Exceptional Exporter Performance? Evidence from Chinese Manufacturing Firms

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Firm-Level Trade - Some Background

- Classical trade theory delivers aggregate predictions by assuming countries are different
  - Heckscher-Ohlin Model
  - Ricardian Model
- "New" trade theory explains two-way trade between similar countries
  - Krugman: differentiated products
- Current theory explains **heterogeneous exporting behavior of firms**
  - Melitz: heterogeneous productivity
  - Heckscher-Ohlin plays no role

Firm-Level Evidence in the Literature

- Exporters are in the minority
- Exporters are typically more productive, and sell much more in domestic market than non-exporters
- Most exporters export only a small fraction of their output

Manufacturing Firms in China

- Overall exporters are in the minority.
- Exporters are typically **less** productive, and sell less in domestic market than non-exporters
- Most exporters export a **large** fraction of their output

Models Explained the Firm-Level Evidence

Melitz (2003)

- Heterogeneous productivity across firms
- Market selection: firm's profit depends on trade barrier, market size and competition in the market

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⇒Countries are symmetric. The foreign market is tougher because of extra transportation cost and higher fixed cost.

⇒**Only the most productive firms are entering the tougher foreign markets**

Explain the Contrasting Facts

- Do the new facts call into question the generality of recent trade theory?
- The exact economic force in Melitz explains the opposite patterns
  - Melitz (2003): tougher market selects the most efficient firms

Explain the Contrasting Facts

- Do the new facts call into question the generality of recent trade theory?
- The exact economic force in Melitz explains the opposite patterns
  - Melitz (2003): tougher market selects the most efficient firms
- What if the domestic market is tougher?
- How could this be so?

  Heckscher-Ohlin: China has comparative advantage in labor-intensive goods

  In labor-intensive sectors, foreign markets can be less competitive than the domestic market for Chinese firms.

Systematic Relations to the Factor Intensity

- **Labor-intensive sectors**
  - Exporters are in the **majority**
  - Exporters are **less** productive than non-exporters
  - Exporters export a **large** fraction of their output
  - Most exporters only export
- **Capital-intensive sectors**
  - Exporters are in the **minority**
  - Exporters are **more** productive than non-exporters
  - Exporters export a **small** fraction of their output
  - Most exporters sell in the domestic market

Related Literature

- Exporters vs Non-exporters
  Bernard and Jensen (1995 1999); Clerides, Lach and Tybout (1998); Aw, Chung and Roberts (2000); Bernard, Eaton, Jensen and Kortum (2003); Bernard, Jensen and Schott (2005); Bernard and Wagner (1997)
- Theory about firm level trade
  Melitz (2003); Chaney (2005); Eaton, Kortum and Kramarz (2005); Arkolakis (2008)
- Factor endowment
  Bernard, Redding and Schott (2007); Romalis (2004); Schott (2003)

Road Map

- Model predictions
  - Melitz and H-O / BRS
- Observations from Chinese firm-level data
  - Relations between export behaviors and the capital-labor ratio of sectors/firms
  - Robust to different institutional factors and productivity measures
  - French firms
- GE and effects of trade liberalization (China joins the WTO)

Model

Model

- Which market is tougher?
- Bernard, Redding and Schott (2007)
  - Melitz (2003): trade costs/ fixed costs
  - Heckscher-Ohlin: comparative advantage also affects the relative toughness of markets

Countries

- 2 countries: $m, n \in \{N, S\}$ produce goods using K and L
- South is relatively labor abundant

$$\frac{K_S}{L_S} < \frac{K_N}{L_N}$$

For the time being, assume in equilibrium

$$\frac{w_S}{r_S} < \frac{w_N}{r_N}$$

- Sectors $i = 1, ..., I$ in each country

Firms and Preferences

- Preferences are the same in two countries:

$$U_n = \prod_i \left(C_n^i\right)^{\gamma_i}$$

$$C_n^i = \left[\int_{\Omega_n^i} q^i(z)^{\frac{\sigma-1}{\sigma}} \, d\mu(z)\right]^{\frac{\sigma}{\sigma-1}}$$

Technology

- In each (m, i), productivity distribution is $\mu_m^i(z)$
- Production function for a firm in sector i with productivity z

$$y^i(z) = z l^{\beta_i} k^{1-\beta_i}$$

Trade Costs

- Trade barriers
  - Transportation cost: $d > 1$
  - Tariff rate: $\tau > 0$
  - Market access cost in n: E_n
- Each firm in each country chooses:
  - Countries to sell its output
  - Price in each country

Pricing

- The unit cost function:

$$c^i(z) = B\frac{w^{\beta_i} r^{1-\beta_i}}{z}$$

- Markup equation:

$$\begin{aligned} p_d^i(z) &= \frac{\sigma}{\sigma-1} c^i(z) \\ p_x^i(z) &= d(1+\tau)\frac{\sigma}{\sigma-1} c^i(z) \end{aligned}$$

- Revenue

$$s_n^i(z) = (\gamma_i X_n)\left(\frac{p_n^i(z)}{P_n^i}\right)^{1-\sigma}, \; n = d, x$$

Productivity Cutoffs

- Market entry cost E_d and E_x

$$\pi_d^i(z) = \frac{s_d^i(z)}{\sigma} - E_d$$

- The cutoff $\bar{z}_d^i$ and $\bar{z}_x^i$

$$\begin{aligned} s_d^i\left(\bar{z}_d^i\right) &= \sigma E_d \\ s_x^i\left(\bar{z}_x^i\right) &= \sigma E_x \end{aligned}$$

Intuition For Firms Market Selection

$$\underbrace{\frac{\bar{z}_x^i}{\bar{z}_d^i}}_{\text{Threshold ratio}} = \underbrace{d\left(1+\tau\right)}_{\text{Exporting cost}} \underbrace{\frac{P_d^i}{P_x^i}}_{\text{Relative price}} \left(\underbrace{\frac{X_d}{X_x}}_{\text{market size}} \underbrace{\frac{E_x}{E_d}}_{\text{entry cost}} \right)^{\frac{1}{\sigma-1}}$$

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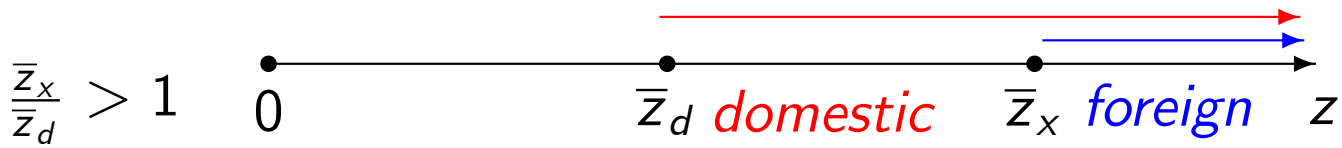
- In Melitz (2003), countries are symmetric, then $\frac{P_d^i}{P_x^i} = 1$ and $\frac{\bar{z}_x^i}{\bar{z}_d^i} > 1$.



Intuition For Firms Market Selection

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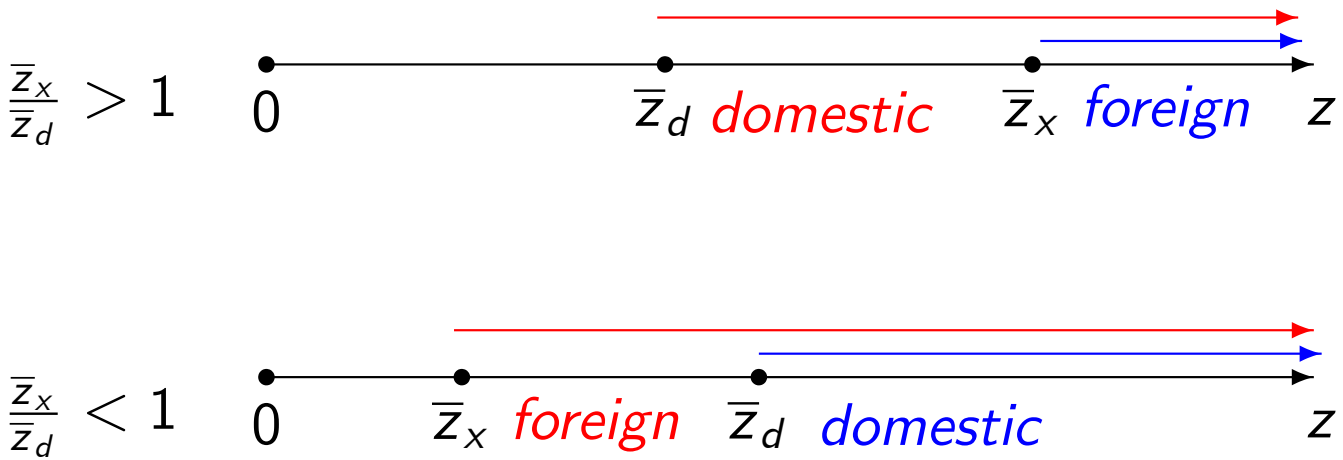
- But this ratio can be less than 1.
- If $\frac{X_d}{X_x}, \frac{E_x}{E_d}$ or $\frac{P_d^i}{P_x^i}$ is low enough, then $\frac{\bar{z}_x^i}{\bar{z}_d^i} < 1$.

Intuition for Firms Market Selection



Relation Between Relative Price Index and Factor Intensity

- In the South, $\frac{P_d^i}{P_x^i} = \frac{P_S^i}{P_N^i}$ is decreasing in the labor intensity of sector i
- So in the South, $\frac{\bar{z}_x^i}{\bar{z}_d^i} = d\left(1+\tau\right)\frac{P_d^i}{P_x^i}\left(\frac{X_d E_x}{X_x E_d}\right)^{\frac{1}{\sigma-1}}$ is decreasing in the labor intensity of sector i

Relation Between Relative Price Index and Factor Intensity

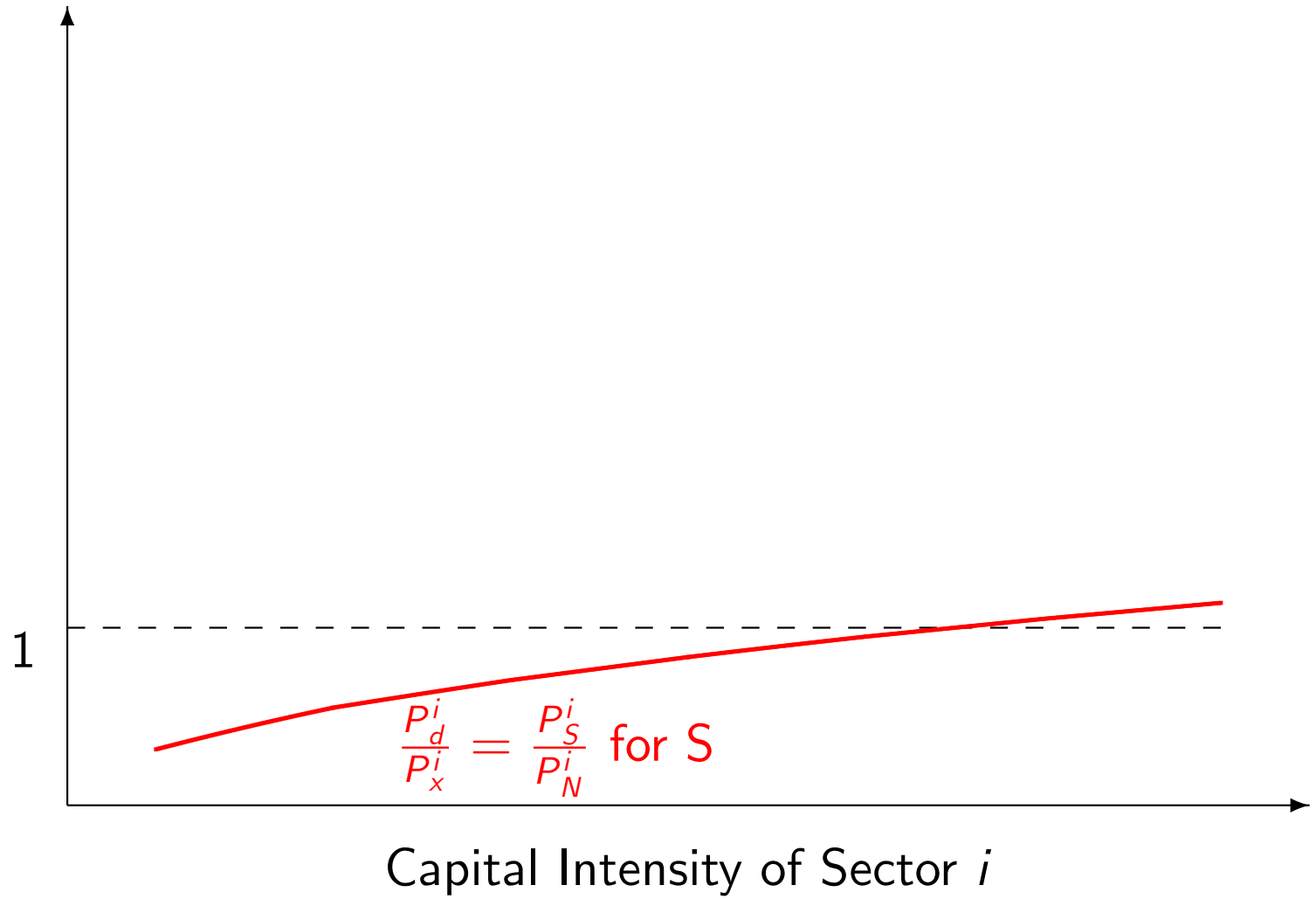
Proposition

With frictional trade $(d(1+\tau) > 1)$, *if South is more labor abundant* $(\frac{w_S}{r_S} < \frac{w_N}{r_N})$, *and sector* i *is more labor intensive than sector* j $\left(\beta_i > \beta_j\right)$, *then*

$$\frac{P_S^i}{P_N^i} < \frac{P_S^j}{P_N^j},$$

more labor-intensive goods will have a lower relative price index in the (labor-abundant) South.

US and Chinese Firms' Market Selection, Simultaneously



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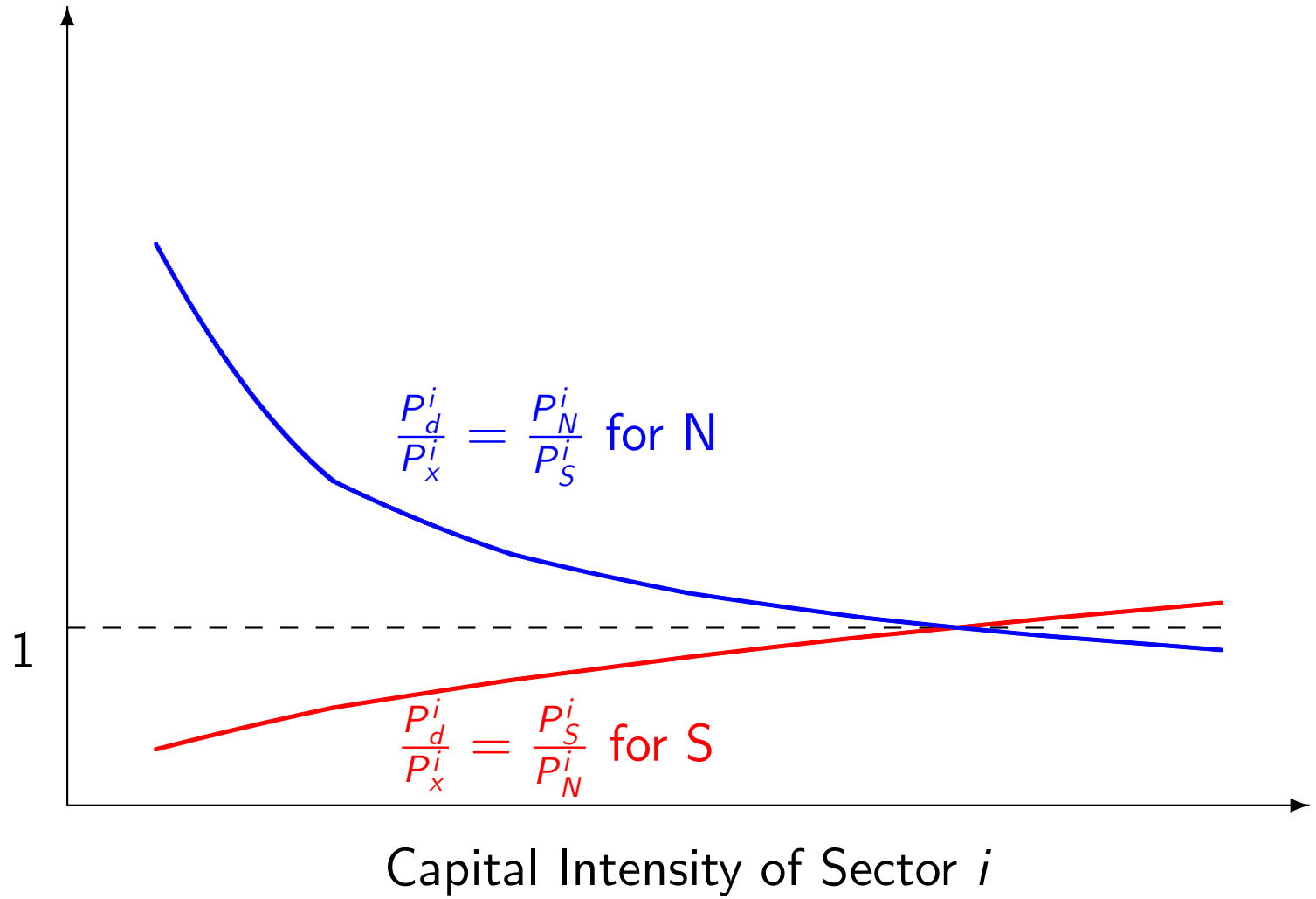

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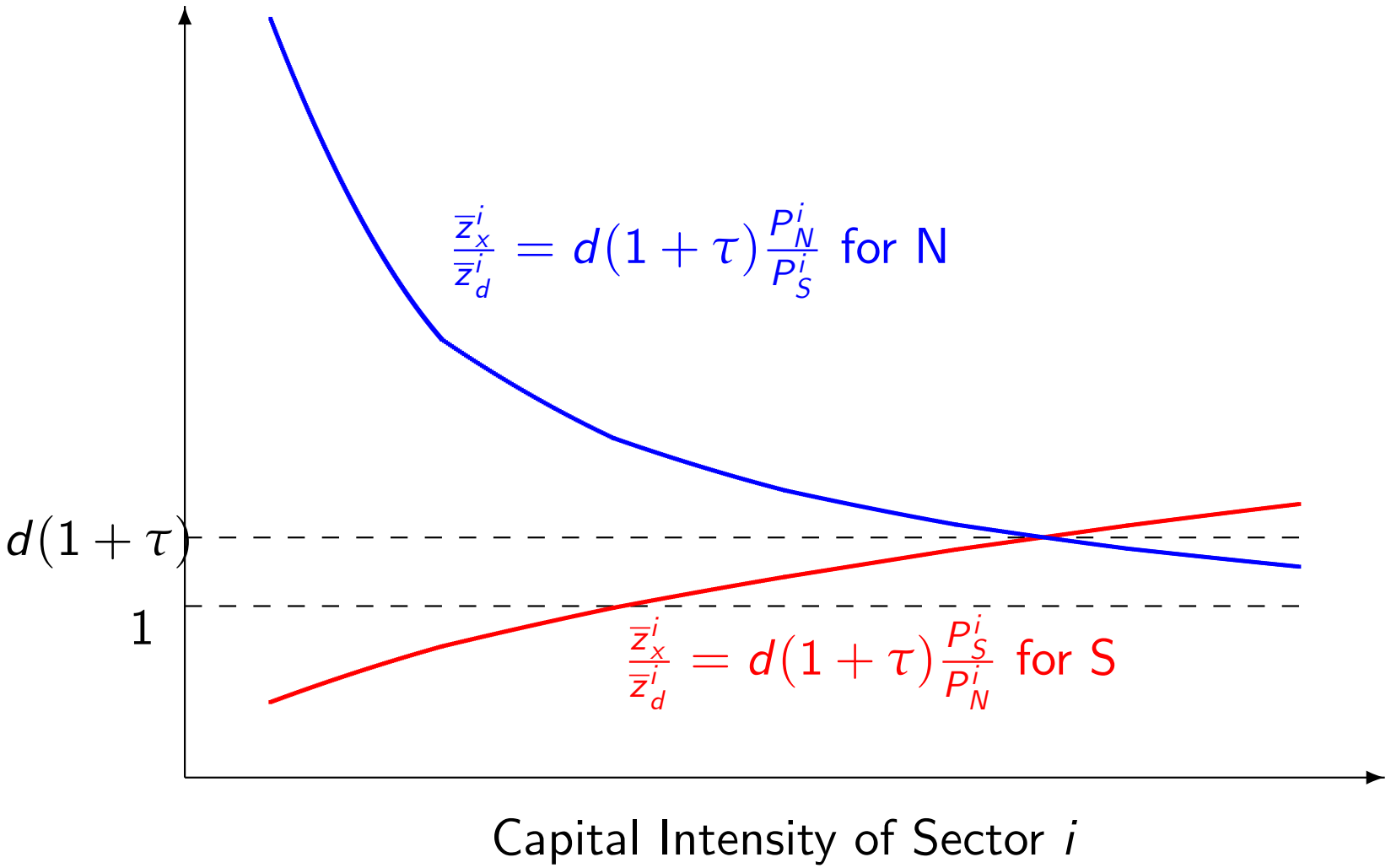

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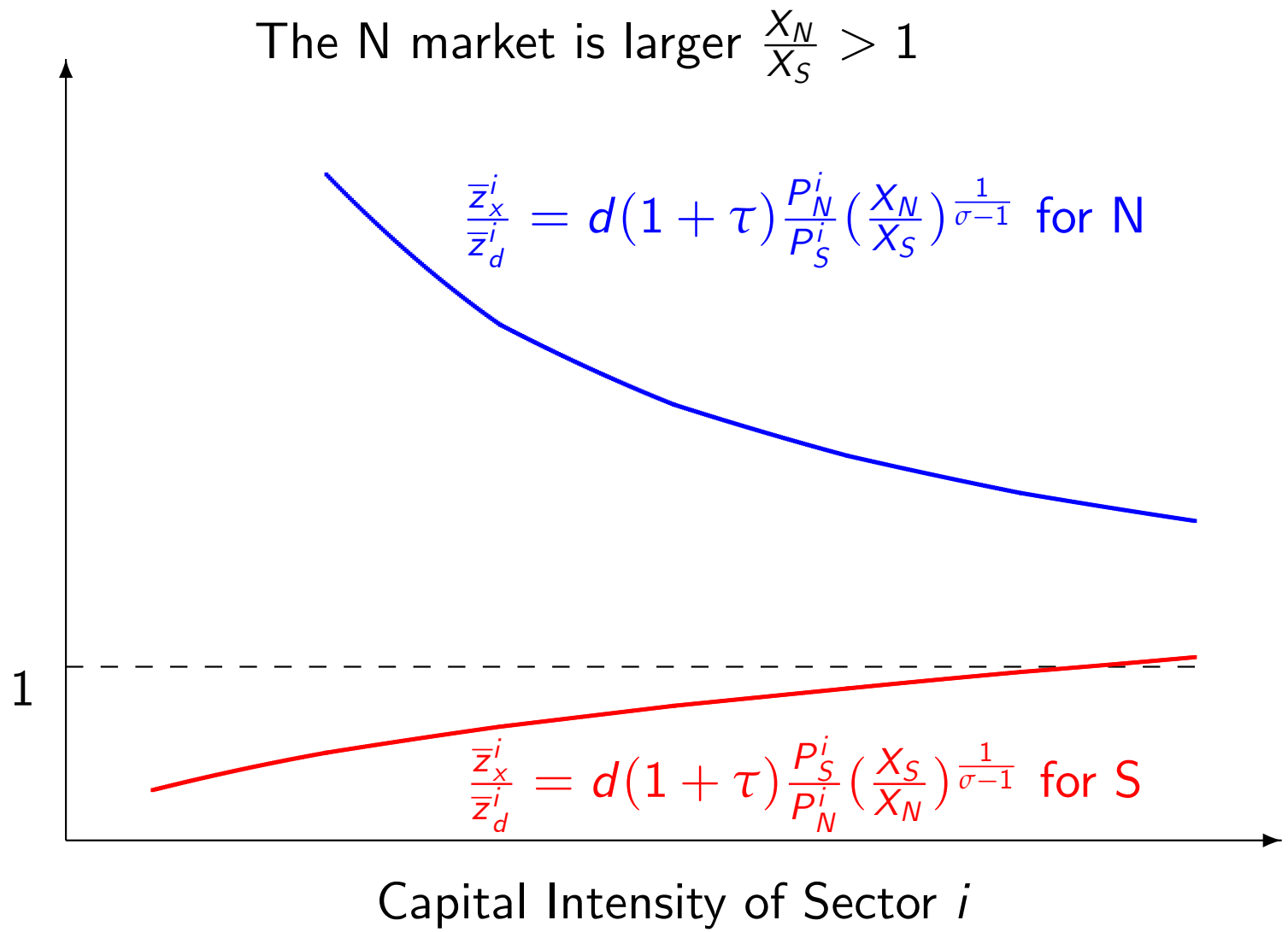


Facts

Data

- Chinese firm-level production data
  - Annual Census from National Bureau of Statistics
  - 1998-2007
  - All SOE, and non-SOE with sales more than 5 million RMB =600,000$
  - Balance sheet, profit & loss statement, and cash flow statement
  - Includes export values
  - Coverage of manufacturing export

Three Observations

- How many firms export?
- Which firms export?
- How much do they export?
- How the answers vary across sectors?

