ECO862 - International Trade
Lecture 4: Dynamic Trade Models - Exporter life cycle model

Model and Trade Costs

1. Focus on how models have been used to recover trade costs across time, industries, and countries.

Model outline

1. Basic Model (Das et al., 2007; Alessandria and Choi, 2007; Alessandria and Choi, 2014b; Alessandria and Choi, 2014a)
   - Sunk-cost models get many things right
   - Imply large upfront sunk costs, small cont. costs.
   - Miss on the dynamic trajectories of exporters
2. Relaxing the trade cost assumptions (Ruhl and Willis, 2017; Alessandria et al., 2021; Alessandria and Avila, 2020)
3. Customer accumulation (Fitzgerald et al., 2023; Piveteau, 2021; Ruhl and Willis, 2017; Rodrigue and Tan, 2019; Krolikowski and McCallum, 2021; Steinberg, 2023)

- How does the exporter life cycle change our estimates of trade costs?

Micro-Dynamics: Successes, Failures, and Fixes

- Basic model captures exporter cross-section and dynamics, but what about other features?

1. Employment & Sales Growth w Changes in Export Status
   - Growth rates vary w/Δ in status: Bernard and Jensen (1999)

2. Export Persistence at Longer Horizons
   - Frequent re-entry: Roberts and Tybout (1997); Bernard and Jensen (2004)

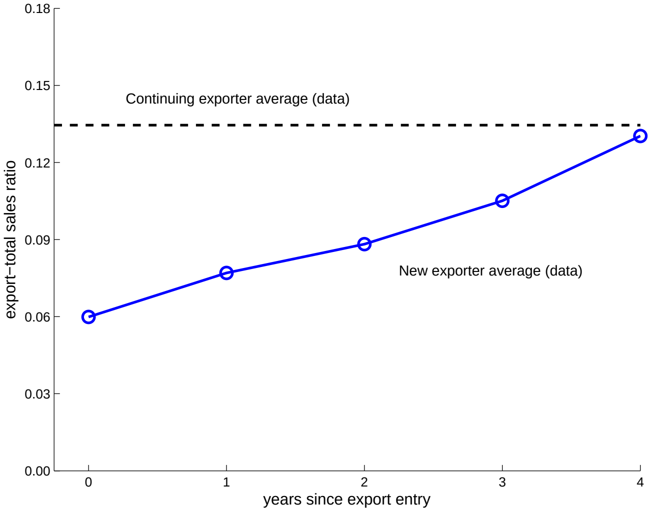
3. New Exporter Growth
   - Export intensity grows w/time in market: Ruhl and Willis (2017)

- Will focus on models of #3 today.

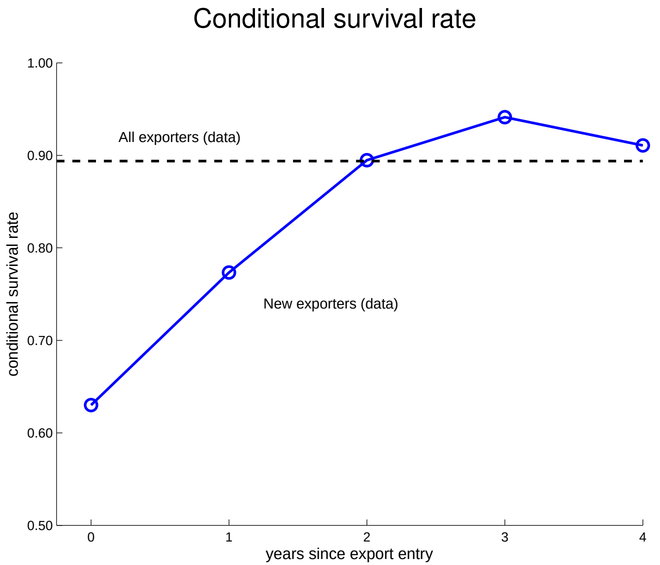
The discrete nature of entry:

- Follow Ruhl and Willis (2017)
- Model: fixed entry cost induces a discrete choice between exporting and not exporting
- Evidence from export volume
  - 70–80 percent of plants export nothing
  - Initial growth is discrete
  - Smooth adjustment afterward
- Evidence from export persistence
  - 89 percent of plants exporting in t export in $t + 1$
  - New exporter survival much lower
- Robust to industry, cohort effects (in paper)
- Revisit based on 81-91 sample used by Das et al., 2007
  - Export-intensity based on entrants that last 5+ years in market.

