# Global Sourcing and Domestic Production Networks

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Penn State Seminar

April 22, 2019

# Remaining questions about global value chains (GVC)

- Production has become increasingly fragmented within and across countries.
- An extensive literature studies the causes and consequences of global production fragmentation.
- Research on the domestic segment of global value chains has been sparse, both the spatial and sectoral aspects.
- Who is trading with whom in the domestic economy? How foreign sourcing complements or substitutes for domestic sourcing?
- Broad implications: propagation of shocks; knowledge spillover; the aggregate effects of misallocation of resources; gains (and losses) from trade.

# What we do in this paper?

- Use Japanese firms' production network data (4.5 million buyer-supplier links for 2005, 2010, and 2013) to study:
  - the spatial and sectoral patterns of firms' global and domestic sourcing;
  - how firms' offshoring decisions affect their choices of domestic suppliers.
- Extend the model of Antràs, Fort, and Tintelnot (2017) (Eaton-Kortum 2002 within firms):
  - Heterogeneous buyers and sellers;
  - Fixed and variable costs for both domestic and foreign trade;
  - Multiple input industries with varying degrees of product differentiation;
  - Firms' endogenous trade costs that depend on the intensity of face-to-face communication.

# Main Empirical Findings

- Firms are less likely to source inputs from distant suppliers and foreign suppliers (countries), especially for differentiated inputs.
- Based on a firm-level instrument for offshoring (based on world export supply shocks):
  1. Firms after offshoring are more likely to add but less likely to drop domestic suppliers, compared to non-offshorers (i.e., the net effect is positive).
  2. Suppliers that are being added are on average bigger but located closer to the offshoring firms.
  3. New input industries in the domestic economy that are being added tend to be more differentiated and located more proximately.
- These choices of suppliers reduce the average distance of domestic sourcing (i.e., localization of domestic production networks).

Literature Review

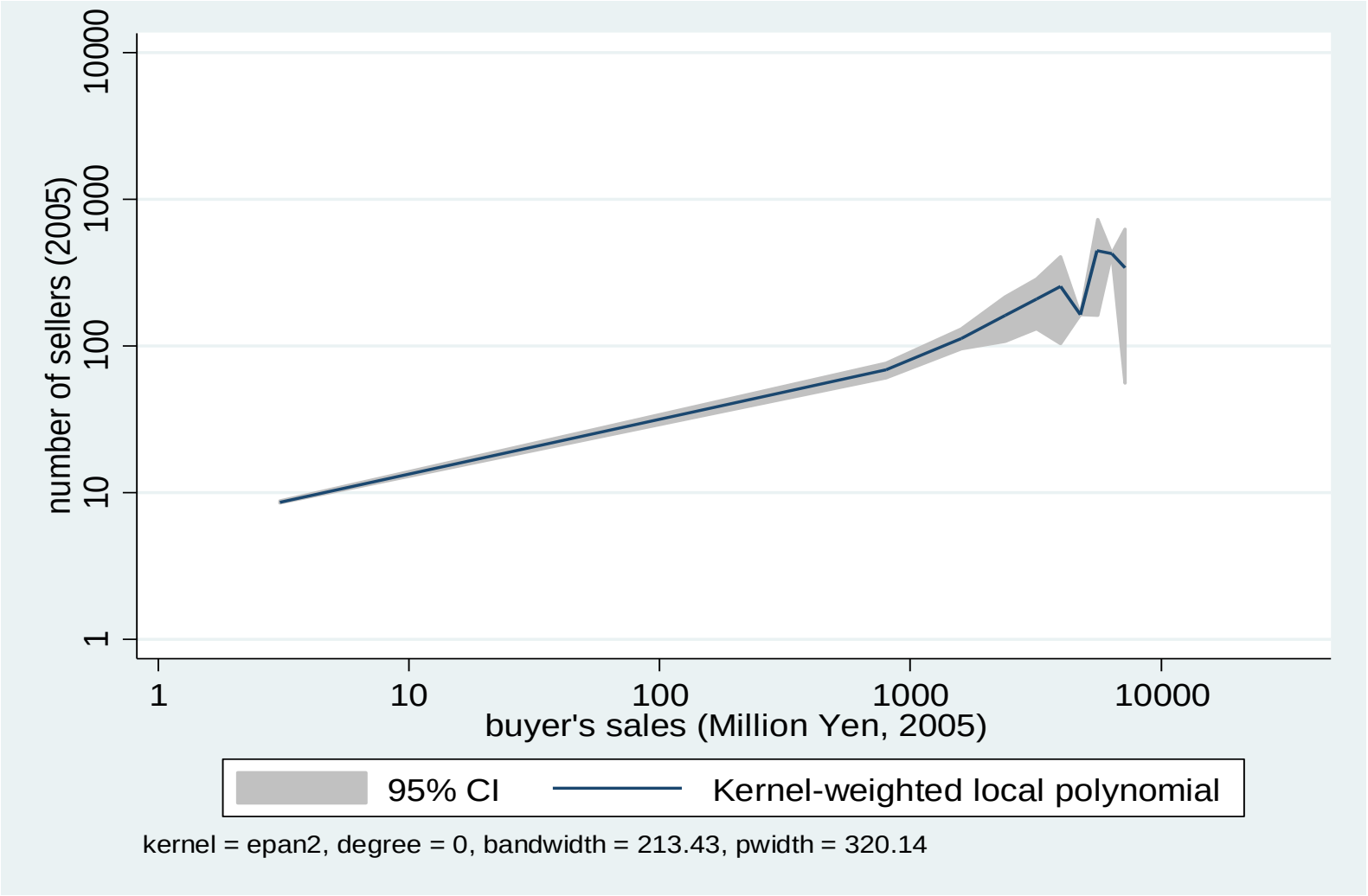
# Literature Review

- Domestic production networks
  - Acemoglu et al. (12); Oberfield (13); Carvalho and Gabaix (13); Carvalho, Nirei, and Saito (14); Boehm, Flaaen, Pandalai-Nayar (15); Baqaee (16); Barrot and Sauvagnat (18); Lim (17); Bernard, Moxnes and Saito (18); Tintelnot, et al. (18); Baqaee and Farhi (19) ...
- Firms' global sourcing and endogenous firms' performance
  - Ramanarayanan (14); Blaum, Lelarge, and Peters (16); Kee and Tang (16); Antràs, Fort, and Tintelnot (17), Bernard et al. (18)
- Two-sided heterogeneity and trade
  - Rauch (99); Rauch and Trindade (02); Chaney (14); Eaton et al. (14); Carballo, Ottaviano, and Volpe Martincus (16); Bernard, Moxnes and Ulltveit-Moe (17); Sugita, Teshima, Seira (17), ...
- Economic Georgraphy
  - Davis and Weinstein (02); Duranton and Overman (05); Redding and Turner (15); Davis and Dingel (16), Gaubert (18), ...

