Learning and the Buyers' Margin of Trade

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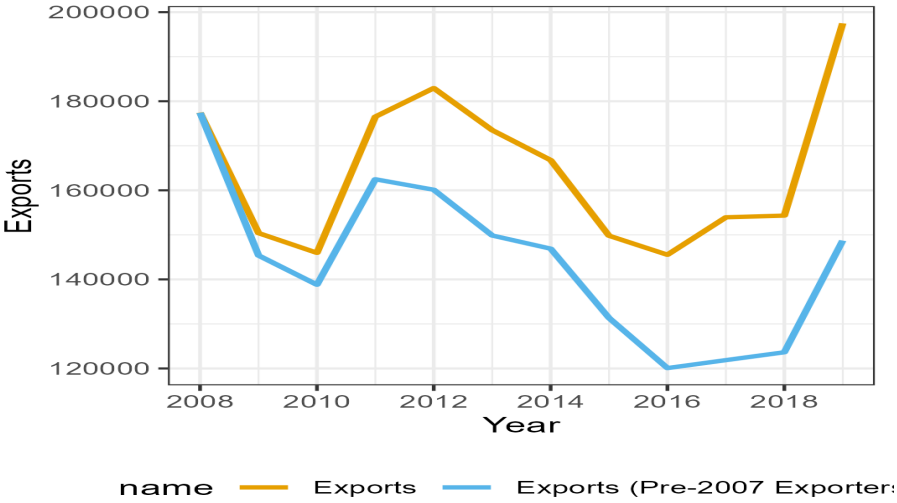
- Most of the theoretical predictions and empirical studies emphasize on the firm or the product level, for example Berman et al(2019), and Albornoz et al(2022)
  - These models lack a very important consideration, which is central in trade transactions, the **buyers' margin.**
- Recently, the availability of raw customs data and ML techniques have allowed to analyze detailed firm-firm transaction data. These data provide novel facts about the process of export growth and the entry and exit patterns of new exporters.

New exporters are important



New buyers are important

What I do:

- From raw Colombian customs data, I replicate the process to produce statistics at the exporter-buyer level, tracking the officially published data at the exporter level.
  1. I provide novel facts on new exporters that are directly comparable to the existing facts on exporters:
     - Entry: Young Exporters are more probable to enter export markets, but even more probable to enter export relationships.
     - Exit: Exporter and Relationship exit patterns closely mirror each other.
     - Export Growth: Conditional on survival, most growth is due to new relationships.
     - These facts paint a picture where learning is important for young exporters, but the margin of growth is the buyers' margin.

  2. The facts imply the important role the buyers' margin has in export decisions:
     - I build a tractable model of international trade incorporating
     - buyer heterogeneity & uncertainty for export destinatios

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  2. The facts imply the important role the buyers' margin has in export decisions:
     - I build a tractable model of international trade incorporating
     - buyer heterogeneity & uncertainty for export destinatios
  3. Have desirable theoretical properties (Not in this presentation):
     - The model combined with the gravity framework can be used to study counterfactuals, e.g. changing the belief distribution of exporters.

Literature

- Learning, imperfect information and international trade:
  - Morales et al(2019), Chen et al(2019)
  - Arkolakis et al(2018), Timoshenko(2018), Timoshenko and Sager(2020)
  - Berman et al(2018), Hamilton(2018), Albornoz et al.(2022)

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  - Berman et al(2018), Hamilton(2018), Albornoz et al.(2022)

- Empirics of exporter heterogeneity and growth
  - Eaton et al., (2019); Fitzgerald, Haller, & Yedid-Levi, (2019),Foster, Haltiwanger, & Syverson, 2016, Gourio & Rudanko, 2014; Piveteau, 2016
  - Kamal and Krizan (2012), Kamal and Sundaram (2013),Bernard et al.(2018), Carballo et al(2018), Bernard and Moxnes(2018), Monarch and Schmidt-Eisenlohr (2019)

Colombian Customs Data

- Colombian export data, at the transaction level, from 2009-2019
- Each transaction contains
  1. Value and quantity (and "unit value")
  2. HS 10 industry code.
  3. Exporter identification information (local tax identification number - directly merged to Orbis).

