Understanding the Bimodality of the Distribution of Export Intensity in Thailand

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Motivation

- Bernard et al. (2003) document that the exporters in the United States sell most of their products in their domestic markets
  - Two-thirds of American firms sell less than ten percent of their output abroad
  - Fewer than five percent of them export more than 50 percent of their output.

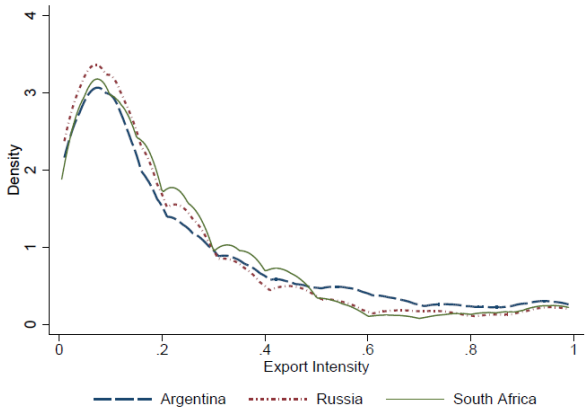
Export status	Percentage of all plants
No exports	79
Some exports	21

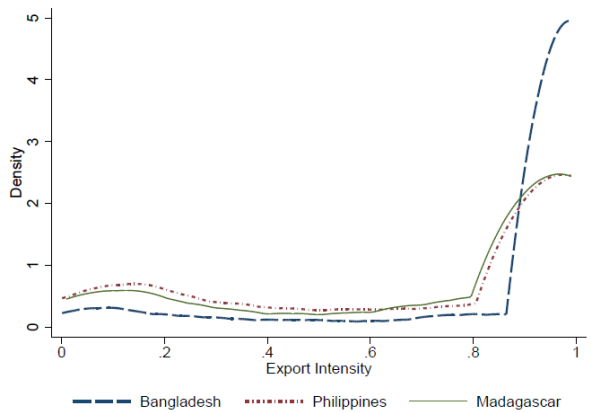
Export intensity of exporters (percent)	Percentage of exporting plants
0 to 10	66
10 to 20	16
20 to 30	7.7
30 to 40	4.4
40 to 50	2.4
50 to 60	1.5
60 to 70	1.0
70 to 80	0.6
80 to 90	0.5
90 to 100	0.7

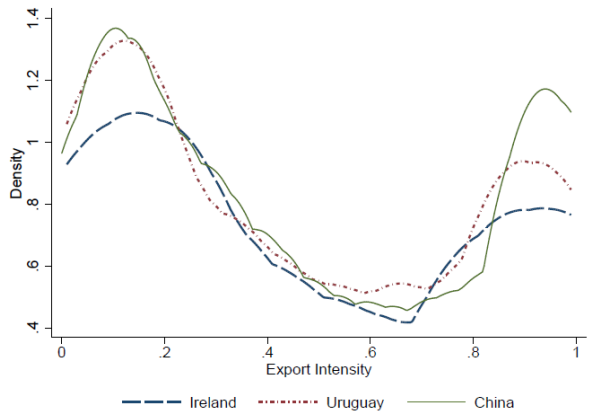
Note: The statistics are calculated from all plants in the 1992 Census of Manufactures.

Motivation

- The distribution of export intensity varies across countries and often is bimodal (Defever and Riano, 2017).
  - Use firm-level data from the World Bank Enterprise Survey for 72 countries.

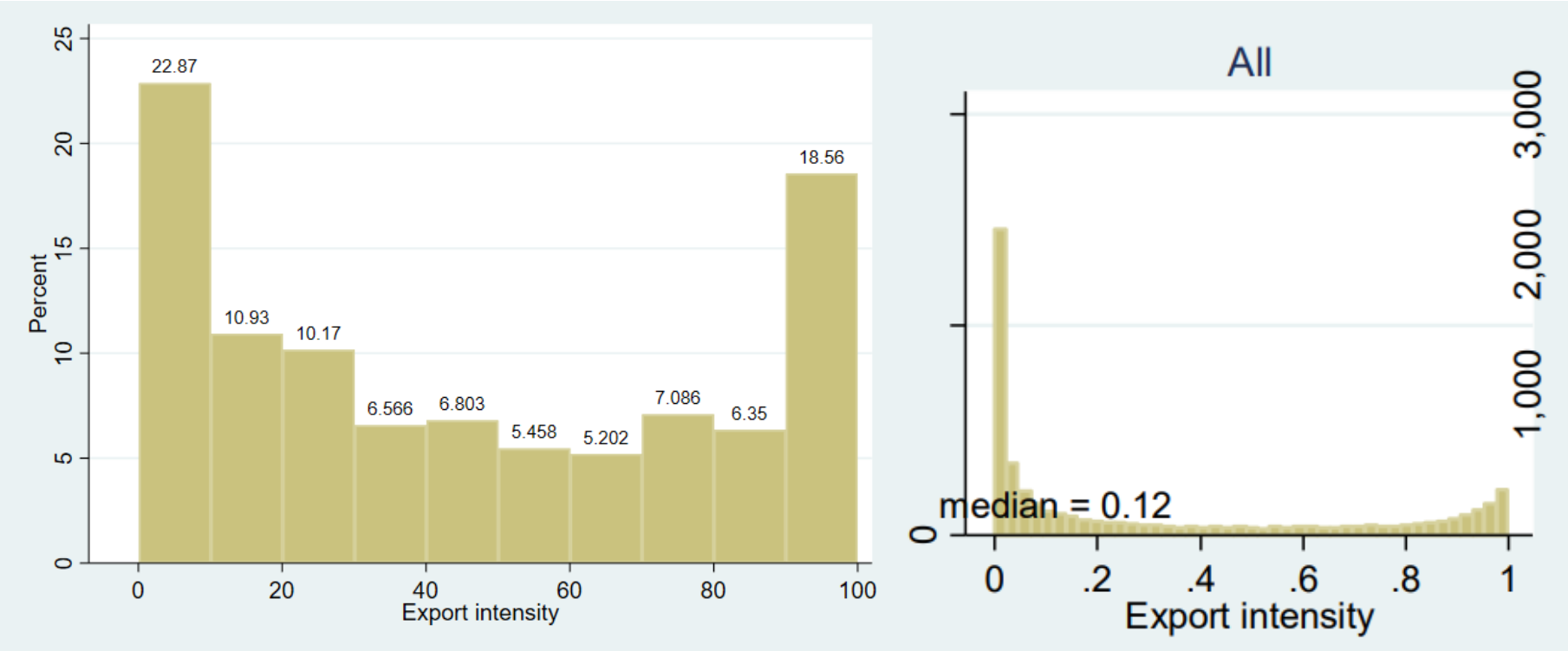






Motivation

- In this paper, we look at the distribution of export intensity in Thailand.