# Data

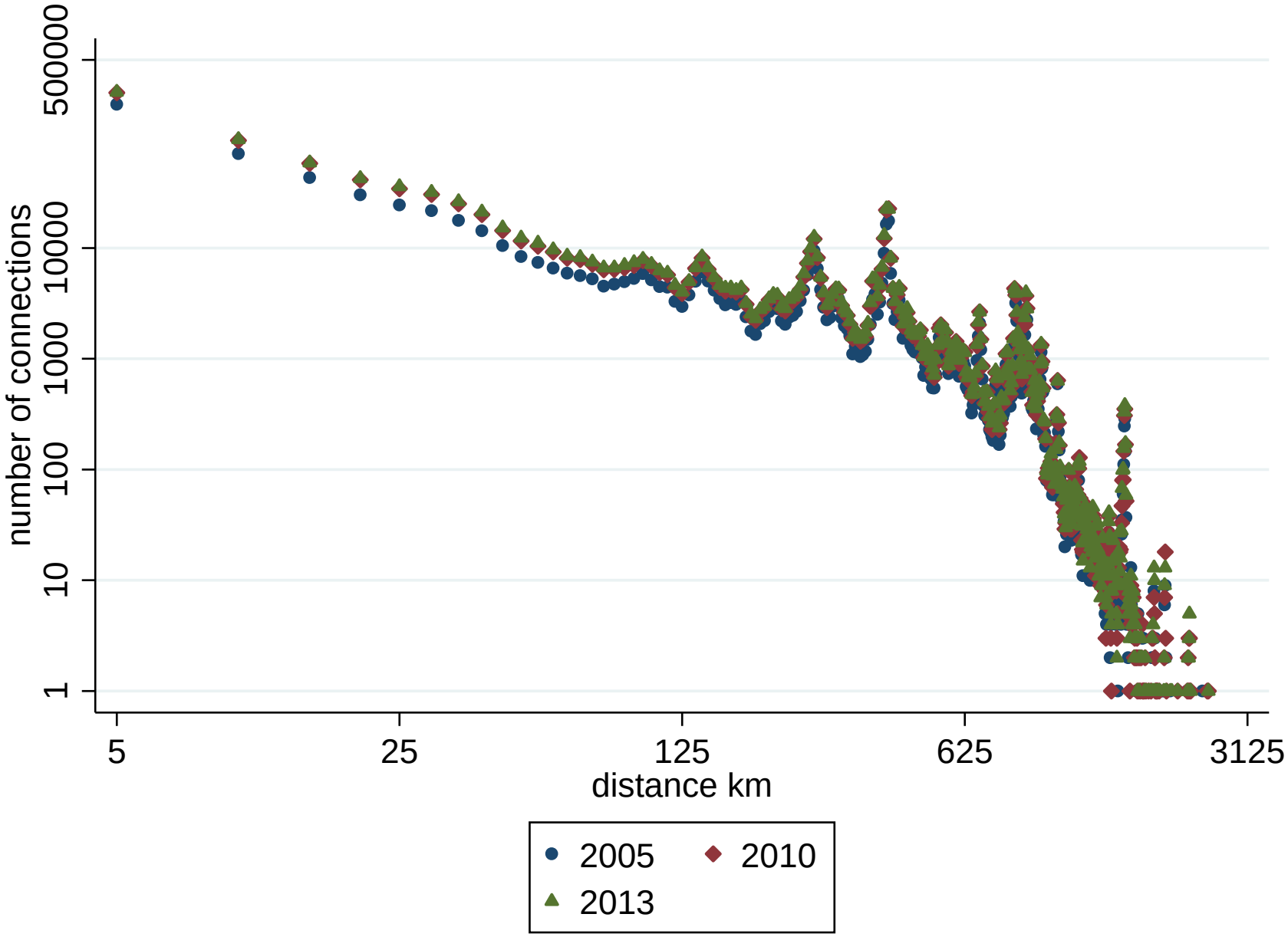
- Data from the Tokyo Shoko Research, Ltd. (TSR)
- Around 800,000 firms per year in our 3-year sample.
- Info on between-firm relationships: the names of a firm's top *domestic* suppliers (up to 24) and buyers (up to 24).
- Use a two-way matching method to construct the domestic production network in Japan.
- The top seller (an intermediary) in our constructed production network has over 11,000 buyers in 2010; the top buyer (construction company) has close to 8,000 suppliers.
- Basic firm-level balance sheet info:
  - employment, sales, location, up to three main industries (4-digit), establishment year, number of factories.

# Productivity and the Scope of Sourcing




regressions map

# Distance and the Number of Sellers



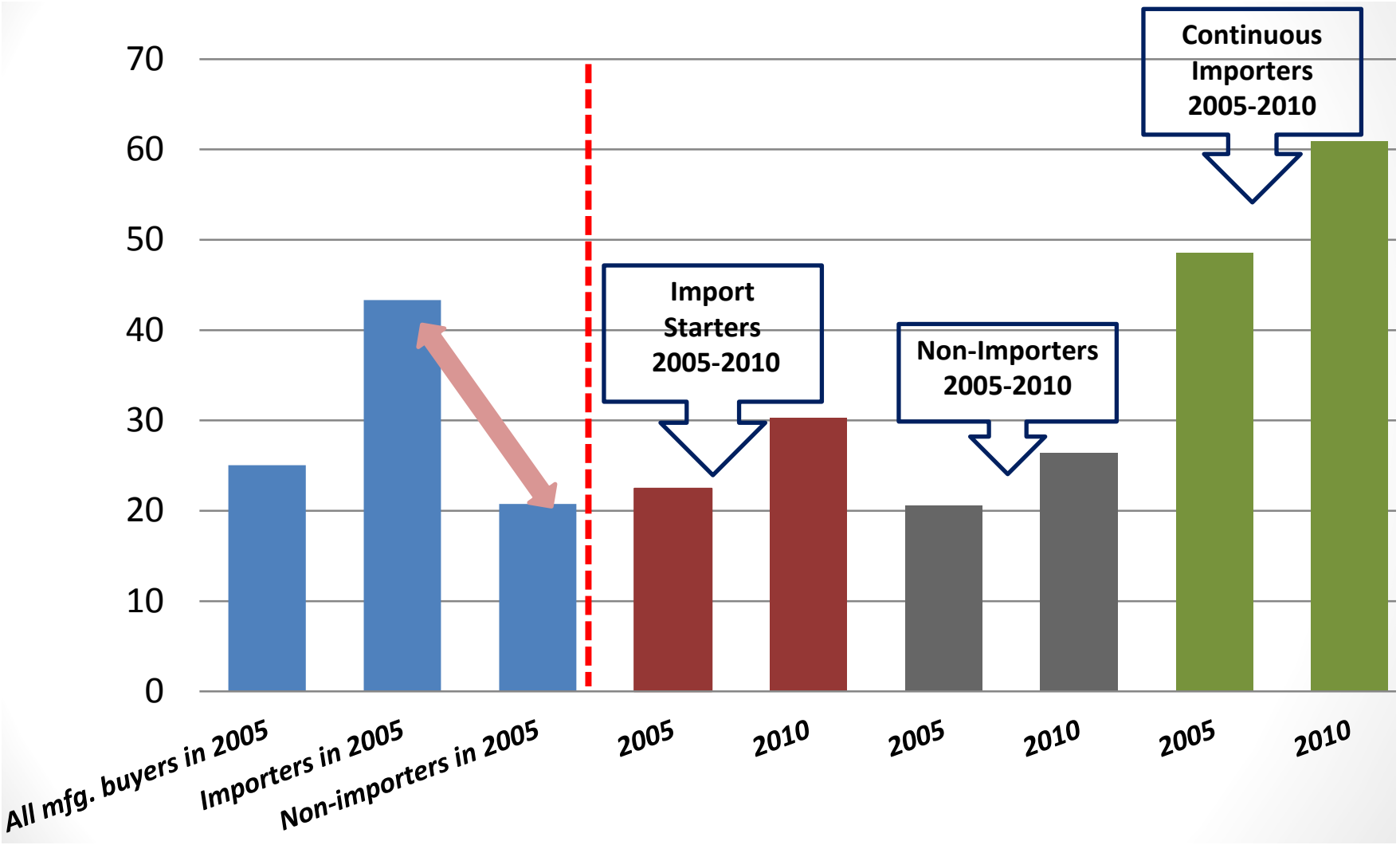
# Manufacturing Buyers' Data

Basic Survey on Business Structure and Activities (BSBSA), from Japan's Ministry of Economy, Trade and Industry (METI).