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  - **Record Linkage** for buyers: "Create a unique buyer ID"
  1. Translate text in forms to english and create temporary buyer ID based on customs information on name, address, city
  2. Create ML algorithm that calculates similarity of IDs (deal with missing information over time)

	Overall	U.S.	Ecuador	Mexico
Number of exporters	75185	18926	32624	10362
Number of buyers	134166	25423	60735	17734
Share trade, top 15 sellers	.90	.87	.54	.76
Share trade, top 15 buyers	.93	.84	.67	.73
Share of total export	100	35.2	33.5	13.4

Data: Buyer dispersion and uncertainty

- Trade Shares, and Trade Costs

1. BACI: Trade dataset at the HS6-bilateral level
2. WITS: Tariffs at the country-HS6 levels
3. CEPII: Standard Gravity measures

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- Economic Uncertainty (Bloom et al(2020))

Exporter Dynamics

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$$\text{Growth}_{ijpt} = \ln\left(x_{ijpt}\right) - \ln\left(x_{ijpt-1}\right).$$

- Exit is a binary variable:

$$\text{Exit}_{ijpt} = \begin{cases} 1 & \text{if } x_{ijpt} = 0 \text{ and } x_{ijpt-1} > 0 \\ 0 & \text{if } x_{ijpt} > 0 \text{ and } x_{ijpt-1} > 0. \end{cases}$$

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Past Export Experience

- Testing how export dynamics depend on past export experience through learning effects:

$$X_{ijpt} = \alpha_0 + \alpha_Y FY_{ijp,t-1} + \alpha_{YM}\left(FY_{ijp,t-1} \times FM_{ij}\right) + \alpha_M FM_{ij} + \alpha_{YP}\left(FY_{ijp,t-1} \times FP_{ip}\right) + \alpha_P FP_{ip} + \alpha_{MP}\left(FM_{ij} \times FP_{ip}\right) + \alpha_{YMP}\left(FY_{ijp,t-1} \times FM_{ij} \times FP_{ip}\right) + G_{jt} + \{FE\} + u_{ijpt},$$

- $FYijpt$: First Year Dummy(records the first year in which a triplet ijp has recorded exports),
- $FMij$: First market(s) served by firm i,
- $FPip$: First product(s) exported by firm i.

However: If you do not account for exporter-buyer relationships you are missing:

- Entry and Exit in new relationships even if Entry and Exit in a market is zero
- The margin of export growth: Is export growth after survival due to new relationship or increased quantities in existing relationships

Entry Patterns

	(1) Entry	(2) Entry	(3) Entry	(4) Entry	(5) Entry	(6) Entry
γ_Y	0.002***	0.004***	0.004***	0.004***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
γ_{YM}	0.007*	0.008*	0.008*	0.009**	0.017***	0.017***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Gravity controls	no	yes	yes	yes	yes	yes
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes
Product FE	no	no	yes	no	yes	no
Firm FE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.014	0.021	0.022	0.027	0.019	0.023
Number of Observations	7.7e+06	7.2e+06	7.2e+06	7.2e+06	2.9e+06	2.9e+06

Standard errors clustered by firm in parentheses.
***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Relationship Entry Patterns

	(1) Entry	(2) Entry	(3) Entry	(4) Entry	(5) Entry	(6) Entry
γ_Y	0.005***	0.004***	0.003***	0.001***	0.004***	0.002***
	(0.00033)	(0.00031)	(0.00029)	(0.00023)	(0.00049)	(0.00038)
γ_{YM}	0.000	0.001*	0.001**	0.002***	0.001*	0.002***
	(0.00045)	(0.00045)	(0.00041)	(0.00033)	(0.00066)	(0.00058)
Gravity controls	no	yes	yes	yes	yes	yes
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes
Product FE	no	no	yes	no	yes	no
Firm FE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.00234	0.02263	0.02386	0.02860	0.02170	0.02482
Number of Observations	9.2e+06	8.6e+06	8.6e+06	8.6e+06	4.0e+06	4.0e+06

