Two-way Complementarity: New Insights into Global Firms

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Introduction

- Firms participate in the international economy not only as **exporters** of final goods but also as **importers** of intermediate inputs from abroad
  - Firms that export and import at the same time → "Global firms"

- Two salient patterns at firm-level data
  1. **Selection** into exporting and importing (e.g., Bernard et al., 2018)
     → Aggregate trade is concentrated on a few number of global firms
  2. **Complementarity** between exporting and importing (e.g., Blaum, 2024)
     → Intensive exporters are also intensive importers

Introduction

- Complementarity for firm revenue
  1. **Exporting** allows firms to ship final goods to abroad, which *directly* increases firm revenue
  2. **Importing** allows firms to source inputs from abroad, which *indirectly* increases firm revenue by improving production efficiency

- Research questions
  - How does complementarity affect trade flows and welfare gains?
  - How can we empirically measure this complementarity and test its role?

What We Do

- This paper develops a heterogeneous firm model of importing-exporting
  - Domestic firms, pure exporters, pure importers, and global firms
  - Globalization generates amplified effects toward global firms through uneven reallocations, but it requires **complementarity at industry level**

- We provide a model-consistent measure of complementarity in China
  - Evidence on complementarity in the majority of Chinese industries
  - Evidence on the role of global firms in amplifying (1) the trade elasticity and (2) the welfare gains from trade

Literature Review

- Importing-exporting complementarity
  - Empirical evidence: Amiti et al. (2014), Blaum (2024), Li et al. (2024)
  - Quantitative analysis: Kasahara and Lapham (2013), Grieco et al. (2022)
  - **Ours**: provide a direct measure of complementarity and show its role in shaping trade liberalization effects

- Trade elasticities and gains from trade
  - Export: Chaney (2008), Arkolakis et al. (2012), Melitz and Redding (2014)
  - Import: Antràs et al. (2017), Brandt et al. (2017), Blaum et al. (2018)
  - **Ours**: focus on the linkage between exporting and importing, and relate to two-way complementarity

Model

- Setup
  - N asymmetric countries where each firm decides to export and import
  - Cobb-Douglas preferences over numeraire and CES aggregate differentiated goods of elasticity σ, with expenditure shares $1 - \beta$ and β, respectively
  - Production
    - $\rightarrow$ **Inputs** are produced under perfect competition
    - $\rightarrow$ **Final goods** are produced under monopolistic competition
  - Melitz (2003)-type heterogeneity
    - $\rightarrow$ Variable trade costs τ_{Xij}, τ_{Mki}
    - $\rightarrow$ Fixed trade costs f_D, f_X, f_{DM}, f_{XM}

Technology

- A firm's production function

$$q_i = \varphi x_i$$

where the input bundle combines domestic and imported inputs

$$x_i = \left(z_{Di}^{\rho} + x_{Mi}^{\rho}\right)^{1/\rho}$$

- The bundle of imported inputs

$$x_{Mi} = \left(\sum_{k \in n_i} z_{Mki}^{\rho}\right)^{1/\rho}$$

where n_i is the set of sourcing countries

Input Share

- The firm's marginal cost

$$c_i = \frac{1}{\varphi} \left(1 + \sum_{k \in n_i} \tau_{Mki}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

- The domestic input share at firm level

$$\eta_i = \frac{1}{1 + \sum_{k \in n_i} \tau_{Mki}^{1-\sigma}}$$

which means

$$c_i = \frac{\eta_i^{1/(\sigma-1)}}{\varphi}$$

Profits

- **Profits in domestic market**

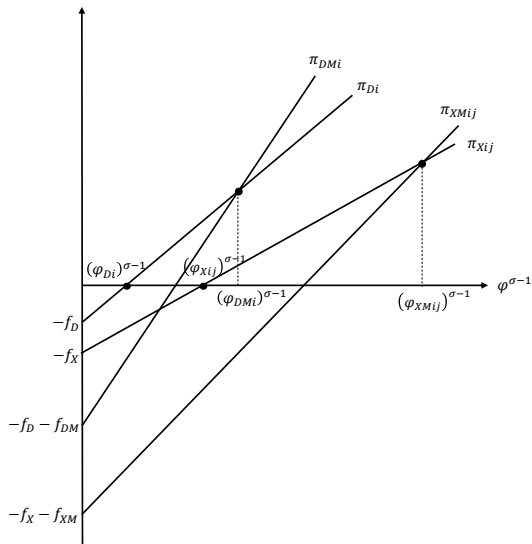$$\pi_{Di} = B_i \varphi^{\sigma-1} - f_D$$

$$\pi_{DMi} = \frac{B_i}{\eta_i} \varphi^{\sigma-1} - f_D - n_i f_{DM}$$

- **Profits in foreign market**

$$\pi_{Xij} = \tau_{Xij}^{1-\sigma} B_j \varphi^{\sigma-1} - f_X$$

$$\pi_{XMij} = \frac{\tau_{Xij}^{1-\sigma} B_j}{\eta_i} \varphi^{\sigma-1} - f_X - n_i f_{XM}$$