Average export to total sales ratio



* Bernard et al., 2014 attribute to partial year effects (small bias) with Peru data.


Conditional survival rate
1.00
0.90
0.80
0.70
0.60
0.50
All exporters (data)
New exporters (data)
conditional survival rate
0
1
2
3
4
years since export entry

The discrete nature of entry

- Compare these dynamics to a standard PE sunk-cost model
  - Shocks to firm productivity and exchange rates (ϵ, Q), AR(1)
  - Fixed cost and sunk-cost to export (f_0, f_1)
  - Home (C=1) and foreign demand fixed (C*)
    - Foreign demand and shipping cost not separately identified.
- Start with a "standard calibration"

Estimation preliminaries

- Quarterly model; aggregate to yearly to compare to data
- Parameters that can be set without solving the model

Parameter	Value	Target
r (annual)	0.109	Average observed interest rate
ρ_Q	0.826	Real effective exchange rate
σ_Q	0.036	Real effective exchange rate
α_N	0.450	Labor share of income
α_K	0.550	Plant-level returns to scale
θ	5.0	Elasticity of substitution

Parameters to estimate

Parameter	Description
ρ_ϵ	Idiosyncratic shock persistence
σ_ϵ	Idiosyncratic shock std
f_0	Export entry cost
f_1	Export continuation cost
C^*	Foreign demand scale

- Parameter vector: $\phi = (\rho_\epsilon, \sigma_\epsilon, f_0, f_1, C^*)$
- Choose parameters to solve:

$$L(\phi) = \min_{\phi}(m_s(\phi) - m_d)' W (m_s(\phi) - m_d),$$

- W is inverse of covariance matrix

Identification

- Idiosyncratic shock process $(\rho_\epsilon, \sigma_\epsilon)$ mostly determine
  - Size distribution of plants: std(employment)/mean(employment)
  - Serial correlation of plant sales (remove plant and time effects)

$$\log y_{i,t} = \gamma_i + \delta_t + \beta \log y_{i,t-1} + \nu_{i,t},$$

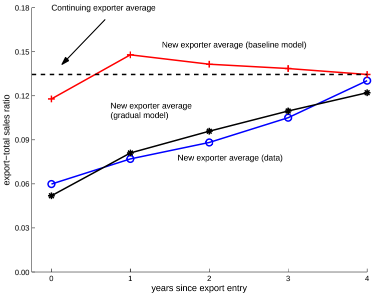
- Continuation cost and entry cost
  - Entry and exit rates
- Foreign demand scale
  - Average export-sales ratio

Estimates

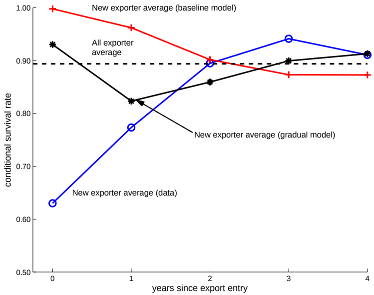
	f_0	f_1	C^*	σ_ϵ	ρ_ϵ
Baseline	0.961	0.047	0.146	0.116	0.873
	(0.102)	(0.005)	(0.010)	(0.011)	(0.023)

- Entry and continuation costs in units of median plant sales
  - Export entry almost 1 year's sales
- What drives this result?
  - Discrete nature of entry front-loads profits
  - Autocorrelation of shocks makes first few years great
  - Need large entry costs to offset high value of exporting

New exporter dynamics



(a) Export-sales ratio



(b) Conditional survival rate

- Baseline model: fails to capture growth and increasing survival
- Gradual model: (1) export sales growth success; (2) survival rates counterfactual: plants tend to enter the export market in response to favorable (autocorrelated) shocks
- Note: Baseline model has non-monotonicity (first period) growth due to partial year effect (aggregating over quarterly calibration of the model)

Slow growth in export demand

- Standard model is “too discrete”
- Modify export demand to be conditional on exporter age, a

$$c_j^*(a) = \gamma(a) \left(\frac{p_j^*(a)}{P^*} \right)^{-\theta} C^*$$

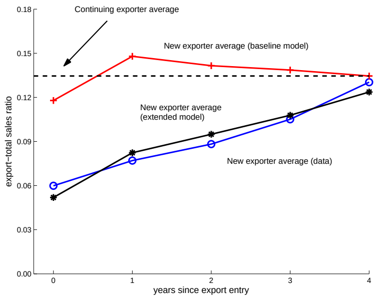
$$\gamma(a) = \begin{cases} \gamma_0 + \gamma_1 \times a & \text{if } a = 0, \ldots, 21 \\ 1 & \text{if } a > 21. \end{cases}$$