Exit Patterns

	(1) Exit	(2) Exit	(3) Exit	(4) Exit	(5) Exit	(6) Exit
β_{YMP}	0.206***	0.211***	0.139***	-0.038***	0.102***	0.011
	(0.011)	(0.010)	(0.010)	(0.009)	(0.014)	(0.012)
$\beta_{Y+YM+M+YP+P+MP+YMP}$	0.325***	0.297***	0.212***	-0.007	0.174***	0.061***
	(0.011)	(0.010)	(0.010)	(0.009)	(0.013)	(0.011)
$\beta_{YM+M+YP+P+MP+YMP}$	0.007	-0.005	-0.047***	-0.197***	-0.081***	-0.154***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.012)	(0.010)
Gravity controls	no	yes	yes	yes	yes	yes
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes
Product FE	no	no	yes	no	yes	no
Firm FE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.149	0.226	0.266	0.372	0.261	0.318
Number of Observations	9.2e+05	8.5e+05	8.5e+05	8.5e+05	4.5e+05	4.5e+05

Relationship Exit Patterns

	(1) Exit	(2) Exit	(3) Exit	(4) Exit	(5) Exit	(6) Exit
β_{YMP}	0.055***	0.147***	0.119***	-0.037***	0.137***	0.004
	(0.013)	(0.012)	(0.011)	(0.010)	(0.014)	(0.013)
$\beta_{Y+YM+M+YP+P+MP+YMP}$	0.202***	0.201***	0.165***	0.009	0.184***	0.052***
	(0.011)	(0.011)	(0.011)	(0.009)	(0.013)	(0.013)
$\beta_{YM+M+YP+P+MP+YMP}$	-0.094***	-0.055***	-0.054***	-0.158***	-0.027**	-0.124***
	(0.008)	(0.007)	(0.007)	(0.006)	(0.011)	(0.011)
Gravity controls	no	yes	yes	yes	yes	yes
YearFE	no	yes	yes	yes	yes	yes
CountryFE	no	yes	yes	yes	yes	yes
ProductFE	no	no	yes	no	yes	no
FirmFE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.108	0.201	0.228	0.287	0.247	0.289
Number of Observations	1.1e+06	1.1e+06	1.1e+06	1.1e+06	5.5e+05	5.5e+05

Conditional Export Growth

	(1)	(2)	(3)	(4)	(5)	(6)
α_{YMP}	0.153**	0.154**	0.192***	0.150*	0.113	0.073
	(0.066)	(0.068)	(0.070)	(0.078)	(0.100)	(0.111)
$\alpha_{Y+YM+M+YP+P+MP+YMP}$	0.446***	0.475***	0.523***	0.601***	0.359***	0.435***
	(0.034)	(0.036)	(0.038)	(0.052)	(0.060)	(0.076)
$\alpha_{YM+M+YP+P+MP+YMP}$	0.121***	0.146***	0.129***	0.230***	0.046	0.159**
	(0.037)	(0.037)	(0.038)	(0.051)	(0.062)	(0.075)
Gravity controls	no	yes	yes	yes	yes	yes
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes
Product FE	no	no	yes	no	yes	no
Firm FE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.017	0.021	0.049	0.151	0.060	0.100
Number of Observations	9.9e+04	9.3e+04	9.3e+04	9.3e+04	4.1e+04	4.1e+04