- All firms with at least 50 employees or 30 million yen of paid-in capital in the Japanese manufacturing, mining, wholesale and retail, and several other service sectors.
- 22,000-25,000 firms for our sample period.
- Detailed information on firms' business activities: main industry code (3 digit), employment, sales, purchases, exports, and imports (by 5 continents and 12 broad sectors).

Firm-Size Rank

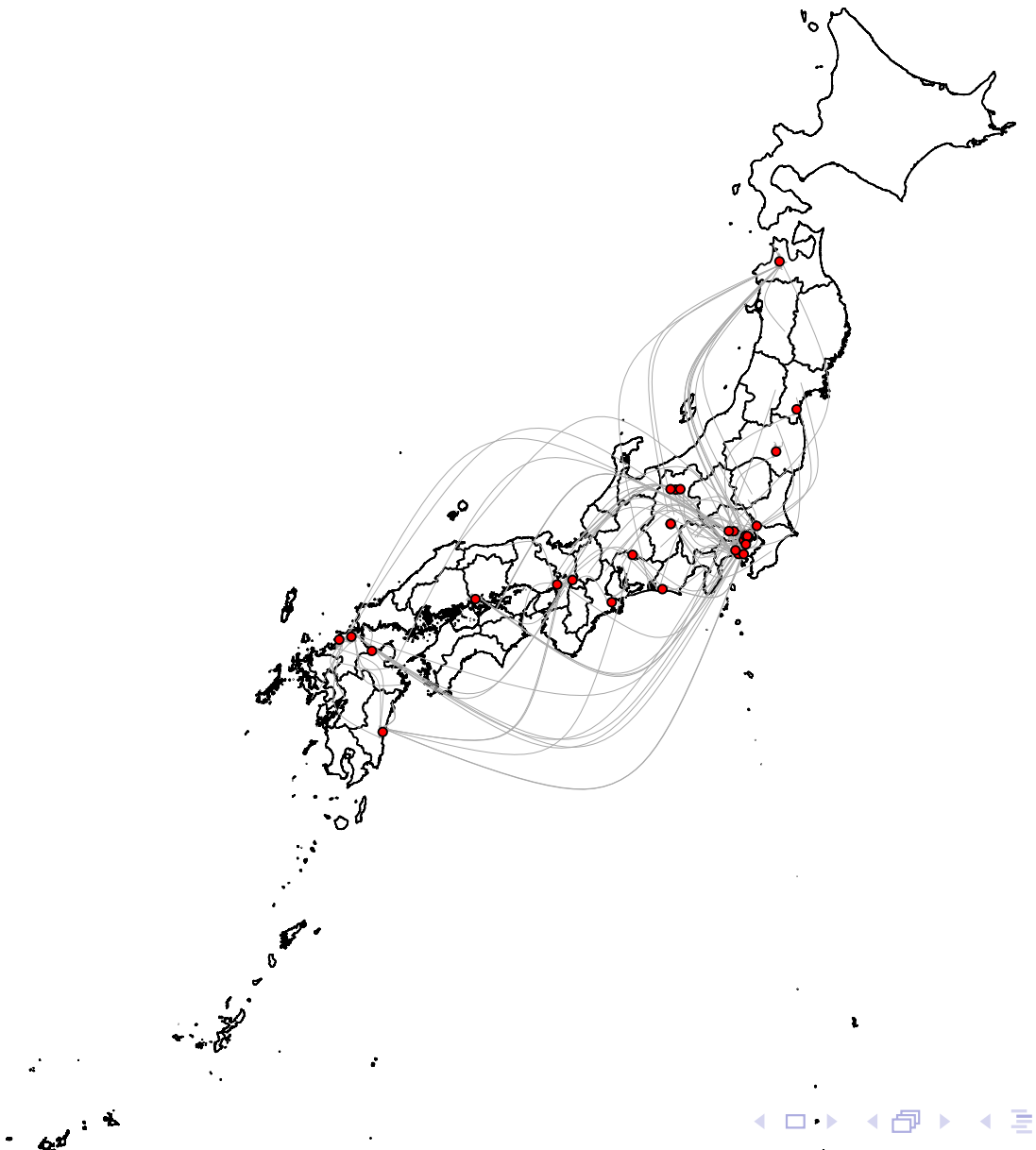
# Number of Suppliers by Buyer Type




Number of Sellers

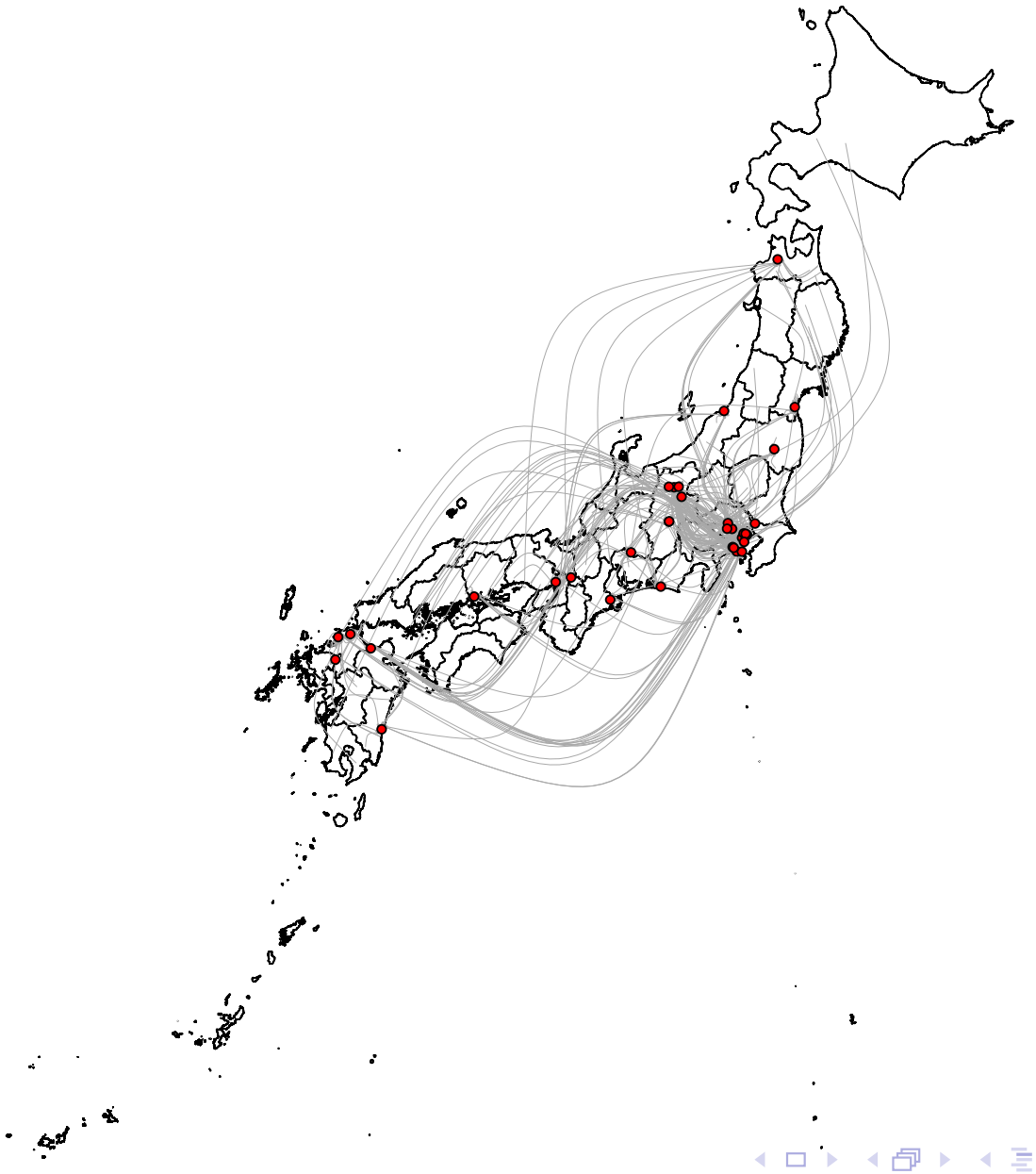
# Newly Offshoring Electronics Producers

