

# Bilateral Economies of Scope

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2023 Global Value Chain Training and Research Workshop  
UIBE, Beijing, China  
Aug 30 - Sep 5, 2023

# Roadmap

- 1 Introduction
- 2 Data and Illustration
- 3 Empirical Facts
- 4 Theory
- 5 Quantitative Analysis
- 6 Concluding Remarks

# Introduction

International trade is costly,

- e.g. logistics, contracts, and local institutional knowledge.
- Export fixed cost (FC) in Colombia: US\$400k [Das et al., 2007];
- Import fixed cost (FC) in US: US\$50k [Antràs et al., 2017]

Firms decide *where to sell goods and where to source inputs*.

- **Inter-dependent** trade decisions across countries.

However, few research on the **joint determination** of firm's bilateral choices.

- e.g. exporting to cty 1 affects importing from cty 1,2,3?
- Policy implication?

## Main Findings

We document novel fact of **market-specific bilateral economies of scope**,

- i.e. exporting to a country  $\Leftrightarrow$  importing from the same country 

Modelling: If firm exports to and imports from a country, then

- export FC  $\Downarrow$  by  $\alpha_0$  fraction, and
- import FC  $\Downarrow$  by  $\alpha_1$  fraction.

In an augmented [Antràs et al. \[2017\]](#) (AFT) model, we show

- $\hat{\alpha}_0 = 41\%$ ,  $\hat{\alpha}_1 = 37\%$ ,
- in China, **export FC: US\$360k; import FC: US\$187k;**
- Counter-factual 1: To account for aggregate bilateral trade relationships.
- Counter-factual 2: To decompose WTO entry effect into export and import side contribution.

## Literature and Contributions

Export-import complementarity:

- two-way traders [Bernard et al., 2009],
- firm-level export and import correlation [Feng et al., 2016]
- We show firm's export and import complementarity is market-specific.

Firm's optimal trade choices:

- export only [Eaton et al., 2011, Tintelnot, 2017] or import only [Antràs et al., 2017]
- We jointly solve firm's optimal decision in terms of market-specific export and import.

Trade liberalization and firm performance:

- effect on firm productivity [Amiti and Konings, 2007, Brandt et al., 2017]
- RTA and PTA [Caliendo and Parro, 2015]
- Our mechanism enhances trade liberalization effects on both sides.

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# Data

Chinese customs sample, General Administration of Customs of China (2000-2015):

- Ordinary transactions (**excluding processing trade**) [▶ More tests](#)
- Manufacturing firms (non-trade intermediaries) [Ahn et al., 2011]
- Firm-country-level export and import records in each year
- Firm's export of consumption goods, import of intermediate inputs (BEC Rev. 4)
- Top 30 export destinations and top 30 import sourcing origins in each year (36 countries in 2007, 93% of total export and 96% of total import)

Annual Survey of Industrial Enterprise, National Bureau of Statistics of China (1998-2009):

- Firm-level information, such as sales income and total input purchase
- Calculate firm's **domestic sales and domestic input purchases**.

## Summary Statistics

Customs sample (2007):

- # of exporters: 66,822
- (mean) # of export markets per firm: 4.86
- # of importers: 81,395
- (mean) # of import origins per firm: 3.09

Merged sample (2007):

- # of firms: 301,897
- Share of exporters: 8.73%
- Share of importers: 10.78%



## Market-Specific Bilateral Economies of Scope: An Illustration

Table: Market-Specific Bilateral Economies of Scope and Fixed Investments in Trade<sup>1</sup>

Import Dummy \ Export Dummy	0	1
	0	$[0, 0]$
1	$[f^X, 0]$	$[(1 - \alpha_0) f^X, (1 - \alpha_1) f^M]$

where we assume

$$0 < \alpha_0, \alpha_1 < 1. \quad (1)$$

<sup>1</sup>This echos the finding of Grieco et al. [2022] that importing (exporting) experience significantly reduces export (import) fixed cost for Chinese firms, though they do not consider this mechanism as market-specific.

# Market-Specific Bilateral Economies of Scope: An Illustration

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## Empirical Fact 1: Conditional Trade Probability

Takeaway:

- Importers (exporters) in a country are more likely to be exporters (importers) in the same country than non-importers (non-exporters).

Table: Conditional Share of Exporters and Importers

	Share of Exporters			Share of Importers		
	Importers	Non-Importers	Ratio	Exporters	Non-Exporters	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)
Avg. Cty.	9.68%	1.04%	9.33	7.34%	0.81%	9.05
Global Market	35.23%	5.53%	6.37	43.47%	7.65%	5.68

Note: We use a merged sample of customs sample and enterprise information of China in year 2007. The share of exporters conditional on being importers or non-importers is calculated separately for each country in column (1) and (2). The ratio between these two conditional shares is listed in column (3). An analogous exercise can be done for conditional share of importers in the rest columns.

## Empirical Fact 2: Reduced-Form Evidence

Takeaway:

- Importing from a country  $\Leftrightarrow$  exporting to the same country.

A model of firm trade decisions à la [Chaney \[2014\]](#), [Morales et al. \[2019\]](#):

$$\begin{aligned}
 \Pr(\text{Trade}_{fct} > 0 | \text{Observables}) = & \Phi\left(\beta_1 \mathbb{I}\{\text{Imp.}_{fct-1} > 0\} + \beta_2 \mathbb{I}\{\text{Exp.}_{fct-1} > 0\}\right. \\
 & + \delta \text{Standard Gravity}_{\text{CHN},ct} \\
 & + \gamma_1 \text{Extended Gravity: Distance}_{fct-1} + \gamma_2 \text{Remoteness}_{ct-1} \\
 & + \gamma_3 \text{Other Extended Gravity}_{fct-1} \\
 & \left. + \omega \text{Controls}_{ft-1}\right),
 \end{aligned} \tag{2}$$

where  $\text{Trade}_{fct}$  is either export value or import value.