Conditional Export (Existing Relationship) Growth

	(1)	(2)	(3)	(4)	(5)	(6)
α_{YMP}	0.518	0.314	0.423	0.302	-0.029	0.030
	(0.345)	(0.379)	(0.397)	(0.423)	(0.594)	(0.581)
$\alpha_{Y+YM+M+YP+P+MP+YMP}$	0.469***	0.402*	0.424*	0.481	0.441*	0.548*
	(0.132)	(0.212)	(0.236)	(0.301)	(0.262)	(0.281)
$\alpha_{YM+M+YP+P+MP+YMP}$	-0.399**	-0.327*	-0.313	-0.295	-0.246	-0.320
	(0.193)	(0.187)	(0.210)	(0.260)	(0.341)	(0.355)
Gravity controls	no	yes	yes	yes	yes	yes
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes
Product FE	no	no	yes	no	yes	no
Firm FE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.016	0.023	0.071	0.140	0.100	0.125
Number of Observations	5.2e+04	5.0e+04	5.0e+04	5.0e+04	2.5e+04	2.5e+04

Buyers: Final good producing firms

- I build on Jovanovic(1982) and Berman et al (2019). Consumers:

$$U_j = \mathbb{E}\sum_{t=0}^{+\infty} \beta^t \ln\left(C_{jt}\right) == \mathbb{E}\sum_{t=0}^{+\infty} \beta^t \alpha_s \ln\left(c_{jst}\right)$$

  For simplicity, I drop t (time) and j(country):

- Final good producing firms (sector s) with id v:

$$Z(v)\left(\int_{\Xi(v)} c(\omega)^{(\sigma-1)/\sigma} d\omega\right)^{\sigma/(\sigma-1)}$$

- $c(\omega)$: purchases of intermediate variety ω,$Z(v)$:productivity (Pareto parameter Γ) and $\Xi(v)$: set of varieties available to firm v.

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- Total spending in intermediates denoted by $E(Z)$ and input costs-index $q(Z)$
- Pricing (assuming constant markups+monopolistic competition)

$$P_j = \bar{m} q_j(Z)/Z$$

Simplified model: Intermediate good producing firm

- Continuum of firms of type τ, producing one variety of the differentiated input, with marginal cost w/z(productivity z Pareto parameter γ).

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- Conditional on matching with buyer of productivity Z:

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- The total mass of buyers (final goods producers) N,and sellers (intermediate goods producers) M is exogenous.

Information and Export Entry

- Selling to any buyers requires hiring advertisers (fixed cost $f = f_a/A_a$) Exporters are uncertain about these costs. Each exporter is of prior type τ (with density π_τ): f, v_τ : mean and variance of prior beliefs.

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- Exporters receive signals about (log-) advertising real cost:

$$s(\omega) = \log f + \varepsilon(\omega), \varepsilon(\omega) \sim N\left(0, \sigma_\varepsilon^2\right) \text{ i.i.d.}$$

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- **Bayesian updating**:

$$\log(f, \tau) \sim N(\log f, \Sigma[W_\tau, \sigma_\epsilon^2, v_\tau])$$

Define the belief parameter $b(f, \tau) = \mathbb{E}_{s,\tau} f$.

Buyer-exporter sorting

- Exporter's net profits from a (z, Z) match, in expectation, is

$$\mathbb{E}\Pi(z, Z) = r(z, Z)/\sigma - b(f, \tau) \equiv \Pi(z, Z, b)$$

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- **Guess and Verify:** $\hat{\underline{z}}(Z) = \underline{z}(Z, b) = WZ^s b^{-a}$.

Firm level predictions:

- Total Revenue for exporter of type τ

$$r_{\tau}^{TOT}(z,b) \propto Nb(f,\tau)Z(z,b)^{-\Gamma}$$

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- Total Revenue for exporter of type τ

$$r_{\tau}^{TOT}(z,b) \propto Nb(f,\tau)Z(z,b)^{-\Gamma}$$

- Number of buyers

$$n_{\tau}(z,b) \propto NZ(z,b)^{-\Gamma}$$

Identification and measurement

- Combining the equation for revenues and number of customers:

$$\begin{aligned}\ln\left(r_{fkdt}\right) =& \alpha_{idt} + \alpha_{fkt} - \\ &+ \beta \underbrace{\ln\left(\text{Tariff}_{HS6dt}\right) + grav_{fkt}}_{f_{fkt}} + \mathrm{E}\left(e^{f_{fkdt}}\right)\end{aligned}$$