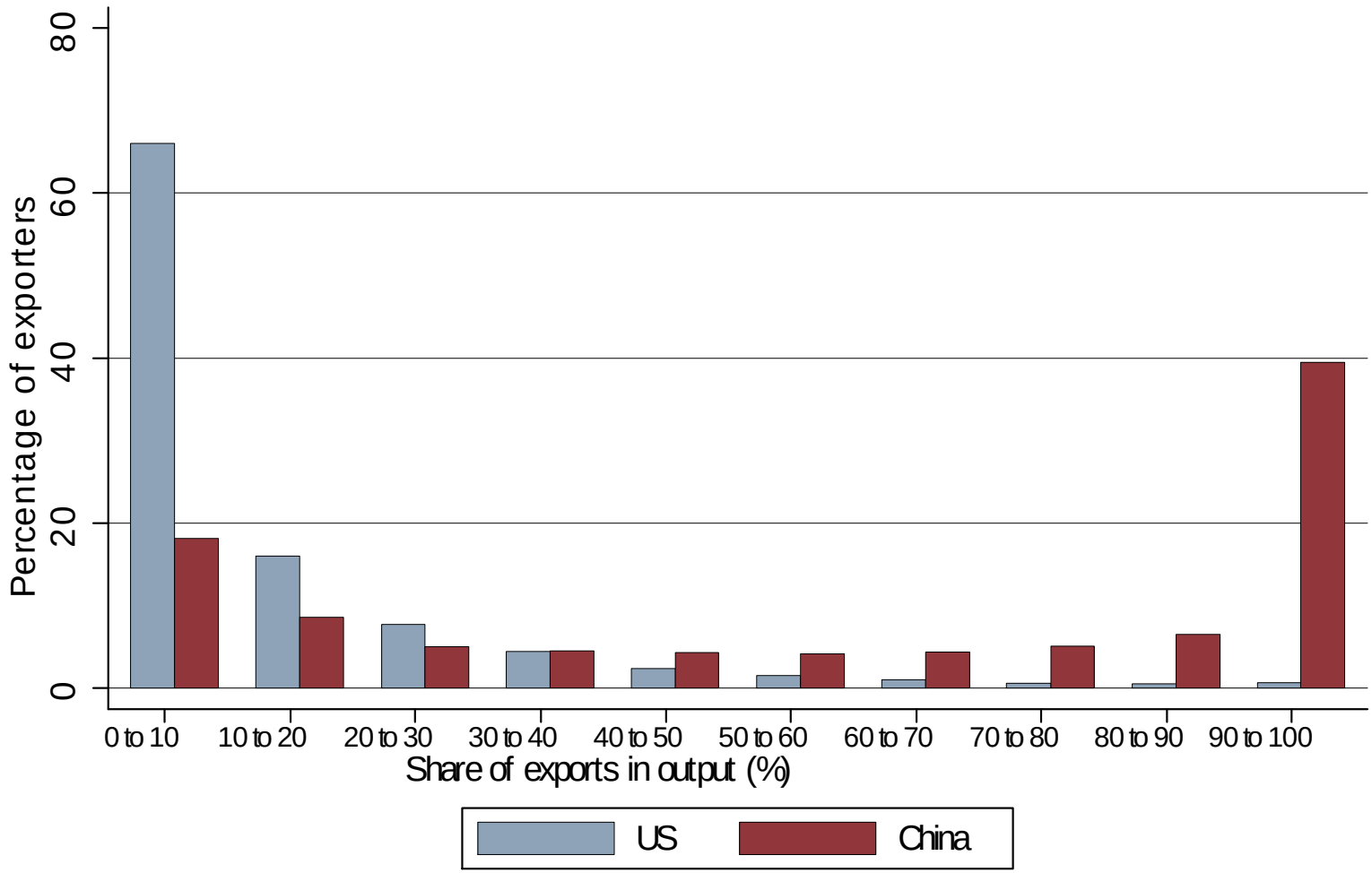
Export Participation

	Percentage of Manufacturing Firms	
	China	U.S.
export	29.6	21

Exporters vs Non-exporters

	Exporters Relative to Non-exporters	
	China	U.S.
Domestic sales	0.96	4.80
Value added per worker	0.86	1.39
Sales per worker	0.91	1.36

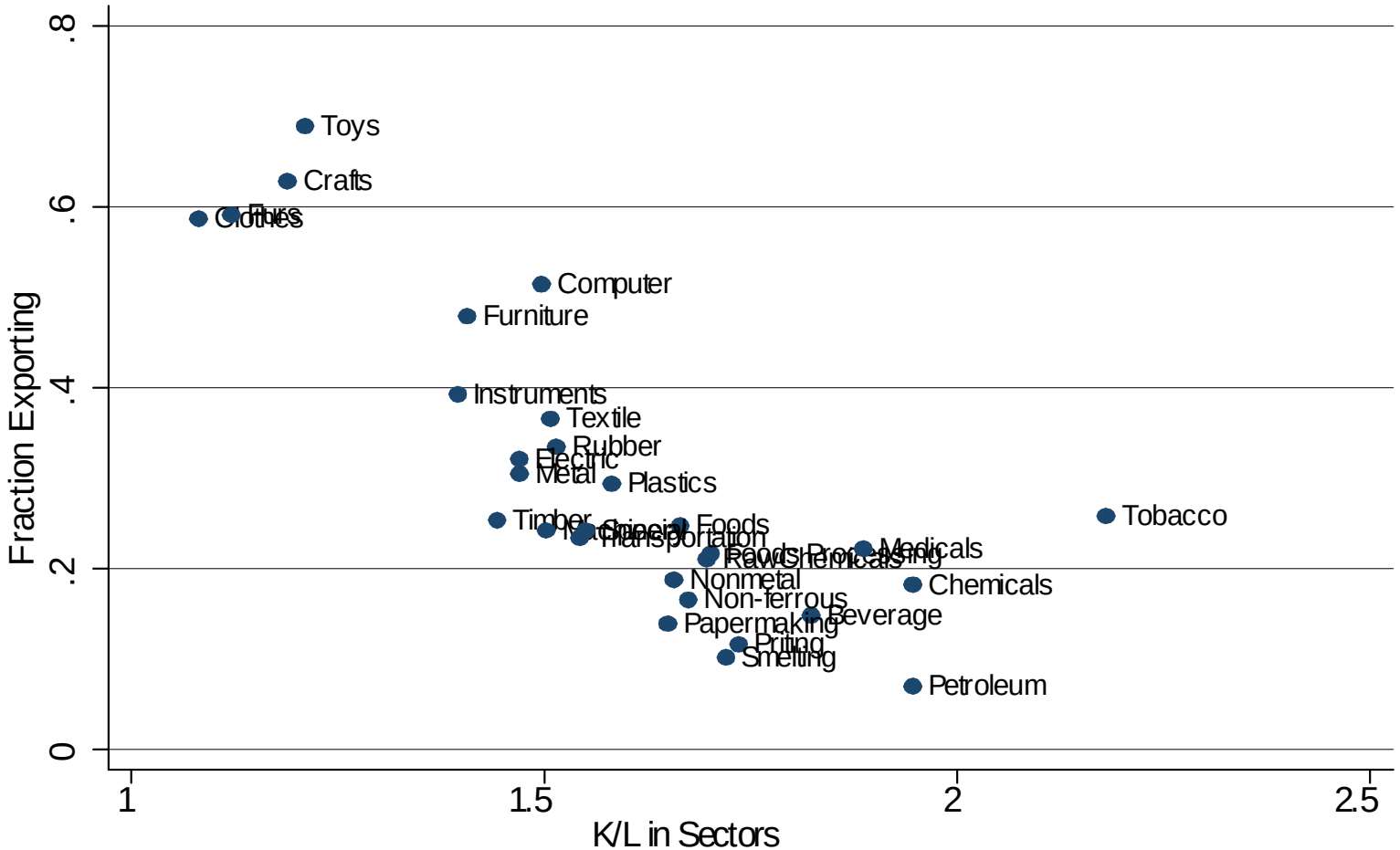
Distribution of Export Intensity



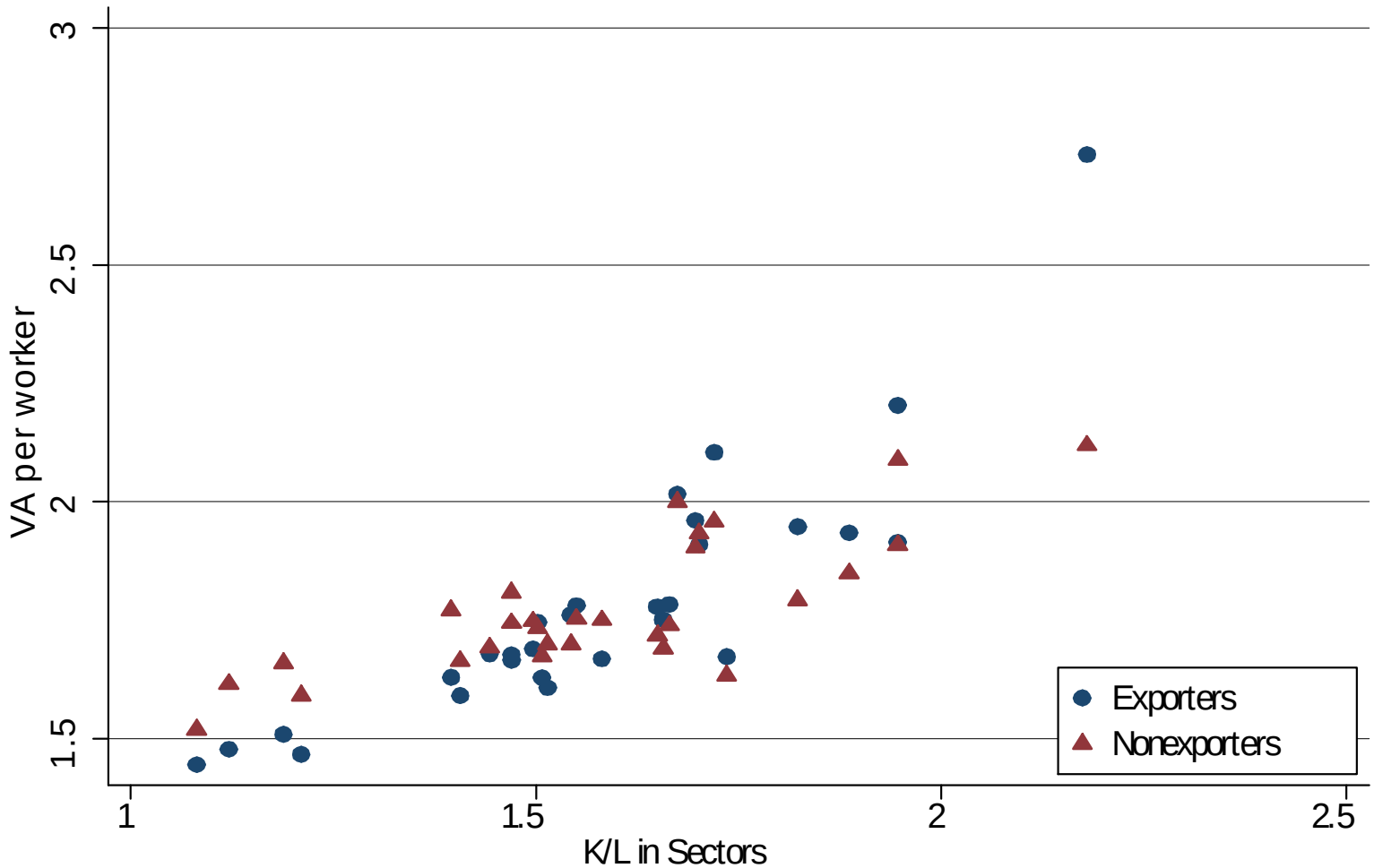
Relation to the Labor Intensity

Export Participation By Sectors

Labor-intensive sectors have more exporting firms



Productivity of Exporters and Non-exporters (Across Sectors)



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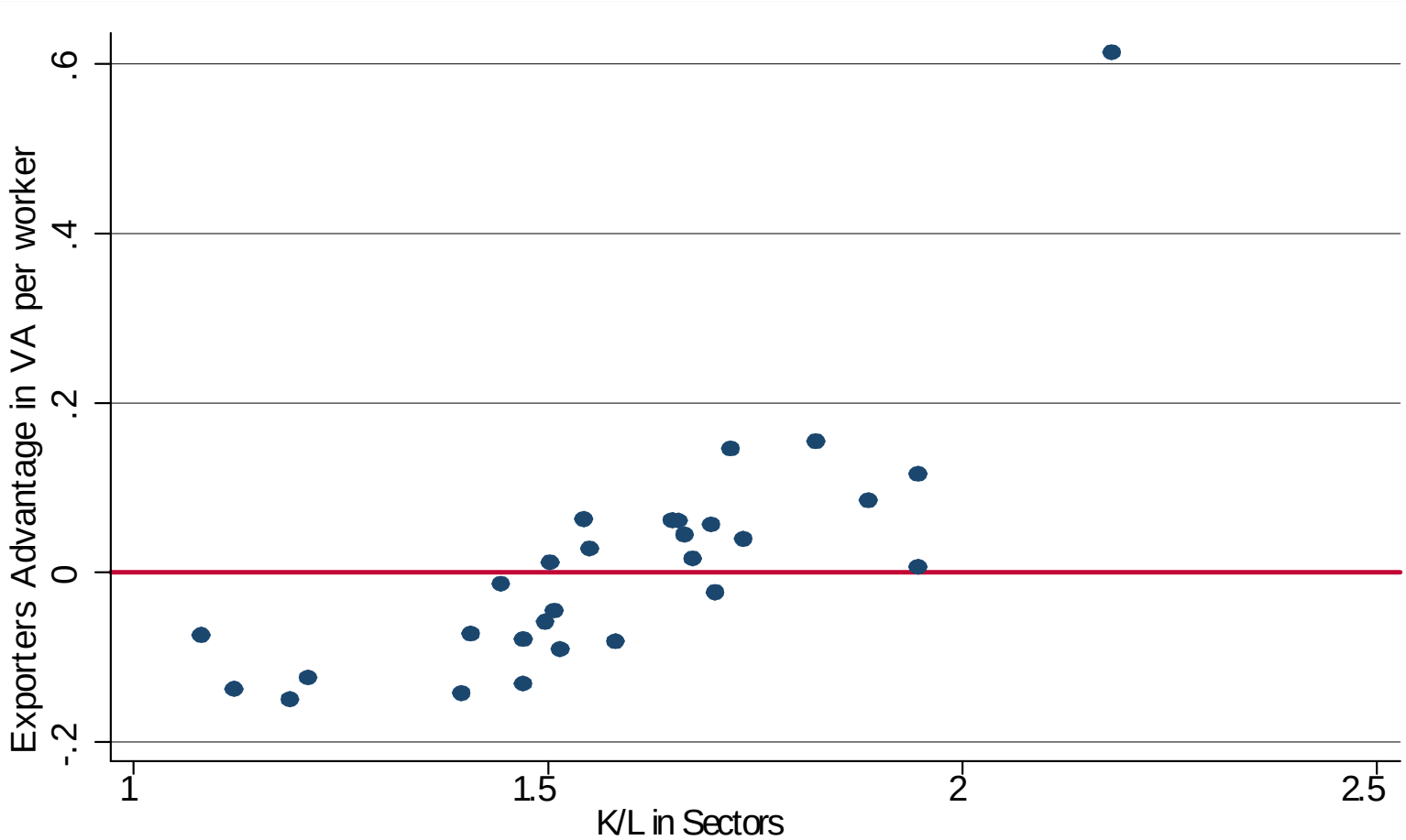
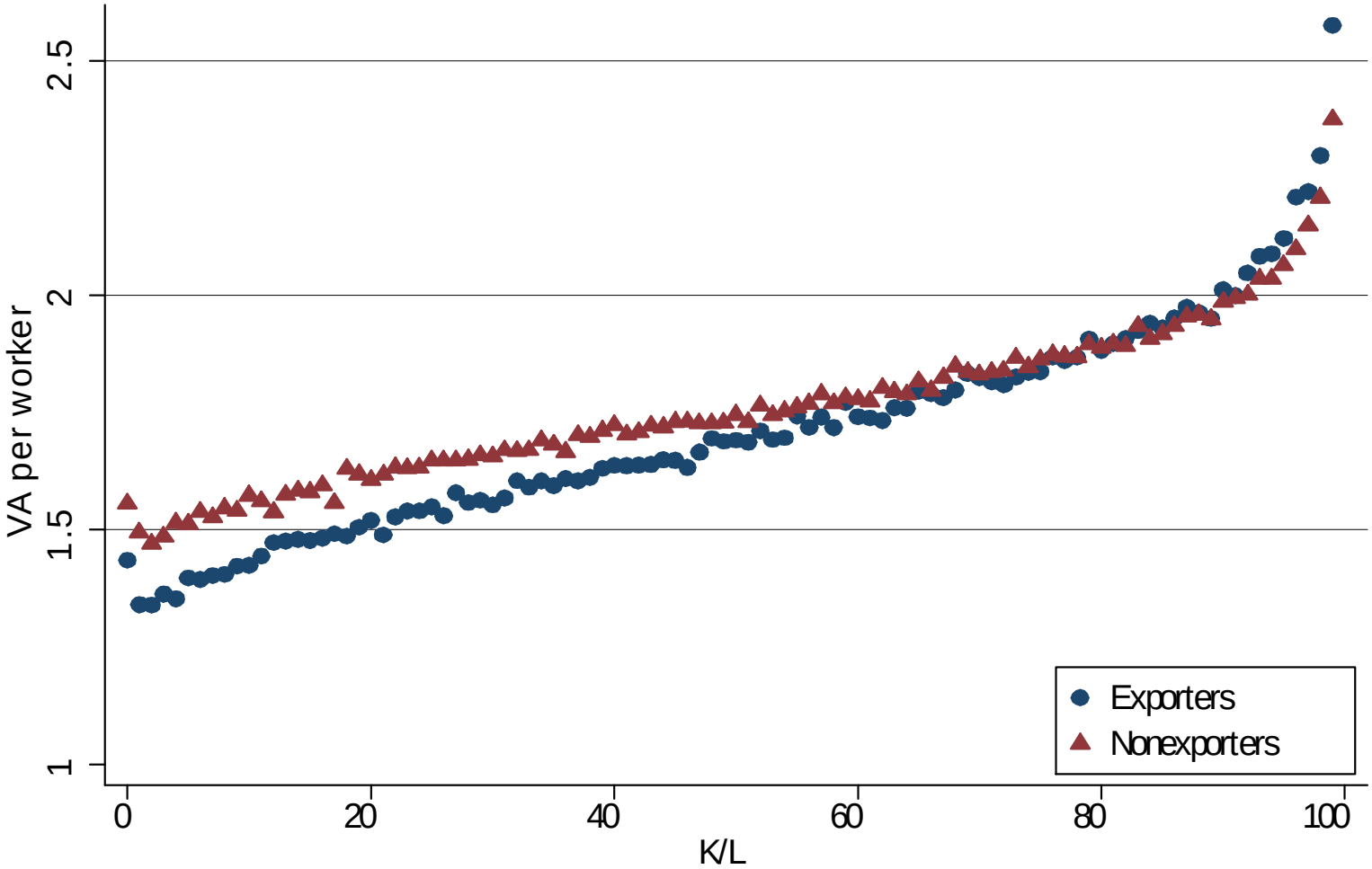


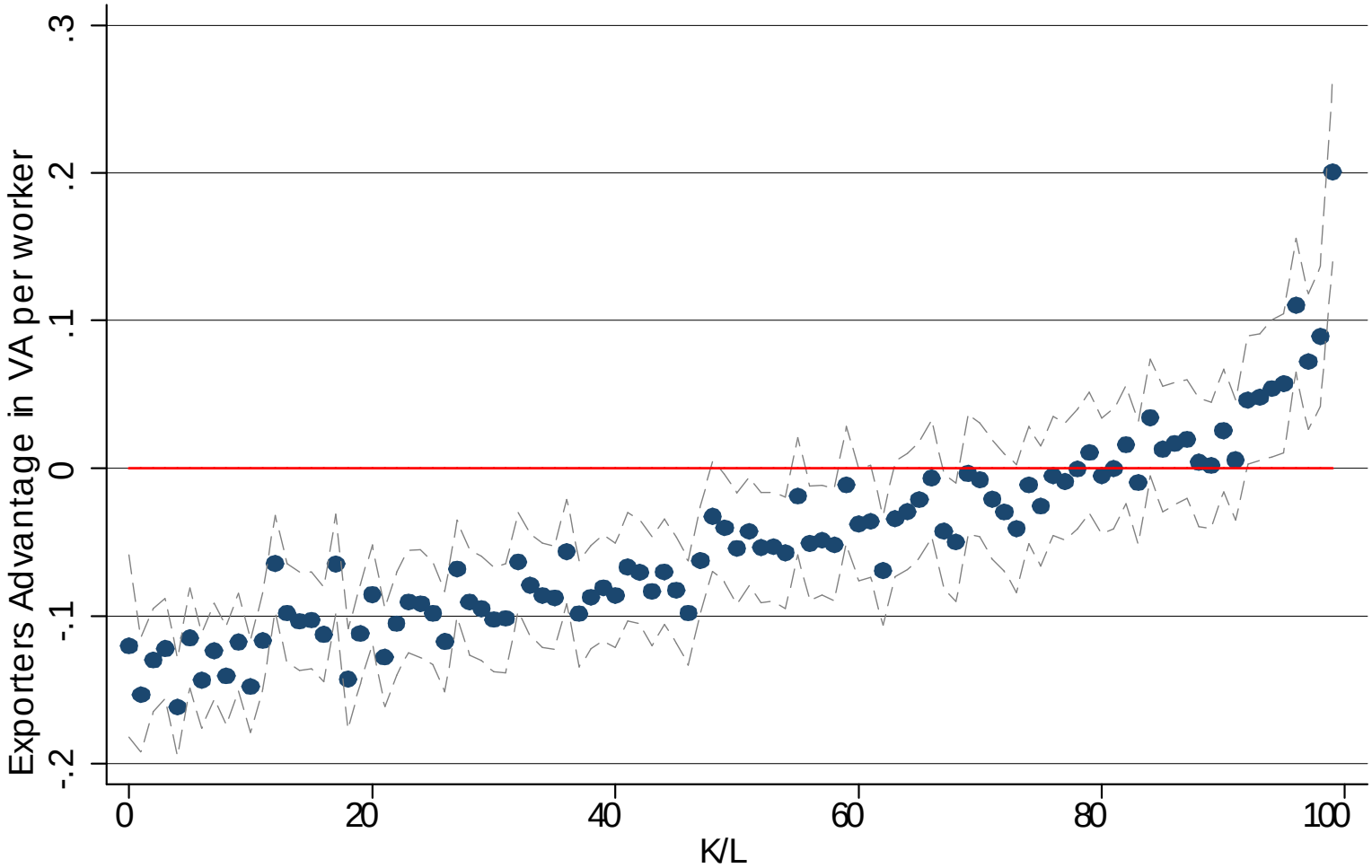
control for regions and ownership

Productivity of Exporters and Non-exporters Across K/L Bins



▸ K/Lvalue

Exporters Relative to Non-exporters (Across K/L Bins)