(Left: census data, all samples; Right: customs data)

Motivation

- This bimodality of export intensity distribution is puzzling because it cannot be delivered in a standard trade model with two countries and CES preferences such as Melitz (2003) and Bernard et al. (2007).
- In these models, the revenue of a firm with productivity ω is

$$r_{ij}(\omega) = \left[\left(\frac{\sigma}{\sigma - 1} \frac{1}{\tau_{ij}} \right)^{\sigma-1} Y_j P_j^{\sigma-1} \right] \omega^{\sigma-1}$$

- A firm's revenues from selling to two markets grow proportionally with the firm's productivity. Therefore, the export intensity is identical across firms.
- A variation of export intensity can arise in a multi-country model as export intensity varies across firms because the firms may select a different set of export markets.
  - However, conditional on selling to the same set of export markets, the export intensity is identical across firms and is independent of firm productivity.

What We Do In This Paper

1. We document evidence for the bimodality of the export intensity distribution.
   - The bimodality of export intensity holds across various classifications.
   - Pure exporters are not processing-trade firms.
2. We compare characteristics of general exporters (GEs) and pure exporters (PEs).
   - PEs are younger and less productive than GEs.
   - PEs likely use more capital and labor and import more inputs than GEs do .
   - PEs export fewer products and to high income destinations compared to GE.
3. We identify the determinants of being a pure exporter.
   - We do not find evidence that the choice is driven by the underlying firm productivity.
   - Both Probit and Logit models agree that foreign ownership is a crucial factor that determines the probability of being a pure exporter.

Related Literature

- The main contribution of this paper is to investigate the fundamental difference between pure exporters and general exporters
- Only four previous studies have explored the bimodal export intensity issue.
  1. Brooks (2006) finds that high-intensity exporters in Columbia are the highest quality producers and tend to sell most successfully abroad
  2. Lu (2010) shows that the export intensity in China is bimodal and exporters are relatively less productive.
  3. Defever and Riano (2017) show that the pattern arises in other countries and argue that exporters choose export intensity based on realized firm-specific demand shocks in the domestic and world markets.
  4. Alfaro et al. (2017) find that the same pattern is also found in firms in emerging Asia. The high export intensity of firms in emerging Asia is due to large foreign demand relative to domestic demand.

Data Source

- Thailand's firm-level data from the 2007 and 2017 Industrial Census and the 2012 Business Trade and Industrial Census, focusing on Manufacturing Industry.
  - One main advantage of our chosen dataset is that the Census data presented the operational information of manufacturing establishment in Thailand
- The original data set comes in two forms: a set of three repeated cross-sectional data and a set of panel data.
  - The repeated cross-sectional data has 291,052 observations all three census years.
  - The panel data includes 9,211 establishments for a total of 27,633 observations.
    - ★ allows for productivity estimation

Variable Description

The information can be grouped into two sets:

1. firm-specific general characteristics
   - region, province, industry classification (ISIC code), size, the legal and economic forms of organization, age, registered capital, foreign investment, promotion from BOI.
2. firm-specific decisions made by firms individual
   - export status, export intensity, input usages (capital, labor, and intermediate inputs), output, use of imported materials, and capacity utilization

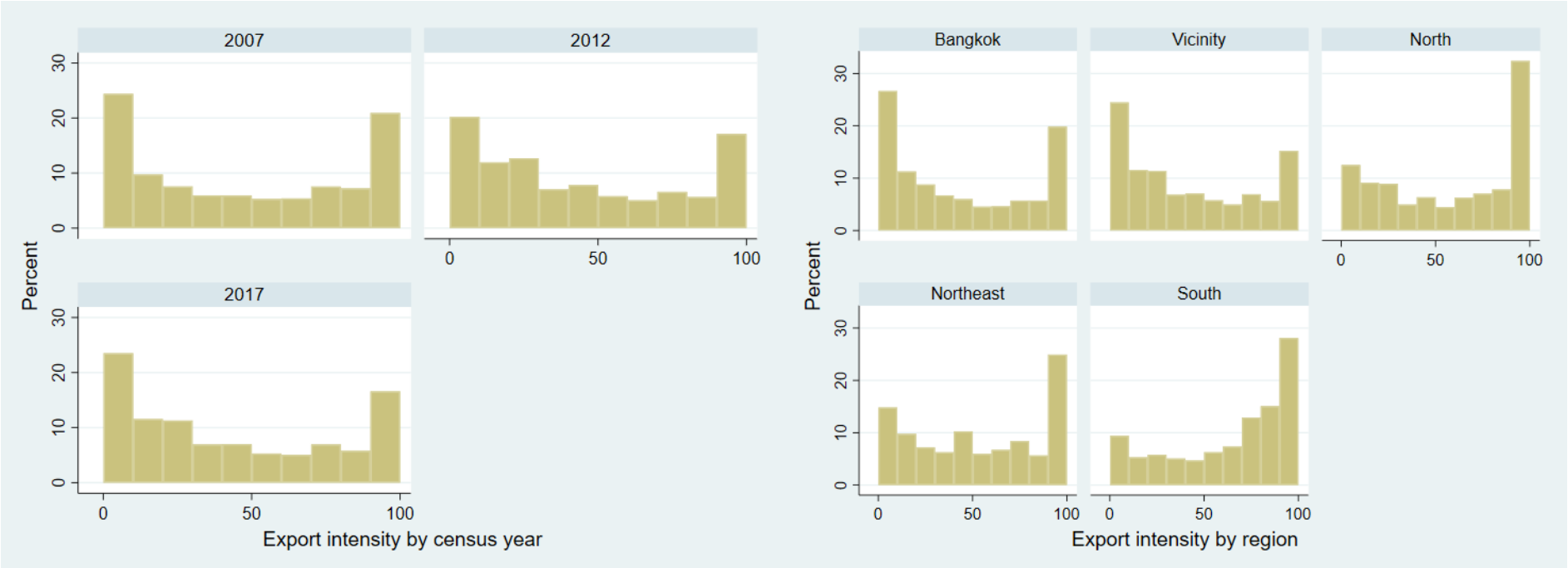
We define the firms that have export intensity larger or equal to 90% as pure exporters (PE). The others are considered general exporters.