## Empirical Fact 2: Reduced-Form Evidence

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## Empirical Fact 2: Reduced-Form Evidence

Table: The Effect of Import Choice on Export Decision: Probit

	Dependent Var.: $\mathbb{I}\{\text{Exp.}_{fct} > 0\}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	0.590*** (0.00309)	0.327*** (0.00335)	0.328*** (0.00337)	0.487*** (0.00282)	0.286*** (0.00307)	0.287*** (0.00309)
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	1.792*** (0.00343)	1.555*** (0.00381)	1.551*** (0.00383)	1.488*** (0.00324)	1.281*** (0.00351)	1.277*** (0.00352)
Exp. Ext. Distance $_{fct-1}$				-0.176*** (0.00201)	-0.220*** (0.00220)	-0.220*** (0.00221)
Exp. Ext. Contiguity $_{fct-1}$				0.217*** (0.00207)	0.206*** (0.00270)	0.205*** (0.00271)
Exp. Ext. Continent $_{fct-1}$				0.195*** (0.00326)	0.208*** (0.00371)	0.209*** (0.00371)
Exp. Ext. Com. Lang. $_{fct-1}$				0.191*** (0.00195)	0.268*** (0.00280)	0.268*** (0.00282)
Exp. Ext. Income Group $_{fct-1}$				0.403*** (0.00324)	0.309*** (0.00387)	0.311*** (0.00399)
Constant	-0.788*** (0.0233)	-2.337*** (0.0155)	-2.529*** (0.0361)	-5.775*** (0.0322)	-9.662*** (0.176)	-11.69*** (0.608)
Gravity Variables	YES	YES	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Country FE		YES			YES	
Country-Year FE			YES			YES
Observations	13,026,937	13,026,937	13,244,910	12,840,780	12,840,780	13,020,420

Note: Standard errors are in the parentheses and clustered at firm and country level. The number of asterisk indicates significance at 1%(\*\*\*) , 5%(\*\*) and 10%(\*) level. Extended gravity for distance $_{fct-1}$  is constructed following Chaney [2014] while the other variables of extended gravity are constructed after Morales et al. [2019]. Gravity variables include distance, remoteness [Chaney, 2014], indicator for contiguity, common continent, common language, common income group and RTA between China and foreign country, and foreign GDP per capita. Firm-level controls include firm's total value of export and import, number of export destinations and number of import sourcing origins.

## Empirical Fact 2: Reduced-Form Evidence

Table: The Effect of Export Choice on Import Decision: Probit

	Dependent Var.: $\mathbb{I}\{\text{Imp.}_{fct} > 0\}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	0.563*** (0.00301)	0.318*** (0.00323)	0.320*** (0.00323)	0.489*** (0.00291)	0.285*** (0.00309)	0.286*** (0.00310)
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	2.032*** (0.00349)	1.702*** (0.00383)	1.696*** (0.00384)	1.812*** (0.00369)	1.478*** (0.00391)	1.474*** (0.00392)
Imp. Ext. Distance $_{fct-1}$				-0.0971*** (0.00196)	-0.186*** (0.00219)	-0.186*** (0.00221)
Imp. Ext. Contiguity $_{fct-1}$				0.279*** (0.00284)	0.195*** (0.00355)	0.194*** (0.00355)
Imp. Ext. Continent $_{fct-1}$				0.128*** (0.00348)	0.0601*** (0.00424)	0.0600*** (0.00426)
Imp. Ext. Com. Lang. $_{fct-1}$				0.120*** (0.00251)	0.176*** (0.00355)	0.175*** (0.00356)
Imp. Ext. Income Group $_{fct-1}$				0.253*** (0.00335)	0.147*** (0.00425)	0.141*** (0.00445)
Constant	2.632*** (0.0257)	-2.254*** (0.0140)	-2.353*** (0.0353)	-1.469*** (0.0406)	-0.759*** (0.0243)	-0.877*** (0.0404)
Gravity Variables	YES	YES	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Country FE		YES			YES	
Country-Year FE			YES			YES
Obs.	11,712,820	11,712,820	11,764,732	11,543,307	11,712,820	11,764,732

Note: Standard errors are in the parentheses and clustered at firm and country level. The number of asterisk indicates significance at 1%(\*\*\*) , 5%(\*\*) and 10%(\*) level. Extended gravity for distance $_{fct-1}$  is constructed following Chaney [2014] while the other variables of extended gravity are constructed after Morales et al. [2019]. Gravity variables include distance, remoteness [Chaney, 2014], indicator for contiguity, common continent, common language, common income group and RTA between China and foreign country, and foreign GDP per capita. Firm-level controls include firm's total value of export and import, number of export destinations and number of import sourcing origins.

## Empirical Fact 3: Rank-Rank Correlation

Takeaway:

- Country with more Chinese exporters also has more Chinese importers.

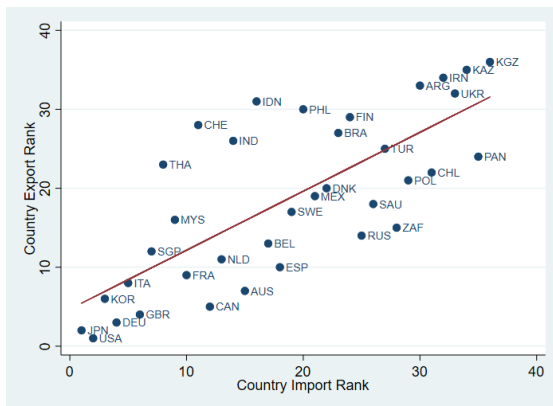


Figure: Country Rank Correlation by Number of Firms

Note: We focus on top 30 trading partners for China in year 2007. The export and import ranking across countries are based on number of Chinese exporters and importers, respectively. The rank-rank correlation in the figure is 0.75.

## Robustness and Discussion

Dynamic panel regressions:

- **Robustness:** dynamic Probit with random effects; system GMM with IVs.

FDI-induced economies of scope [Wang, 2021, Fan, 2021, Antràs et al., 2022]:

- **Robustness:** excluding foreign-related firms.

Cross-market bilateral economies of scope:

- e.g. exporting to cty 1  $\rightarrow$  importing from cty 2 since they are adjacent?
- **Robustness:** more intricate extended gravity.

Eliminate WTO-entry effect:

- **Robustness:** using only the data from 2008 to 2015.