▸ control for industry, region and ownership ▸ K/Y ▸ TFP ▸ domsales

Regression

	Value Added per Worker
Exporters	-0.192^{***}
	(-16.78)
Exporters$\times$ firms K/L	0.064^{***}
	(22.30)

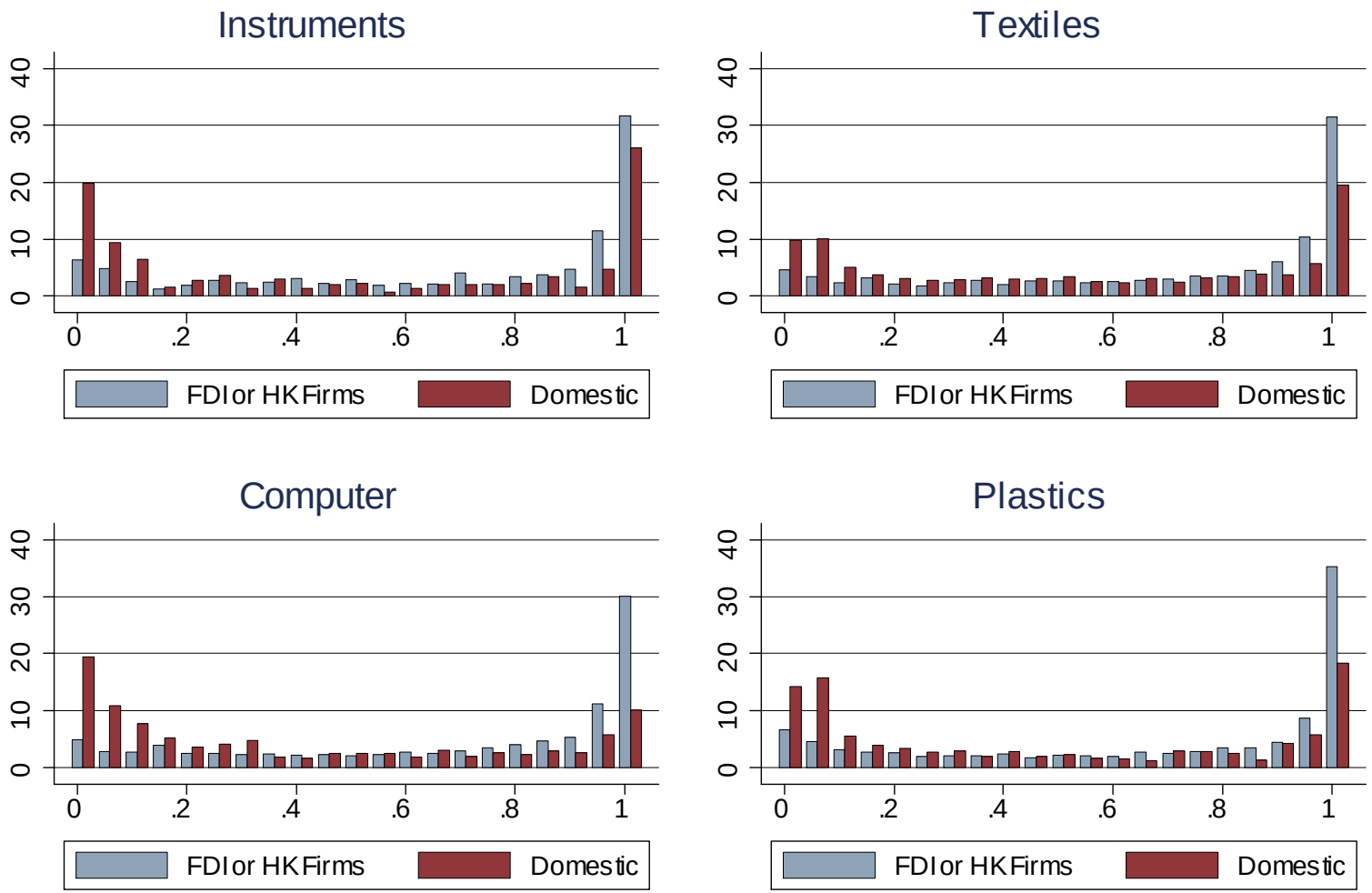
T statistics are in parentheses. Regression controls for 4-digit industries, 6-digit cities, 3-digit ownerships, and the log of firms capital and the log of firms employment.

Histogram of Exporters Export Intensity

Labor-Intensive Sectors

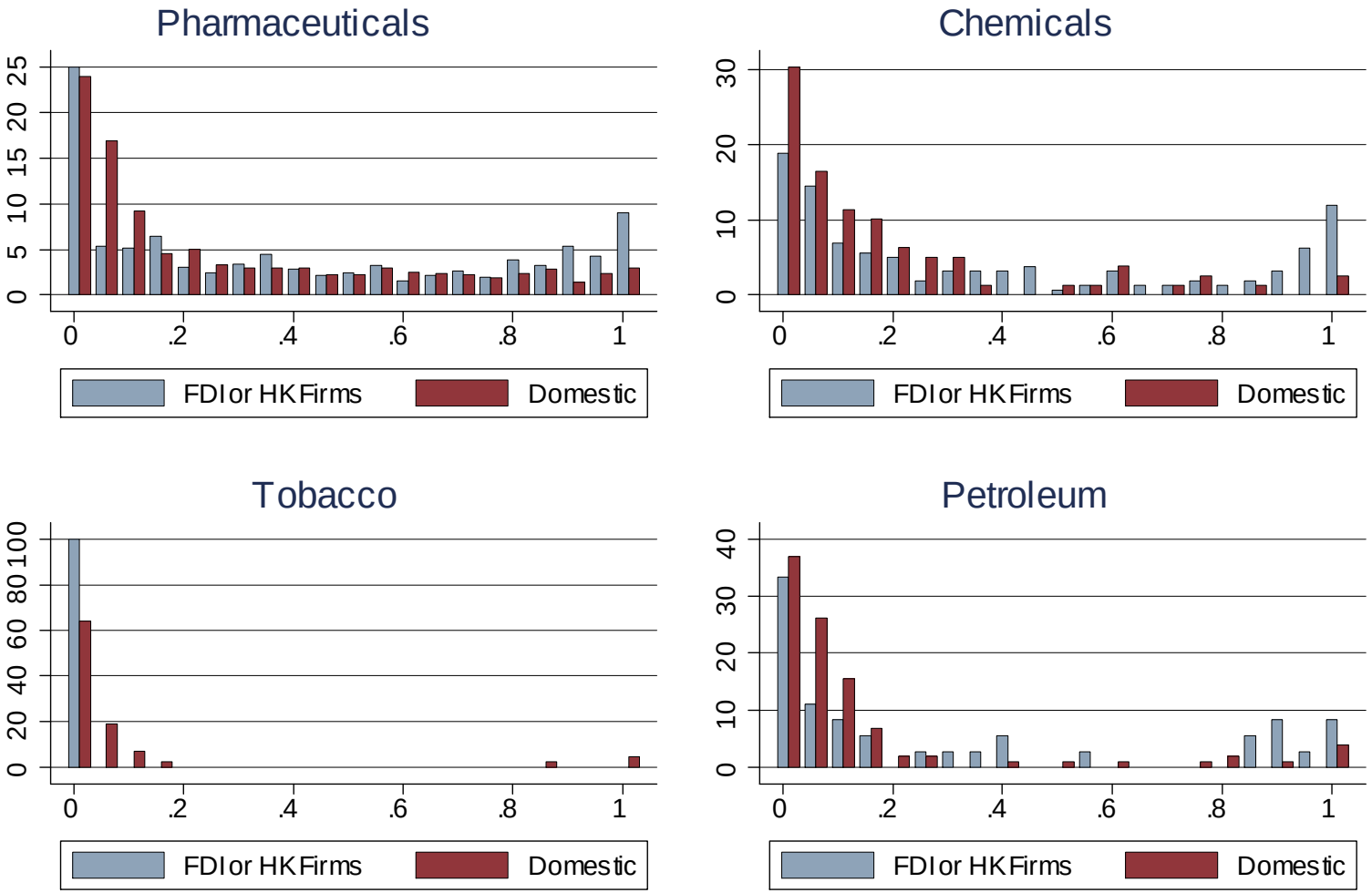
Histogram of Exporters Export Intensity

Sectors with Medium Capital Intensity

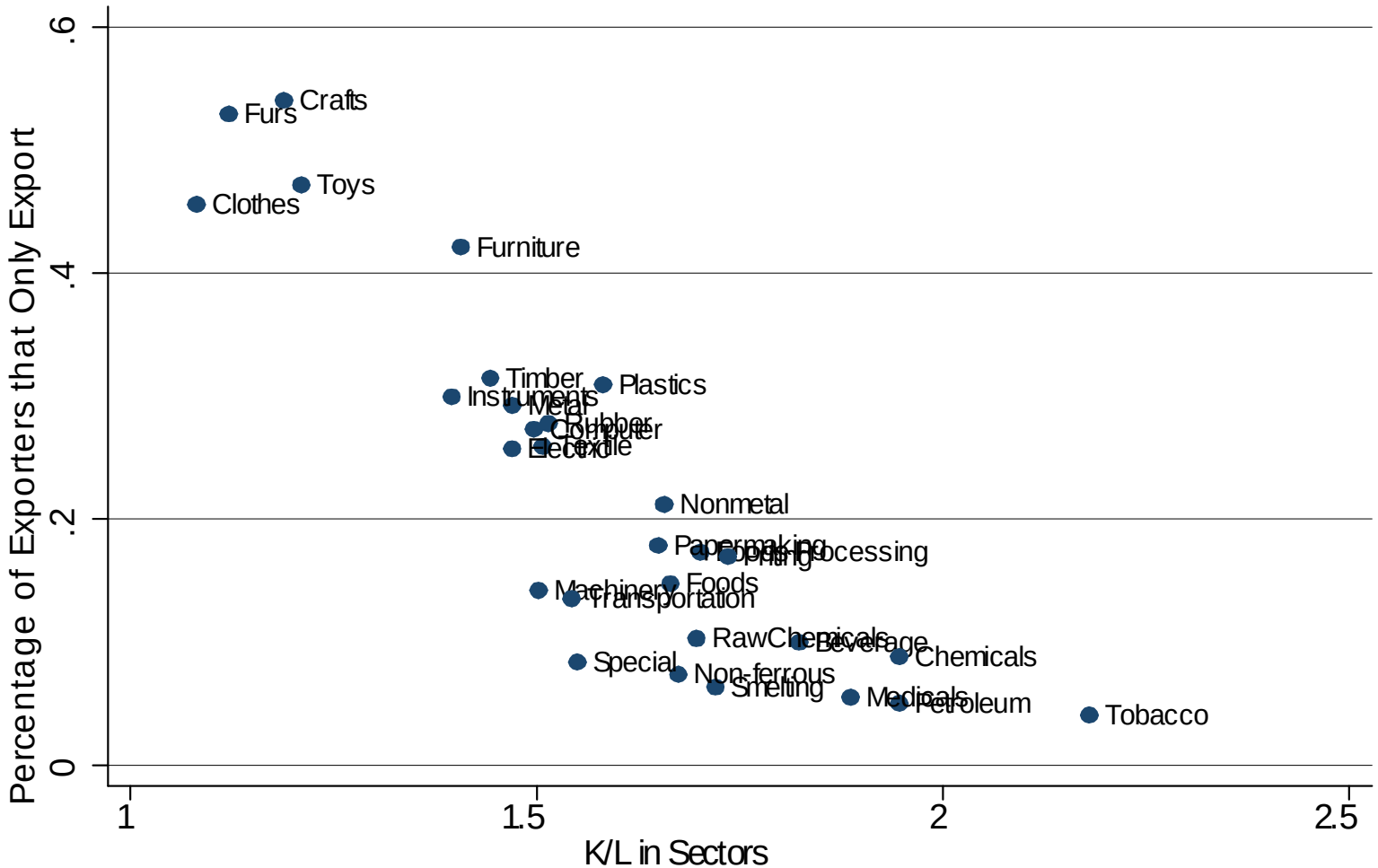


Histogram of Exporters Export Intensity

Capital-Intensive Sectors



Percentage of Exporters that Only Export



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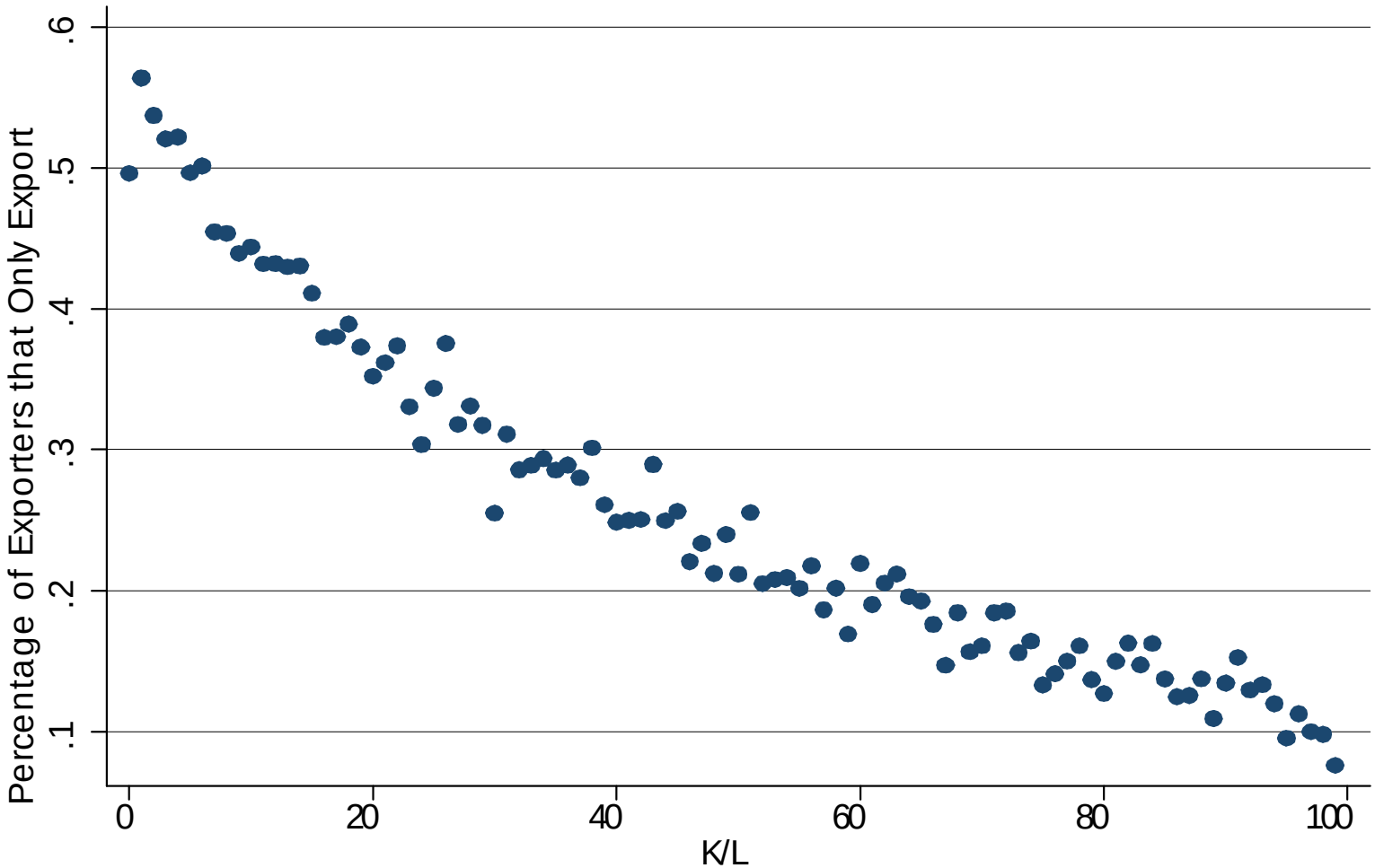


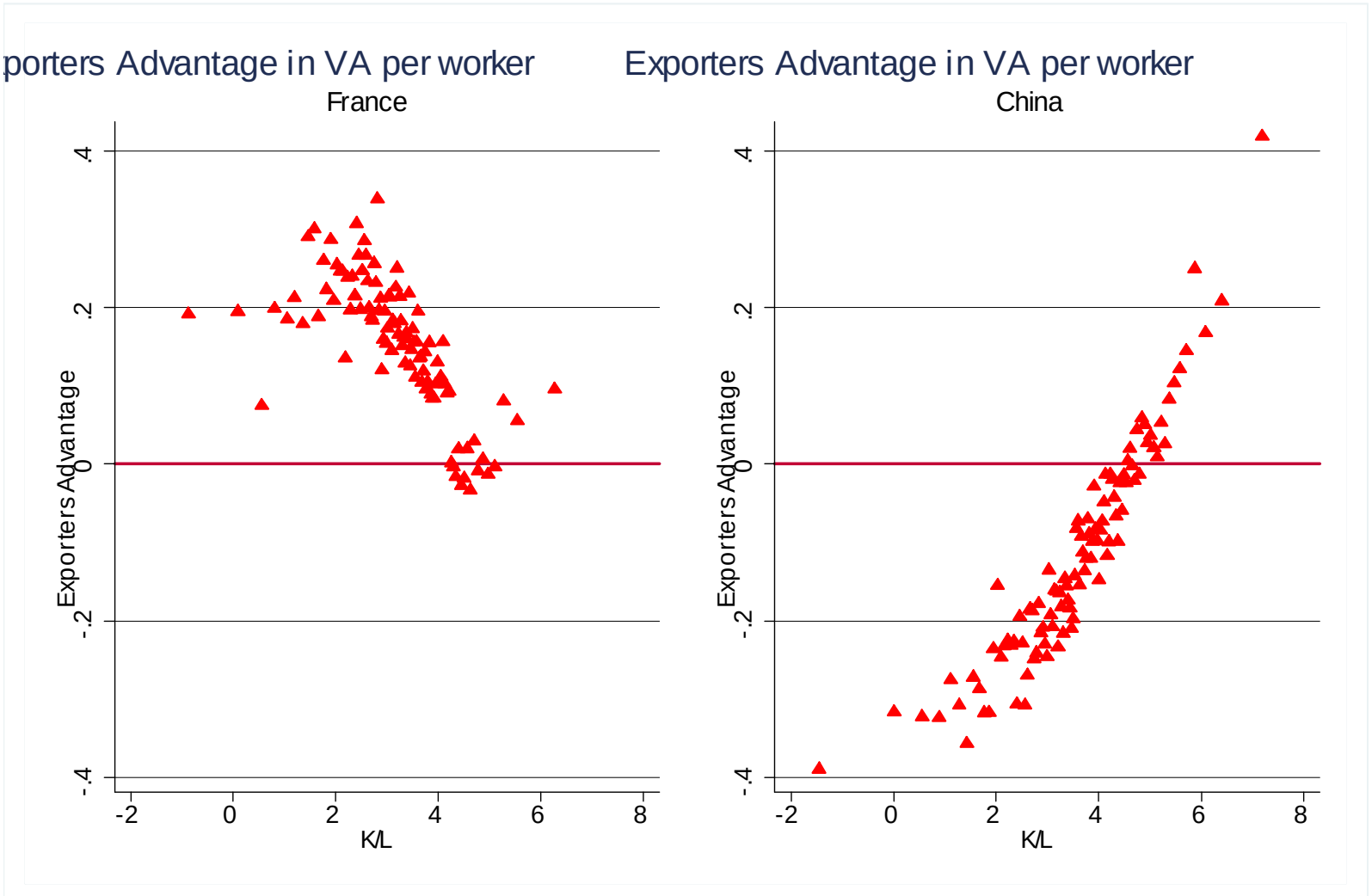
Summary

- **Labor-intensive sectors**
  - Exporters are in the **majority**
  - Exporters are **less** productive than non-exporters
  - Exporters export a **large** fraction of their output
  - Most exporters only export
- **Capital-intensive sectors**
  - Exporters are in the **minority**
  - Exporters are **more** productive than non-exporters
  - Exporters export a **small** fraction of their output
  - Most exporters sell in the domestic market

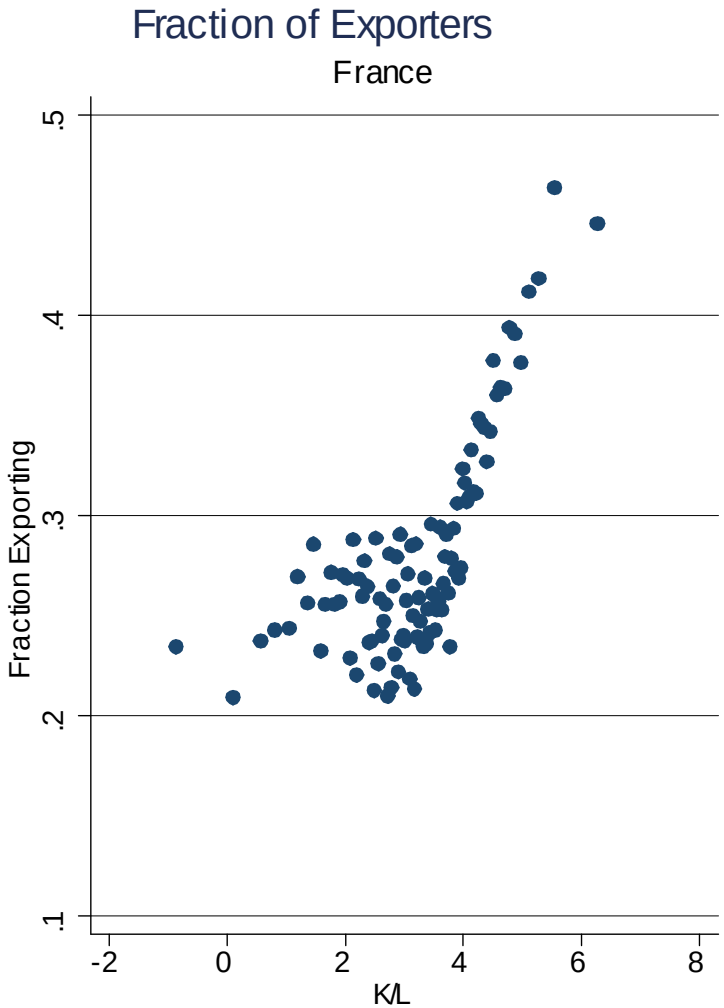
Robustness

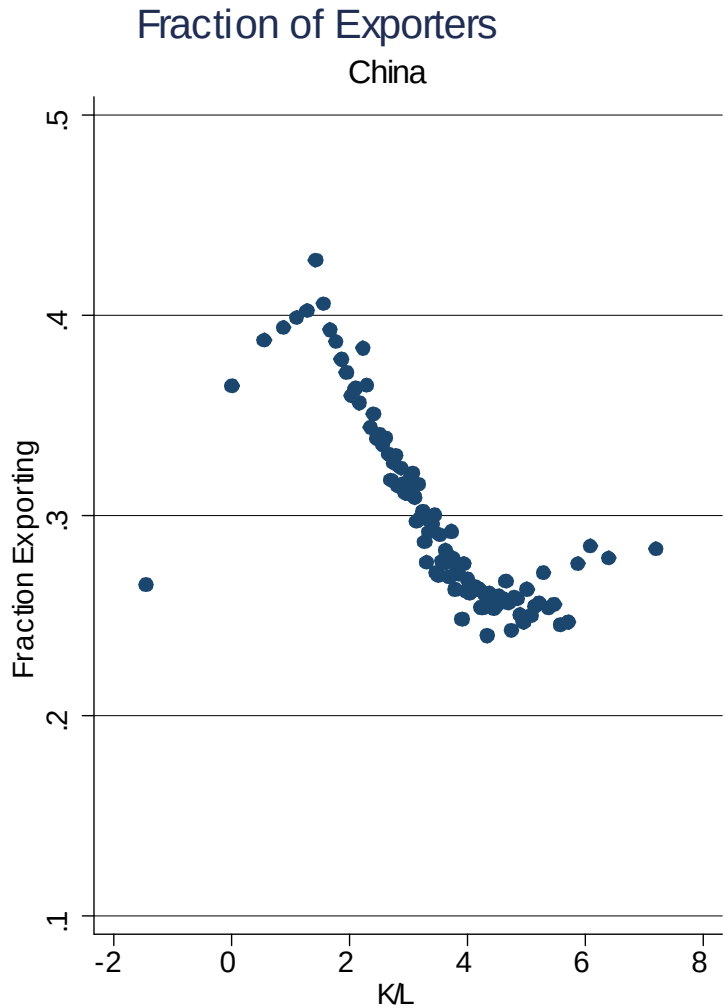
- **Type of firm/location:**
  - SOE ▸ ownership ▸ non-SOE only
  - Foreign-owned firms ▸ Foreign-owned
  - Tariff free zone ▸ TFZ
  - Processing trade by sectors ▸ Processing Trade
- **Productivity Measures:**
  - Labor quality / human capital ▸ LaborQuality
  - Sales and domestic sales ▸ Sales
  - TFP ▸ TFP