- Estimate γ_0 and γ_1 to match slow growth in data
- I-O literature: demand, not supply key for new firms (Foster, Haltiwanger, Syverson 2012)

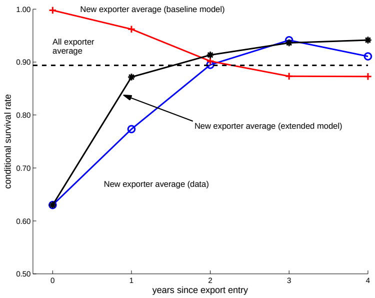
Decreasing export hazard

- Gradual demand model will not capture survival rates
- AR(1) nature of shocks still drive exit
- Need “bad” plants to enter
- With probability ζ_L, $f_0 = 0$; with probability $1 - \zeta_L$, $f_0 = f_H$
- Estimate ζ_L to match first year survival rate (0.63)

New exporter dynamics



(a) Export-sales ratio



(b) Conditional survival rate

- In the extended model, this 5-year survival rate is 44%, vs. 37% in the data and 65% in the sunk-cost model

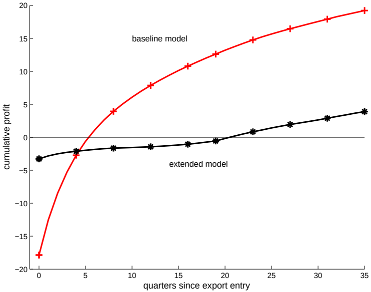
Estimates

	f_0	f_1	C^*	σ_ϵ	ρ_ϵ	γ_0	γ_1	ζ_L
Baseline	0.961	0.047	0.146	0.116	0.873			
	(0.102)	(0.005)	(0.010)	(0.011)	(0.023)			
Gradual	0.286	0.064	0.198	0.116	0.873	0.258	0.024	
	(0.126)	(0.008)	(0.019)	(0.011)	(0.023)	(0.082)	(0.006)	
Extended	0.590	0.057	0.185	0.116	0.873	0.278	0.026	0.009
	(0.479)	(0.006)	(0.017)	(0.011)	(0.023)	(0.146)	(0.009)	(0.003)

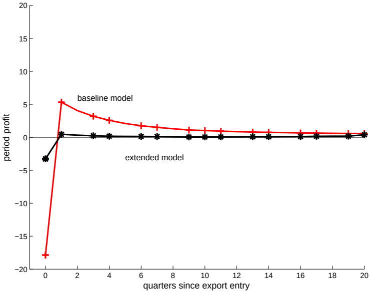
* gradual model reduces ratio of sunk/cont: 20 to 4.5 * Extended bumps it back up but entry costs not always paid.

- Slow-growing export demand significantly lowers the size of the estimated entry cost: As we decrease the present value of exporting, we decrease the entry cost needed to limit export entry.
- However, the entry cost is still about ten times larger than the continuation cost in the extended model.
- The entry cost in the extended model is twice as large as in the gradual demand model , but this cost is not paid often – in simulated data, 68 percent of firms entered when they drew the low entry cost.

Average new exporter profits



(a) Cumulative profits



(b) Flow profits

- In the sunk-cost model, entrant incurs a large negative profit on entry due to large f_0, but then high profits. Profits inherit the persistence of the underlying shock process: It takes seven quarters to break-even.
- In the extended model the initial quarter's profit is negative, but much less due to the smaller export entry cost and because many plants are entering the export market when the entry cost is zero. Following entry, profit grow slowly: It takes 22 quarters to break even — three times longer than in the sunk-cost model.