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- Obtain value of beliefs from

$$\mathrm{b}_{ijkt} = \mathrm{E}\left(e^{f_{ijkt}}\right) = \ln\left(r_{ijkt}\right) - \hat{\alpha_{ikt}} - \hat{\alpha_{jkt}} + \hat{\beta} f_{fkt}$$

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- **Discussion**:Tariffs, distance, ... observed part of underlying fixed cost

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- Obtain value of beliefs from

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- **Discussion**:Tariffs, distance, ... observed part of underlying fixed cost
- **Discussion**: Same firm across different destination markets, evolution of firm productivity does not affect estimation
- **Discussion**:Consistent estimation the residual, so $\mathrm{b}_{ijkt} \perp \{w_{it}, z_{ikt}\}, \{Y_{jt}, P_{jkt}\}$.

Firm level predictions: Buyer productivity dispersion

$$\text{Variance of buyer margin} = V\left[\Delta \ln n_{ijkt+1}\right] = V\left[\Delta \ln \epsilon^{n}_{ijkt+1}\right] = \left(\frac{\frac{\Gamma}{\sigma-1}\sigma_{\epsilon}}{\left(\frac{\sigma^2_{\epsilon}}{\sigma^2_{jk0}} + W_t\right)} \right)^2$$

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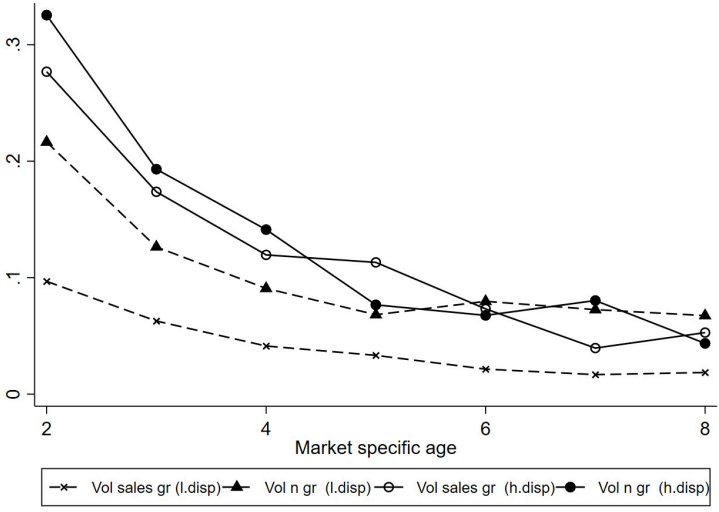
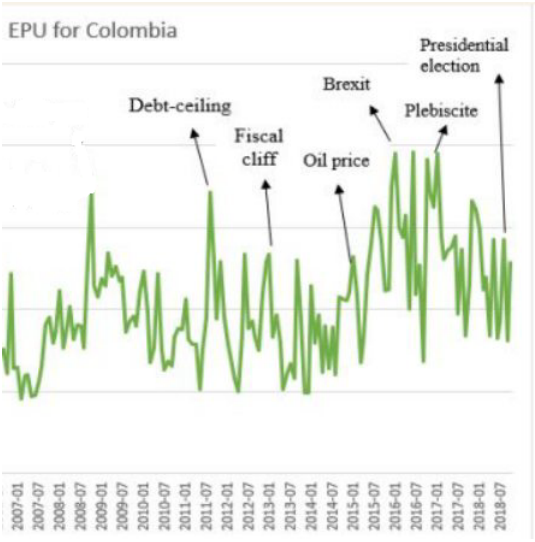
Testing model predictions: Buyer Dispersion

