</td>
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<td>share CHN trade intermediaries</td>
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<td>0.41</td>
<td>0.24</td>
<td>0.40</td>
<td>3,695</td>
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<td>0.22</td>
<td>0.44</td>
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<tr>
<td>share CHN foreign-owned exporters</td>
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<td>0.17</td>
<td>0.12</td>
<td>0.15</td>
<td>3,695</td>
<td>0.17</td>
<td>0.12</td>
<td>0.14</td>
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<tr>
<td>share CHN multi-product exporters</td>
<td>2,865</td>
<td>0.95</td>
<td>0.11</td>
<td>0.99</td>
<td>3,695</td>
<td>0.94</td>
<td>0.11</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Number of observations vary due to missing values.
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 \( t_0 = 2000, N_{EXP_{p,t_0}} \)
  - 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 \( N_{p,t_0} = N_{EXP_{p,t_0}} / DER_{s,t_0} \) where \( p \) belongs to sector \( s \).
  - Infer the potential number of firms that could export product \( p \) at time \( t \) as \( N_{IV_{p,t}} = N_{p,t_0} DER_{st} \) where \( p \) belongs to sector \( s \).
### Instrumental Variables

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<tbody>
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<td>•Reg. K ≥ 2M</td>
<td>•Reg. K ≥ 2M</td>
<td>•Reg. K ≥ 2M</td>
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<tr>
<td></td>
<td>•Register</td>
<td>•Register</td>
<td>Reg. K ≥ 1M if M&amp;E</td>
<td>Reg. K ≥ 1M if M&amp;E</td>
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<tr>
<td>Pudong New Area</td>
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<td>No difference from the rest of China</td>
<td>No difference from the rest of China</td>
<td>•Reg. K ≥ 0.5M</td>
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<td>State or Public Owned</td>
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<td>•Reg. K ≥ 3M</td>
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<td>Domestic Firm</td>
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<td>•Reg. K ≥ 2M if Inst.</td>
<td>•Reg. K ≥ 2M if Inst.</td>
<td>•Reg. K ≥ 2M if Inst.</td>
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<tr>
<td></td>
<td>•Register</td>
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<td>•Register</td>
<td>•Register</td>
<td>•Register</td>
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<td>Private Owned Domestic Firm</td>
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<tr>
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<tr>
<td></td>
<td>Sales ≥ 30M if M&amp;E</td>
<td>•Apply for Approval</td>
<td>•Register</td>
<td>•Register</td>
<td>•Register</td>
</tr>
</tbody>
</table>

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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