Symmetric Countries

- Market shares
  - Let Λ_c denote revenue share of firms with global status $c \in \{D, DM, X, XM\}$; e.g., Λ_{XM} is revenue share of global firms

- Importing-exporting complementarity

$$\underbrace{\frac{\Lambda_{XM}}{\Lambda_X}}_{\substack{\text{Relative market share of importers} \\ \text{who are \textcolor{red}{also} exporters}}} \quad > \quad \underbrace{\frac{\Lambda_{DM}}{\Lambda_D}}_{\substack{\text{Relative market share of importers} \\ \text{who are \textcolor{red}{not} exporters}}} \qquad (*)$$

Intuition: Complementarity at **firm** level $\rightarrow$ Complementarity at **industry** level

Equilibrium

- Variable trade costs decline equally between final goods and inputs

$$d\tau_X = d\tau_M \equiv d\tau < 0$$

- Firm productivity is Pareto distributed with a shape parameter θ

$$G(\varphi) = 1 - \varphi^{-\theta}$$

Trade Elasticities

- The trade elasticity is given by

$$\varepsilon_X = (\ \underbrace{\sigma - 1}_{\text{Intensive margin}} + \underbrace{\theta}_{\text{Extensive margin}})(\ \underbrace{1 + \kappa_M}_{\text{Complementarity}}\ )$$

where

(i) κ_M is positive iff $(*)$ holds

(ii) κ_M is associated only with global firms

- **Implications**

The trade elasticity is greater for global firms than for pure exporters $\rightarrow$ Global firms are more responsible to any trade shocks

Welfare Gains

- The gains from trade (GFT) are

$$G = 1 - \underbrace{\left(\lambda\right)^{\frac{1}{\varepsilon_X}}}_{\text{GFT from final goods}} \times \underbrace{\left(\delta\right)^{\frac{1}{\varepsilon_M}}}_{\text{GFT from inputs}}$$

where

(i) If input trade is not available ($\delta = 1$), this collapses to ACR

(ii) If input trade is available ($\delta < 1$), we need **four** sufficient statistics

- **Implications**

Rapid growth of input trade implies $\delta < \lambda$ and $\varepsilon_M > \varepsilon_X \rightarrow$ GFT are much greater in a world of "offshoring" and "outsourcing"

Data

- Annual Survey of Industrial Enterprise (1998-2009)
    - Firm-level information, such as sales income and total input purchase

- Chinese Customs Database (2000-2015)
    - Ordinary transactions (excluding processing trade)
    - Manufacturing firms (non-trade intermediaries)
    - Firm's export of final goods, import of intermediate inputs

- Our main focus on the period $\rightarrow$ 2000-2007

Two-way Complementarity

- Examine whether the complementarity ($*$) is satisfied in Chinese industries

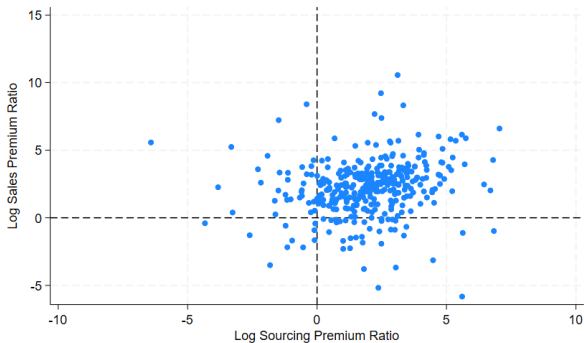- The importing-exporting premium ratio on the **sales side** for industry s

$$\zeta_s = \frac{\Lambda_{XMs}/\Lambda_{Xs}}{\Lambda_{DMs}/\Lambda_{Ds}}$$

- Similar ratio on the **sourcing side**

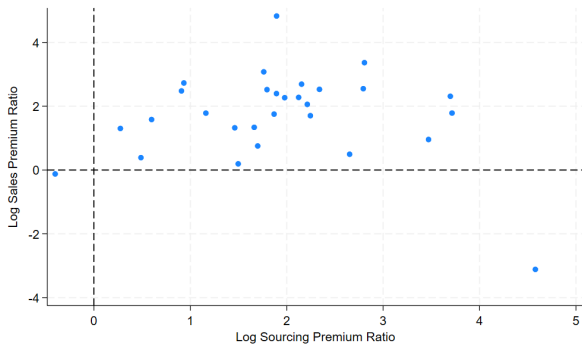$$\xi_s = \frac{\Delta_{XMs}/\Delta_{DMs}}{\Delta_{Xs}/\Delta_{Ds}}$$

Two-way Complementarity

Most **disaggregate** industry level (CIC-4)