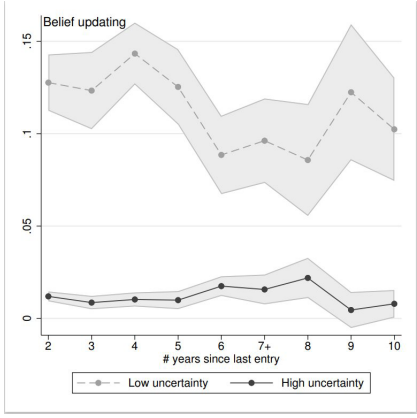


Aggregate Uncertainty in Colombia



Firm level predictions:Uncertainty

$$\frac{\partial\left(\Delta \text{beliefs}^{r}_{ijkt+1}\right)}{\partial\sigma^{2}_{\epsilon}\partial W^{2}_{t}} = -1/\sigma^{2}_{jkt} < 0 : \Delta log \text{beliefs}_{ijkt} = \sum_{g=1}^{G}\beta_{g}\text{AGE}^{g}_{ijkt} + \sum_{g=1}^{G}\beta_{g}\text{AGE}^{g}_{ijkt} \times Unc_{jt} + u_{ijkt}$$



Conclusion

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- This paper provides novel insight about export growth and learning
  - Showcases the importance of firm-to-firm granular data
- Developed a theoretical trade framework with tight connection to data
  - Explores how aggregate variables, like Uncertainty and buyers' information, like their productivity dispersion interacts with the learning margin
- What are some future applications?
  1. Learning from others and spillovers

$$\text{Signal}_{kdt} = \frac{1}{F_{kdt}} \sum_{f=1}^{B_{\text{kdt}}} \text{Signal}_{fkdt}$$

  2. Studying the impact of buyers' characteristics.
- Thank you! Comments very welcome. Contact me at ec1269@georgetown.edu

General equilibrium

- Setup:
  - Time $t = 0, 1, \ldots$
  - $\mathcal{I}$ countries, indexed by i
  - L_i workers, perfect competition, mobility in the labor market
  - a homogeneous good sector characterized by perfect competition, final and intermediate goods producing sectors
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Variable trade barriers

iceberg trade costs $\tau_{ijt} \geq 1$

Importer-exporter sorting

- An intermediate firm's net profits from a (z, Z) match, in expectation, is

$$\mathbb{E}\Pi(z, Z) = r(z, Z)/\sigma - b(f, \tau) \equiv \Pi(z, Z, b)$$

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- **Guess and Verify:** $\underline{\hat{z}}(Z) = \underline{z}(Z, b) = WZ^s b^{-a}$ and $E(Z) = \kappa_3 Z^\gamma$

$$s = -a = -1$$

Price Index for final goods producer

- **Price index**

$$q_j(Z)^{1-\sigma} = \int_{\Xi(Z)} p(z)^{1-\sigma} dz$$

$$q(Z)^{1-\sigma} = \frac{\gamma z_L^{\gamma}}{\gamma_2} \bar{m}^{1-\sigma} n \sum_{\tau} \pi_{\tau} \int_b \underline{z}(Z,b)^{-\gamma_2} G_{\tau}(b)$$

$$q(Z) = \kappa_3 f^{-\gamma_2/(\sigma-1)-1/(\sigma-1)} Z^{\gamma_2} (\mathcal{B}^q)^{1/(1-\sigma)}$$

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- Impact of beliefs:

$$\mathcal{B}^q = \sum_{\tau} \pi_{\tau} e^{\gamma_2^2 \Sigma'[W_{\tau}, \sigma_{\epsilon}^2, v_{\tau}]}$$

where $\gamma_2 = \gamma - \sigma + 1 > 0$

Aggregate Trade

Aggregate trade is given by

$$X_{ijt} = A_2(\sigma, \gamma, \Gamma) n_{it} Y_{jt} \left(w_{it} f_{ij}\right)^{1-\gamma/(\sigma-1)} \mathcal{B}^{\mathcal{X}}{}_{ijt} \left(\tau_{ijt} w_{it} \Omega_{jt}\right)^{-\gamma}$$

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$$Q_{it} = N_{it} \int_1^{\infty} P_{it}(Z)^{1-\sigma} dG_t(Z)$$