- There are 3,401 pure exporters among 14,803 exporters (22.9%) in the cross-sectional data and there are 1,042 pure exporters among 4,611 exporters (22.6%) in the panel data.

Pure Exporters versus General Exporters

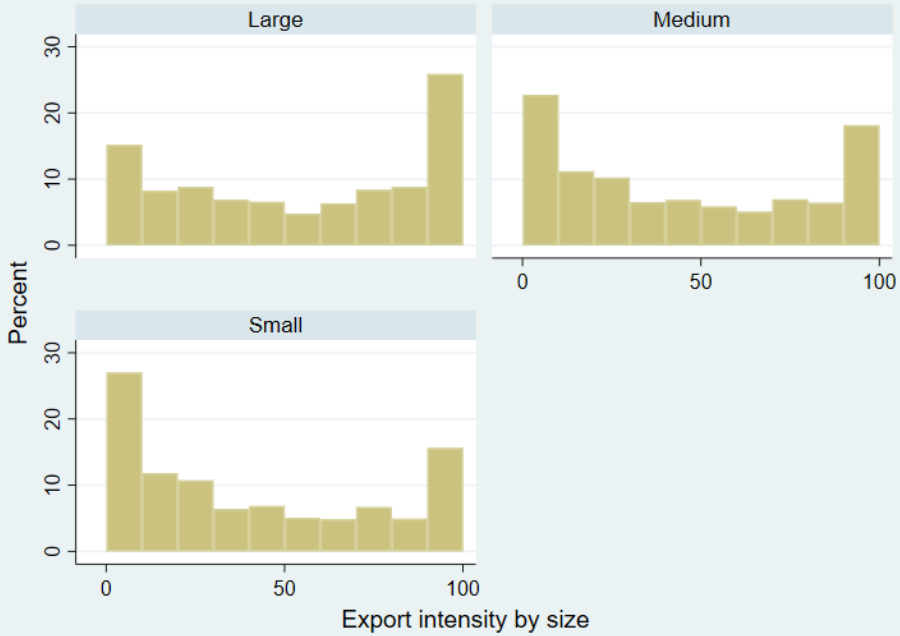
We use the cross-sectional data to document strong evidence that export intensity is distributed bimodally.

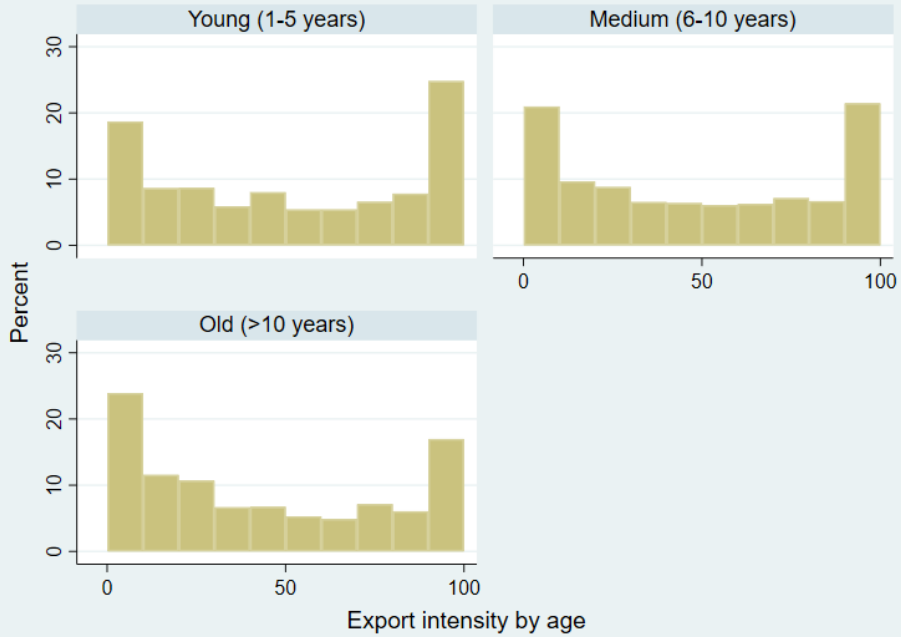
By census year and region:



Pure Exporters versus General Exporters

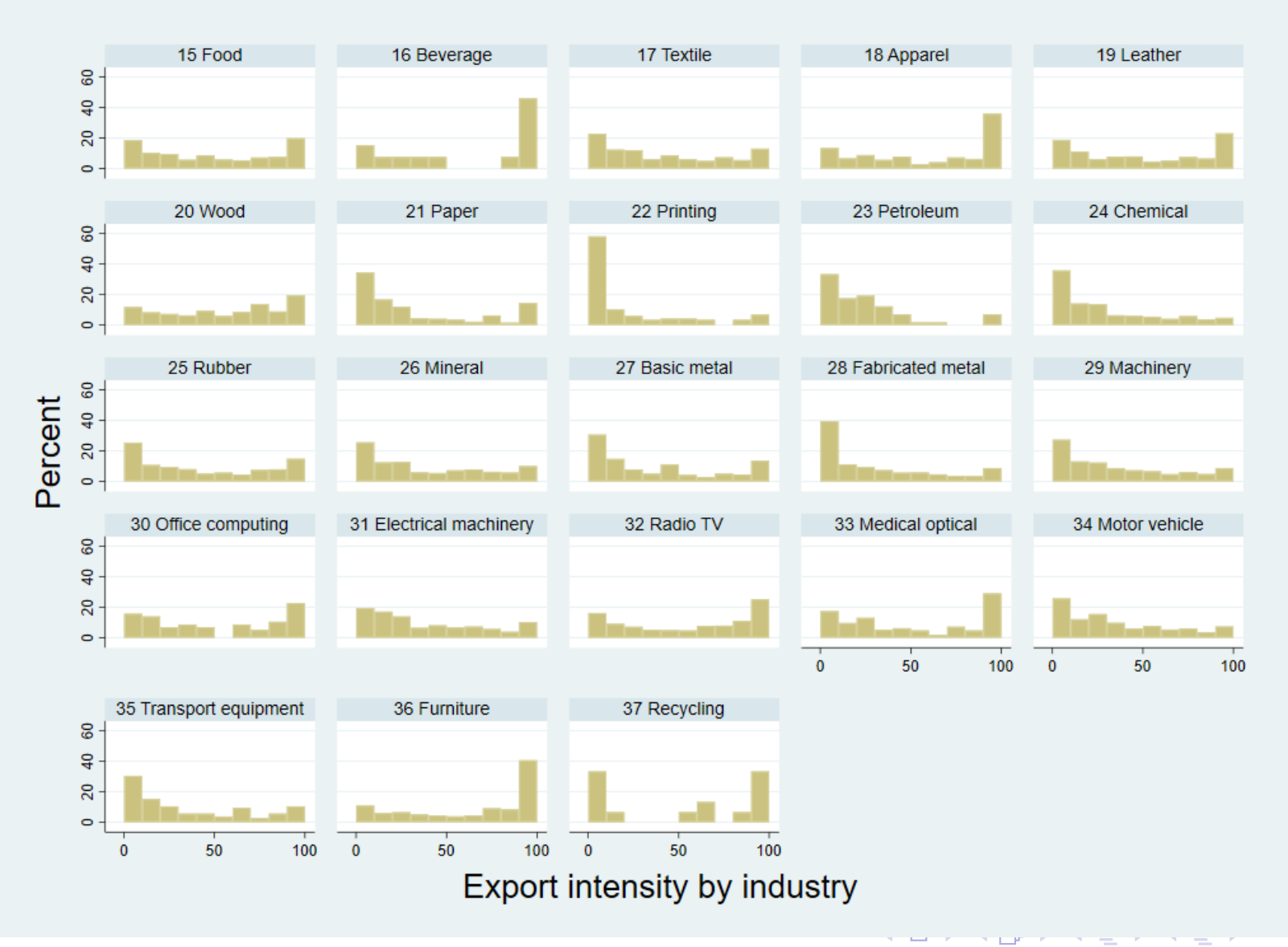
By firm size and firm age:





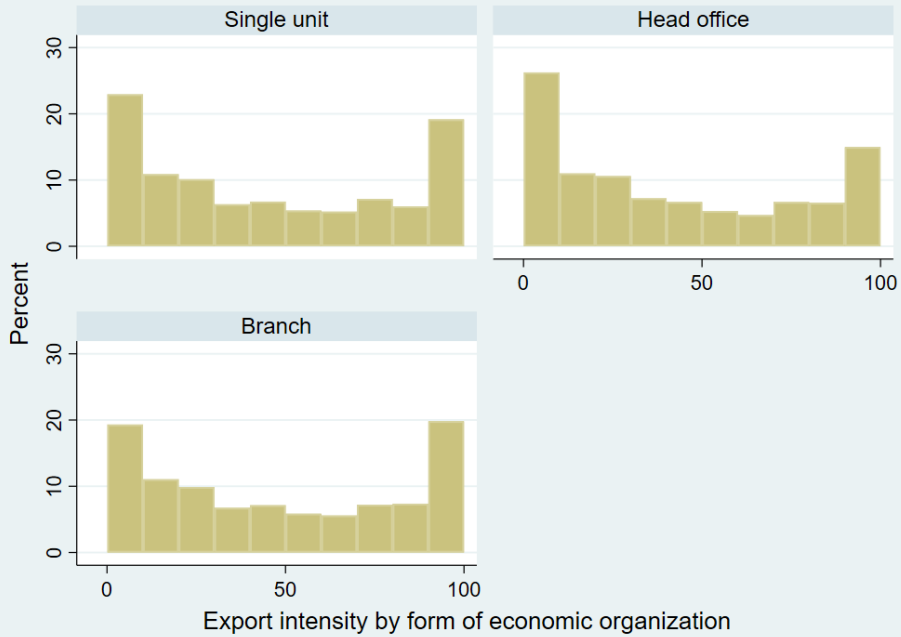
Pure Exporters versus General Exporters

By industry:



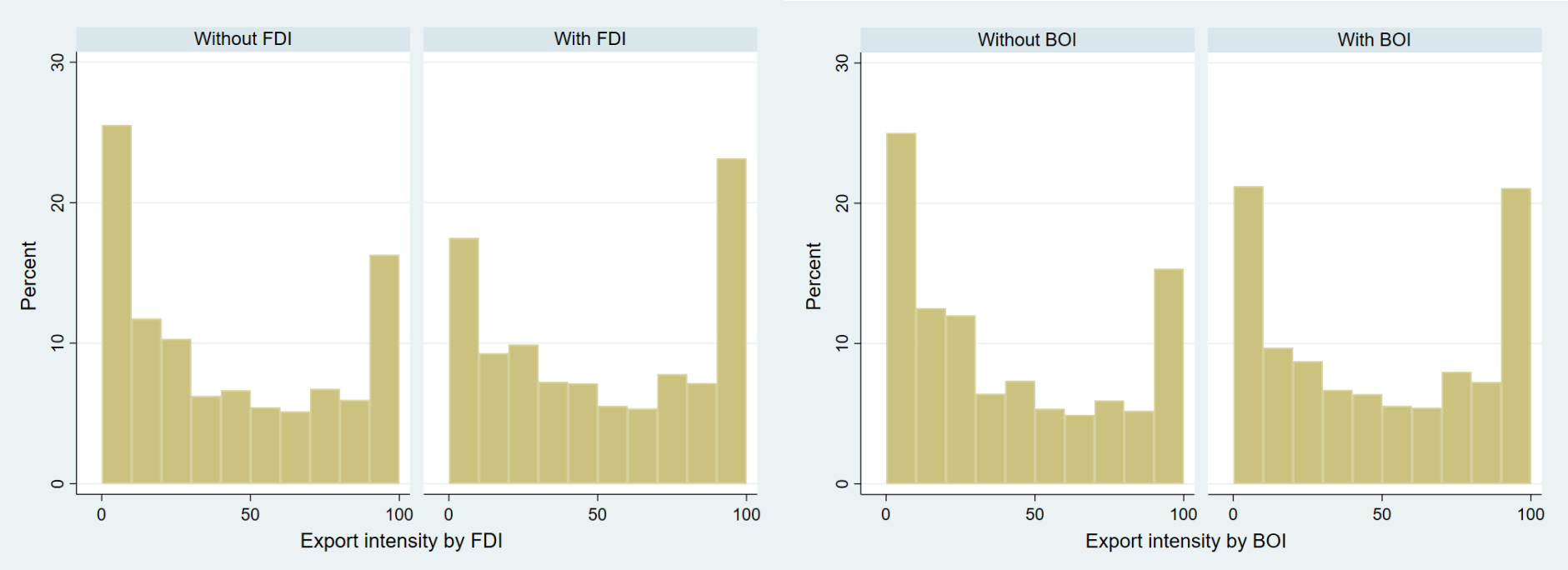
Pure Exporters versus General Exporters

By the legal and economic forms of organization:



Pure Exporters versus General Exporters

By foreign shareholdings and promotion from the Board of Investment (BOI):



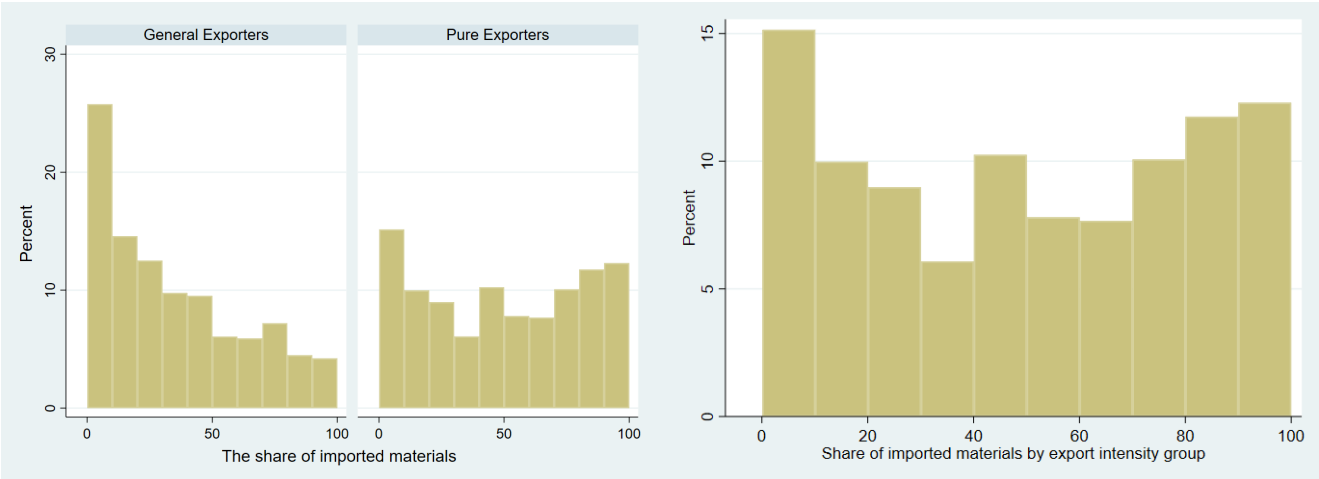
Not Only Processing-Trade Firms

One possible reason for the bimodality is that the pure exporters involve in processing trade.

- Firms that import materials, assemble the output, and then re-export the final products.

We argue that it is not the case.

- The bimodality exists even among firms that do not import materials.
- Only 8% of the pure exporters import 100% of their inputs and around 50% of the pure exporters import at most 50% of their inputs.



Not OEMs or in Free Trade Zone

- The 2017 Industrial Census asks the question "Does the establishment assemble or produce for another establishment?".
  - whether a firm is an original equipment manufacturer (OEM) which imports inputs and exports the final product to another firm.
- We find that 8.7% of general exports and 12.7% of pure exporters involve with activities related to OEMs.
  - A large portion of pure exporters is not related to processing trade.
- We exploit the information about the firm location to determine whether the firm located inside the free trade zones.
  - Around 42.8% of all firms in the sample located in 8 provinces covering the free trade zone areas
  - Only 18.8% of pure exporters are located in the free trade zone areas.

Pure Exporter premia

- We compare pure exporters versus general exporters.
  - Define a dummy d_{PE} which takes the value of 1 if the firm is a pure exporter and 0 if it is a general exporter.
  - Use a simple OLS regression of the characteristics with industry fixed effects and year fixed effects.

$$y_{ist} = \left(d_{PE}\right)_{ist} + \alpha_s + \alpha_t + \epsilon_{ist}$$

- We compare
  1. general characteristics
  2. input usages
  3. employment composition
  4. export destination

Pure Exporter premia

Table: Pure exporter premia

Variables	Coefficient	Standard error
log (Output)	0.29***	0.04
log (Value added)	0.25***	0.04
log (Output per worker)	-0.05***	0.02
log (Value added per worker)	-0.09***	0.02
Firm age	-2.05***	0.20
Number of products	-0.06***	0.02

Note: The coefficient is from regressing the variable in column 1 on the dummy d_{PE} including industry fixed effects and year fixed effects. *,**, and *** indicate the significance level of 0.10, 0.05, and 0.01, respectively.