▶ Robustness tests

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## Extended AFT Framework

Environment:

- $J$  countries indexed by  $i$  (host),  $j$  (import origin) and  $k$  (export destination).
- 3 types of agents: consumers, **final-goods producers (firms)** and input suppliers.
- Firms are heterogeneous in productivity  $\varphi$ .
- They decide optimal set of origins  $M^*(\varphi) \subseteq \mathbb{J}$  to source input [Eaton and Kortum, 2002],
- and optimal set of markets  $X^*(\varphi) \subseteq \mathbb{J}$  to sell final goods [Melitz, 2003].
- $M^*(\varphi)$  and  $X^*(\varphi)$  are **jointly determined**.
- FCs are country-specific but common to firms.

**Market-specific bilateral economies of scope:** if firm exports to and imports from  $j$  simultaneously,

- export FC  $\Downarrow$  by  $\alpha_0$  fraction, and
- import FC  $\Downarrow$  by  $\alpha_1$  fraction.

## Extended AFT Framework

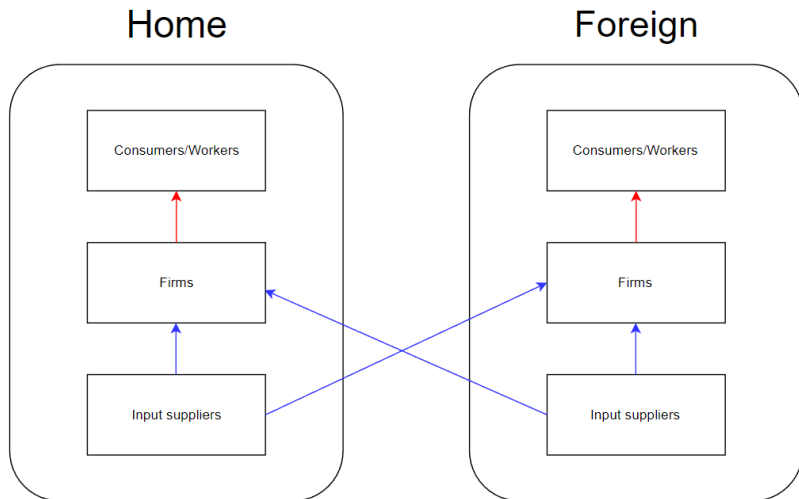


Figure: AFT Environment

# Extended AFT Framework

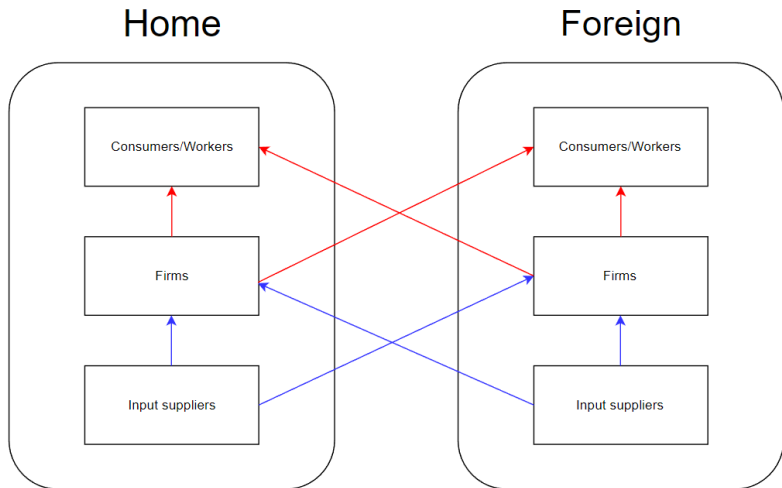


Figure: AFT Environment: Extended



# Preference

Worldwide common utility function over manu. and non-manu. sectors:

$$U_i = U_{Mi}^\mu U_{Ni}^{1-\mu}. \quad (3)$$

Rep. consumer has CES preference over manu. goods:

$$U_{Mi} = \left( \int_{\omega \in \Omega_i} q_i(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}. \quad (4)$$

Non-manu. is large enough to pin down wages in terms of non-manu. output.

## Sourcing Strategy

Firm  $\varphi$  decides

- the set of origins  $M(\varphi) \subseteq \mathbb{J}$  to source inputs from, and
- choose the lowest-price supplier for each input.

There is a continuum of inputs used in production of each firm.

Given  $M(\varphi)$ , MC for firm  $\varphi$  is

$$c_i(\varphi; M) = \frac{1}{\varphi} \left( \int_0^1 z_i(\nu, \varphi; M(\varphi))^{1-\rho} d\nu \right)^{\frac{1}{1-\rho}}, \quad (5)$$

where price of input  $\nu$  is

$$z_i(\nu, \varphi; M(\varphi)) = \min_{j \in M(\varphi)} \left\{ \tau_{ij}^M a_j(\nu) w_j \right\}. \quad (6)$$

## Sourcing Strategy

Given  $M(\varphi)$ , **firm's input expenditure share** in  $j \in M(\varphi)$  is

$$\chi_{ij}(\varphi) = \frac{\xi_{ij}^M}{\Theta_i^M(\varphi)}, \quad (7)$$

and zero if  $j \notin M(\varphi)$ . [Eaton and Kortum, 2002]

Here, **sourcing potential of origin  $j$**  is

$$\xi_{ij}^M \equiv T_j \left( \tau_{ij}^M w_j \right)^{-\theta}, \quad (8)$$

and **sourcing capacity of  $M(\varphi)$**  is

$$\Theta_i^M(\varphi) \equiv \sum_{j \in M(\varphi)} \xi_{ij}^M. \quad (9)$$

MC of  $M(\varphi)$  is then

$$c_i(\varphi) = \frac{1}{\varphi} \left( \gamma \Theta_i^M(\varphi) \right)^{-\frac{1}{\theta}}. \quad (10)$$

## Sales Strategy

Firm  $\varphi$  decides

- the set of markets  $X(\varphi) \subseteq \mathbb{J}$  to sell final goods.

Given  $X(\varphi)$ , firm's sales share for  $k \in X(\varphi)$  is

$$\chi_{ki}^X(\varphi) = \frac{\xi_{ki}^X}{\Theta_i^X(\varphi)}, \quad (11)$$

and zero if  $k \notin X(\varphi)$ .