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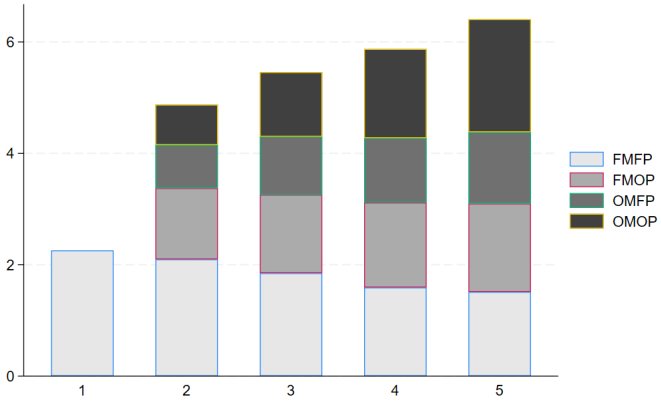
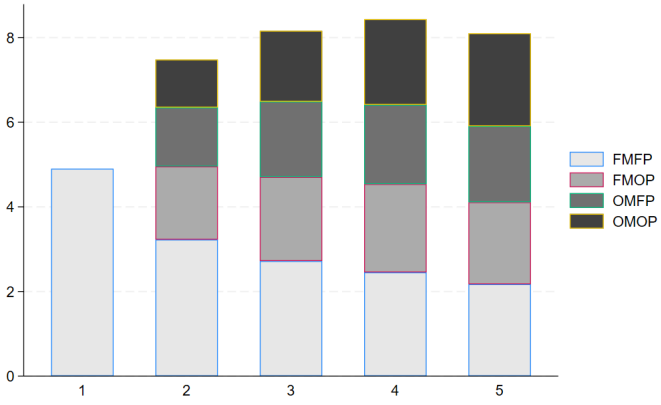
where

$$\Omega_{it}^{\gamma} = A(m, \sigma, \gamma, \Gamma) \sum_k Y_k (\tau_{kit} w_{kt})^{-\gamma} \mathcal{B}_{kit}^{q1/(1-\sigma)} (w_{kt} f_{kit})^{-\gamma_2/(\sigma-1)}$$

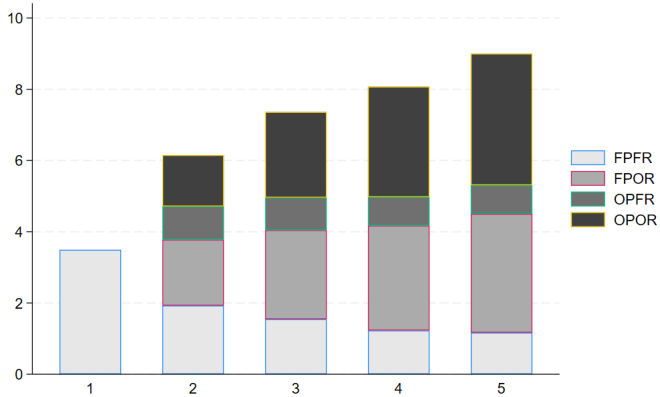
How young exporters grow (Product Margin)



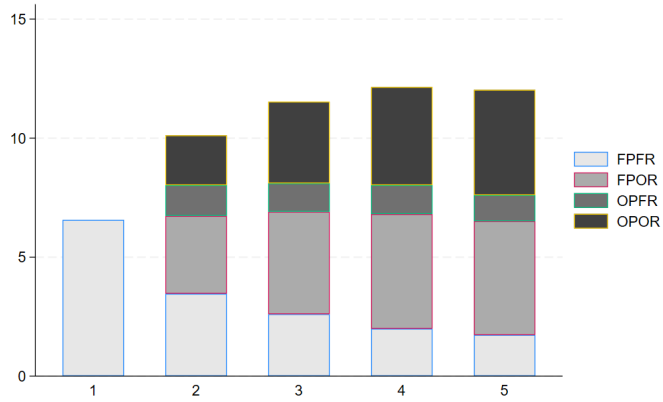
How young (surviving) exporters grow (Product Margin)