Pure Exporter premia

Table: Pure exporters' input usages

Variables	Coefficient	Standard error
log (capital)	0.11***	0.05
Capital utilization	2.46***	0.37
log (labor)	0.33***	0.03
log (capital-labor ratio)	-0.24***	0.04
log (Materials)	-0.06***	0.02
Share of imported materials	0.16***	0.01

Note: The coefficient is from regressing the variable in column 1 on the dummy d_{PE} including industry fixed effects and year fixed effects. *,**, and *** indicate the significance level of 0.10, 0.05, and 0.01, respectively.

Pure Exporter premia

Table: Pure exporters' employment composition

Variables	Coefficient	Standard error
log (labor)	0.33***	0.03
log (skilled labor)	0.27***	0.03
log (unskilled labor)	0.29***	0.05
Skill intensity	-0.06***	0.02
log (labor in production)	0.07	0.05
log (labor not in production)	0.32***	0.03
log (wage payment to labor in production)	0.33***	0.03
log (wage payment to labor not in production)	0.08**	0.04

Note: The coefficient is from regressing the variable in column 1 on the dummy d_{PE} including industry fixed effects and year fixed effects. *,**, and *** indicate the significance level of 0.10, 0.05, and 0.01, respectively.

Pure Exporter premia

Table: *Export destinations by share of pure exporters*

Ranking	*Export Destination*	*Share of pure exporters*	*Average export intensity of all exporters*	*Average export intensity of general exporters*
1	*Switzerland*	*0.62*	*70.4*	*26.7*
2	*Canada*	*0.50*	*70.8*	*42.0*
3	*Israel*	*0.50*	*64.9*	*29.7*
4	*Belgium*	*0.46*	*61.2*	*27.5*
5	*France*	*0.46*	*69.3*	*46.8*
6	*U.S.A.*	*0.45*	*69.9*	*47.4*
7	*Italy*	*0.44*	*66.0*	*40.9*
8	*U.K.*	*0.44*	*67.0*	*44.1*
9	*Spain*	*0.43*	*60.1*	*31.0*
10	*Germany*	*0.42*	*66.2*	*43.7*

Pure Exporter premia

Table: *Export destinations by share of pure exporters*

Ranking	*Export Destination*	*Share of pure exporters*	*Average export intensity of all exporters*	*Average export intensity of general exporters*
37	*Pakistan*	*0.04*	*29.3*	*26.6*
38	*India*	*0.04*	*32.1*	*29.6*
39	*Vietnam*	*0.03*	*22.0*	*20.0*
40	*Indonesia*	*0.02*	*20.9*	*19.7*
41	*Myanmar*	*0.01*	*13.1*	*12.1*
42	*Lao PDR*	*0.00*	*19.2*	*19.2*
43	*DPR of Korea*	*0.00*	*41.9*	*41.9*
44	*Bangladesh*	*0.00*	*20.6*	*20.6*
45	*Sri Lanka*	*0.00*	*11.6*	*11.6*
46	*Nigeria*	*0.00*	*30.4*	*30.4*

Firm-Level Productivity

- One possible reason for the bimodality of the distribution of export intensity is that underlying productivity itself could be bimodally distributed.
- We use the confidential panel data to estimate firm-level productivity

To estimate firm productivity, we follow the literature by assuming sector-specific translog production functions with three inputs, labor, capital, and raw materials in the form

$$y_{ist} = a + \beta_s^k k_{ist} + \beta_s^l l_{ist} + \beta_s^m m_{ist} + \omega_{ist} + \epsilon_{ist},$$

- ω_{ist} is firm-specific productivity and ϵ_{ist} is the estimation error or the unexpected productivity.
  - the input choice is made based on ω_{ist} but not ϵ_{ist}.

Firm-Level Productivity

- OLS estimators are biased and inconsistent due to the input-choice endogeneity problem
  - The firm's input decisions are influenced by productivity that is known to the firm but unknown to the econometrician.
  - Thus, the regressors and the residuals are correlated.
- We follow the production estimation methodology in Levinsohn and Petrin (2003).
  - Assume that the demand functions of variable inputs are a function of productivity and fixed inputs.
  - Assuming that these demand functions are invertible, we can recover productivity from information on variable inputs and fixed inputs.
  - Use raw materials as a proxy for the unobservable productivity.

Firm-Level Productivity

- We assume

$$m_{ist} = f_{st}\left(\omega_{ist}, k_{ist}\right)$$

- If the intermediate input demand is monotonic in ω_{ist}, then

$$\omega_{ist} = f_{st}^{-1}\left(m_{ist}, k_{ist}\right)$$

- We get unbiased β_s^l from estimating the production function

$$y_{ist} = a + \beta_s^k k_{ist} + \beta_s^l l_{ist} + \beta_s^m m_{ist} + f_{st}^{-1}\left(m_{ist}, k_{ist}\right) + \epsilon_{ist},$$

- We then use the moment condition to identify β_s^k and β_s^m.
- The productivity estimation is done using Stata command "prodest".