Here, sales potential of market  $k$  is

$$\xi_{ki}^X \equiv \left(\tau_{ki}^X\right)^{1-\sigma} B_k, \quad (12)$$

and sales capacity of  $X(\varphi)$  is

$$\Theta_i^X(\varphi) \equiv \sum_{k \in X(\varphi)} \left(\tau_{ji}^X\right)^{1-\sigma} B_k. \quad (13)$$

# Optimal Sourcing and Sales Strategy

Given  $M(\varphi)$  and  $X(\varphi)$ , total profit of firm  $\varphi$  in  $i$  is

$$\begin{aligned} \pi_i(\varphi) = \varphi^{\sigma-1} & \underbrace{\left( \gamma \Theta_i^M(\varphi) \right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi)}_{\text{Non-market-specific bilateral economies of scope}} - w_i \sum_{k \in X(\varphi)} f_{ki}^X - w_i \sum_{j \in M(\varphi)} f_{ij}^M \\ & + w_i \underbrace{\sum_{h \in X(\varphi) \cap M(\varphi)} \left( \alpha_0 f_{hi}^X + \alpha_1 f_{ih}^M \right)}_{\text{Market-specific bilateral economies of scope}}. \end{aligned} \quad (14)$$

Firm's problem is formulated as

$$\begin{aligned} \max_{\substack{\mathbb{I}_{ij}^M \in \{0, 1\}_{j=1}^J \\ \mathbb{I}_{ki}^X \in \{0, 1\}_{k=1}^J}} \pi_i(\varphi, X, M) = \varphi^{\sigma-1} & \left( \gamma \sum_{j=1}^J \mathbb{I}_{ij}^M T_j (\tau_{ij} w_j)^{-\theta} \right)^{\frac{\sigma-1}{\theta}} \sum_{k=1}^J \mathbb{I}_{ki}^X \left( \tau_{ki}^X \right)^{1-\sigma} B_k \\ & - w_i \sum_{k=1}^J \mathbb{I}_{ki}^X \left( 1 - \alpha_0 \mathbb{I}_{ik}^M \right) f_{ki}^X - w_i \sum_{j=1}^J \mathbb{I}_{ij}^M \left( 1 - \alpha_1 \mathbb{I}_{ji}^X \right) f_{ij}^M. \end{aligned} \quad (15)$$

## The role of $\alpha$ 's

We assume

$$0 < \alpha_0, \alpha_1 < 1, \quad (16)$$

to be consistent with intuition and empirical facts.

They measure the extent of market-specific bilateral economies of scope.

- $\alpha_0 \uparrow$ , importers are more likely to be exporters.
- $\alpha_1 \uparrow$ , exporters are more likely to be importers.

▶ More illustration

## Equilibrium

Free entry condition in  $i$  is

$$\int_{\tilde{\varphi}_i}^{\infty} \left[ \varphi^{\sigma-1} (\gamma \Theta_i^M(\varphi))^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi) - w_i \sum_{k \in X(\varphi)} f_{ki}^X - w_i \sum_{j \in M(\varphi)} f_{ij} \right. \\ \left. + w_i \sum_{h \in X(\varphi) \cap M(\varphi)} (\alpha_0 f_{hi}^X + \alpha_1 f_{ih}^M) \right] dG_i(\varphi) = w_i f_{ei}. \quad (17)$$

Labor market clearing condition is

$$N_i = \frac{\eta L_i}{\sigma \left( \int_{\tilde{\varphi}_i}^{\infty} \sum_{k \in X(\varphi)} f_{ki}^X + \sum_{j \in M(\varphi)} f_{ij} - \sum_{h \in X(\varphi) \cap M(\varphi)} (\alpha_0 f_{hi}^X + \alpha_1 f_{ih}^M) dG_i(\varphi) + f_{ei} \right)}. \quad (18)$$

### Definition 1

Given the wage level  $w_i$ , labor endowment  $L_i$ , and the other exogenous parameters, the general equilibrium consists of firm's optimal choice of export and import profile,  $X$  and  $M$ , the cutoff productivity of survival  $\tilde{\varphi}_i$ , aggregate demand  $B_i$ , and measure of potential entrants  $N_i$  such that (i)  $X$  and  $M$  solves firm's profit maximization problem, (ii) firms enter the market until the free entry condition holds, and (iii) labor market clears.

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## Matching Model to Data

We make several additional assumptions:

- Firm-country-specific export and import FCs:

The specifications of  $f_{f,ij}^M, f_{f,ji}^X$  are

$$\log \left( f_{fij}^M \right) = \beta_C^M + \beta_d^M \log \text{Distance}_{ij} + \beta_{disp}^M \varepsilon_{fij}^M; \quad (19)$$

$$\log \left( f_{fji}^X \right) = \beta_C^X + \beta_d^X \log \text{Distance}_{ji} + \beta_{disp}^X \varepsilon_{fji}^X, \quad (20)$$

where  $\varepsilon_{fij}^M, \varepsilon_{fji}^X$  are drawn from bivariate standard normal distribution with correlation

$\rho$ . ▶ Fixed costs correlation

- FCs in domestic market are assumed to be zero.
- Consumer in each country has constant expenditure share across markets.
  - ⇒ Fixed firm mass and no response in aggregate conditions to change in firm's trade strategy.
  - ⇒ Separate identification of aggregate variables and other parameters.

## Calibration

Step 1: Estimation on country's sourcing and sales potential

Transform relative sourcing and sales shares

$$\frac{\chi_{fij}^M}{\chi_{fii}^M} = \frac{\xi_{ij}^M}{\xi_{ii}^M}$$

and

$$\frac{\chi_{fki}^X}{\chi_{fii}^X} = \frac{\xi_{ki}^X}{\xi_{ii}^X},$$

into empirical specifications

$$\log(\chi_{fij}^M) - \log(\chi_{fii}^M) = \log(\xi_{ij}^M) + \epsilon_{fij}^M \quad (21)$$

and

$$\log(\chi_{fki}^X) - \log(\chi_{fii}^X) = \log(\xi_{ki}^X) + \epsilon_{fki}^X, \quad (22)$$

where China's sourcing potential and sales potential are normalized to be one.