Exporters Relative to Non-exporters (France vs China)

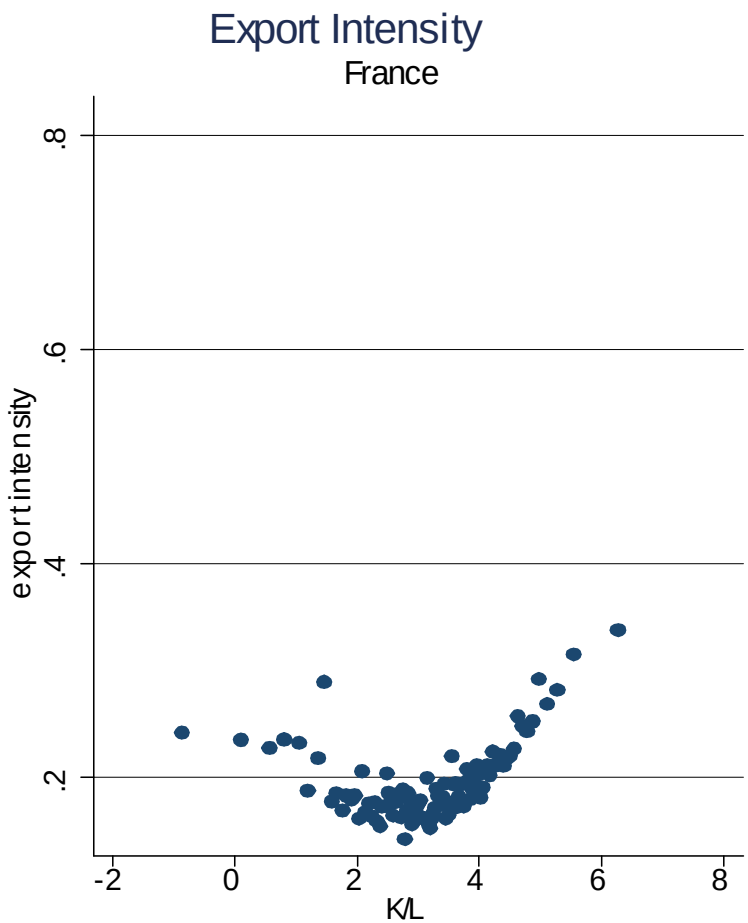


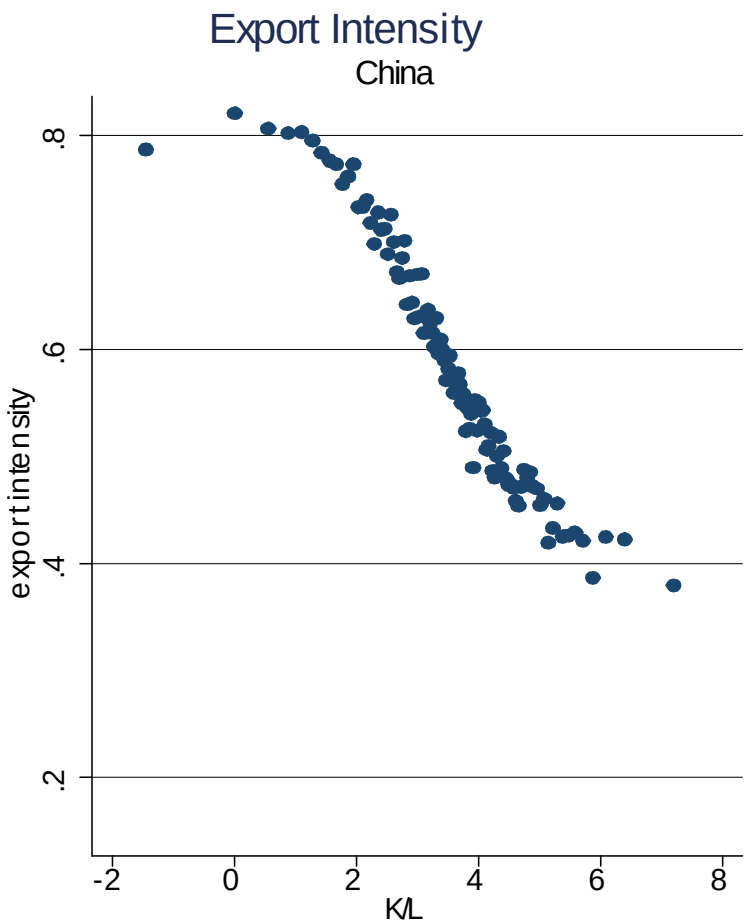
Export Participation (France vs China)





Export Intensity (France vs China)





Full Model

- In the baseline model
  - Deterministic ranking of markets
  - Distribution of export intensity is degenerate
- Introduce
  - Firm specific shocks in entry cost /demand
  - Endogenous market entry cost

Market Access Cost

- ε: firm-market specific idiosyncratic entry shock / demand shock
- $M(f)$: marketing cost (Arkolakis 2008)

Market Access Cost

- ε: firm-market specific idiosyncratic entry shock / demand shock
- $M(f)$: marketing cost (Arkolakis 2008)
- For firm $(z, \varepsilon_m, \varepsilon_n)$, cost to sell in market n is (EKK 2009):

$$E_n(z, \varepsilon_n) = \varepsilon_n M(f_n) E$$

Firms Optimization

$$\max_f \pi(z, \varepsilon) = f \frac{s(z)}{\sigma} - \varepsilon EM(f)$$

where

$$M(f) = \frac{1 - (1-f)^{1-\frac{1}{\lambda}}}{1 - \frac{1}{\lambda}}, \ \lambda > 0$$

Why Marketing Cost?

- Sales:

$$s_d^i(c) = (\gamma_i X_d)\left(\frac{\sigma}{\sigma-1}\frac{c}{P_d^i}\right)^{1-\sigma}$$

- Export intensity:

$$\frac{s_x^i}{s_x^i + s_d^i} = \frac{\left(\frac{P_x^i}{\tau(1+d)}\right)^{\sigma-1} X_x}{\left(\frac{P_x^i}{\tau(1+d)}\right)^{\sigma-1} X_x + \left(P_d^i\right)^{\sigma-1} X_d}$$

Why Marketing Cost?

- Sales:

$$s_d^i(c) = f_d\left(\frac{c}{\bar{c}_d^i}\right)(\gamma_i X_d)\left(\frac{\sigma}{\sigma-1}\frac{c}{P_d^i}\right)^{1-\sigma}$$

- Export intensity:

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$$\max_f \pi(z, \varepsilon) = f \frac{s(z)}{\sigma} - \varepsilon EM(f)$$

where

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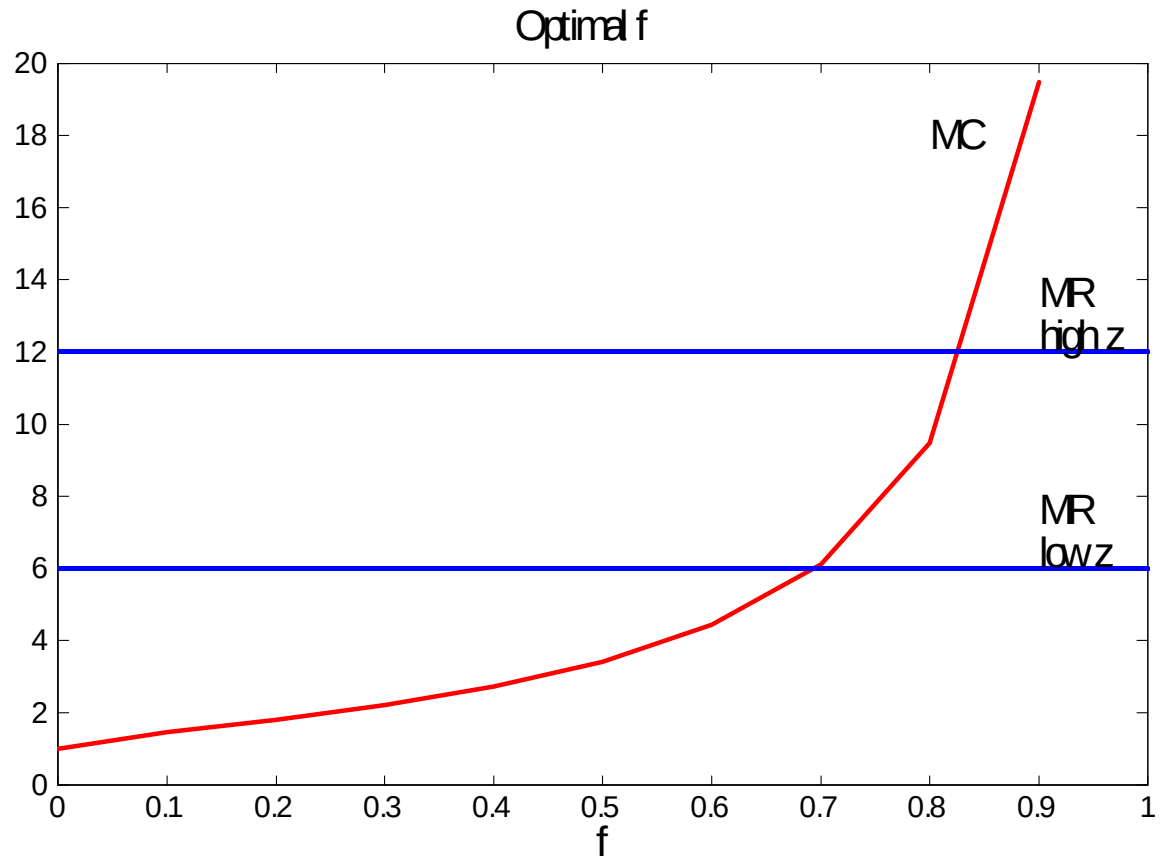
- FOC:

$$\frac{s(z)}{\sigma} - \frac{\varepsilon E}{(1-f)^{\frac{1}{\lambda}}} = 0$$

$$\frac{s(z)}{\sigma} = \frac{\varepsilon E}{(1-f)^{\frac{1}{\lambda}}}$$



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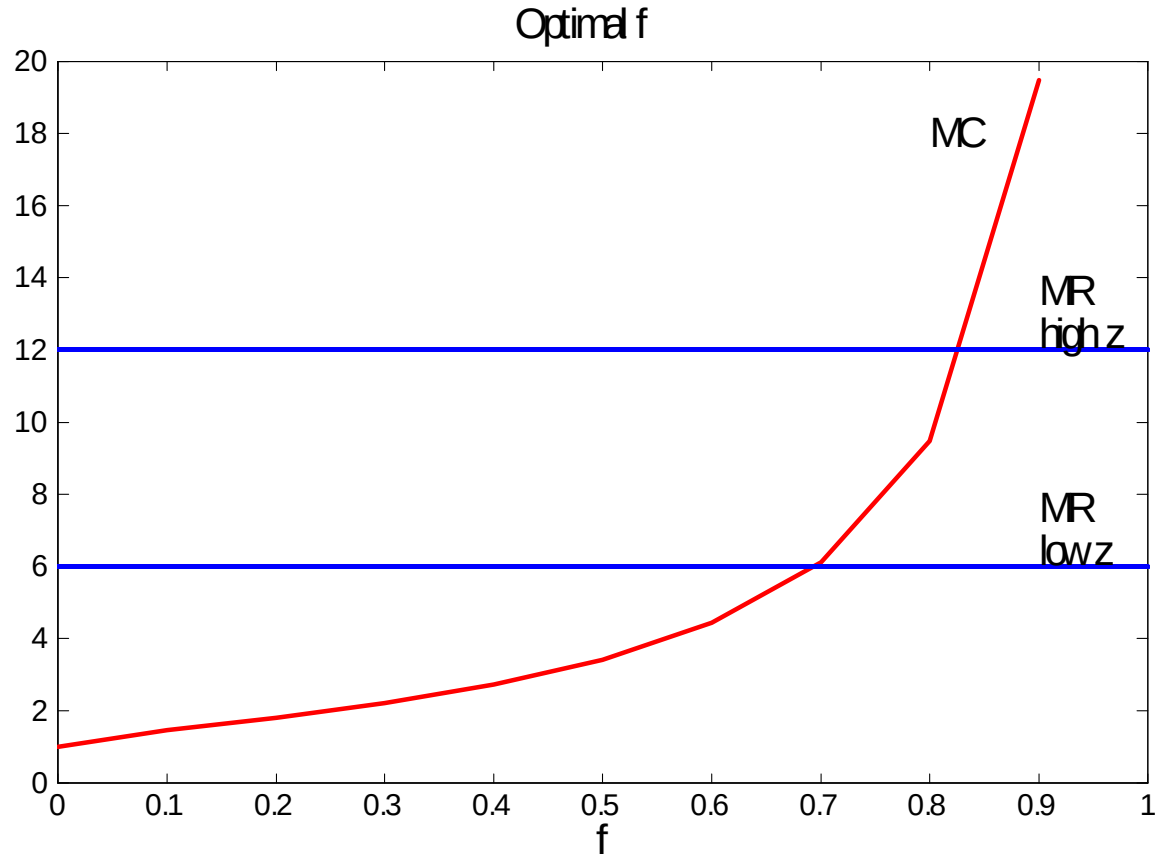


- More efficient firms choose a larger fraction of consumers

Firms Market Selection

- The cost cutoff:

$$\bar{c}^i(\varepsilon) = M\left(\frac{\gamma^i X}{\varepsilon E}\right)^{\frac{1}{\sigma-1}} P^i$$

- Firm $(c(z), \varepsilon)$ enters the market if

$$c \leq \bar{c}^i(\varepsilon)$$

and chooses to reach fraction of consumers:

$$f(c, \varepsilon) = 1 - \left(\frac{c}{\bar{c}^i(\varepsilon)}\right)^{(\sigma-1)\lambda}$$

Markets Competitiveness and Factor Intensity

Lemma

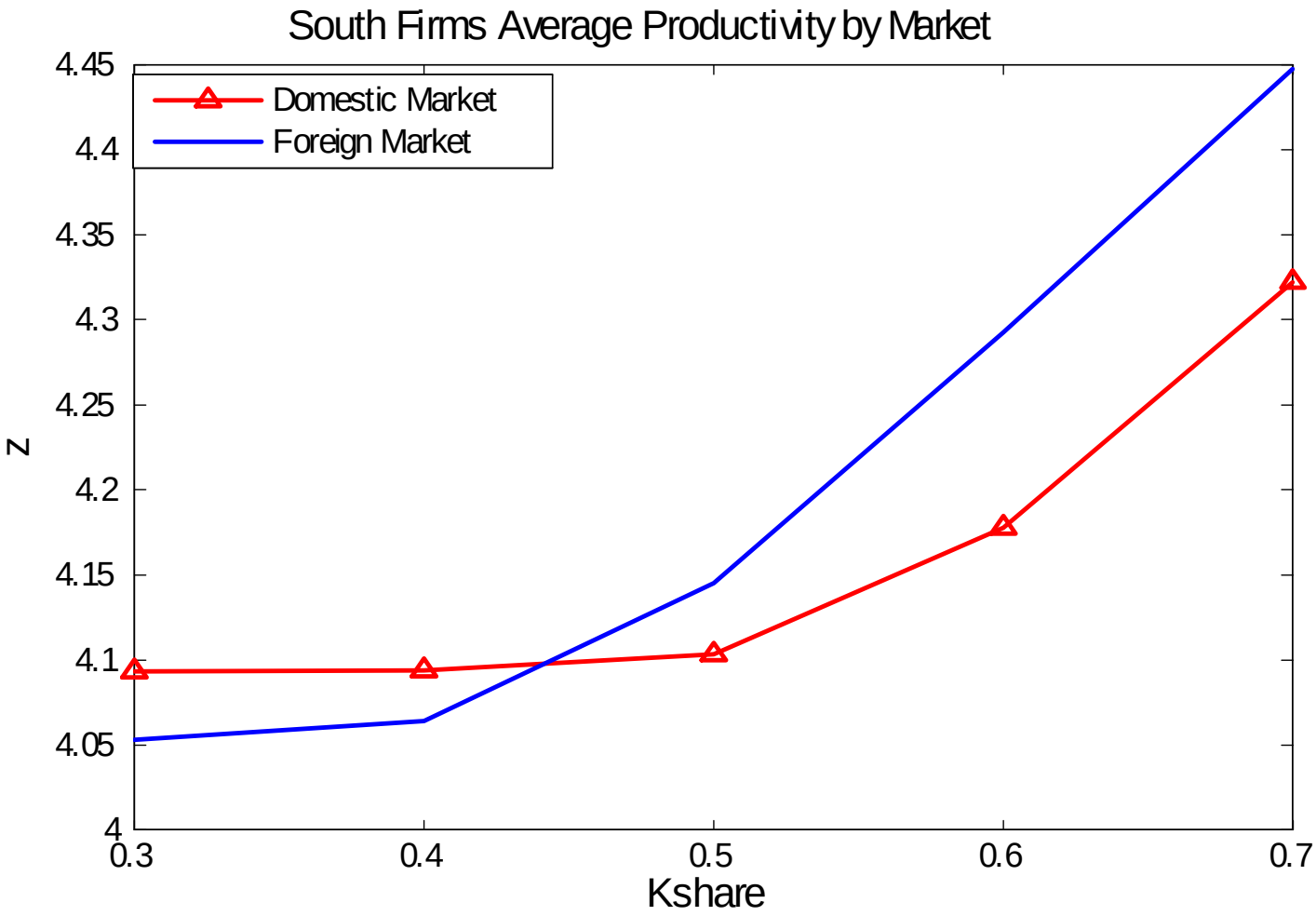
The competitiveness of the South market in sector i, relative to the North market, is increasing in the labor intensity β_i.

$$\bar{c}^i(\varepsilon) = M\left(\frac{\gamma^i X}{\varepsilon E}\right)^{\frac{1}{\sigma-1}} P^i$$

$$\frac{\bar{c}_S^i}{\bar{c}_N^i} < \frac{\bar{c}_S^j}{\bar{c}_N^j} \quad \text{for} \quad \beta_i > \beta_j$$

Simulation Results:

Productivity For South Firms



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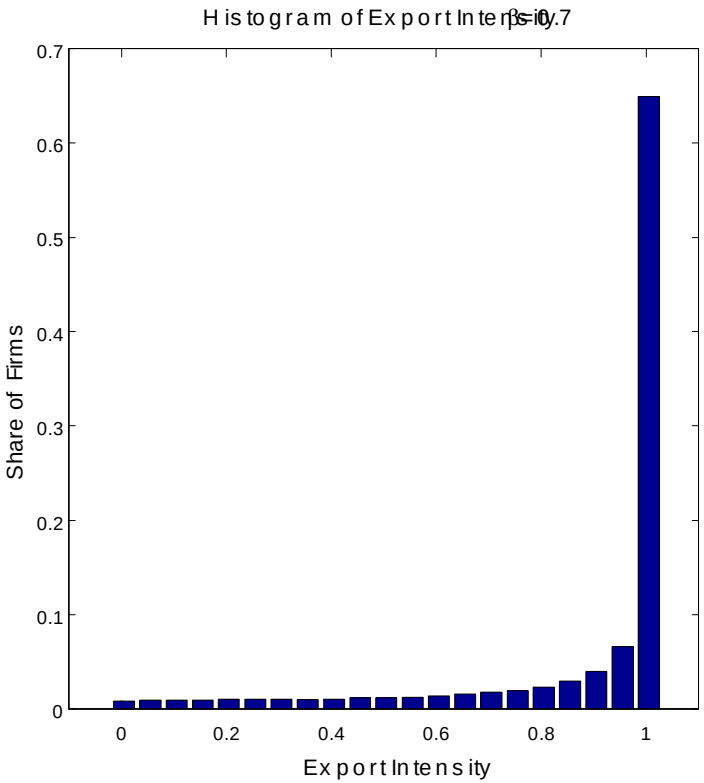
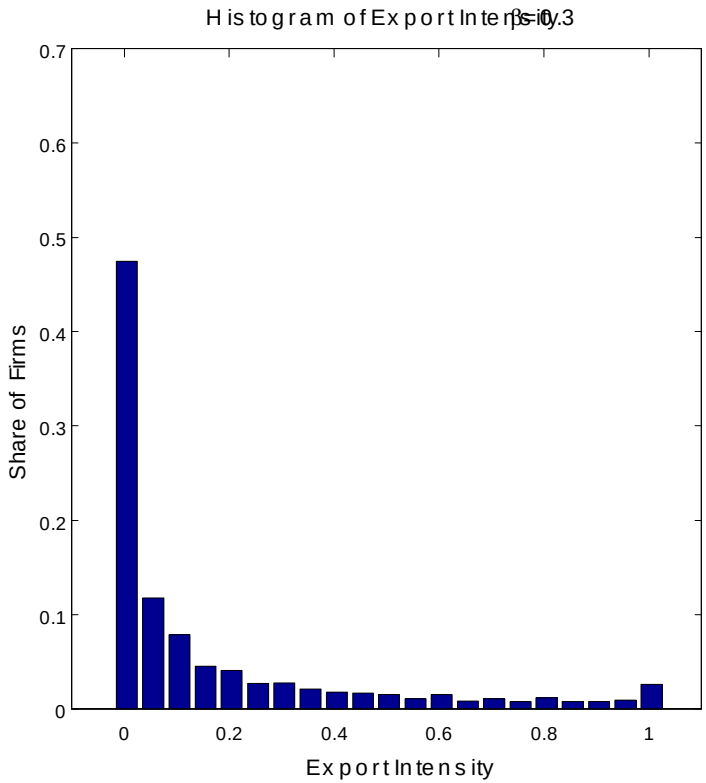
Simulation Results:

Export Intensity For South Firms



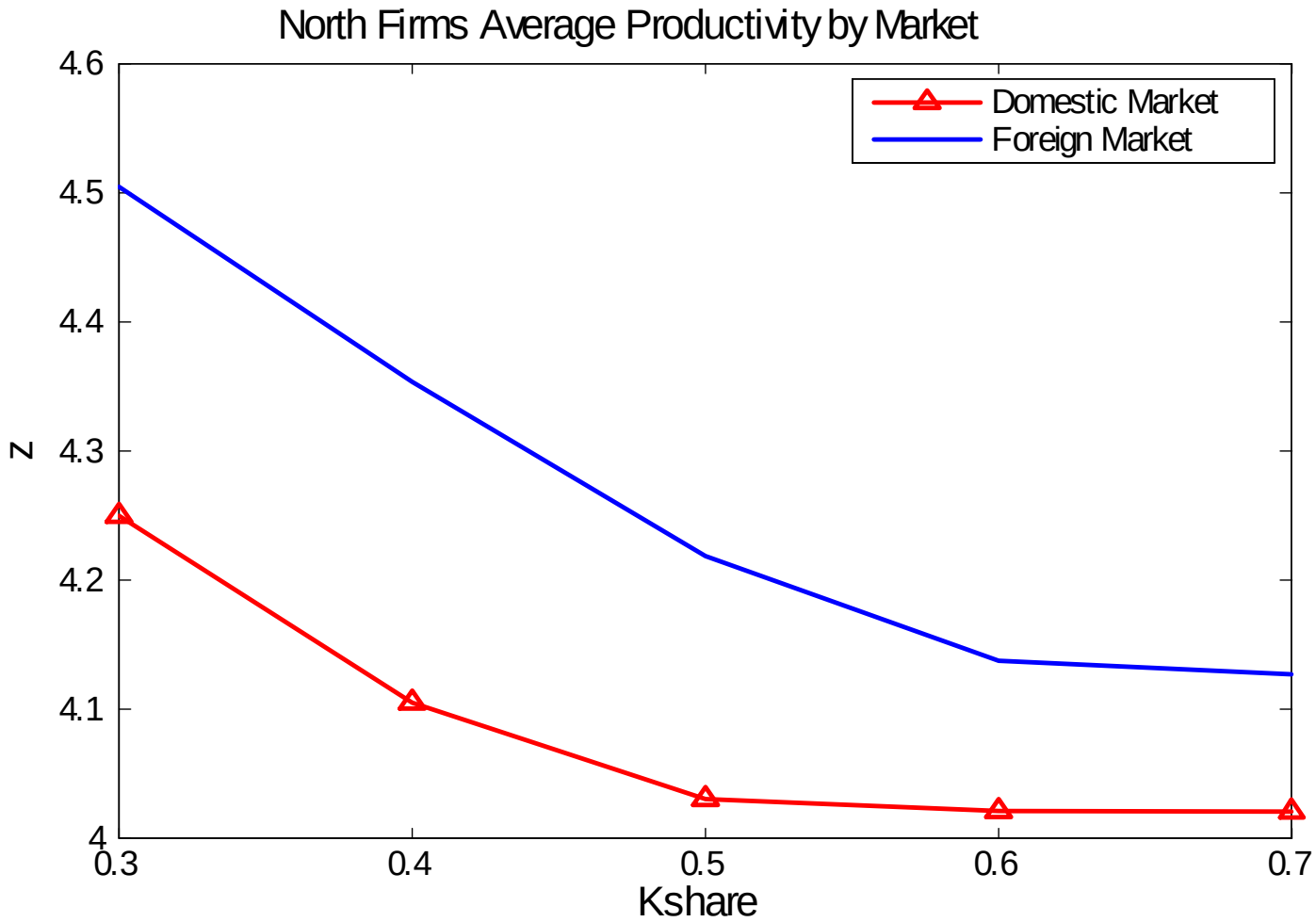
Labor-intensive sector $\beta = 0.7$



Capital-intensive sector $\beta = 0.3$

Simulation Results:

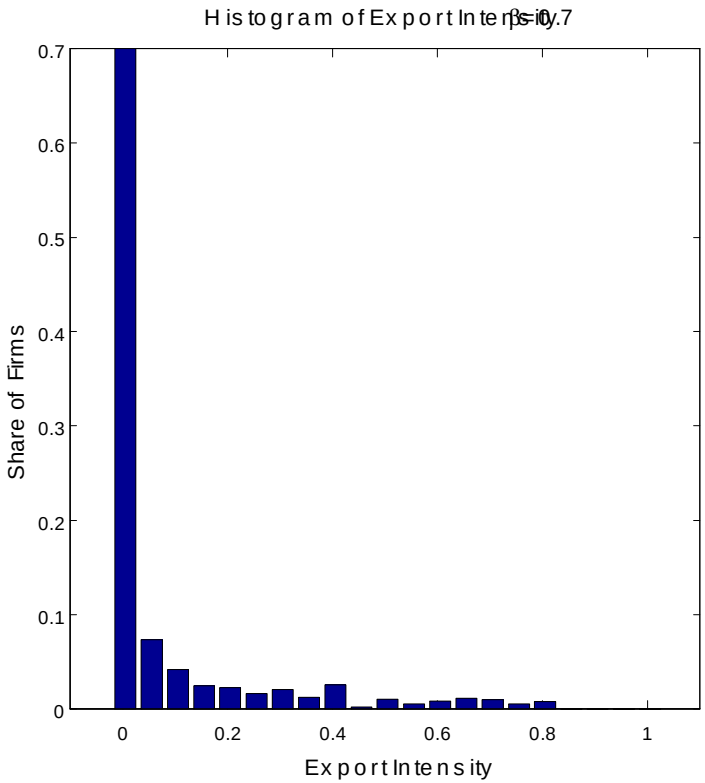
Productivity For North Firms



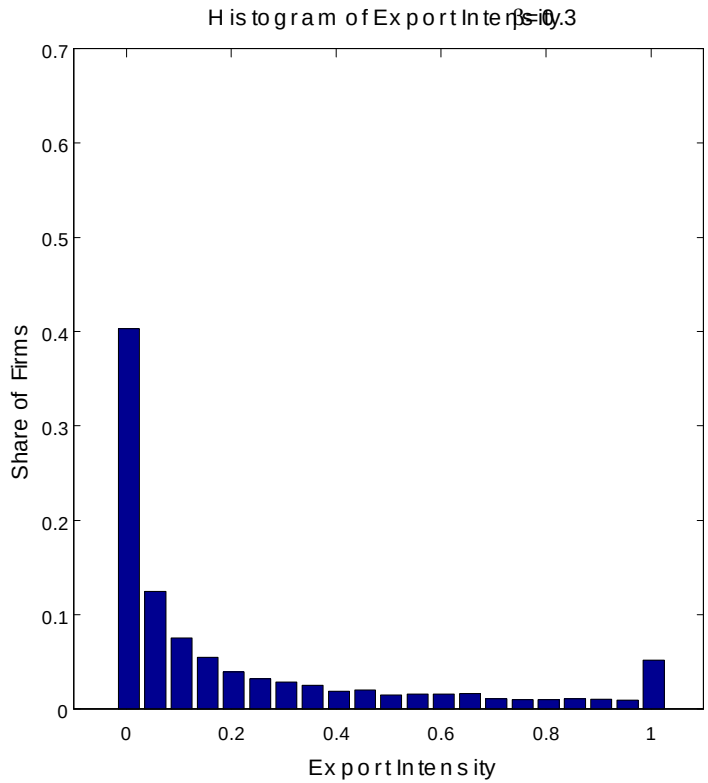
For North firms, exporters are always more productive

Simulation Results:

Export Intensity For North Firms



Labor-intensive sector $\beta = 0.7$



Capital-intensive sector $\beta = 0.3$

General Equilibrium

Equilibrium

Definition

Given $\left\{K_m, L_m, \tau^i_{nm}, \pi^i_{nm}, \beta^i, \gamma_i\right\}$, an equilibrium is a set of factor prices and factor allocations $\left\{w_m, r_m, k^i_m, l^i_m\right\}$ that satisfy:

1. Factor allocation conditions
2. Factor market clearing conditions
3. Goods market clearing conditions

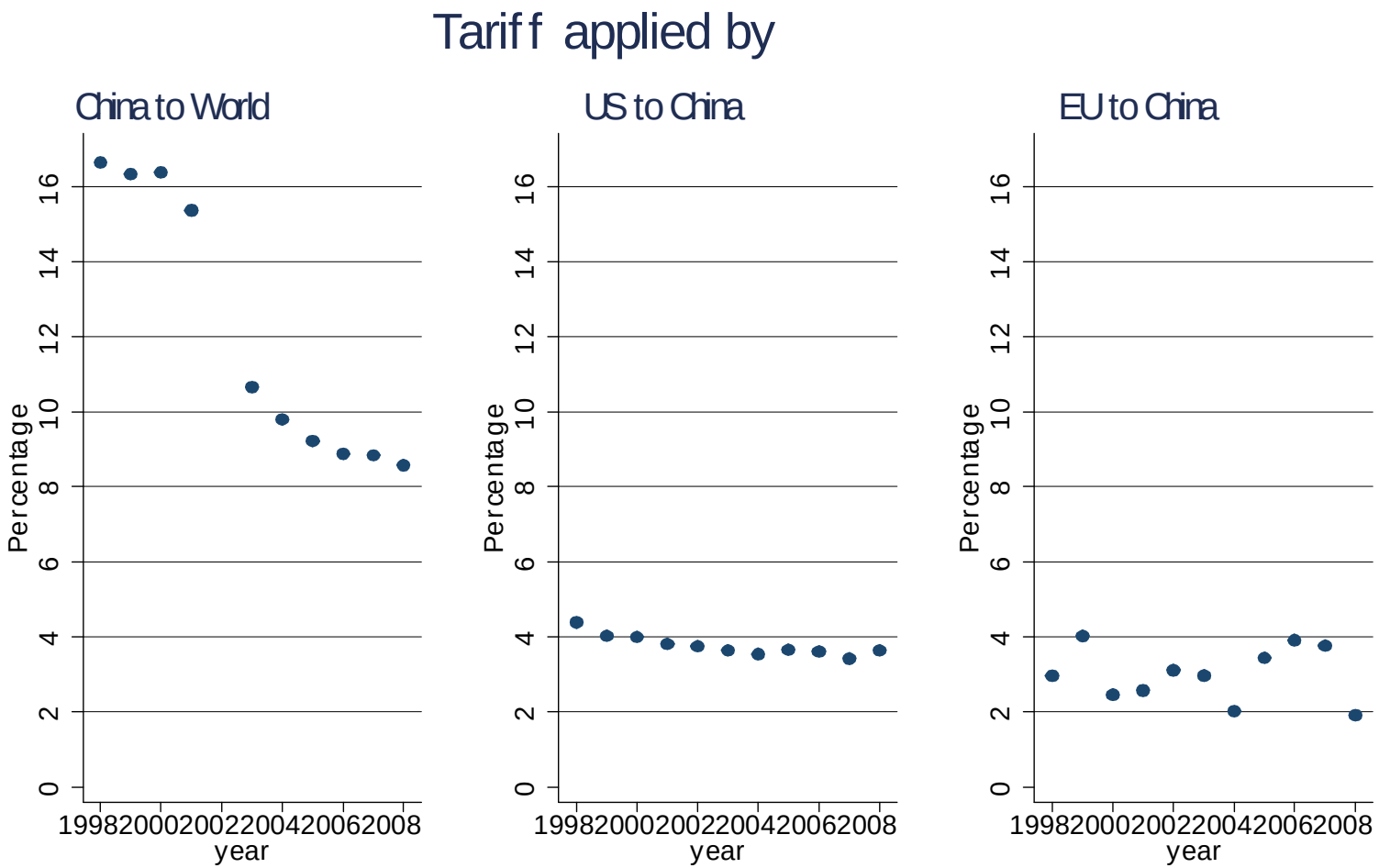
The Effects of Import Tariff Reduction

Proposition

If South reduces its import tariff, then:

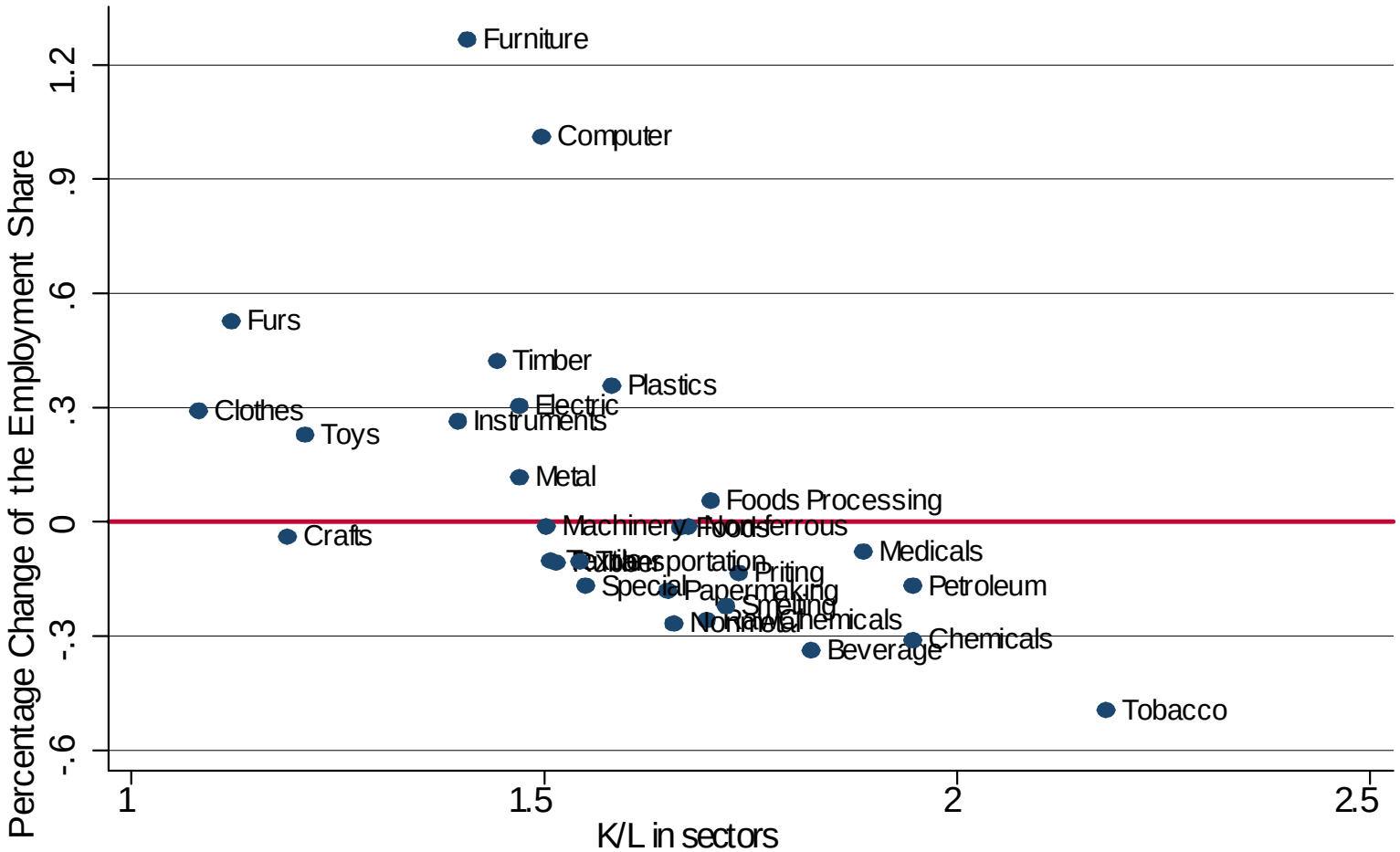
1. *Trade volume increases for both countries;*
2. *In the South, labor moves to labor-intensive sectors;*
3. *Price indices in all sectors in South decrease relative to North. The South markets become more competitive, and exporters productivity advantage decreases;*
4. *Real returns increase for both factors in North.*

Tariff Change After China Joins the WTO

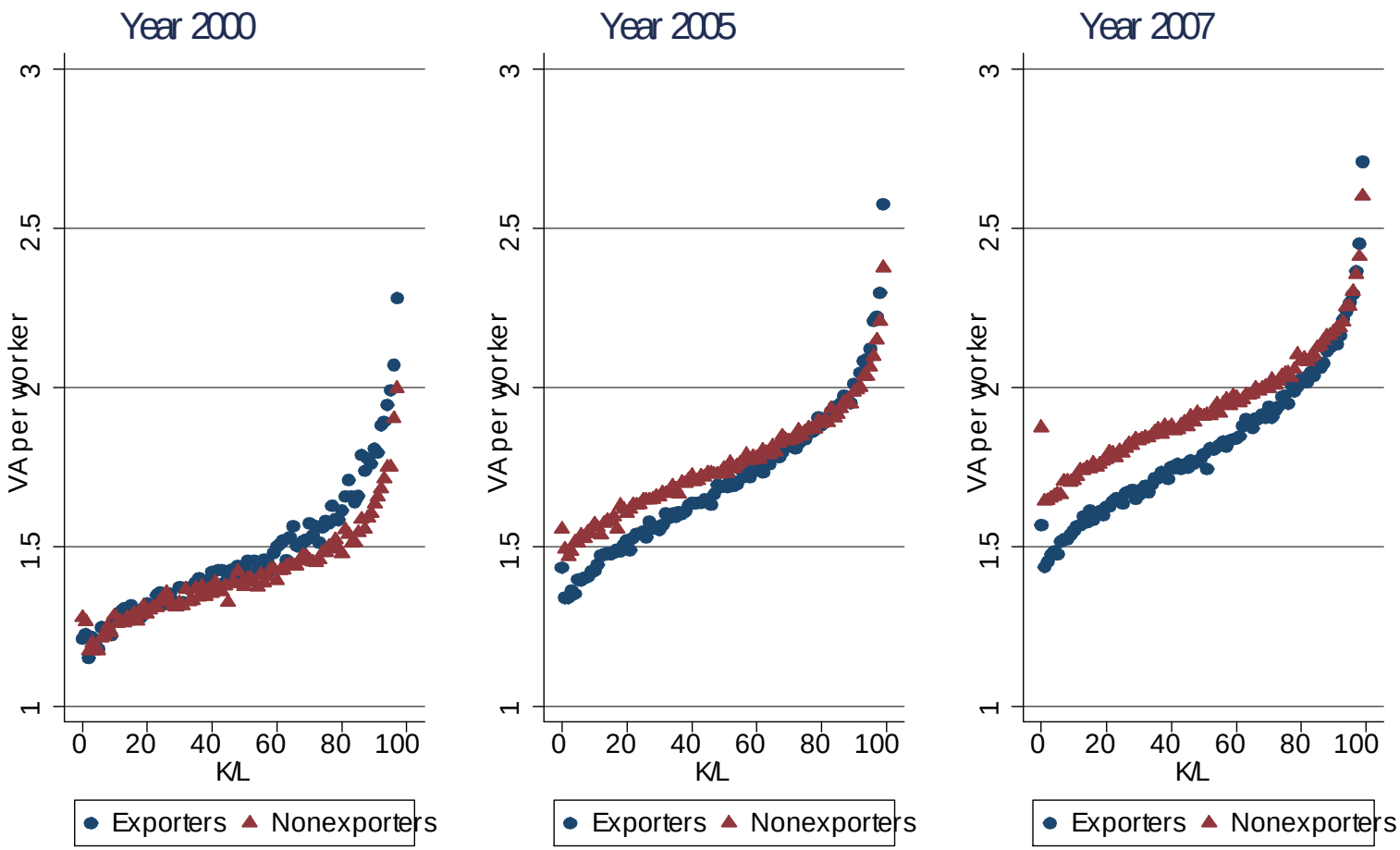


Labor Moves to Labor-Intensive Sectors

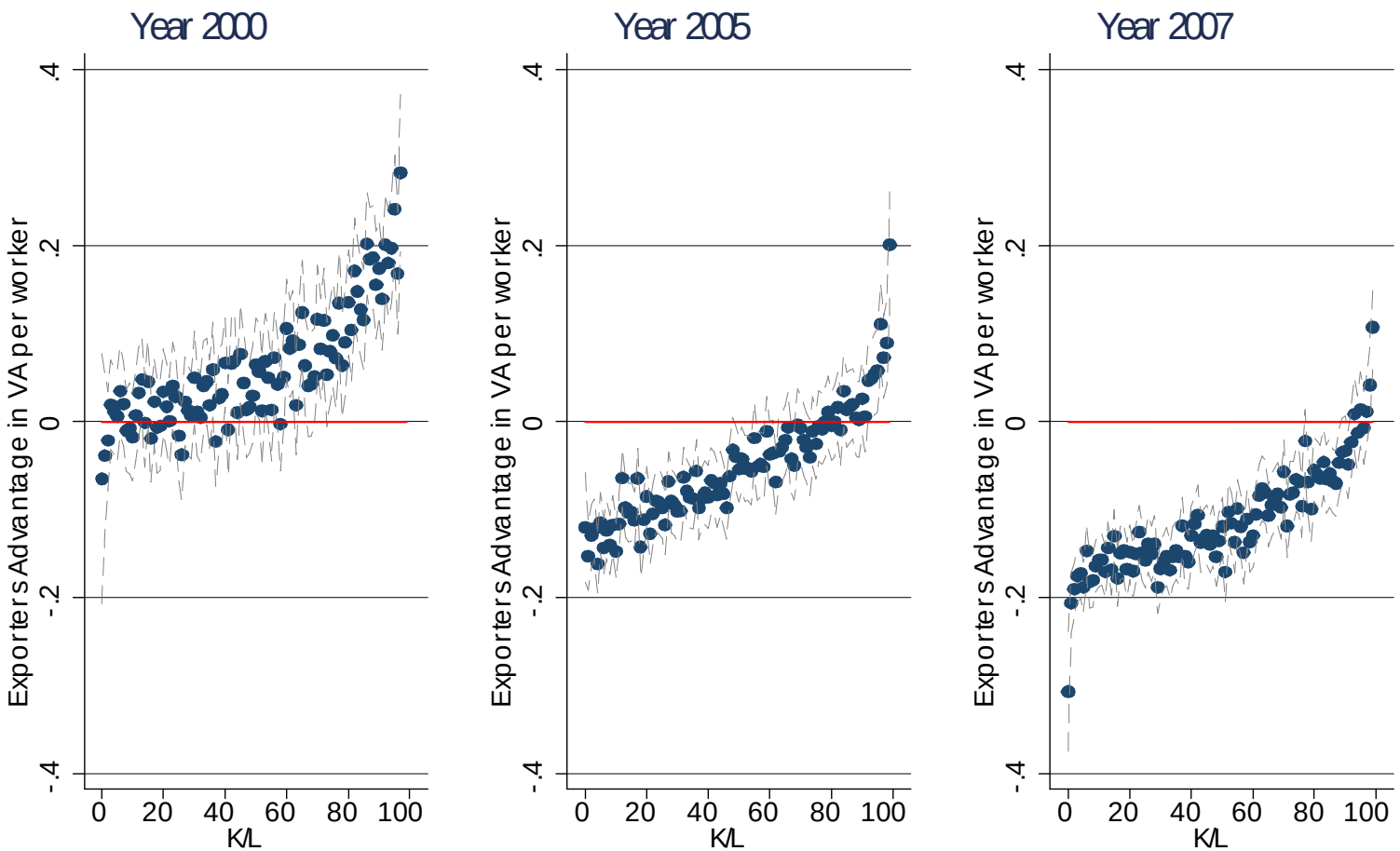
2000-2007



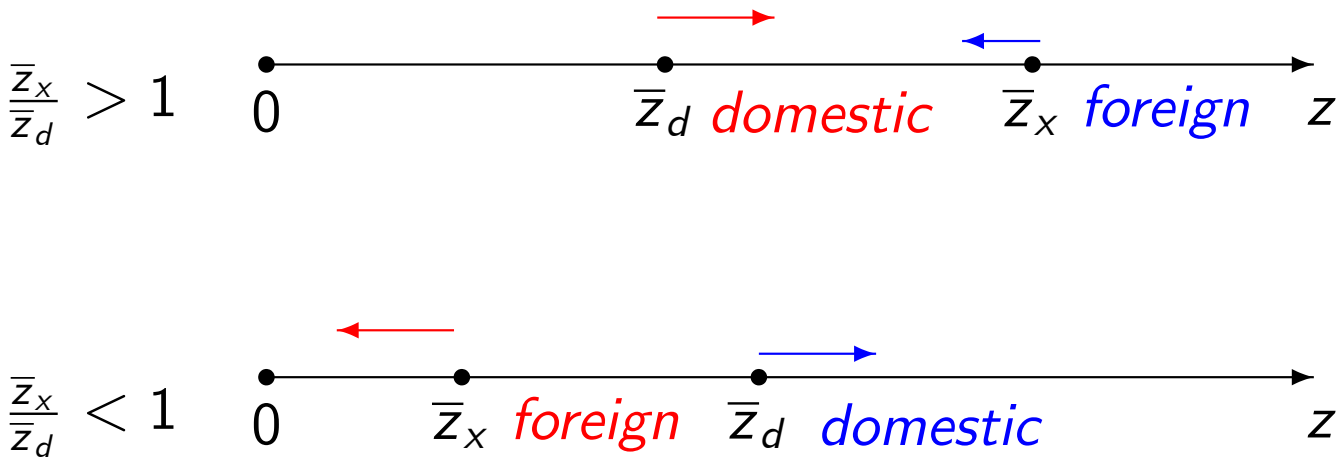
Productivity (Exporters and Non-exporters) Over Time