Export intensity dynamics

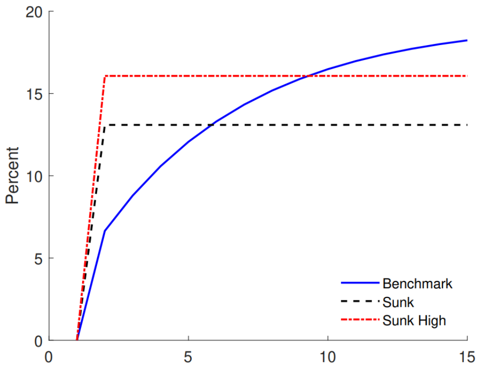
- With CES, the export-sales ratio is

$$exs(z, \hat{\xi}) = \frac{(\tau \xi \hat{\xi})^{1-\sigma}}{1 + (\tau \xi \hat{\xi})^{1-\sigma}}$$

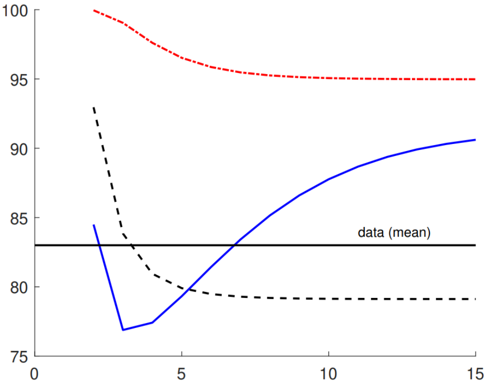
- Ruhl and Willis (2017) assume firm enters at ξ_0 and then ξ_a is falling with age, deterministically build export market by continuing to pay f_1
- Alessandria et al. (2021) assume firm enters at $\xi_0 = \xi_H > \xi_L$ and then Markov transition between states; build market share by continuing to pay f_1 but investment is risky
- This pushes more of the export access investment into the future, so need smaller f_0
- Not terribly sophisticated model, but useful when embedding the model into GE with aggregate uncertainty and generalizes the investment in market access.