## Dropped Suppliers



# Newly Offshoring Electronics Producers

## Added Suppliers



# Post-offshoring Firm Performance

| Dep. Var.: | Δlog(Sales) | Δlog(Nb. Sellers) | Δlog(Nb. Source Industries) | Δlog(Nb. Source Regions) | $\frac{dist_{10} - dist_{05}}{\frac{1}{2}(dist_{10} + dist_{05})}$ | Δlog(dist) |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Imp Starter$_{t-5,t}$ | 0.0348** | 0.0489** | 0.0491** | 0.0282 | -0.0407* | -0.0526* |
| | (0.016) | (0.022) | (0.022) | (0.020) | (0.023) | (0.029) |
| Cont Importer$_{t-5,t}$ | 0.00404 | -0.00909 | -0.0196 | -0.0126 | -0.0298** | -0.0358* |
| | (0.012) | (0.013) | (0.012) | (0.012) | (0.014) | (0.019) |
| log(TFP)$_{t-5}$ | -0.0351* | 0.0269 | 0.0157 | 0.0212 | -0.0396 | -0.0354 |
| | (0.019) | (0.022) | (0.020) | (0.019) | (0.024) | (0.031) |
| Buyer (4-digit) Ind FE | √ | √ | √ | √ | √ | √ |
| Buyer Region FE | √ | √ | √ | √ | √ | √ |
| Nb Obs | 6655 | 6183 | 6182 | 6172 | 6181 | 6177 |
| R-squared | .21 | .161 | .16 | .131 | .114 | .123 |

s.e. clustered by buyer's region.

## Model

# Set-up

- Antràs, Fort and Tintelnot (2017; AFT) + Bernard, Moxnes and Saito (2017; BMS) + multiple input industries.
- Final goods markets: Dixit-Stiglitz preferences with $\sigma > 1$; monopolistic competition.
- Production of 1 final good requires $S$ types of intermediate inputs.
- Two-sided firm heterogeneity in productivity
- Intermediate inputs can be sourced from $M$ domestic regions + $M*$ foreign regions.
- Each region has an exogenous number of input suppliers.

# Final-good Producers (Buyers)

- First, for each input industry $s$, aggregates input varieties (indexed by $j$) into composites:

$$\tilde{x}_{is} = \left[ \int_0^1 x_{is}(j)^{\frac{\rho_s - 1}{\rho_s}} dj \right]^{\frac{\rho_s}{\rho_s - 1}},$$

  where $\rho_s$ is the elasticity of substitution between different intermediate varieties.

- Then assemble the composite inputs into final goods:

$$y_i = \varphi_i \prod_{s=1}^{S} \left( \frac{\tilde{x}_{is}}{\beta_s} \right)^{\beta_s},$$

- where $\varphi$ is the buyer's core productivity.

# Buyer's Problem

1. Buyer $i$ and each potential supplier draw its productivity of input production (z's) from an industry-specific Fréchet distribution, before making sourcing decisions.

2. Given final-good and input productivities, pay fixed $f$ to outsource in each industry; and additional $f_s$ to search in a region for input suppliers. Supplier set: $\Omega_{is}$. ▸ Trade Costs

3. For each input variety $j \in [0, 1]$ from industry $s$ that it has chosen to outsource, choose the lowest-cost (inclusive of trade costs) supplier in $\Omega_{is}$ + itself.

4. For each region $r \in \Omega_{is}$, choose the sector-specific optimal intensity of communication with the sellers.

5. Buyer $i$ optimally sets its final-good price (= constant mark-up over marginal cost) to sell the goods to consumers.

# Input Quality and Endogenous Communication

- Firms can engage in (face-to-face) communication with the supplier, with intensity measured by ($q$).
- Benefit of communication:
  - Prob $q$ ($q = 1$ for insourcing), an input supplier will produce high-quality inputs.
  - Prob $1 - q$, the supplier will produces low-quality (useless) inputs.
- Communication is costly:
- The iceberg trade cost is multiplied by $e^{m(d)q}$, where $m$ is an increasing function of distance.

# Unit Cost of Production and Communication Intensity

- For input composite $s$, conditional on the set of sourcing regions chosen, the marginal cost is

$$\tilde{c}_{is} = \left[ \mu(I_{is0}) \int_0^\infty p^{1-\rho_s} dG_{is0}(p) + \sum_{r \in \Omega_{is}} \mu(I_{isr}) \int_0^\infty \left( q_{isr}^{\frac{\rho_s}{1-\rho_s}} p \right)^{1-\rho_s} dG_{isr}(p) \right]^{\frac{1}{1-\rho_s}}.$$

- where $p$ denotes the lowest cost the buyer pays for each unit of input variety $j$.
- The optimal communication intensity:

$$q_{isr} = \frac{\rho_s}{(\rho_s - 1) m(d_{ir})}.$$

$q_{isr}$ is decreasing in $\rho_s$ and $d_{ir}$.

# Firms' Equilibrium Sourcing Patterns

- Thanks to Fréchet and Eaton and Kortum (2002), the share of inputs $s$ sourced from region $r$:

$$s_{isr} = \frac{\Phi_{isr}}{\Phi_{is0} + \sum_{r \in \Omega_{is}} \Phi_{isr}}$$

- where sourcing capability in each sector-region:

$$\Phi_{isr} = \begin{cases} T_{s0}(w_0 c_s)^{-\theta_s} & \text{if } r = 0 \\ n_{sr} T_{sr}(\tau_s(d_{ir}) w_r c_s)^{-\theta_s} \left[\frac{\rho_s}{(\rho_s - 1) m(d_{ir})}\right]^{\frac{\rho_s \theta_s}{\rho_s - 1}} e^{-\frac{\rho_s \theta_s}{\rho_s - 1}} & \text{if } r > 0, \end{cases}$$

# Buyer's Profit

- Buyer i's profits:

$$\pi_i(\varphi_i) = B\psi_i^{1-\sigma} - \sum_{s=1}^{S} \delta_{is} \left[ f + \sum_{r \in \Omega_{is}} f_s \right]$$

where

- $$\psi_i \equiv \varphi_i^{-1} \prod_{s=1}^{S} \gamma_s^{\beta_s} \Phi_{is}^{-\frac{\beta_s}{\theta_s}}.$$

- and $\delta_{is}$ is a dummy equal to 1 if sourcing in industry s.