# Calibration

Step 1: Estimation on country's sourcing and sales potential

▶ Extensive margins

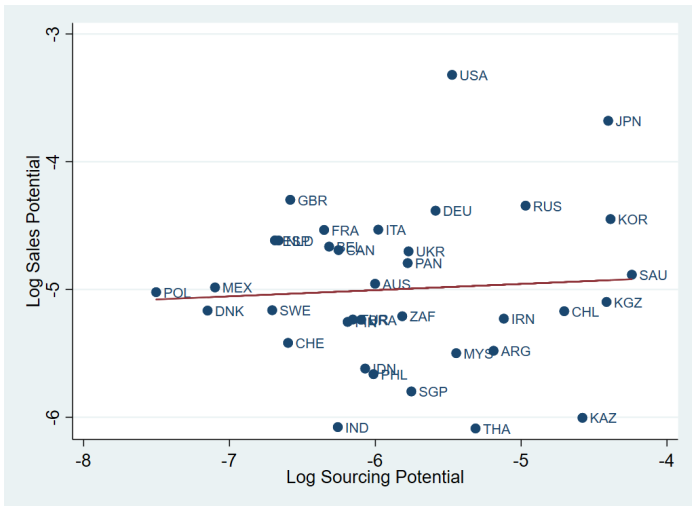


Figure: Estimated Sourcing and Sales Potential Across Countries

# Calibration

## Step 2: Demand and sourcing elasticity

- The mean markup of Chinese firms is 1.31 and the implied  $\hat{\sigma} = 4.23$ . [De Loecker and Warzynski, 2012]
- Estimate sourcing elasticity  $\theta$  [Antràs et al., 2017]

$$\begin{aligned} \log \left( \hat{\xi}_{ij}^M \right) = & \beta_0 + \beta_1 \log \text{R\&D}_j + \beta_2 \log \text{capital per worker}_j \\ & + \beta_3 \log \text{number of firms}_j \\ & - \theta \left[ \log \left( \tau_{ij}^M w_j \right) \right] - \beta_g \times \text{Gravity}_{ij} + \epsilon_{ij}. \end{aligned} \quad (23)$$

As a result,  $\hat{\theta} = 1.072$ .

## Calibration

## Step 2: Demand and sourcing elasticity

Table: Estimating Sourcing Elasticity

	$\log \xi_j^M$		$\log$ aggregate import $_j$	
	OLS (1)	IV (2)	OLS (3)	IV (4)
$\log \tau_{ij}^M w_j$	-1.094** (0.416)	-1.072** (0.508)	-1.762*** (0.557)	-1.273** (0.639)
$\log R\&D_j$	-0.0499 (0.127)	-0.0512 (0.104)	-0.0806 (0.234)	-0.110 (0.202)
$\log$ capital per worker $_j$	0.254 (0.430)	0.263 (0.402)	-0.0148 (0.551)	0.188 (0.556)
$\log$ number of firms $_j$	0.121 (0.177)	0.121 (0.150)	0.304 (0.199)	0.303* (0.168)
$\log$ domestic input $_j$			0.984*** (0.228)	0.985*** (0.189)
Constant	-8.817*** (1.730)	-8.757*** (1.817)	-10.18** (4.746)	-8.848** (4.210)
Gravity Vars	YES	YES	YES	YES
F-Statistic	-	15.637	-	18.834
Obs.	36	36	36	36
R <sup>2</sup>	0.526	0.526	0.860	0.856

Note: Robust standard errors are in the parentheses. The number of asterisk indicates significance at 1%(\*\*\*), 5%(\*\*) and 10%(\*) level. Following Antràs et al. [2017], we use population as instrument for  $\log \tau_{ij}^M w_j$  in IV regressions. Our sample includes top 30 exporting and importing trading partners for China in 2007, amounting to 36 foreign countries.

# Calibration

## Step 3: Fixed Costs and Aggregate Demands

- SMM approach.
- 10 internal parameters:
  - Economies of scope  $\alpha_0$  and  $\alpha_1$
  - Export and import FCs  $\beta_C^X, \beta_C^M, \beta_d^X, \beta_d^M, \beta_{disp}^X, \beta_{disp}^M$ , and  $\rho$
  - Domestic demand scale  $\tilde{B}_i$
- Targeted moments:
  - Conditional ratios; within-firm export-import correlation.
  - Share of exporters (importers) among all firms and among small firms.
  - Share of exporters (importers) for each foreign country.
  - Median input purchase from domestic market.

## Calibration

Parameters	Symbols	Baseline	Source
<i>Panel A: Assigned</i>			
Pareto shape	$\kappa$	4.25	Literature
<i>Panel B: Reduced-form regressions</i>			
Demand elasticity	$\sigma$	4.23	Estimation
Sourcing elasticity	$\theta$	1.07	Estimation
<i>Panel C: SMM</i>			
Demand scale	$\tilde{B}_i$	3.44 (0.150)	Estimation
Cost reduction (import-induced export)	$\alpha_0$	0.41 (0.045)	Estimation
Cost reduction (export-induced import)	$\alpha_1$	0.37 (0.025)	Estimation
Correlation of fixed costs	$\rho$	0.07 (0.004)	Estimation
Import: constant term	$\beta_C^M$	1.24 (0.050)	Estimation
Import: distance parameter	$\beta_d^M$	1.86 (0.003)	Estimation
Import: standard deviation	$\beta_{disp}^M$	1.85 (0.013)	Estimation
Export: constant term	$\beta_C^X$	2.48 (0.055)	Estimation
Export: distance parameter	$\beta_d^X$	1.40 (0.014)	Estimation
Export: standard deviation	$\beta_{disp}^X$	2.66 (0.020)	Estimation