Firm-Level Productivity

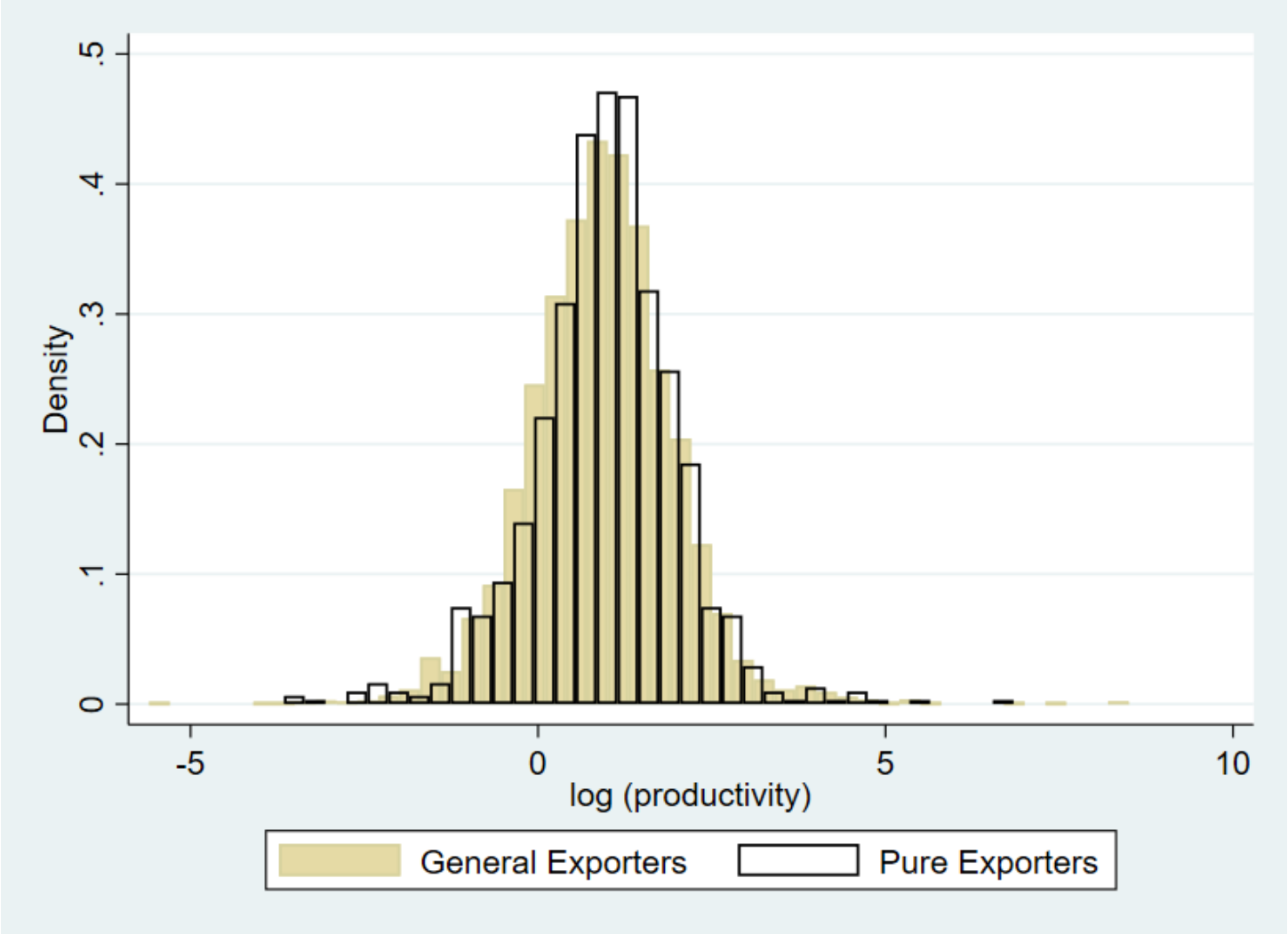
We normalize productivity by the industry-year average to remove industry and year fixed effects.

Table: Productivity comparison.

	Exporters			Non-exporters	Total
	General exporters	Pure exporters	All exporters		
Mean	0.92	0.97	0.93	-0.20	0
Std. Dev.	1.07	1.06	1.07	1.35	1.38
10^{th} percentile	-0.34	-0.28	-0.33	-1.94	-1.78
25^{th} percentile	0.27	0.41	0.31	-1.05	-0.87
75^{th} percentile	1.54	1.55	1.54	0.67	0.91
90^{th} percentile	2.14	2.16	2.15	1.43	1.64
Observations	3,524	1,026	4,550	20,801	25,351

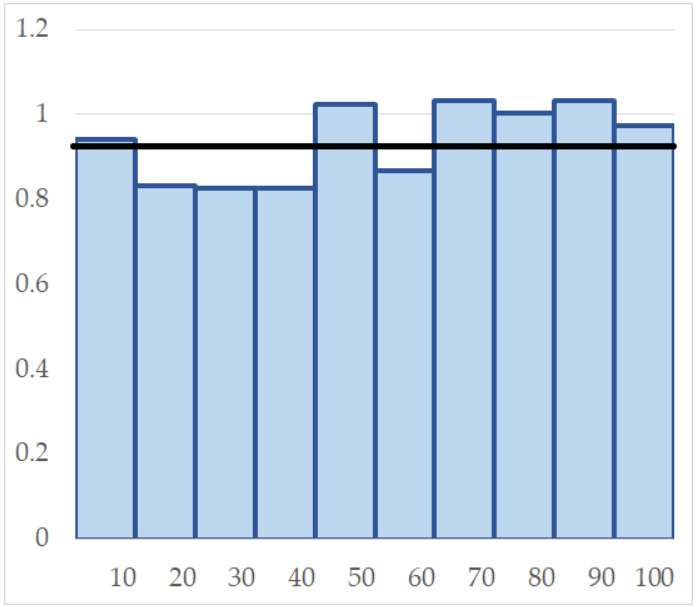
Firm-Level Productivity

The productivity distributions of general exporters and pure exporters.



Firm-Level Productivity

Our conclusion is robust to the definition of pure exporters



Determinants of Export Intensity

- We investigate the determinants of export intensity using baseline OLS, Probit and Logit models.
  - Since our dependent variable is a proportion, we also use fractional response and zero inflated beta models.
- The baseline regression is represented by

$$\text{Export Intensity}_{ist} = X_{ist}\beta + \alpha_s + \alpha_t + \mu_{ist}.$$

- The variables in our regressions include firm-level productivity, firm age, the share of imported materials.
  - Control for capital intensity and skilled intensity.
  - Include the number of products and dummies for FDI, BOI, and high-income export destination.