## Hypothesis

*The share of inputs insourced and the share of inputs sourced to closer regions are both greater for the more differentiated inputs.*

# Effects of Firms' Offshoring

- Direct Replacement Effect: When triggered by foreign cost shocks, firms start offshoring inputs from foreign suppliers, which replace their less productive domestic suppliers in the same industry.
- Productivity Effect: The resulting decline in the firms' marginal costs induces the firm to expand domestic sourcing to the more productive suppliers located farther away.
- Industry Composition Effect: Outsourcing in new input industries (tend to be more differentiated).

# The Pattern of Domestic Sourcing

- $$\log \frac{\Phi_{isr}}{\Phi_{isr_s(i)}} = \underbrace{-\log n_{sr_s(i)} - \log T_{sr_s(i)} + \theta_s \log w_{r_s(i)} + \frac{\rho_s \theta_s}{\rho_s - 1} \log m(d_{ir_s(i)})}_{\text{input-industry base-region-specific}}$$
$$+ \quad \underbrace{\log n_{sr} + \log T_{sr} - \theta_s \log w_r}_{\text{input-industry source-region-specific}}$$
$$- \theta_s \frac{\rho_s}{\rho_s - 1} \times \log m(d_{ir}) - \theta_s \log t_s(d_{ir})$$
- Suppose
$$m(d_{ir}) = d_{ir}^{\beta}$$
$$t_s(d_{ir}) = d_{ir}^{\gamma \phi_s}$$
- where $\phi_s$ stands for the time sensitivity of the input delivery.
- Empirical counterpart:
$$\log \frac{N^s_{irs}}{N^s_{isr(i)}} = -\beta \left[ \frac{\rho_s \theta_s}{\rho_s - 1} \log d_{ir} \right] - \gamma \left[ \phi_s \theta_s \log d_{ir} \right] + \left[ FE_{sr(i)} + FE_{sr} \right] + \varepsilon_{irs}$$

# Estimated Parameters

- $\rho_s$: estimated elasticity of substitution between imported varieties in each industry s in the U.S. from Soderbery (2015), improved the original estimates by Broda and Weinstein (2006).
- $\theta_s$: Caliendo and Parro (2015), who estimate $\theta$ using data on bilateral trade between 16 economies for 20 ISIC sectors.
  - Our own firm-based estimates: use the empirical distribution of firms' revenue to estimate.
- $\phi_s$: the share of air freight costs in U.S. imports in industry s to proxy for the importance of timely delivery.

# Distance, Product Differentiation, and Domestic Sourcing

**Table 4: Distance, Scope of Domestic Outsourcing, and Product Differentiation of Inputs**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dependent Variable: | $\ln(N_{i,\text{source pref}}/N_{i,\text{nearest pref}})_{\text{input ind}}$ | | | | | |
| Estimated θ: | Caliendo-Parro | | | Estimates using Firm Data | | |
| $\ln(\text{dist})_{i,\text{source pref}} \times \theta$ | -0.00535*** | 0.00262 | | -0.00386*** | 0.00215 | |
| | (0.001) | (0.002) | | (0.001) | (0.002) | |
| $\ln(\text{dist})_{i,\text{ source pref}} \times \theta \times \rho/(\rho-1)$ | | -0.00565*** | -0.00516*** | | -0.00441*** | -0.00524*** |
| | | (0.002) | (0.002) | | (0.001) | (0.001) |
| $\ln(\text{dist})_{i,\text{source pref}} \times \theta \times \text{air}$ | | | -0.000379 | | | -0.000651** |
| | | | (0.000) | | | (0.000) |
| Input Ind × Closest Region FE | √ | √ | √ | √ | √ | √ |
| Input Ind × Source Region FE | √ | √ | √ | √ | √ | √ |
| Input Ind × Buyer Region FE | - | - | - | - | - | - |
| R-sq | .278 | .275 | .274 | .325 | .275 | .274 |
| Nb of Obs | 49485 | 48735 | 48550 | 55609 | 49668 | 49483 |

relationships are removed from the sample. Data for 2005 are used while the results based on 2010 data are reported in Table A5 in the appendix. Observations are at the buyer input-industry source-region level. All regressions include input-industry-closest-region and input-industry-source-region fixed effects, where the closest region is the closest prefecture from which firm i sources intermediate inputs in a particular industry. Standard errors, clustered at the input-industry-source-region level, are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

s.e. clustered by input-industry-source-region. Parent-child pairs were removed (5%).

- Results are robust to clustering by buyer; restricting to single-plant buyers or single-plant sellers.

# Back of the Envelope Calculation

- Relative to the nearest region, a 10% increase in the distance lowers the number of sellers by 0.5% for an industry with a mean value of $\theta_s$ (9.82).
- -0.47%=-0.00535*0.1*9.82.
- A one standard-deviation increase in $\rho_s/(\rho_s - 1)$ (0.262) from the sectoral mean is associated with an additional 0.13% decline in the relative number of sellers.

# Extensive Margin of Domestic Sourcing

**Table 5: The Incidence of Domestic Sourcing and Product Differentiation of Inputs**

| Panel A | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dependent Variable: | $\text{Outsource}_{\text{source pref, input industry}}$ | | | | | |
| Estimated θ: | Caliendo-Parro Estimates | | | | | |
| $\ln(\text{dist}+1)_{\text{i, source pref}} \times \theta$ | -0.0010*** | 0.00403*** | | -0.00100*** | 0.00402*** | |
| | (0.000) | (0.000) | | (0.000) | (0.000) | |
| $\ln(\text{dist}+1)_{\text{i,source pref}} \times \theta \times \rho/(\rho-1)$ | | -0.00399*** | -0.00156*** | | -0.00401*** | -0.00158*** |
| | | (0.000) | (0.000) | | (0.000) | (0.000) |
| $\ln(\text{dist} + 1)_{\text{i,source pref}} \times \theta \times \text{air}$ | | | -0.000194*** | | | -0.000195*** |
| | | | (0.000) | | | (0.000) |
| Buyer FE | - | - | - | √ | √ | √ |
| Input Sector (12) × Source Region FE | √ | √ | √ | √ | √ | √ |
| R-sq | 0.052 | 0.056 | 0.055 | 0.087 | 0.092 | 0.09 |
| Nb of Obs | 7773612 | 7773612 | 7773612 | 7773612 | 7773612 | 7773612 |

s.e. clustered by buyer.

# Extensive Margin of Offshoring

**Table 6: The Incidence of Offshoring and Product Differentiation of Inputs**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Dependent Variable: | $\text{Offshore}_{\text{input industry}}$ | | | |
| Estimated θ: | Caliendo-Parro Estimates | | Estimates using Firm Data | |
| Domestic sourcing dummy | 0.0747*** | 0.0681*** | 0.0748*** | 0.0683*** |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| $\text{TFP}_{\text{buyer,2005}}$ | 0.0109*** | | 0.00962*** | |
| | (0.001) | | (0.001) | |
| $\text{TFP}_{\text{buyer,2005}} \times \theta \times \rho/(\rho\text{-}1)$ | -0.000414*** | -0.000408*** | -0.000193*** | -0.000176*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Input Sector (12) FE | √ | √ | √ | √ |
| Buyer FE | - | √ | - | √ |
| R-sq | .03 | 0.136 | .0297 | .136 |
| Nb of Obs | 257208 | 257208 | 257208 | 257208 |

Note: The regression sample includes manufacturing buyers only and domestic suppliers from both manufacturing and non-manufacturing sectors. Data for 2005 are used. The unit of observation in all columns is at the buyer-source-region-sector level. Parent-child relationships are removed from the sample. Columns 1 and 2 use the estimated θ from Caliendo and Parro (2014), while columns 3 and 4 use our own firm-based estimates of θ. All columns include input-sector fixed effects, while columns 2 and 4 include buyer fixed effects as well. Standard errors, clustered at the buyer level, are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

s.e. clustered by buyer.