Exporters Relative to Non-exporters Over Time



Aggregate Productivity



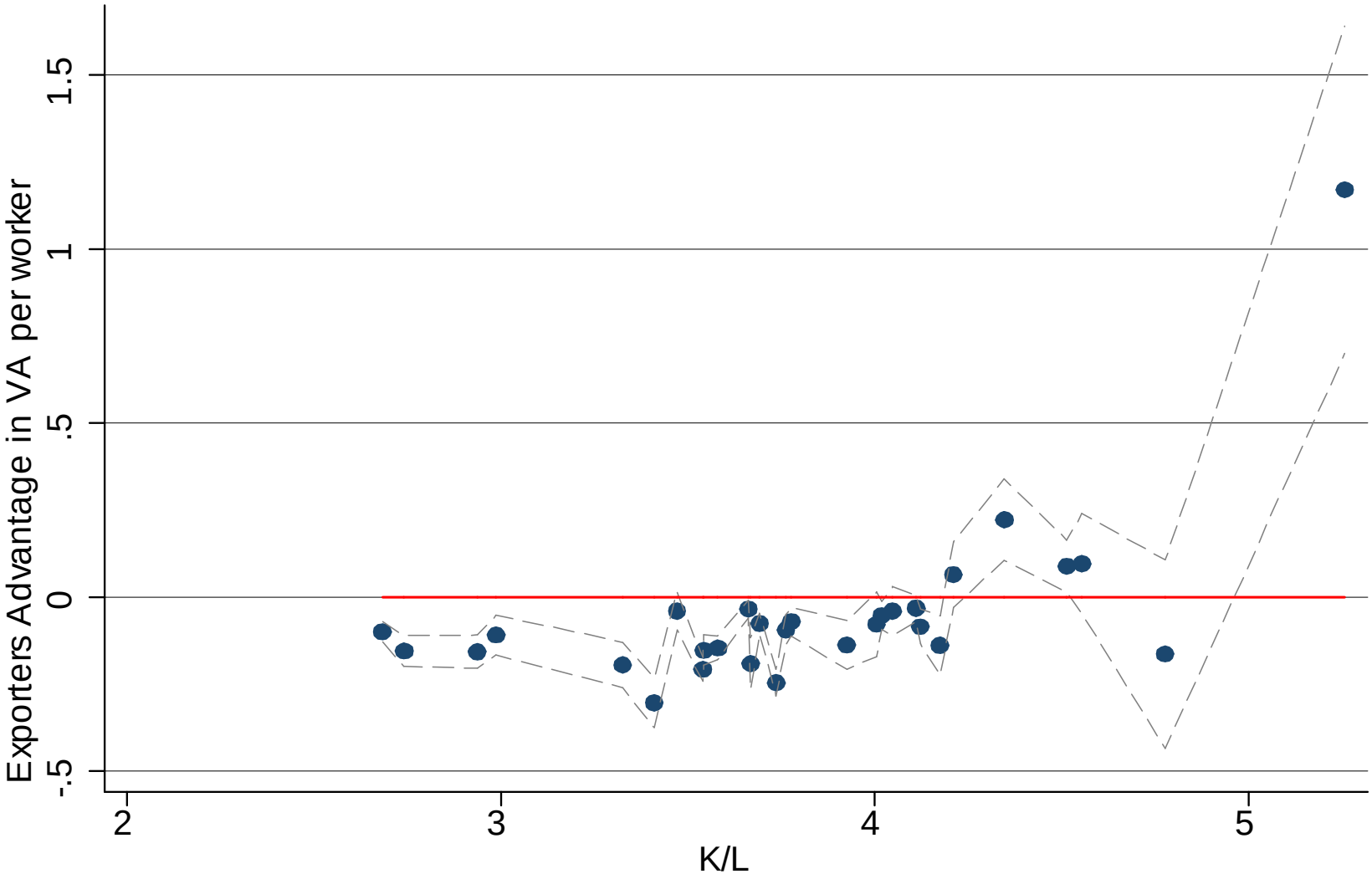
Conclusion

- New facts
  - Exporters are less productive than non-exporters and foreign markets are the main market for some firms
  - Different patterns across sectors: factor endowments play a role
- A natural hybrid model explains the very different patterns
  - Tougher market–either foreign or domestic market–selects the most efficient firms
  - Relative toughness of markets depends on the comparative advantage as well as trade costs

Conclusion

- Other countries
  - Relative toughness of markets are influenced by the trade with all other countries
- Quantitative analysis
  - Multiple countries
  - Effects of trade policy change
- Dynamics of comparative advantage

Exporters Relative to Non-exporters (Across Sectors)



Controlling for Regions and Ownership.

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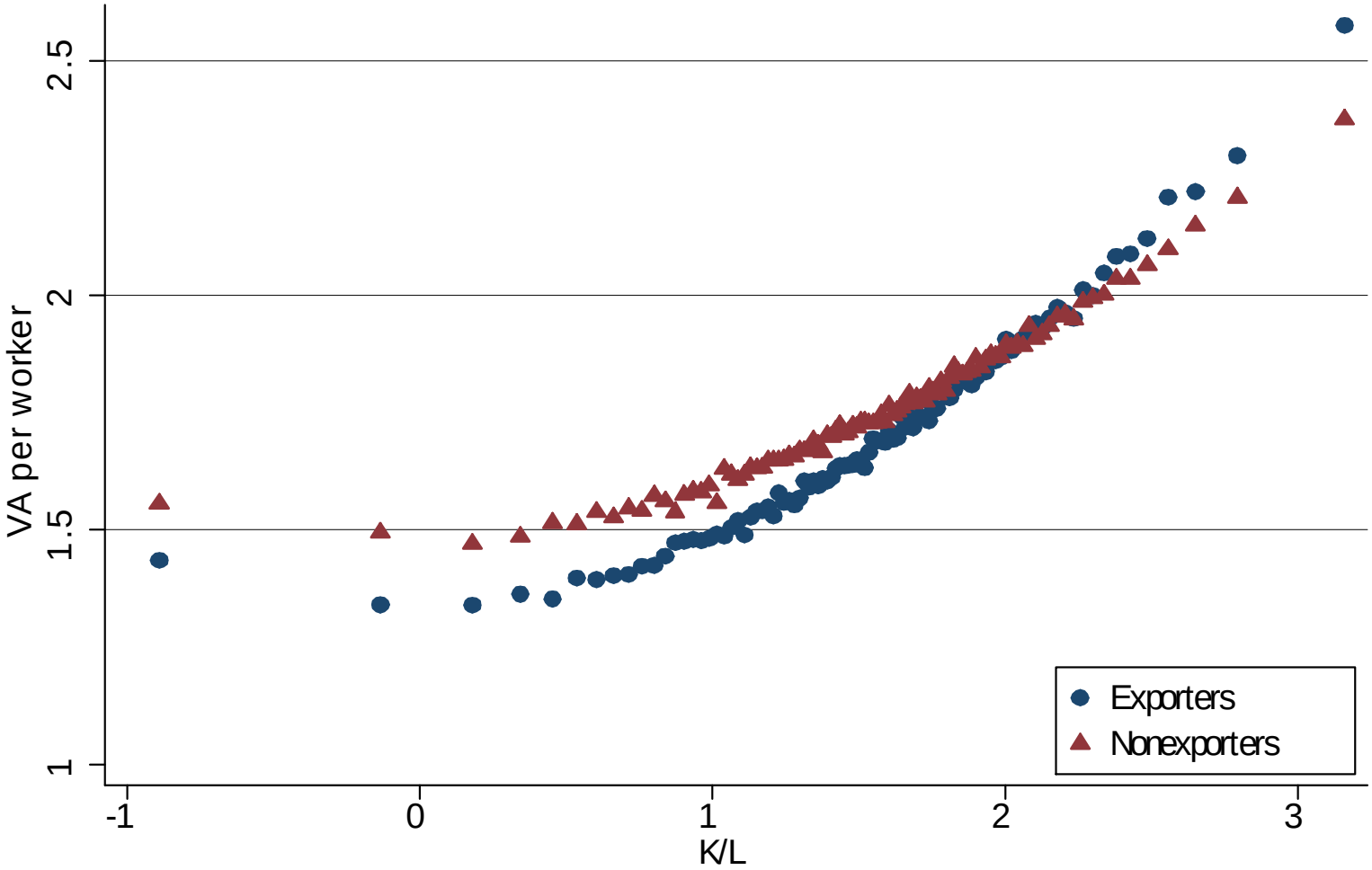
Productivity of Exporters and Non-exporters (Across KL Bins)



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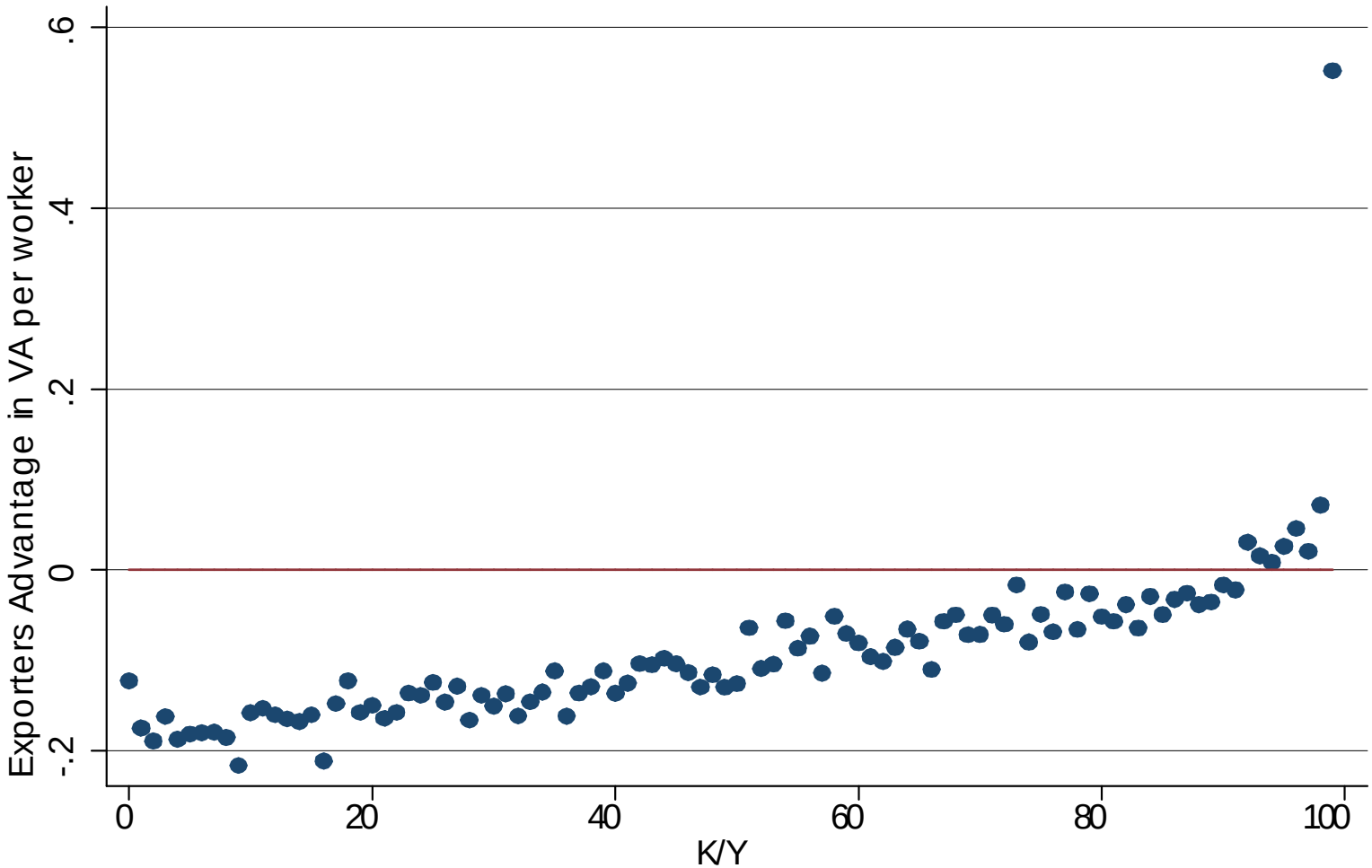
Exporters Relative to Non-exporters (Across KY Bins)



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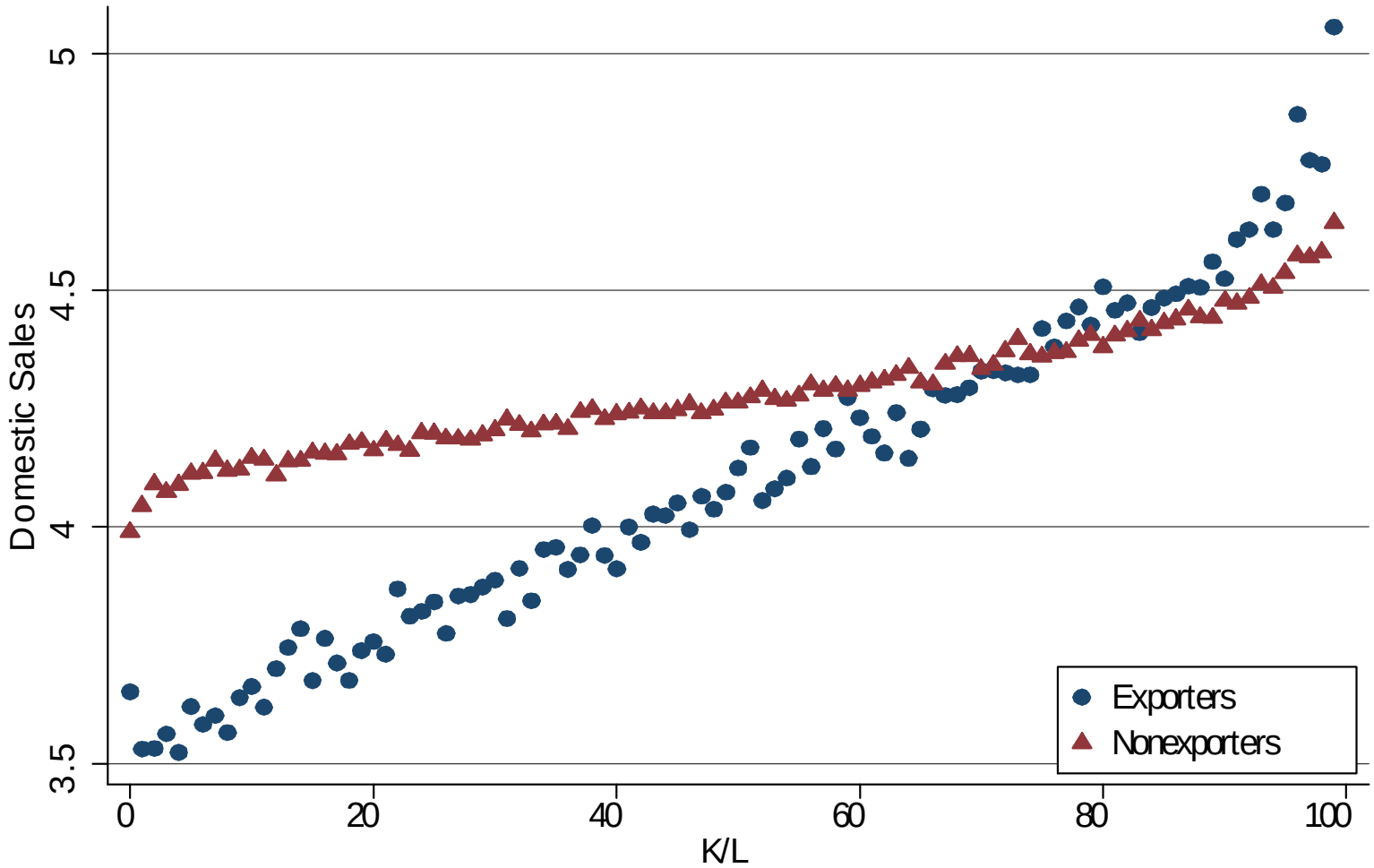
Domestic Sales of Exporters and Non-exporters



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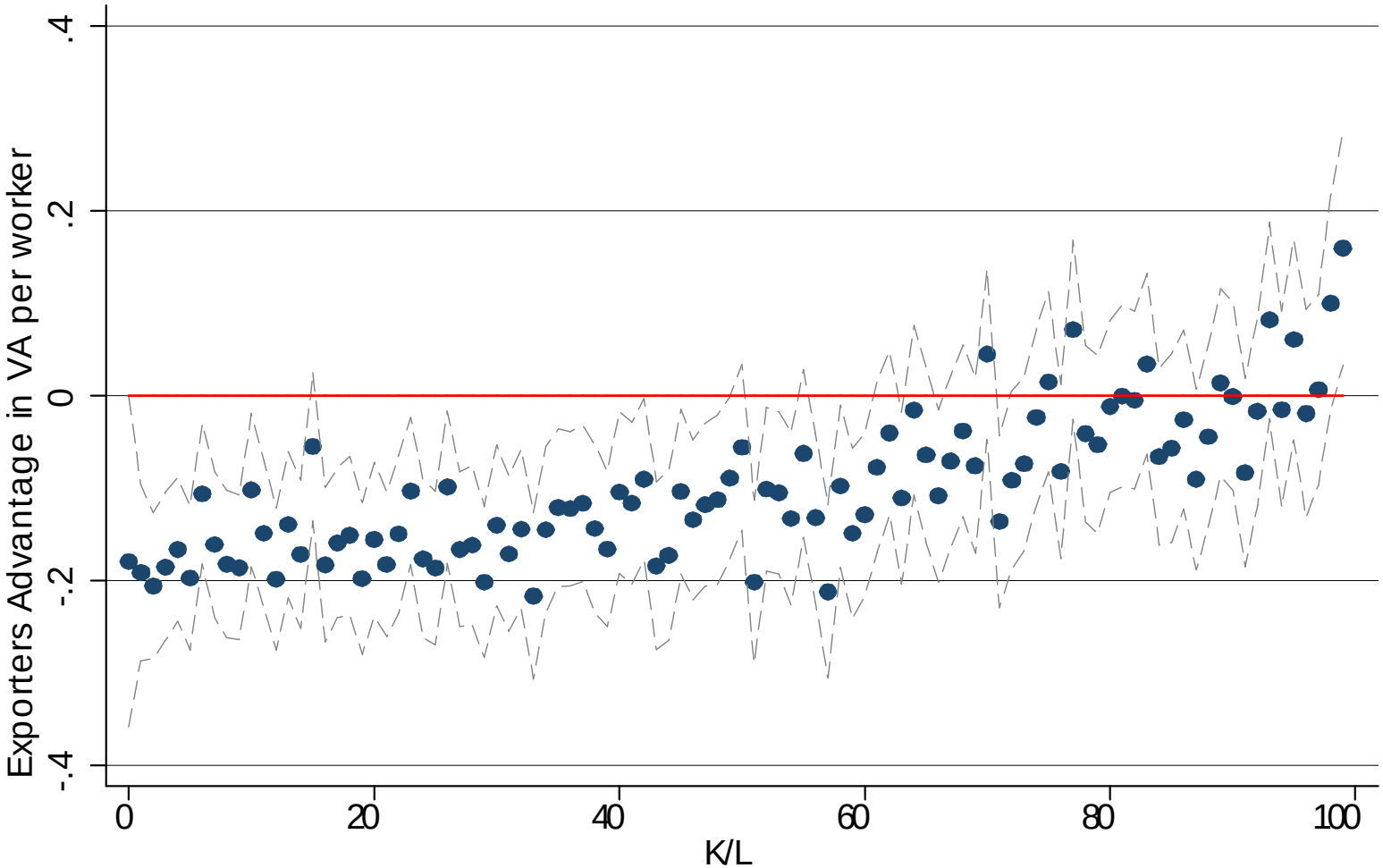
Exporters Relative to Non-exporters (Across KL Bins)



controlling for industry, region and ownership.