► Jacobian Matrix

## Fit of the Model

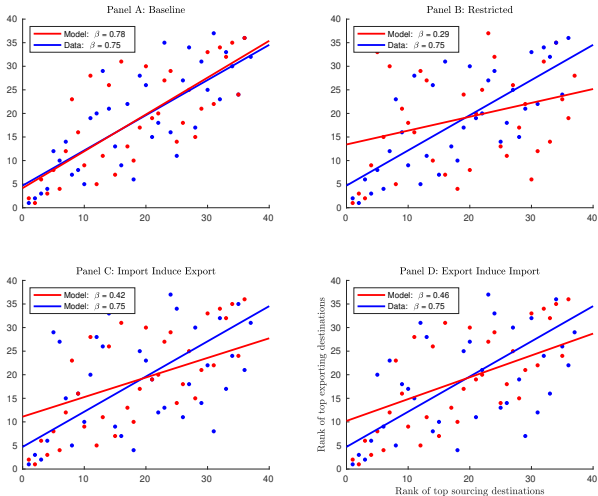
Parameters	Model	Data
<i>Panel A: Targeted moments</i>		
Share of importers	0.12	0.11
Share of exporters	0.12	0.09
Share of importers (below median sales)	0.047	0.061
Share of exporters (below median sales)	0.053	0.073
Share of firms with actual median domestic input purchase	0.52	0.50
Within-firm export-import correlation	0.48	0.40
Ratio b/w share of exporters among importers and non-importers	12.8	9.05
Ratio b/w share of importers among exporters and non-exporters	9.07	9.32
<i>Panel B: Non-targeted moments</i>		
Share of two-way traders	0.04	0.04
Share of two-way traders among exporters	0.35	0.44
Share of two-way traders among importers	0.34	0.36
Number of export destinations, two-way trader over pure exporters	1.46	1.50
Number of sourcing origins, two-way trader over pure importers	1.49	1.50

▶ More



## Counter-Factual 1: Rank-Rank Correlation

Figure: Rank-Rank Correlation.



## Counter-Factual 2: Dissecting Trade Liberalization Effects

WTO entry effects from both export and import sides:

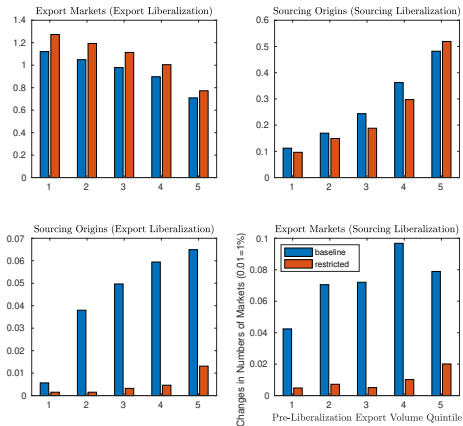
- Tariff reductions  $\Rightarrow$  Data;
- FC reductions  $\Rightarrow$  Match observed changes in share of exporters and importers after WTO.

Decomposition:

	Import liberalization	Export liberalization
<i>Panel A: Baseline</i>		
Number of exporters	0.043	0.957
Number of importers	0.959	0.041
<i>Panel B: Restricted</i>		
Number of exporters	0.015	0.985
Number of importers	0.987	0.013

## Counter-Factual 2: Dissecting Trade Liberalization Effects

Figure: Firm's Response to Trade Liberalization



Note: This figure plots the response of trading volume (export and sourcing), market accession (number of destinations and origins) for five groups for firms sorted by trading volume (with five being the highest). The blue-colored bars are for the baseline model and the orange-colored bars are for the restricted model. The y-axes are in log deviations.

# Roadmap

- 1 Introduction
- 2 Data and Illustration
- 3 Empirical Facts
- 4 Theory
- 5 Quantitative Analysis
- 6 Concluding Remarks**

## Concluding Remarks

In this paper,

- we document novel fact of market-specific bilateral economies of scope;
- we estimate the magnitude of this channel in an extended AFT model;
- this channel is crucial in accounting for **observed trade pattern** and **trade liberalization effect**.

Future research:

- more micro-founded mechanism, e.g. information asymmetry or two-sided searching process;
- optimal trade policy with bilateral economies of scope;
- spillovers in cost reduction across countries.