# Offshoring and Restructuring of Production Networks

- Does a buyer's offshoring decision affect its choices of domestic suppliers?
- What kind of domestic suppliers are most affected?

$$
\begin{aligned}
I_{ijt} = {} & \beta_1 starter_{it} + \gamma_1 starter_{it} \times \log\left(x_{ij}\right) \\
& + \beta_2 cont_{it} + \gamma_2 cont_{it} \times \log\left(x_{ij}\right) \\
& + \delta \log sales_j + \left[FE_{is} + FE_{r(j)t}\right] + \varepsilon_{ij},
\end{aligned}
$$

- $i$ and $j$ are buyer, domestic seller.
- $I_{ijt} = Drop_{ijt} = 1$ if $i$ and $j$ are linked in t, but not anymore in $t + k$.
- $I_{ijt} = Add_{ijt} = 1$ if a link btw $i$ & $j$ was formed since $t$ before $t + k$.
- $(x_{ij})$ is a measure of seller characteristics.

# Instrument for Firms' Offshoring Decision ($\Delta imp_i$)

- Following Hummels et al. (2014)

$$WES_{it} = \sum \phi_{is,t-k} WES_{st}$$

- $WES_{st} = ln(exp)_{s,t} - ln(exp)_{s,t-k}$. Japan is excluded from the set of destination countries.
- $\phi_{is,t-k} = 1$ if firm $i$ sources inputs domestically in industry $s$ in year $t-k$.

# Supplier Adding and Dropping

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dependent Variable | $Drop_{ijt}$ | | $Imp\ Starter_{it}$ | $Add_{ij}$ | | $Imp\ Starter_{it}$ |
| | OLS | 2SLS | First Stage | OLS | 2SLS | First Stage |
| $Imp\ Starter_{it}$ | 0.0173*** | -0.547*** | | 0.0166*** | 0.838*** | |
| | (0.005) | (0.166) | | (0.005) | (0.189) | |
| $Cont\ Imp_{it}$ | 0.00748 | -0.594*** | -1.065*** | -0.0288*** | 0.847*** | -1.066*** |
| | (0.007) | (0.177) | (0.001) | (0.007) | (0.201) | (0.000) |
| $WES_{it}$ | | | 0.119*** | | | 0.108*** |
| | | | (0.006) | | | (0.006) |
| Seller's ln(sales) | √ | √ | √ | √ | √ | √ |
| Buyer*Input Ind FE | √ | √ | √ | √ | √ | √ |
| Seller's Pref FE*Year FE | √ | √ | √ | √ | √ | √ |
| Nb of Obs | 431622 | 431622 | 431622 | 556773 | 556773 | 556773 |
| Kleibergen-Paap F statistic | | | 365.08 | | | 367.65 |

# Patterns of Supplier Dropping

| Dependent Variable | $Drop_{ijt}$ | | | |
|---|---|---|---|---|
| Seller's Characteristics ($x_j$) | dist | dist | emp | emp |
| Imp Starter$_i$ | -2.187 | -2.176* | 48.27 | 17.10*** |
| | (2.119) | (1.129) | (32.231) | (5.645) |
| Cont Imp$_i$ | -1.116** | -0.794*** | 8.651 | 2.057** |
| | (0.564) | (0.210) | (6.197) | (0.852) |
| Imp Starter$_i$ × log($x_j$) | **0.353** | **0.429** | **-2.307** | **-0.812*** ** |
| | **(0.492)** | **(0.286)** | **(1.523)** | **(0.265)** |
| Cont Imp$_i$ × log($x_j$) | **0.0628** | **0.0621** | **-0.414** | **-0.0951*** ** |
| | **(0.088)** | **(0.041)** | **(0.275)** | **(0.032)** |
| log($x_j$) | -0.0489 | -0.0523 | 0.371 | 0.103*** |
| | (0.077) | (0.039) | (0.240) | (0.031) |
| Seller's ln(sales) | √ | √ | √ | √ |
| Buyer*Input Ind FE | √ | | √ | |
| Input Ind FE | | √ | | √ |
| Seller's Pref FE*Year FE | √ | √ | √ | √ |
| Nb of Obs | 430440 | 467324 | 431622 | 468670 |
| Kleibergen-Paap F statistic | 1.58 | 5.27 | 1.23 | 6.15 |

# Patterns of Supplier Adding

| Dependent Variable | $Add_{ijt}$ | | | |
|---|---|---|---|---|
| Seller's Characteristics ($x_j$) | dist | dist | emp | emp |
| Imp Starter$_i$ | 8.078** | 1.978*** | -10.76** | -2.606*** |
| | (3.334) | (0.665) | (4.559) | (0.469) |
| Cont Imp$_i$ | 3.504** | 0.947*** | -2.944* | -0.327 |
| | (1.437) | (0.365) | (1.639) | (0.318) |
| Imp Starter$_i$ × log($x_j$) | -1.616** | -0.337*** | 3.028*** | 0.817*** |
| | (0.682) | (0.108) | (1.170) | (0.095) |
| Cont Imp$_i$ × log($x_j$) | -0.427** | -0.0729*** | 0.791*** | 0.166*** |
| | (0.180) | (0.024) | (0.306) | (0.019) |
| log($x_j$) | 0.390** | 0.0840*** | -0.692** | -0.157*** |
| | (0.157) | (0.022) | (0.270) | (0.019) |
| Seller's ln(sales) | √ | √ | √ | √ |
| Buyer*Input Ind FE | √ | | √ | |
| Input Ind FE | | √ | | √ |
| Seller's Pref FE*Year FE | √ | √ | √ | √ |
| Nb of Obs | 555480 | 590630 | 564195 | 599305 |
| Kleibergen-Paap F statistic | 3.441 | 27.040 | 3.462 | 48.134 |

First Stage

# Region and Industry Adding

| Dependent Variable | $Add_{ir}$ | | $Add_{is}$ |
|---|---|---|---|
| Measure of Prod Diff | Rauch | $\rho/(\rho-1)$ | - |
| | | | |
| Imp $Starter_{it}$ x $Diff_s$ | 0.508** | 1.422** | |
| | (0.225) | (0.585) | |
| | | | |
| Imp $Starter_i$ x $Dist_{ir}$ | | | -0.470*** |
| | | | (0.022) |
| | | | |
| Input Industry FE | √ | √ | √ |
| Buyer FE | √ | √ | |
| Seller's Region FE | | | √ |
| Number of Obs. | 686970 | 673500 | 26169 |
| Kleibergen-Paap F statistic | 10.404 | 6.854 | 16.38 |

# Concluding Remarks

- How offshoring shapes firms' domestic production networks?
- We show that differentiated inputs are less likely to be sourced from distant regions or abroad.
- Upon firms' offshoring, the resulting reduction in variable cost of production expands the scope of domestic outsourcing within each industry, adding more productive domestic suppliers.
- but the increased need to communicate with suppliers in the newly added (differentiated) industries encourage the offshoring firms to source more locally.
- Firms' global sourcing can be a possible source of localization of trade, and possibly industry agglomeration.