OLS

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS
Productivity	1.238***	1.277***	1.178**	0.206	0.0289
	(0.471)	(0.474)	(0.509)	(0.509)	(0.842)
Firm age		-0.315***	-0.281***	-0.203***	-0.244***
		(0.0486)	(0.0520)	(0.0517)	(0.0878)
Imported materials		3.836***	3.457***	1.252	-0.0303
		(1.077)	(1.160)	(1.161)	(1.865)
Capital intensity			-0.530*	-0.922***	0.0863
			(0.284)	(0.283)	(0.427)
Skilled intensity			-0.101	-0.0772	-0.581
			(0.597)	(0.588)	(0.923)
Number of products				-1.036*	-1.489*
				(0.607)	(0.846)
FDI				8.752***	7.693***
				(1.202)	(1.935)
BOI				9.206***	7.117***
				(1.331)	(2.617)
High-income export destination					20.91***
					(1.821)
Observations	4,550	4,550	3,952	3,952	1,605
R-squared	0.115	0.125	0.127	0.155	0.254
Industry FE	yes	yes	yes	yes	no
Year FE	yes	yes	yes	yes	no

Note: Standard errors in parentheses. *,**, and *** indicate the significance level of 0.10, 0.05, and 0.01, respectively.

Probit and Logit

	(1)		(2)		(3)		(4)		(5)	
VARIABLES	Probit	Logit	Probit	Logit	Probit	Logit	Probit	Logit	Probit	Logit
Productivity	0.0193	0.104**	0.0191	0.0925**	0.0171	0.0864*	-0.00272	0.0518	-0.0249	0.104
	(0.0208)	(0.0410)	(0.0211)	(0.0418)	(0.0228)	(0.0459)	(0.0232)	(0.0465)	(0.0393)	(0.0824)
Firm age			-0.0128***	-0.0220***	-0.0125***	-0.0198***	-0.0107***	-0.0158***	-0.0129***	-0.0292***
			(0.00234)	(0.00489)	(0.00251)	(0.00524)	(0.00255)	(0.00529)	(0.00454)	(0.00974)
Imported			0.206***	0.582***	0.179***	0.504***	0.114**	0.389***	0.0520	0.173
materials			(0.0483)	(0.0986)	(0.0522)	(0.106)	(0.0534)	(0.109)	(0.0866)	(0.177)
Capital					-0.0273**	0.0170	-0.0352***	-0.00150	0.00741	0.130**
intensity					(0.0124)	(0.0254)	(0.0126)	(0.0253)	(0.0203)	(0.0509)
Skilled					-0.0481*	-0.120**	-0.0501*	-0.128**	-0.0447	-0.0756
intensity					(0.0262)	(0.0508)	(0.0265)	(0.0512)	(0.0431)	(0.0842)
Number of							-0.0567**	-0.149***	-0.0836**	-0.207**
products							(0.0285)	(0.0570)	(0.0409)	(0.0828)
FDI							0.314***	0.638***	0.327***	0.776***
							(0.0549)	(0.106)	(0.0912)	(0.178)
BOI							0.151**	0.261**	0.0899	-0.0856
							(0.0609)	(0.117)	(0.127)	(0.238)
High-income									0.925***	1.662***
export destination									(0.103)	(0.233)
Observations	4,548	4,080	4,548	4,080	3,950	3,474	3,950	3,474	1,603	1,259
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	no	no

Note: Standard errors in parentheses. *,**, and *** indicate the significance level of 0.10, 0.05, and 0.01, respectively.

Fractional Response

VARIABLES	(1) proportion	(2) one inflate	(3) proportion	(4) one inflate	(5) proportion	(6) one inflate	(7) proportion	(8) one inflate	(9) proportion	(10) one inflate
Productivity	0.0661***	-0.0761*	0.0662***	-0.0604	0.0674***	-0.124**	0.0377*	-0.154***	0.0567*	-0.200**
	(0.0175)	(0.0459)	(0.0176)	(0.0463)	(0.0191)	(0.0492)	(0.0193)	(0.0497)	(0.0338)	(0.0791)
Firm age			-0.00879***	-0.0271***	-0.00777***	-0.0261***	-0.00562***	-0.0206***	-0.00554*	-0.0310***
			(0.00178)	(0.00519)	(0.00191)	(0.00556)	(0.00192)	(0.00578)	(0.00331)	(0.00996)
Imported materials			0.112***	0.173*	0.107**	0.199*	0.0462	0.0412	-0.0702	0.203
			(0.0396)	(0.104)	(0.0428)	(0.112)	(0.0433)	(0.117)	(0.0713)	(0.176)
Capital intensity					-0.00207	-0.126***	-0.0145	-0.139***	0.00650	-0.0605
					(0.0103)	(0.0232)	(0.0106)	(0.0237)	(0.0161)	(0.0368)
Skilled intensity					0.0260	-0.0531	0.0247	-0.0603	-0.00450	-0.0478
					(0.0224)	(0.0583)	(0.0223)	(0.0583)	(0.0353)	(0.0879)
Number of product							0.236***	0.513***	0.216***	0.274
							(0.0452)	(0.113)	(0.0744)	(0.172)
FDI							0.275***	0.293**	0.148	-0.105
							(0.0504)	(0.117)	(0.0998)	(0.252)
BOI							-0.0131	-0.187***	-0.0292	-0.136
							(0.0222)	(0.0697)	(0.0319)	(0.0889)
High-income export destination									0.630***	1.465***
									(0.0683)	(0.241)
Observations	4,550	4,550	4,550	4,550	3,952	3,952	3,952	3,952	1,605	1,605
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Note: Standard errors in parentheses. *,**, and *** indicate the significance level of 0.10, 0.05, and 0.01, respectively.

Conclusion

- This paper studies the bimodality of export intensity distribution and its determinants.
- Using firm-level data on Thai manufacturing firms, we show that the bimodality of the export intensity distribution arises regardless of classification.
- We find that pure exporters are younger, import input materials, export fewer number of product to high income market destinations.