# Inter-dependent Trade Decisions

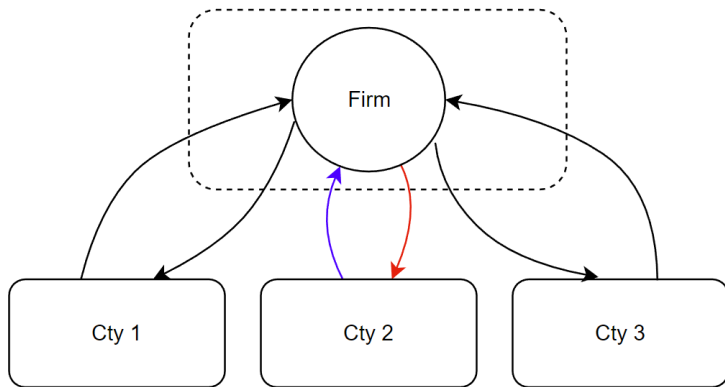


Figure: Inter-dependent Trade Decisions: Market-Specific Linkage

# Inter-dependent Trade Decisions

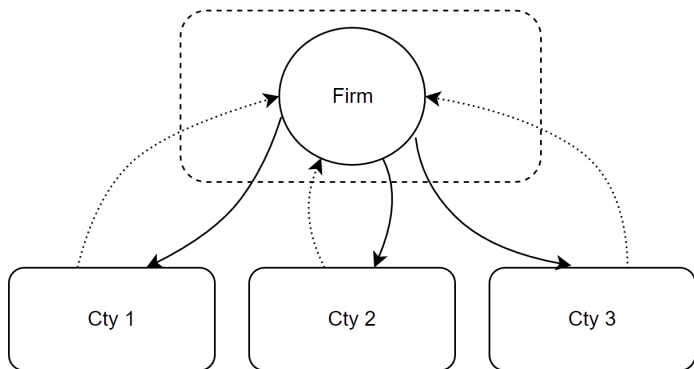


Figure: Inter-dependent Trade Decisions: Export Decisions Only

# Inter-dependent Trade Decisions

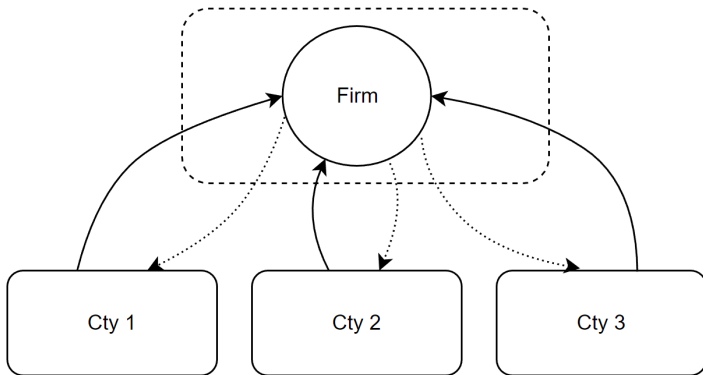


Figure: Inter-dependent Trade Decisions: Import Decisions Only



# Inter-dependent Trade Decisions

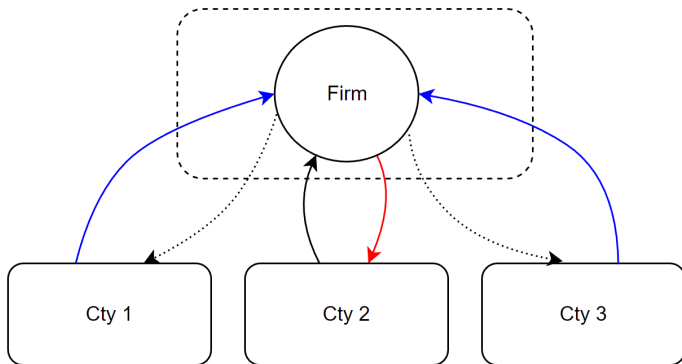


Figure: Inter-dependent Trade Decisions: General Case

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## Processing Trade

Table: Processing Trade and Bilateral Economies of Scope

Dependent Var.:	$\mathbb{I}\{\text{Exp.}_{fct} > 0\}$				$\mathbb{I}\{\text{Im.}_{fct} > 0\}$			
	LPM (1)	Probit (2)	LPM (3)	Probit (4)	LPM (5)	Probit (6)	LPM (7)	Probit (8)
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	0.013*** (0.002)	0.265*** (0.004)	0.018*** (0.002)	0.184*** (0.006)	0.055*** (0.004)	1.473*** (0.004)	0.055*** (0.004)	1.474*** (0.004)
. × G7 Indicator <sub>c</sub>	0.010*** (0.002)	0.045*** (0.005)						
. × Processing Trader <sub>ft</sub>			-0.002 (0.002)	0.133** (0.007)				
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	0.060*** (0.003)	1.276*** (0.004)	0.060*** (0.003)	1.276*** (0.004)	0.005*** (0.001)	0.255*** (0.004)	0.004*** (0.001)	0.222*** (0.006)
. × G7 Indicator <sub>c</sub>					0.015*** (0.003)	0.067*** (0.005)		
. × Processing Trader <sub>ft</sub>							0.006*** (0.001)	0.082*** (0.006)
Constant	0.122*** (0.018)	-0.897*** (0.041)	0.122*** (0.018)	-0.890*** (0.041)	0.016 (0.010)	-0.875*** (0.040)	0.016 (0.010)	-0.874*** (0.040)
Export Extended Gravity	YES	YES	YES	YES	NO	NO	NO	NO
Import Extended Gravity	NO	NO	NO	NO	YES	YES	YES	YES
Gravity Variables	YES	YES	YES	YES	YES	YES	YES	YES
Firm-level Controls	NO	YES	NO	YES	NO	YES	NO	YES
Firm-Year FE	YES	NO	YES	NO	YES	NO	YES	NO
Country-Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-Country FE	YES	NO	YES	NO	YES	NO	YES	NO
Obs.	11,650,553	13,244,910	11,650,553	13,244,910	10,515,452	11,764,732	10,515,452	11,764,732
Adj. R <sup>2</sup>	0.574	-	0.574	-	0.609	-	0.609	-
Pseudo R <sup>2</sup>	-	0.468	-	0.469	-	0.546	-	0.546

## Robustness

Table: The Effect of Import Choice on Export Decision: Robustness

	Dyn. Probit RE		Dependent Var.: $\mathbb{I}\{\text{Exp.}_{fct} > 0\}$ System GMM		Probit	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	0.733*** (0.004)	0.735*** (0.003)	0.052*** (0.007)	0.242*** (0.004)	0.248*** (0.003)	0.293*** (0.003)
$\times$ FDI Indicator $_{fct-1}$				0.093*** (0.00549)		
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	1.372*** (0.004)	1.459*** (0.003)	0.290*** (0.010)	1.276*** (0.004)	1.279*** (0.004)	1.290*** (0.004)
Imp. Ext. Distance $_{fct-1}$					-0.052*** (0.002)	
Imp. Ext. Contiguity $_{fct-1}$					-0.044*** (0.003)	
Imp. Ext. Continent $_{fct-1}$					-0.037*** (0.003)	
Imp. Ext. Com. Lang. $_{fct-1}$					0.067*** (0.003)	
Imp. Ext. Income Group $_{fct-1}$					0.000 (0.003)	
Constant	-1.793*** (0.018)	-2.015*** (0.014)	-1.414*** (0.124)	-0.899*** (0.041)	-0.561*** (0.044)	-0.805*** (0.033)
Export Extended Gravity	YES	YES	YES	YES	YES	YES
Gravity Variables	YES	YES	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES	YES	YES
Country-Year FE	-	-	NO	YES	YES	YES
Obs.	6,609,062	9,752,700	78,494	13,244,910	13,087,380	10,435,448
Pseudo R <sup>2</sup>	-	-	-	0.469	0.470	0.465

## Robustness

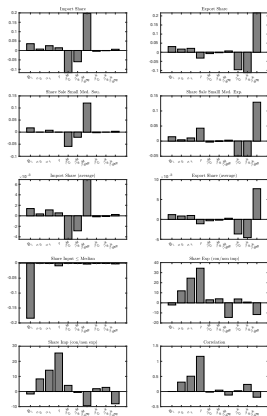
Table: The Effect of Export Choice on Import Decision: Robustness