How young exporters grow (Buyer Margin)



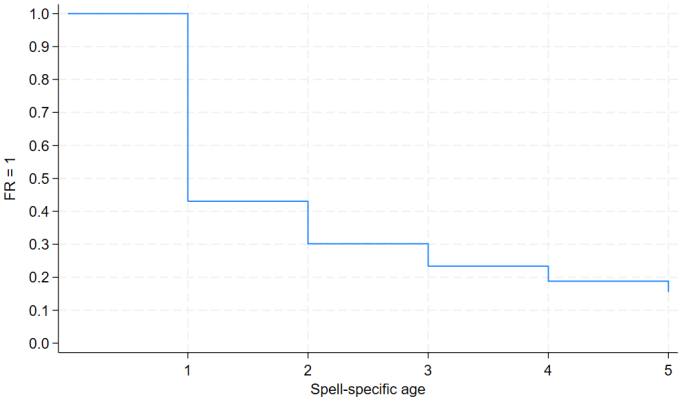
How young exporters grow (Buyer Margin)



Relationship Survival Rate

MANOS TRADE INC 1234 BUNCHE HALL LONDON, GB	MNTRDINCBH1234
MANOS COMERCIO INC 1234 BUNCHE HALL LONDRES, GB	MNCMRCINC1234BH
MANOS TRADE 1234 BUNCHE HALL LONDON, GB	MNTRDINCBH1234
MANOS TRADE 1234 BUNCHE HALL LONDON, GB	MNTRDINCBH1234

Product Survival Rate



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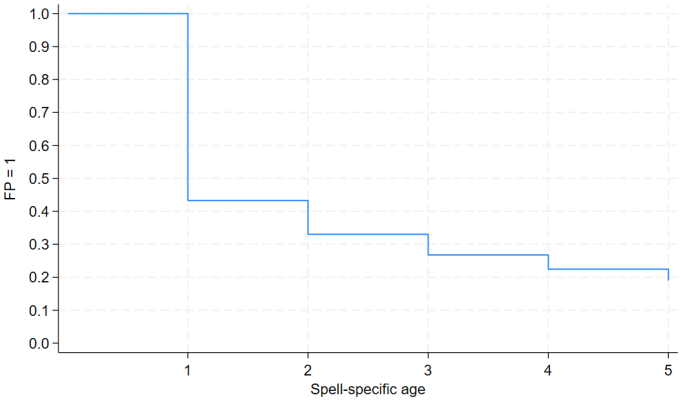
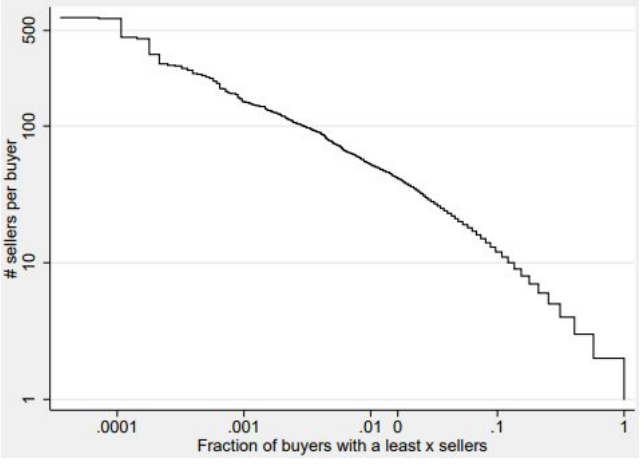


Match Type Statistics

Table 3: Match types

	2010		2015		2019	
Exporter-Importer	Count	Value	Count	Value	Count	Value
$1-1$	0.11	0.03	0.09	0.07	0.10	0.08
1-many	0.14	0.12	0.15	0.12	0.20	0.14
many-1	0.34	0.23	0.33	0.22	0.25	0.23
many-many	0.40	0.61	0.42	0.58	0.44	0.55

Number of exporters per buyer



Number of buyers per exporter