ACR II - New exporter dynamics in stationary steady state

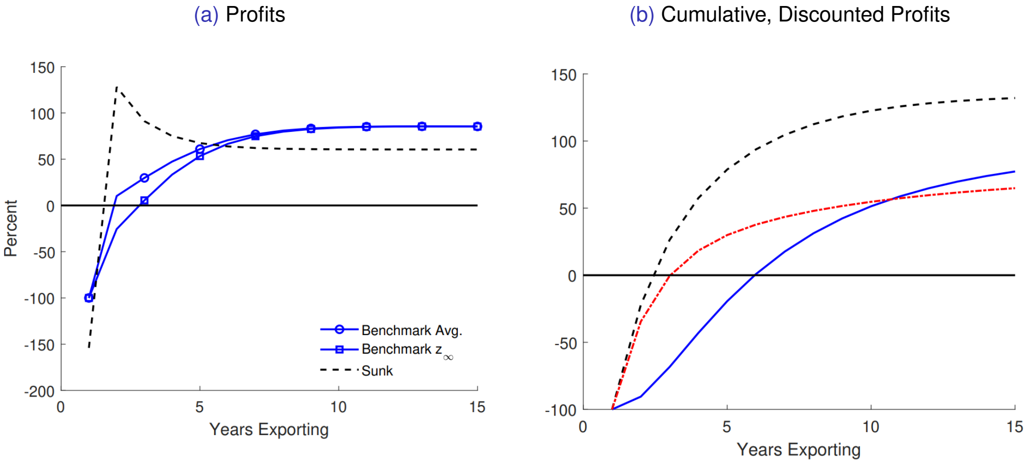
(a) Export Intensity



(b) Survival Rate

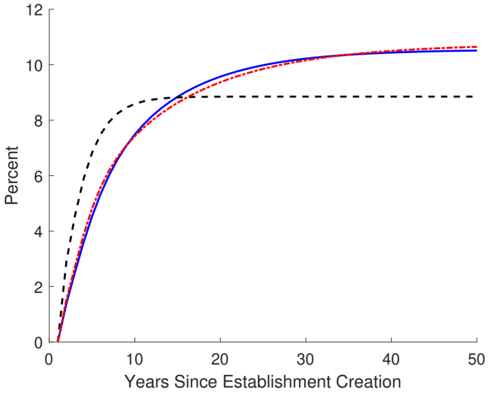


New exporter profits in stationary steady state



New exporter dynamics in stationary steady state by cohort

(a) Export Intensity by Cohort



(b) Export-profit Ratio by Cohort

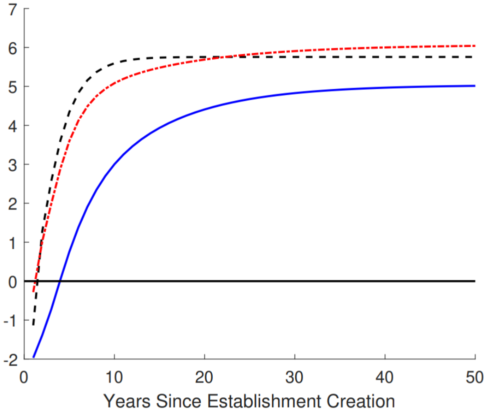


Table: Model Parameters

Common Param.	β	σ	δ	τ	γ_0, γ_1	ρ, σ_ϵ	μ_E
	0.96	2.0	0.10	1.10	21.0, 0.02	0.65, 1.32	–1.34
Model-specific Parameters	Bench-mark	Sunk Cost	Sunk-cost High	No Cost	Reentry	Search	Starters
θ	5.0	5.0	5.0	5.0	5.0	5.0	5.0
α	0.132	0.132	0.132	0.132	0.132	0.132	0.132
α_X	0.810	0.810	0.810	0.810	0.810	0.810	0.810
$\theta\kappa_E$	32.7	33.2	32.7	35.4	32.6	32.6	32.5
$100 \times \kappa_H/\kappa_E$	3.76	5.80	18.34	0.00	5.90	1.12	2.76
κ_H/κ_L	1.40	3.80	11.08	–	2.23	0.38	0.89
ξ_H	1.72	1.42	1.34	1.11	1.70	1.67	2.20
ξ_L	1.07	1.42	1.34	1.11	1.06	1.04	1.00
ρ_ξ	0.92	0.50	0.50	0.50	0.92	0.92	0.92
η	1.00	1.00	1.00	1.00	1.00	0.33	1.00
κ_R/κ_L	1.40	3.80	11.08	–	0.67	1.14	0.89
Overall Fit (RMSE): Size Distributions							
Estab. + Empl.	0.70	0.70	0.78	1.29	0.70	0.67	0.70
Export	14.6	15.7	3.8	49.6	11.9	4.5	15.2
Fixed Trade Costs Relative to							
Plant Creation Cost	10.8	8.7	10.8	0.0	11.3	11.2	11.5
Export Profits	58.1	47.6	58.1	0.0	60.6	60.4	63.0
Selected moments (Data)							
Exit Rate (17.0)	17.0	17.0	4.0	0.0	17.0	17.0	17.0
Starter Ratio (25.1)	65.5	137.5	309.5	–	63.2	52.1	25.1
Starter Export Share (4.9)	12.8	26.4	23.0	–	12.4	10.2	4.9
5-yr Incumbent Share	48.7	29.8	43.5	–	52.7	54.0	58.7
Dom. Expenditure Share	91.2	91.2	91.2	91.2	91.2	91.2	91.3
Export Participation	22.3	22.3	22.3	100.0	22.3	22.3	22.6
Export Intensity	13.3	13.1	16.1	8.1	13.8	15.4	13.0
Exporter Premium	273.5	277.8	226.2	100.0	267.1	239.9	275.1
Average ξ	141.8	142.5	134.2	111.3	140.3	135.9	142.9

Getting Entry Exit Dynamics Right

- Easy Re-entry: let firms take one period break and re-enter with cost f_1
- Search - investment in reducing trade costs succeeds with probability $\eta < 1$
- Starter - raise iceberg costs to target importance of starters

Table: New Exporter Importance and Growth

	Unbalanced panels		Balanced panels			
	Chile (98–06)	Colombia (81–89)	Chile (98–06)	Colombia (81–89)	Compustat (84–92)	U.S. Census (84–92)
Participation rate						
8-year	56.7	57.2	25.0	33.9	27.7	42.0
1-year	11.8	17.6	10.8	14.4	4.7	14.0
Export share						
8-year	39.2	38.4	6.7	13.6	11.0	
1-year	3.5	4.2	3.2	3.2	1.4	
Starter size discount						
Sales	0.53	0.62	0.46	0.59	0.51	0.40–0.55
Intensity	0.45	0.57	0.50	0.65	0.52	0.55
Intensity dynamics						
ρ_{exs}	0.88	0.86	0.88	0.81	1.00	
T	11	10	9	7	16	
$\widehat{exs}_{20} / \overline{exs}$	1.19	1.12	1.29	1.16	1.16	
Export survival						
Incumbent	0.81	0.86	0.83	0.85	0.93	0.66
Entrant	0.65	0.62	0.66	0.64	0.83	
Reentrant probability	0.26	0.28	0.29	0.33	0.03	0.27