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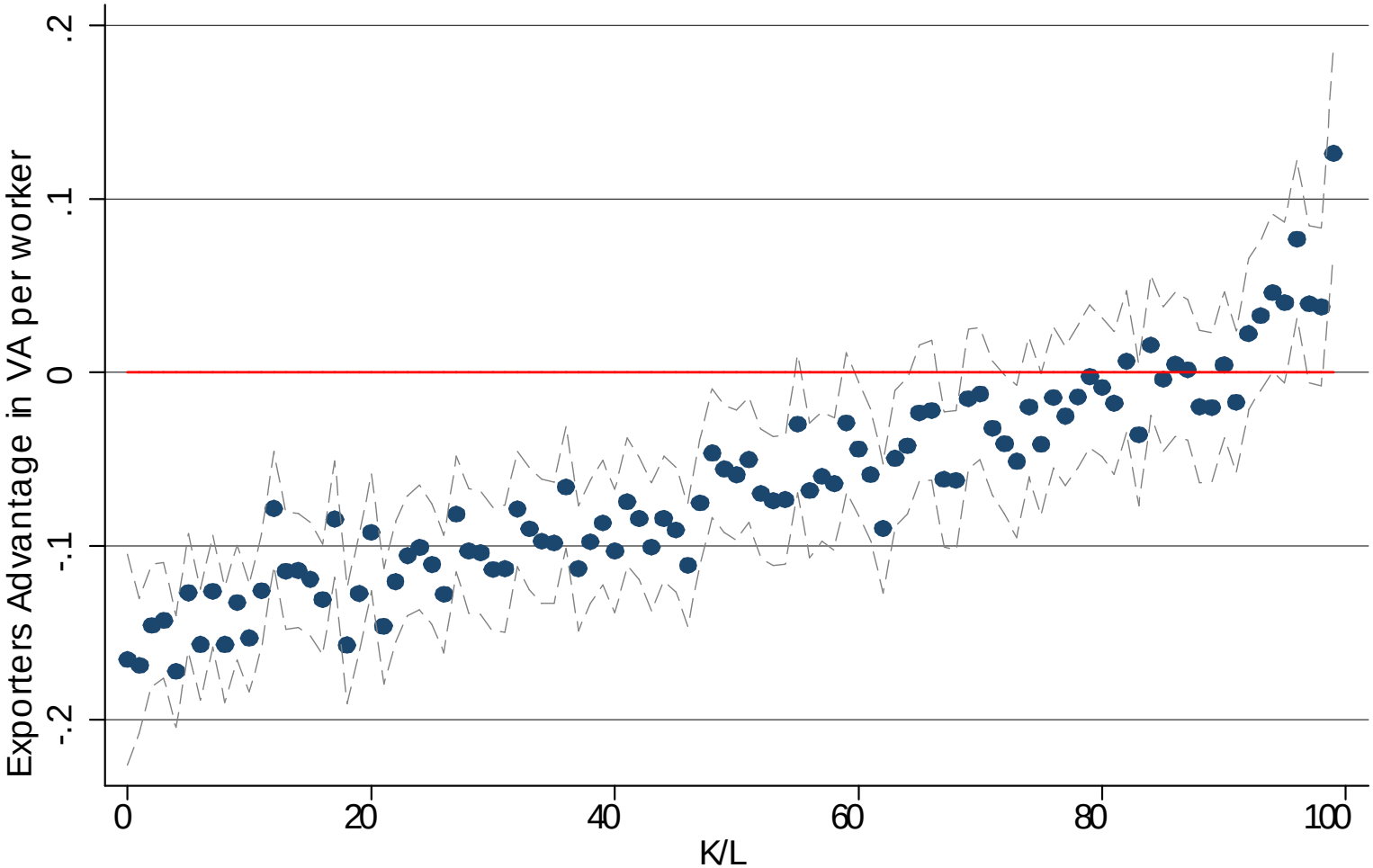
Export Participation by Ownership

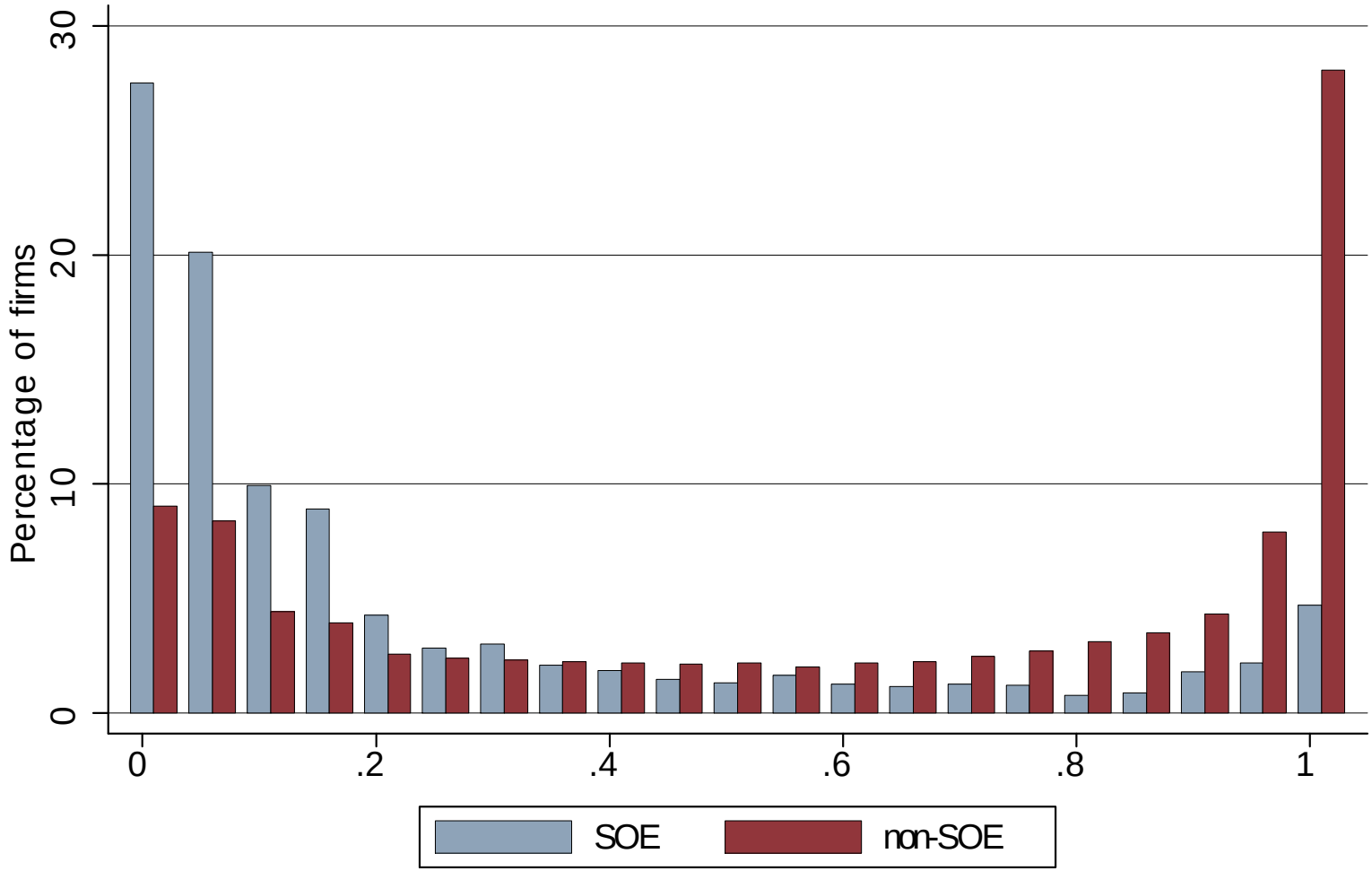
	2000		2005	
	Fraction(%)	Export(%)	Fraction(%)	Export(%)
SOE	24	12	5	15
Collective	42	19	26	20
Private	15	20	47	21
Foreign	8	61	11	63
HK/Macau/Taiwan	11	60	11	62
Total	100		100	

Non-SOE Exporters Advantage (Across KL Bins)



SOE and Non-SOE Export Intensity

Non-SOE firms export intensity still has a bimodal distribution



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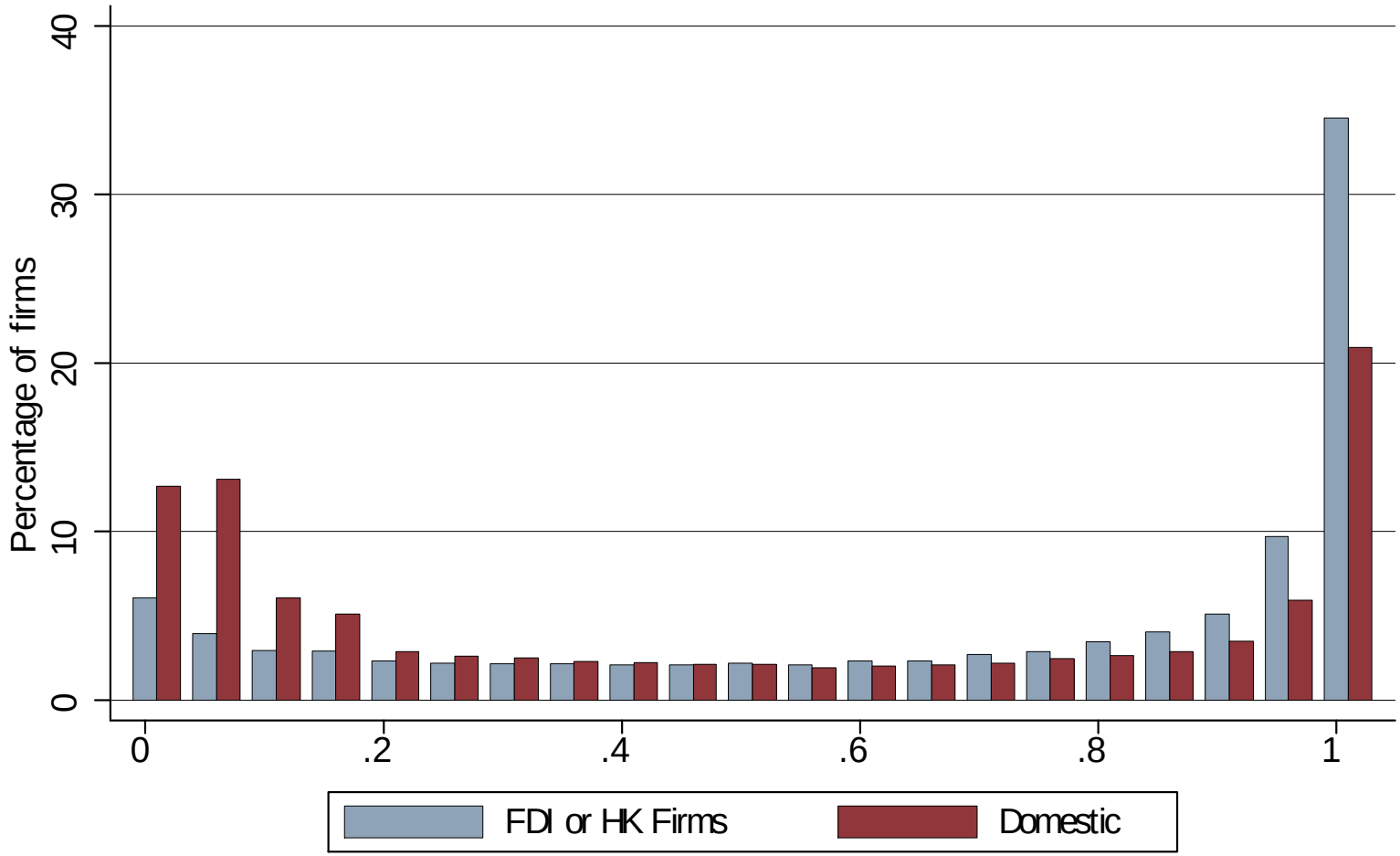
Foreign and Domestic Owned Firms Export Intensity

Domestic firms export intensity still has a bimodal distribution



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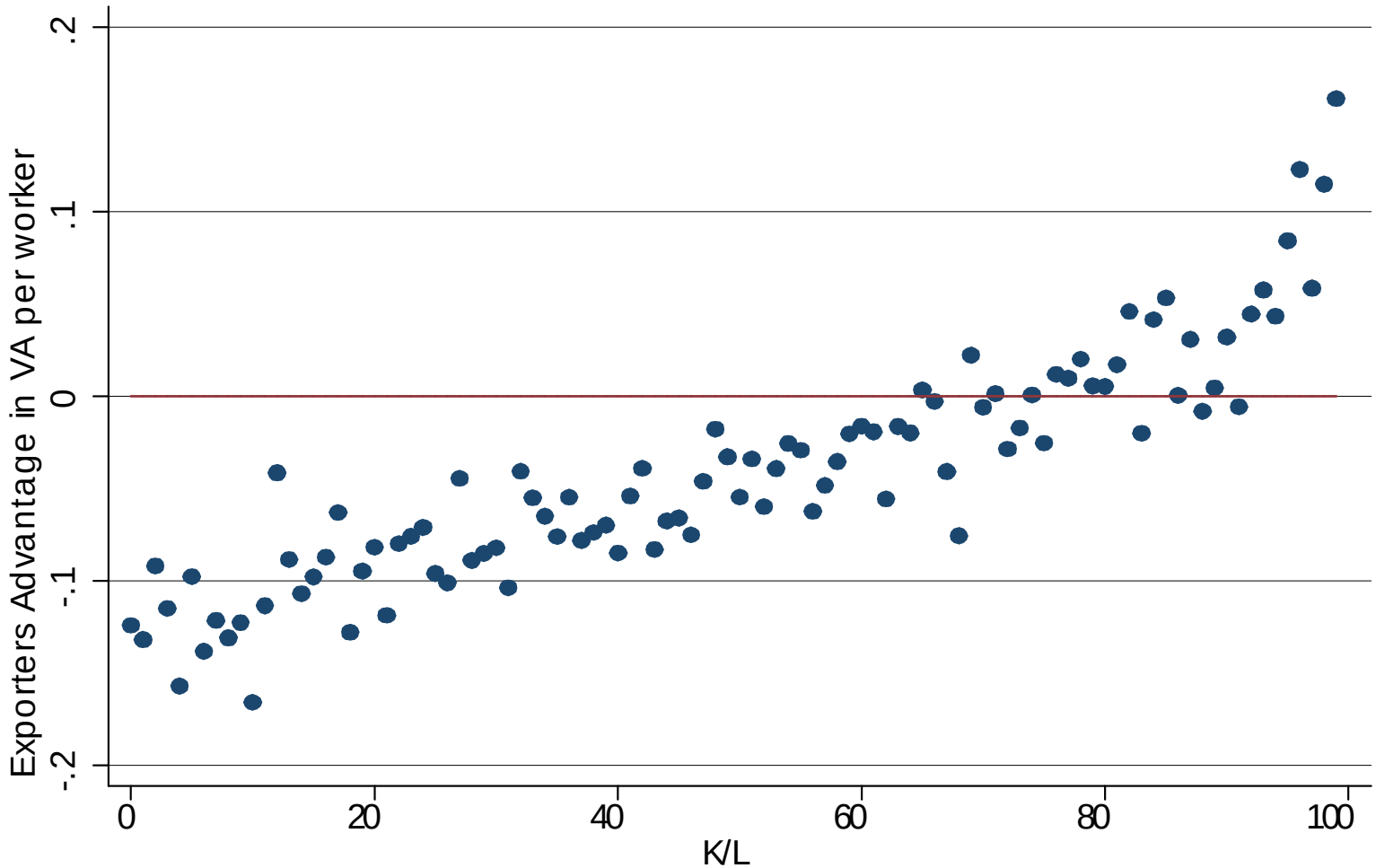
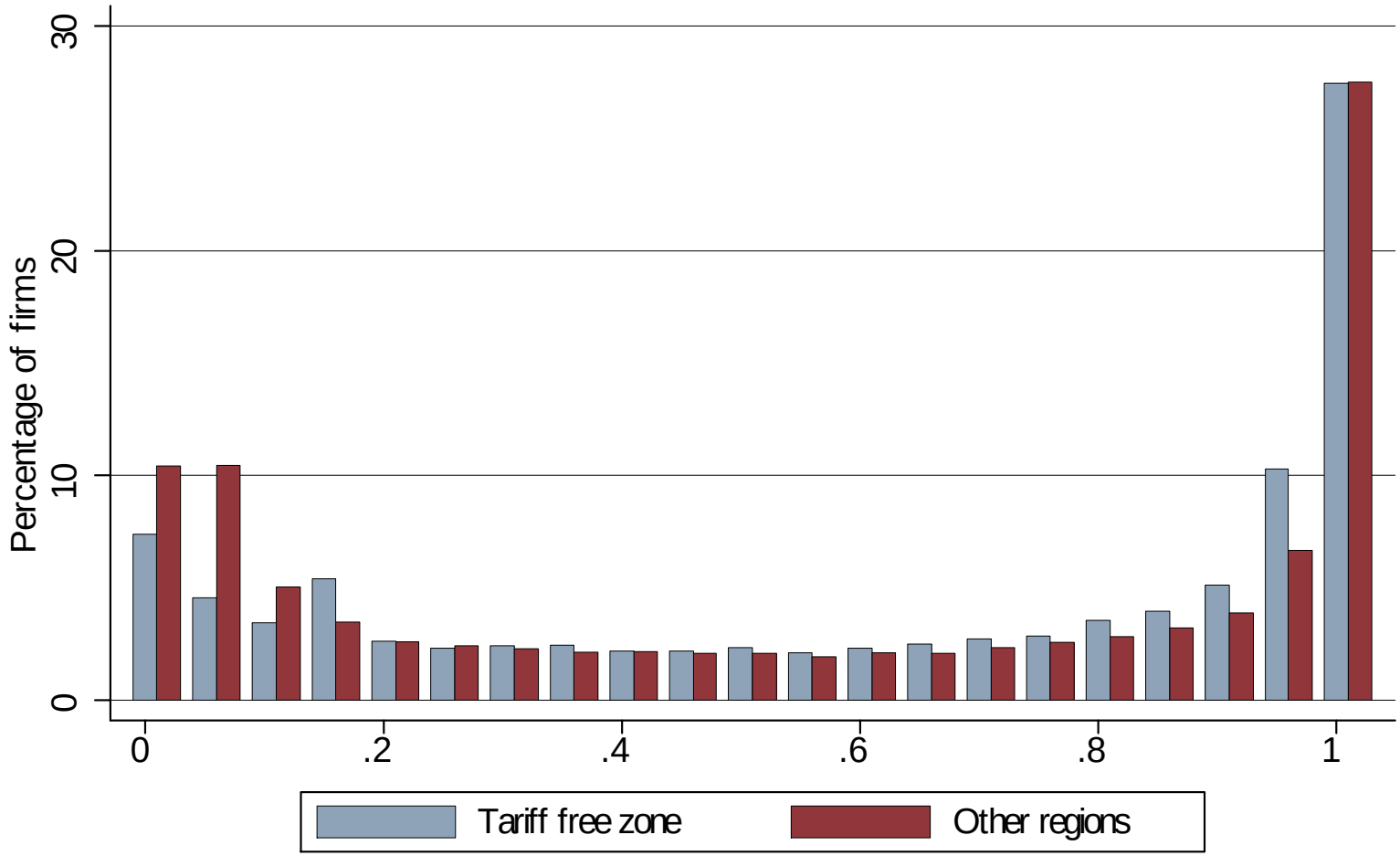
Exporters Relative to Non-Exporters (Other Regions)



Tariff Free Zone and Other Regions Export Intensity

Firms in other regions still has a bimodal distribution



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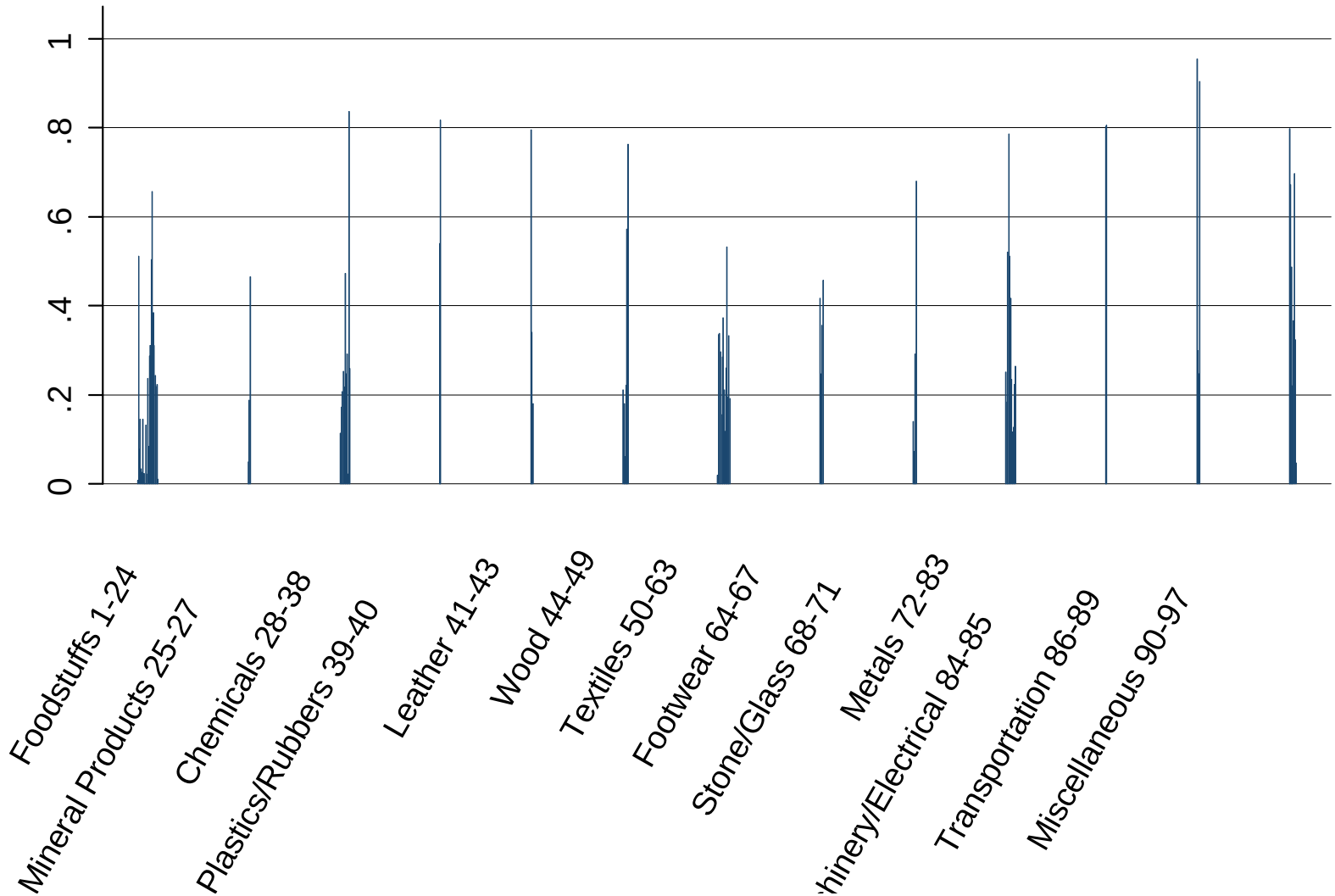
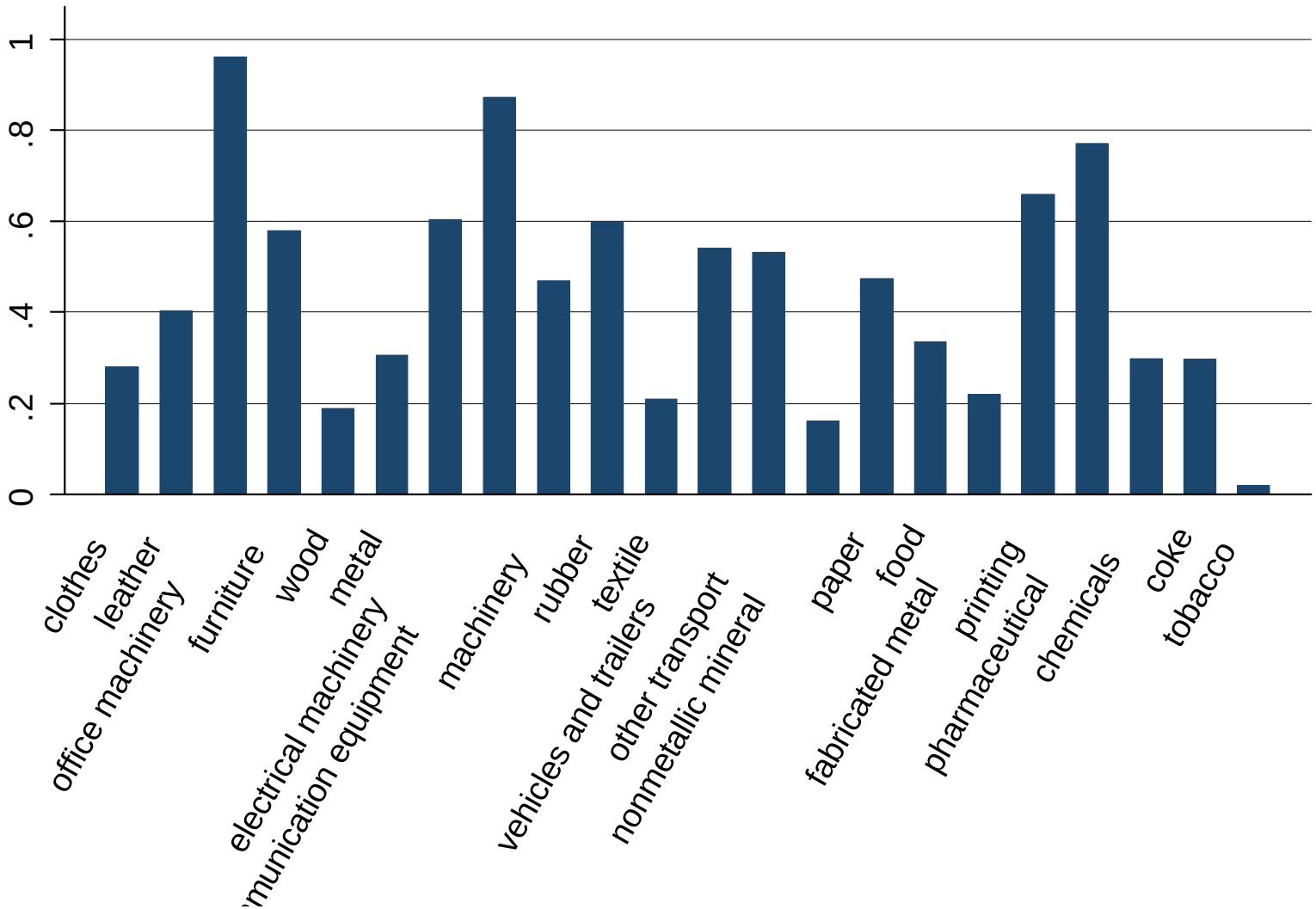
Share of Processing Trade Across Sectors