Two-way Complementarity

Most **aggregate** industry level (CIC-2)

Theoretical predictions

- If there is two-way complementarity and variable trade costs decline equally between final goods and inputs
  1. Trade elasticities

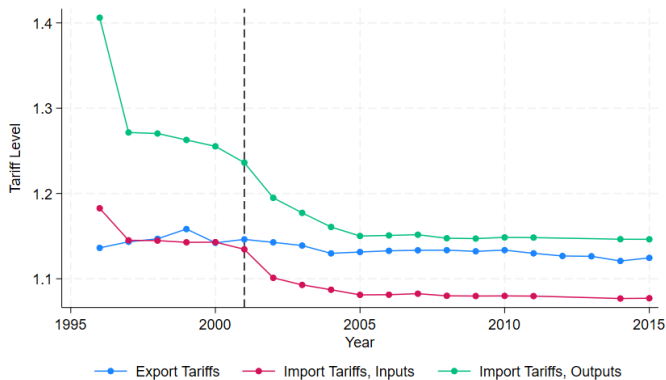 $$\varepsilon_X = (\sigma - 1 + \theta)(1 + \kappa_M)$$
  $$\varepsilon_M = (\sigma - 1 + \theta)(1 + \kappa_X)$$

  2. Welfare gains

  $$G = 1 - \left(\lambda\right)^{\frac{1}{\varepsilon_X}} \left(\delta\right)^{\frac{1}{\varepsilon_M}}$$

- Did variable trade costs decline equally in China ($d\tau_X = d\tau_M$)?

Only **import** tariffs declined proportionately

Trade Elasticities

	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Global Firms			
			Dependent Variable: $\ln \text{Import}_{hjt}$			
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln \text{Import Tariff}_{ht}$	-6.680***	-8.636***	-9.872***	-8.875***	-11.32***	-13.01***
	(0.292)	(0.250)	(0.227)	(0.311)	(0.286)	(0.263)
$\ln \text{Distance}_j$	-0.572***			-0.573***		
	(0.00898)			(0.00883)		
HS4-Year FE	YES	YES	YES	YES	YES	YES
Country-Year FE	NO	YES	YES	NO	YES	YES
Country-HS4 FE	NO	NO	YES	NO	NO	YES
First Stage F	-	-	-	845791	845283	690644
Obs.	269,308	270,105	262,810	269,308	270,105	262,810
R^2	0.213	0.336	0.554	0.018	0.004	0.007
			Panel B: Pure Importers			
			Dependent Variable: $\ln \text{Import}_{hjt}$			
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln \text{Import Tariff}_{ht}$	-5.400***	-7.093***	-8.580***	-7.626***	-9.754***	-11.63***
	(0.338)	(0.310)	(0.292)	(0.374)	(0.355)	(0.338)
$\ln \text{Distance}_j$	-0.486***			-0.488***		
	(0.0100)			(0.00989)		
HS4-Year FE	YES	YES	YES	YES	YES	YES
Country-Year FE	NO	YES	YES	NO	YES	YES
Country-HS4 FE	NO	NO	YES	NO	NO	YES
First Stage F	-	-	-	554990	552286	441990
Obs.	176,429	176,611	170,871	176,429	176,611	170,871
R^2	0.257	0.336	0.533	0.015	0.003	0.005

Welfare Gains
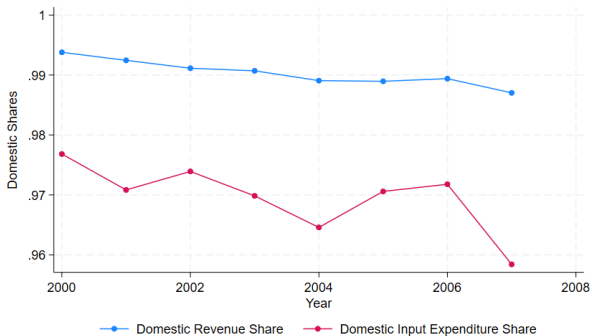
China's trade openness appears so low...

Welfare Gains

- Welfare gains from trade are captured by four sufficient statistics

$$G = 1 - \left(\lambda\right)^{-\frac{1}{\varepsilon_X}} \left(\delta\right)^{-\frac{1}{\varepsilon_M}}$$

- From the estimated trade elasticities ($\varepsilon_X = 10$, $\varepsilon_M = 12$) and domestic expenditure shares ($\lambda = 0.98, \delta = 0.96$), we get

$$G = \begin{cases} 0.0015 \ (0.15\%) & \text{if} \ \delta = 1 \\ 0.0045 \ (0.45\%) & \text{if} \ \delta < 1 \end{cases}$$

Conclusion

- This paper develops a trade model of importing-exporting to shed new light on the role played by global firms

- Key findings
  - Show amplified effects on aggregate variables with complementarity
  - Provide novel empirical evidence on two-way complementarity