# The Spatial Pattern of Domestic Sourcing

**Table A4: Firm Productivity, Distance, and the Scope of Domestic Sourcing (2010)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Dependent Variable | ln(# sellers' prefectures)$_{buyer}$ | | ln(# sellers)$_{buyer}$ | | ln(# jsic 4-digit outsourced)$_{buyer}$ | | ln(Sales/Emp)$_{seller}$ |
| Measure of Buyer's Productivity | TFP (OP) | VA/Emp | TFP (OP) | VA/Emp | TFP (OP) | VA/Emp | - |
| Productivity$_{buyer}$ | 0.104*** | 0.344*** | 0.141*** | 0.553*** | 0.110*** | 0.485*** | |
| | (0.021) | (0.016) | (0.027) | (0.025) | (0.023) | (0.021) | |
| ln(distance) | | | | | | | 0.0543*** |
| | | | | | | | (0.001) |
| Buyers' (4-digit) Industry FE | √ | √ | √ | √ | √ | √ | |
| Buyer's Prefecture FE | √ | √ | √ | √ | √ | √ | |
| Buyer FE | | | | | | | √ |
| Sellers' (4-digit) Industry FE | | | | | | | √ |
| Sellers' Prefecture FE | | | | | | | √ |
| Parent-subsidiary dummy | | | | | | | √ |
| Distance | | | | | | | b/w buyer-seller |
| SE clustering | | | Buyers' (4-digit) Industry | | | | Buyer |
| R-sq | .191 | .247 | .191 | .261 | .2 | .271 | .646 |
| Nb of Obs | 8701 | 8742 | 8701 | 8742 | 8701 | 8742 | 598946 |

Note: The regression sample includes manufacturing buyers only and domestic suppliers that are either manufacturing or non-manufacturing. The unit of observation is at the buyer level from columns (1) to (6), and at the buyer-seller level in columns (7). All regressions include the most exhaustive set of fixed effects possible. Standard errors, clustered at the buyer's industry level, are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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# First Stage of the Supplier Dropping Regressions

**Table A7: First-Stage of the FE-IV Regressions Reported in Table 8**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Dependent Variable | Imp Starter$_i$ | Imp Starter$_i$ | Imp Starter$_i$ × log(dist$_j$/dist$_{10}$) | Imp Starter$_i$ | Imp Starter$_i$ × ln(sales$_j$/sales$_{10}$) | Imp Starter$_i$ | Imp Starter$_i$ × ln(emp$_j$/emp$_{10}$) |
| Seller's Characteristics ($x_j$) | - | dist | dist | sales | sales | emp | emp |
| shock$_i$ | 0.082*** | 0.079*** | -0.0003 | 0.082*** | 0.0095 | 0.082*** | 0.007 |
| | (0.008) | (0.008) | (0.013) | (0.008) | (0.018) | (0.008) | (0.013) |
| shock$_i$ × ($x_j$-$x_{i05}$) | | 0.0077 | 0.498*** | -0.003 | 0.838*** | 0.002 | 0.689*** |
| | | (0.014) | (0.037) | (0.011) | (0.054) | (0.014) | (0.051) |
| $x_j$-$x_{i05}$ | | -0.002 | 0.051*** | 0.0004 | -0.015 | -0.0009 | 0.015 |
| | | (0.003) | (0.005) | (0.002) | (0.010) | (0.003) | (0.010) |
| Input Industry FE | √ | √ | √ | √ | √ | √ | √ |
| Buyer Industry FE | √ | √ | √ | √ | √ | √ | √ |
| Buyer Home Region FE | √ | √ | √ | √ | √ | √ | √ |
| Buyer's ln(sales)$_{2005}$ | √ | √ | √ | √ | √ | √ | √ |
| Nb of Obs | 109407 | 108520 | 108520 | 109407 | 109407 | 109407 | 109407 |
| R-squared | 0.1634 | 0.1638 | 0.1628 | 0.1634 | 0.146 | 0.1634 | 0.148 |

The sample includes only manufacturing buyers that did not import in 2005. Newly added sellers are removed from the sample. The unit of observation is a buyer-seller pair. Parent-child relationships are removed from the sample. Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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# First Stage of the Supplier Adding Regressions

**Table A7: First-Stage of the FE-IV Regressions Reported in Table 8**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Dependent Variable | Imp Starter$_i$ | Imp Starter$_i$ | Imp Starter$_i$ × log(dist$_j$/dist$_{10}$) | Imp Starter$_i$ | Imp Starter$_i$ × ln(sales$_j$/sales$_{10}$) | Imp Starter$_i$ | Imp Starter$_i$ × ln(emp$_j$/emp$_{10}$) |
| Seller's Characteristics ($x_j$) | - | dist | dist | sales | sales | emp | emp |
| shock$_i$ | 0.082*** | 0.079*** | -0.0003 | 0.082*** | 0.0095 | 0.082*** | 0.007 |
| | (0.008) | (0.008) | (0.013) | (0.008) | (0.018) | (0.008) | (0.013) |
| shock$_i$ × ($x_j$ -$x_{i05}$) | | 0.0077 | 0.498*** | -0.003 | 0.838*** | 0.002 | 0.689*** |
| | | (0.014) | (0.037) | (0.011) | (0.054) | (0.014) | (0.051) |
| $x_j$ -$x_{i05}$ | | -0.002 | 0.051*** | 0.0004 | -0.015 | -0.0009 | 0.015 |
| | | (0.003) | (0.005) | (0.002) | (0.010) | (0.003) | (0.010) |
| Input Industry FE | √ | √ | √ | √ | √ | √ | √ |
| Buyer Industry FE | √ | √ | √ | √ | √ | √ | √ |
| Buyer Home Region FE | √ | √ | √ | √ | √ | √ | √ |
| Buyer's ln(sales)$_{2005}$ | √ | √ | √ | √ | √ | √ | √ |
| Nb of Obs | 109407 | 108520 | 108520 | 109407 | 109407 | 109407 | 109407 |
| R-squared | 0.1634 | 0.1638 | 0.1628 | 0.1634 | 0.146 | 0.1634 | 0.148 |