Share of Processing Trade Across Sectors



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Labor Quality / Human Capital

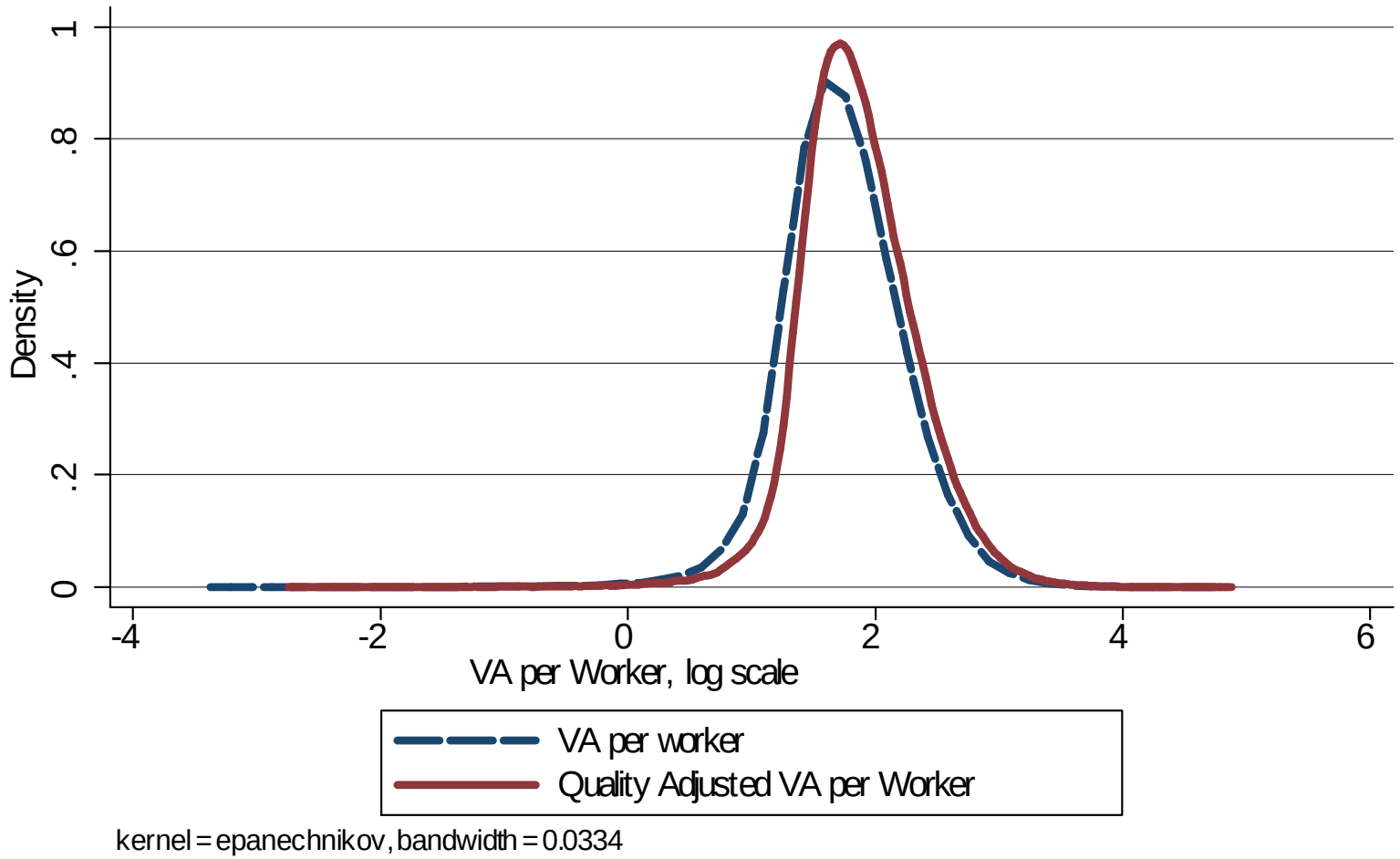
- Define quality adjusted employment as

$$l(j)^* = \frac{w(j)\, l(j)}{w},$$

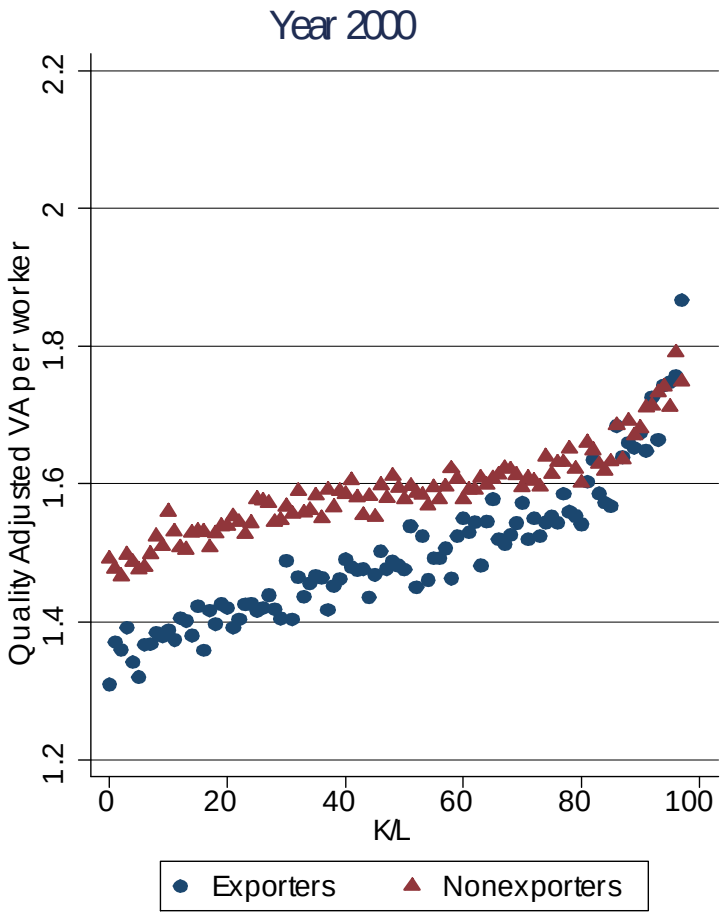
  where w is the average wage markets paid.
- Define quality adjusted VA per worker as

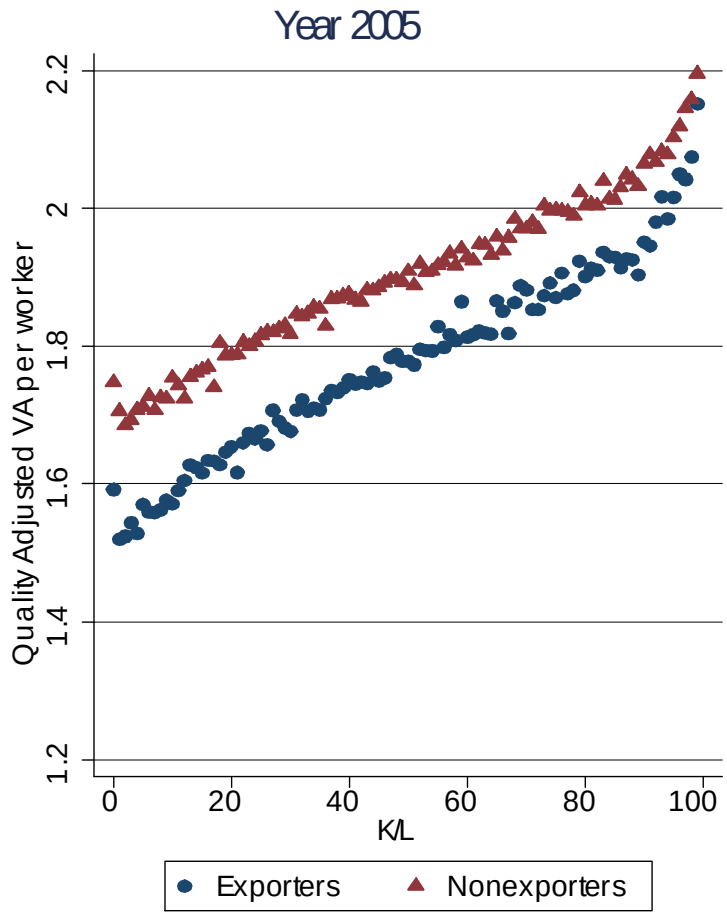
$$\frac{VA}{l(j)^*}$$

Distribution of Quality Adjusted VA Per Worker

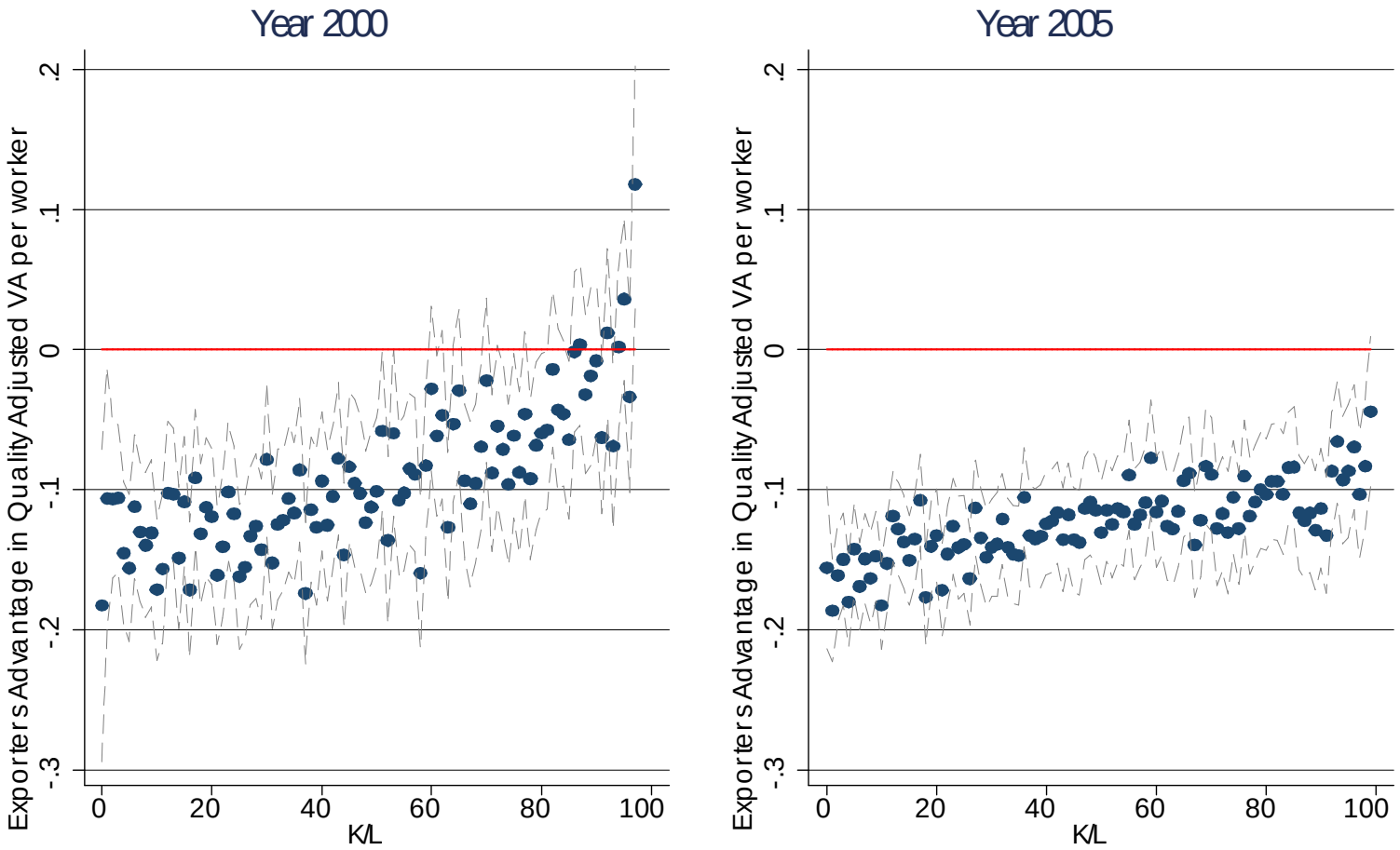


Quality Adjusted VA Per Worker (Exporters and Non-exporters





Exporters Advantage in Quality Adjusted VA Per Worker



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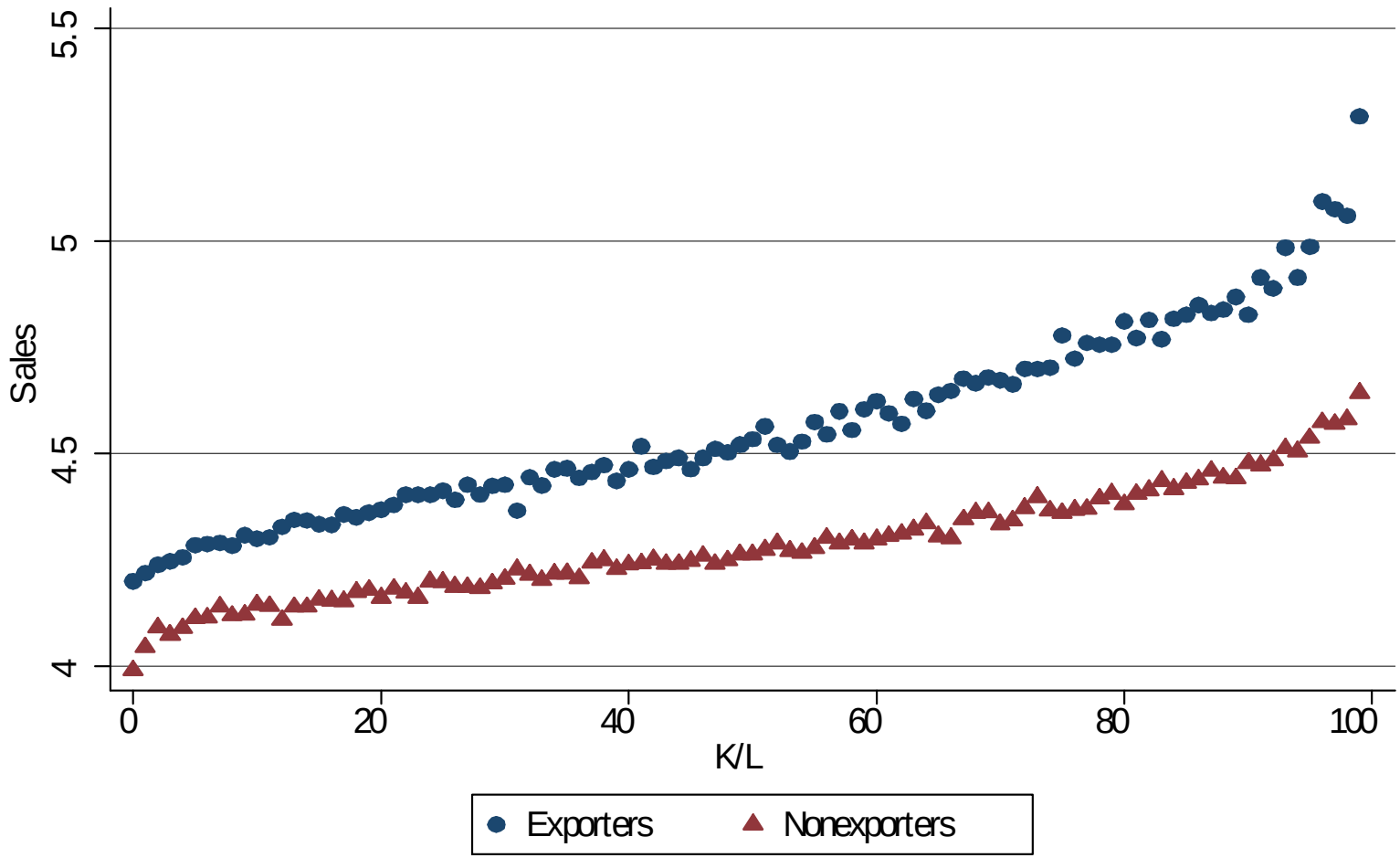
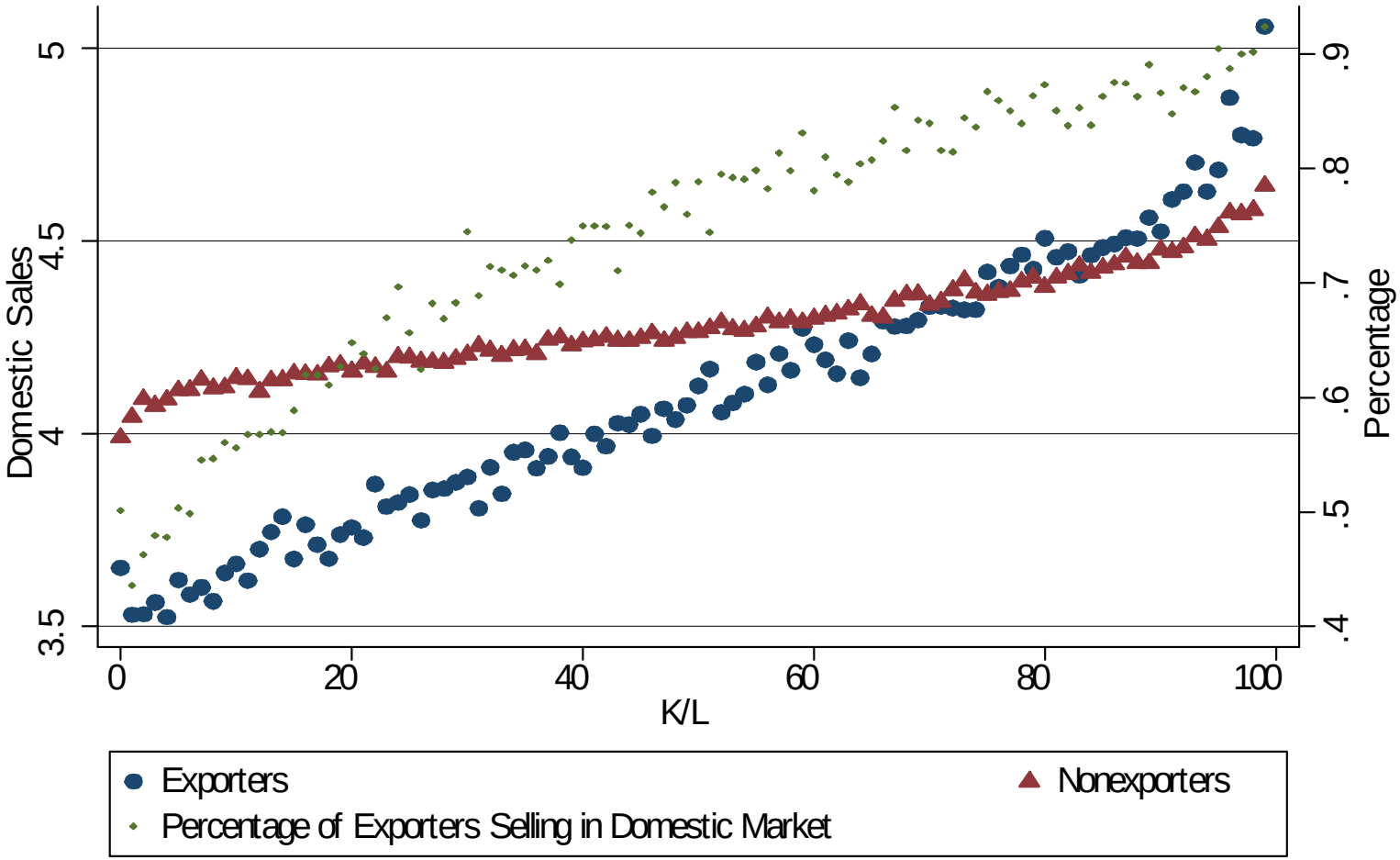
Sales of Exporters and Non-exporters



Domestic Sales of Exporters and Non-exporters



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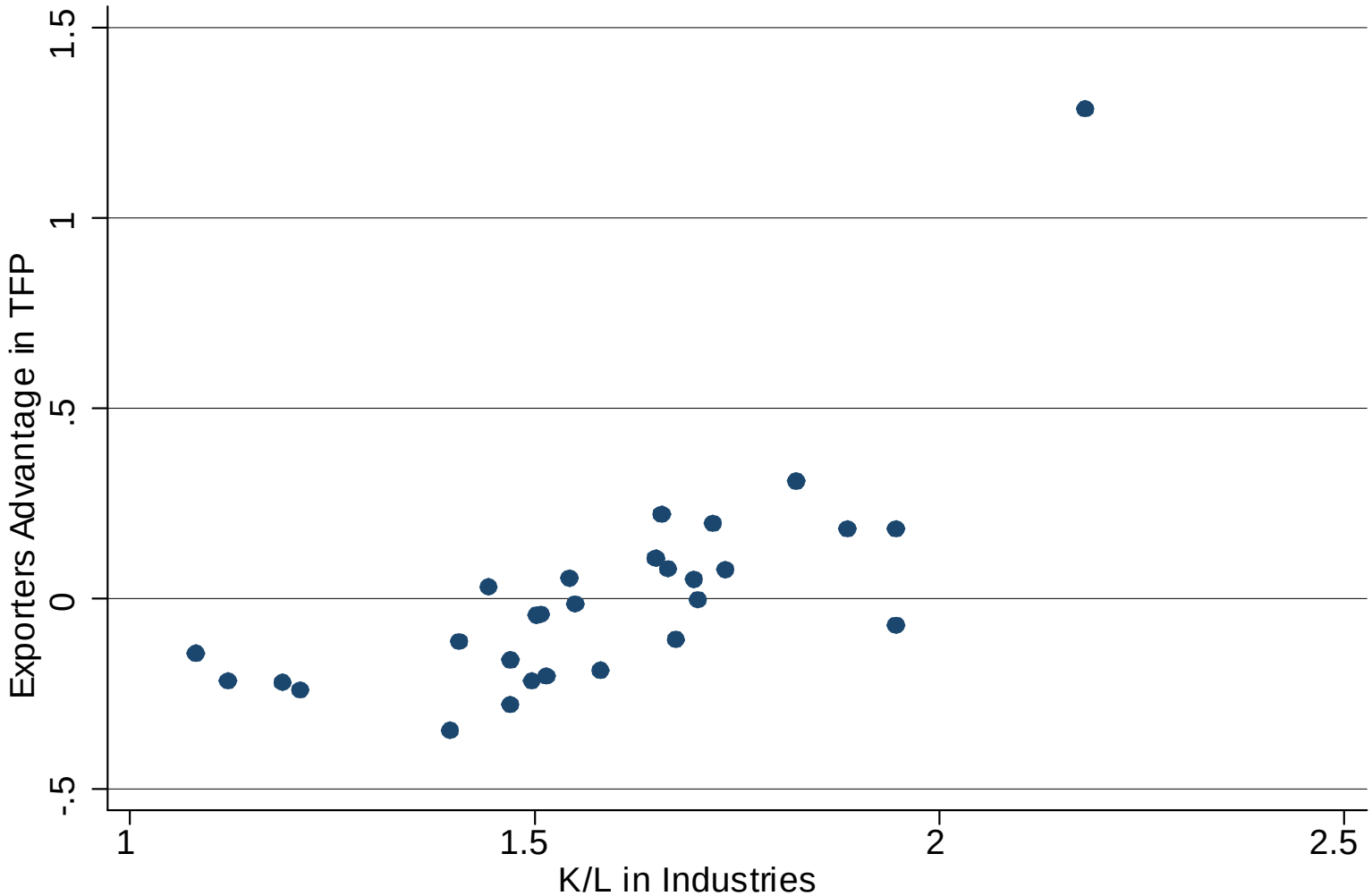
TFP Advantage of Exporters (Across Sector)



TFP Advantage of Exporters (Across Sector)

Firms TFP	
Exporters	-1.473^{***}
	(.0275)
Exporters*SectorK/L	0.913^{***}
	(.0185)
Cons	$.238^{***}$
	(.0024)

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