	Dyn. Probit RE		Dependent Var.: $\mathbb{I}\{\text{Imp.}_{fct} > 0\}$ System GMM		Probit	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	0.645*** (0.004)	0.596*** (0.003)	0.020*** (0.005)	1.473*** (0.00392)	1.481*** (0.00397)	1.509*** (0.00416)
$\cdot \times \text{FDI Indicator}_{ft-1}$				0.0608*** (0.00431)		
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	1.784*** (0.006)	1.955*** (0.004)	0.234*** (0.009)	0.257*** (0.00375)	0.241*** (0.00329)	0.286*** (0.00337)
Exp. Ext. Distance $_{fct-1}$					-0.0574*** (0.00206)	
Exp. Ext. Contiguity $_{fct-1}$					-0.0384*** (0.00333)	
Exp. Ext. Continent $_{fct-1}$					-0.00397 (0.00356)	
Exp. Ext. Com. Lang. $_{fct-1}$					0.0638*** (0.00320)	
Exp. Ext. Income Group $_{fct-1}$					-0.00872** (0.00363)	
Constant	-1.212*** (0.019)	-1.288*** (0.014)	-0.904*** (0.082)	-0.873*** (0.0404)	-0.546*** (0.0439)	-0.620*** (0.0321)
Import Extended Gravity	YES	YES	YES	YES	YES	YES
Gravity Variables	YES	YES	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES	YES	YES
Country-Year FE	-	-	NO	YES	YES	YES
Obs.	5,967,909	8,789,230	126,044	11,764,732	11,557,192	9,383,745
Pseudo R <sup>2</sup>	-	-	-	0.546	0.546	0.547



# Jacobian Matrix

Figure: Jacobian Matrix for Identification



## Fit of the Model

Table: Sourcing and Exporting Hierarchy

	Baseline	$\alpha_1 = 0$	$\alpha_0 = 0$	Restricted	Data
<i>Panel A: Importing</i>					
1	100	100	100	100	100
1-2	4.32	2.55	2.22	2.01	2.92
1-2-3	0.29	0.19	0.17	0.17	0.57
1-2-3-4	0.048	0.028	0.030	0.028	0.52
1-2-3-4-5	0.012	0.006	0.005	0.006	0.64
<i>Panel B: Exporting</i>					
1	100	100	100	100	100
1-2	1.54	0.76	0.52	0.71	2.27
1-2-3	0.044	0.036	0.027	0.034	0.57
1-2-3-4	0.003	0.002	0.003	0.003	0.52
1-2-3-4-5	0.000	0.000	0.000	0.000	0.64

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## Sensitivity Check: Fixed Costs Correlation

Table: Rank-Rank Correlations for Correlated Fixed-Cost Shock Draws

Parameters	Baseline	$\alpha_1 = 0$	$\alpha_0 = 0$	Restricted	Data
<i>Panel A: Number of exporters/importers; Overall sample</i>					
$\rho = 0.00$	0.73	0.40	0.33	0.30	0.75
$\rho = 0.20$	0.74	0.40	0.38	0.29	0.75
$\rho = 0.40$	0.77	0.41	0.40	0.30	0.75
$\rho = 0.60$	0.83	0.45	0.47	0.31	0.75
$\rho = 0.80$	0.87	0.47	0.57	0.32	0.75
<i>Panel B: Number of exporters/importers; Two-way traders only</i>					
$\rho = 0.00$	0.76	0.42	0.42	0.31	0.75
$\rho = 0.20$	0.80	0.49	0.48	0.28	0.75
$\rho = 0.40$	0.85	0.53	0.56	0.36	0.75
$\rho = 0.60$	0.90	0.65	0.70	0.44	0.75
$\rho = 0.80$	0.93	0.74	0.79	0.54	0.75

Note: This table shows the rank-rank correlation when firms fixed cost draw on sourcing and exporting destinations are correlated.



## References I

- J. Ahn, A. K. Khandelwal, and S.-J. Wei. The role of intermediaries in facilitating trade. *Journal of International Economics*, 84(1):73–85, 2011.
- M. Amiti and J. Konings. Trade liberalization, intermediate inputs, and productivity: Evidence from indonesia. *American Economic Review*, 97(5):1611–1638, 2007.
- P. Antràs, T. C. Fort, and F. Tintelnot. The margins of global sourcing: Theory and evidence from us firms. *American Economic Review*, 107(9):2514–64, 2017.
- P. Antràs, E. Fadeev, T. C. Fort, and F. Tintelnot. Global sourcing and multinational activity: A unified approach. *NBER Working Paper Series*, 2022.
- A. B. Bernard, J. B. Jensen, S. J. Redding, and P. K. Schott. The margins of us trade. *American Economic Review*, 99(2):487–93, 2009.
- L. Brandt, J. Van Biesebroeck, L. Wang, and Y. Zhang. Wto accession and performance of chinese manufacturing firms. *American Economic Review*, 107(9):2784–2820, 2017.
- L. Caliendo and F. Parro. Estimates of the trade and welfare effects of nafta. *The Review of Economic Studies*, 82(1):1–44, 2015.
- T. Chaney. The network structure of international trade. *American Economic Review*, 104(11):3600–3634, 2014.

## References II

- S. Das, M. J. Roberts, and J. R. Tybout. Market entry costs, producer heterogeneity, and export dynamics. *Econometrica*, 75(3):837–873, 2007.
- J. De Loecker and F. Warzynski. Markups and firm-level export status. *American Economic Review*, 102(6):2437–71, 2012.
- J. Eaton and S. Kortum. Technology, geography, and trade. *Econometrica*, 70(5):1741–1779, 2002.
- J. Eaton, S. Kortum, and F. Kramarz. An anatomy of international trade: Evidence from french firms. *Econometrica*, 79(5):1453–1498, 2011.
- J. Fan. Talent, geography, and offshore r&d. 2021.
- L. Feng, Z. Li, and D. L. Swenson. The connection between imported intermediate inputs and exports: Evidence from chinese firms. *Journal of International Economics*, 101:86–101, 2016.
- P. L. Grieco, S. Li, and H. Zhang. Input prices, productivity, and trade dynamics: long-run effects of liberalization on chinese paint manufacturers. *The RAND Journal of Economics*, 53(3):516–560, 2022.
- M. J. Melitz. The impact of trade on intra-industry reallocations and aggregate industry productivity. *econometrica*, 71(6):1695–1725, 2003.

## References III

- E. Morales, G. Sheu, and A. Zahler. Extended gravity. *The Review of Economic Studies*, 86(6):2668–2712, 2019.
- F. Tintelnot. Global production with export platforms. *The Quarterly Journal of Economics*, 132(1):157–209, 2017.
- Z. Wang. Headquarters gravity: How multinationals shape international trade. *Journal of International Economics*, 131:103477, 2021.