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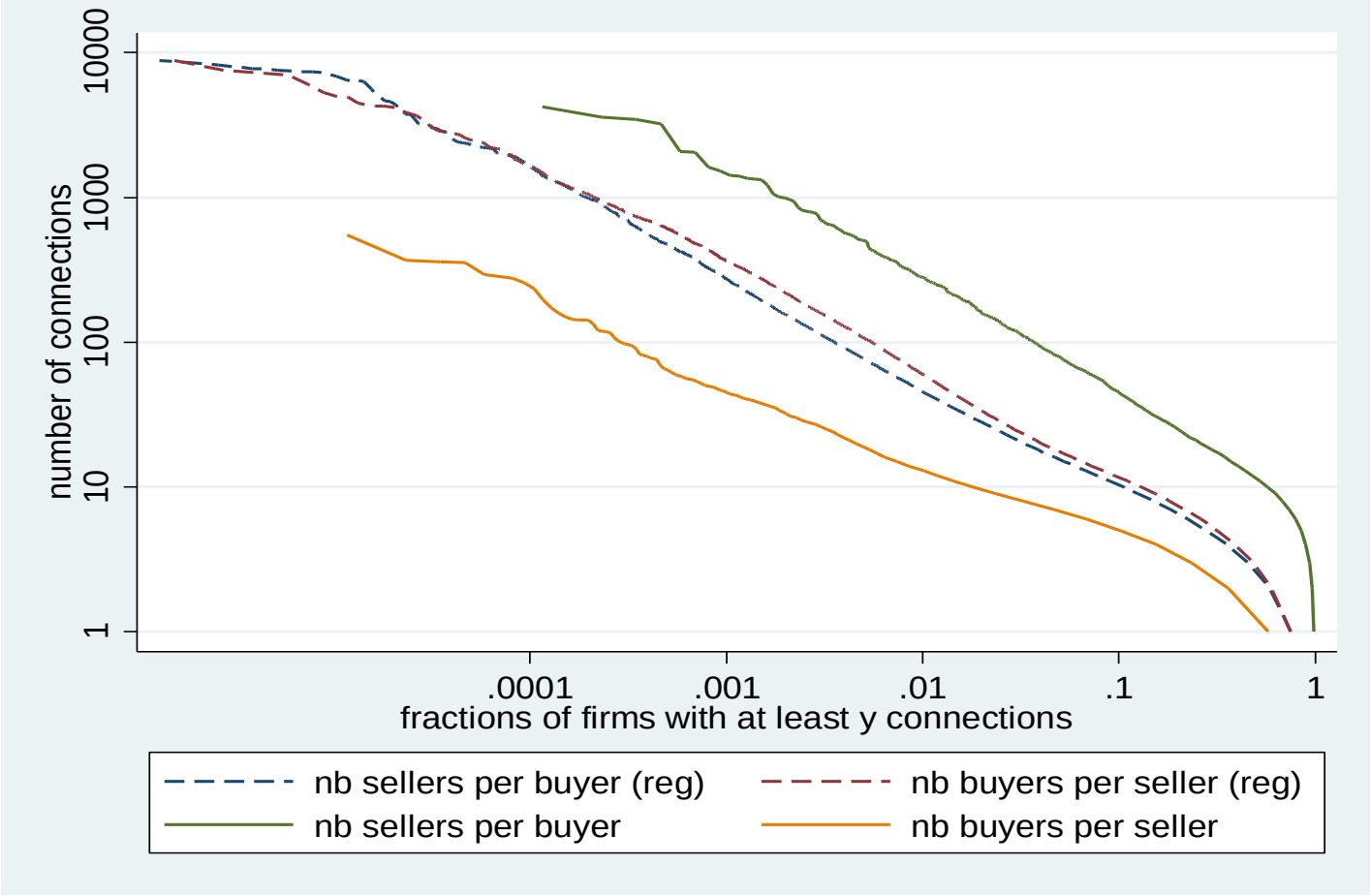
# Firm-size Rank Distribution

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# Number of Sellers

**Summary Statistics (Number of Buyers and Sellers)**

| Sample: | All mfg. buyers | Continuing importers 2005-2010 | Import starters between 2005-2010 | Continuing Non-importers 2005-2010 |
|---|---|---|---|---|
| **A. Number of buyers in 2005** | | | | |
| Count | 13,784 | 1,807 | 1,024 | 10,135 |
| Share | (1.00) | (0.13) | (0.07) | (0.74) |
| **B. Number of sellers per buyer in 2005** | | | | |
| Mean | 25.05 | 48.50 | 22.47 | 20.58 |
| Median | 10 | 16 | 11 | 9 |
| Max. | 4,724 | 4,026 | 1,471 | 4,724 |
| **C. Number of sellers' prefectures per buyer in 2005** | | | | |
| Mean | 5.17 | 7.49 | 5.34 | 4.62 |
| Median | 4 | 5 | 4 | 4 |
| Max. | 47 | 47 | 40 | 46 |

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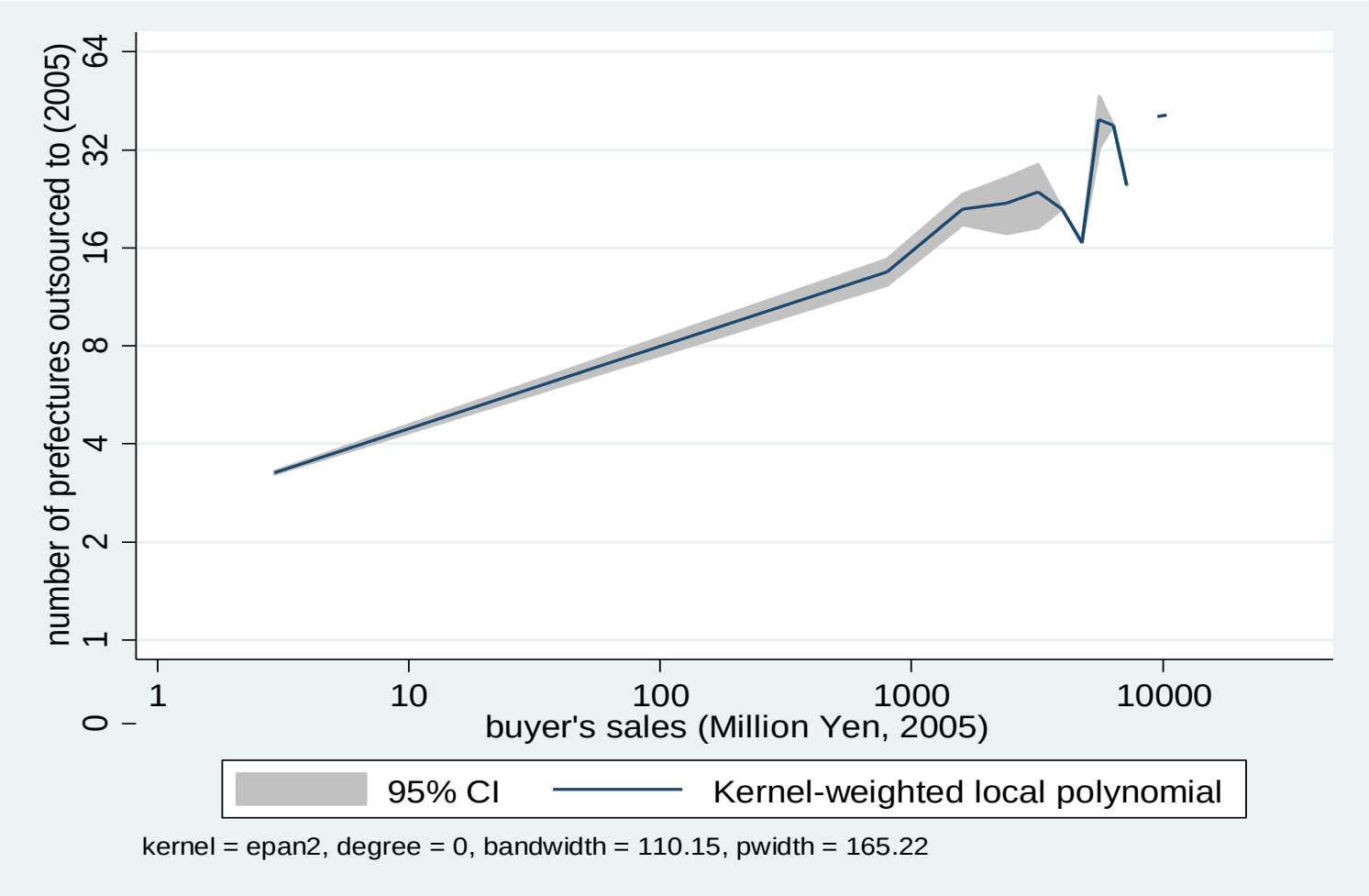
# Productivity and the Scope of Outsourcing

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# Trade Costs

- For each input type outsourced, the buyer pays a fixed cost, $f$, and an additional $f_s$ for each source region.
- No fixed cost for in-house production of inputs.
- Shipping intermediates entails iceberg transport cost $\tau_s(d) = e^{t_s(d)} \geq 1$, where $t_s$ is an industry-specific increasing function of the distance $d$ between a pair of buyer and seller.

Expected outcomes:

- The combination of firm productivity and incremental fixed costs gives rise to the standard scope-productivity relationship.
- Firms will always insource part of the input production in each input type.

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