Export intensity dynamics: Other approaches

- Accumulate customers or build habit (Drozd and Nosal, 2012; Fitzgerald et al., 2023; Piveteau, 2021; Rodrigue and Tan, 2019; Steinberg, 2023)
- Financial Frictions that are more severe on exports (Kohn, Leibovici, Szkup (2016))

Customer-acquisition models of exporter dynamics

- Demand for firm's product depends on price (p), trade cost (τ), and customer base (m):

$$d(p, m; \tau) = (p\tau)^{-\theta} m^{\alpha}$$

  - α governs diminishing returns to having more customers

- Firms heterogeneous in productivity (z)
- Assume constant-markup pricing so that flow profits from exporting given by

$$\pi(z, m; \tau) \propto (z/\tau)^{1-\theta} m^{\alpha}$$

- Firm's problem: choose to export/not export to maximize PDV of profits—and possibly, choose how many customers to acquire
- Q: How to model customer aquisition?

Customer-acquisition models of exporter dynamics

- Fitzgerald et al. (2019, 2021): Quadratic adjustment cost
- Piveteau (2020): Word-of-mouth
- Steinberg (2021): Dynamic version of Arkolakis (2010)
- Customer acquisition in other contexts
  - Arkolakis (2010), EKK (2011): static models of how/why exporter distribution varies across bilateral trade relationships
  - Drozd-Nosal (2021): pricing to market, int'l macro puzzles
  - Ravn, Schmitt-Grohe, & Uribe work on deep habits
- Search models make the customer acquisition technology uncertain.
- Introduces consumer heterogeneity.
  - How do we aggregate?
  - How do we price with costs of switching (hold up problem, contracting)?

Fitzgerald et al. (2019, 2021)

- Pay sunk cost f_0 to start exporting with $\underline{\text{m}}$ initial customers (exogenous)
- Pay fixed cost f_1 to continue exporting; if not, lose all customers
- Customer base depreciates at rate δ, grows by investment a

$$m' = (1-\delta)m + a$$

- Cost of investment:

$$c(m,a) = a + \phi a^2/m$$

- Dynamic program (V^0: potential exporter, V^1: incumbent):

$$\begin{aligned} V^0(z) &= \max\left\{\mathbb{E}V^0(z'), \pi(z,\underline{\text{m}};\tau) - f_0 + \mathbb{E}V^1(z',\underline{m})\right\} \\ V^1(z) &= \max\{\mathbb{E}V^0(z'), \max_m[\pi(z,(1-\delta)m+a;\tau) - f_1 - c(m,a) \\ &\qquad + \mathbb{E}V^1(z',(1-\delta)m+a)]\} \end{aligned}$$

Piveteau (2021)

- Pay sunk cost f_0 to start exporting with $\underline{\text{m}}$ initial customers (exogenous)
- Pay fixed cost f_1 to continue exporting; if not, lose all customers
- Customer base growth depends on sales and size of current customer base ("word of mouth")

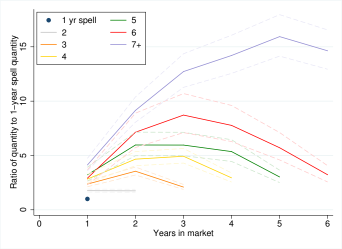
$$m' = 1 - \{1 - \eta_1(1-\psi)pd(p,m;\tau) - \eta_2(1-\psi)m\}^{\frac{1}{1-\psi}} \in (0,1)$$

- No cost of investment (in paper firm can also grow customer base by charging lower prices, and therefore selling more than under constant-markup pricing)

$$V^0(z) = \max\left\{\mathbb{E}V^0(z'), \pi(z,\underline{\text{m}};\tau) - f_0 + \mathbb{E}V^1(z',m')\right\}$$
$$V^1(z) = \max\left\{\mathbb{E}V^0(z'), \pi(z,m';\tau) - f_1 + \mathbb{E}V^1(z',m')\right\}$$

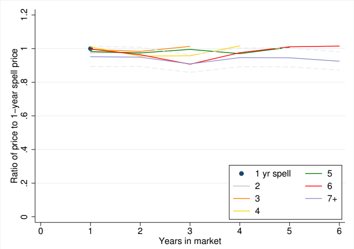
New exporter trajectories

Figure 1: Estimated quantity trajectories



(a) Exports

Figure 2: Estimated price trajectories



(b) Prices

Cross-destination dynamics

- Brazilian data (but similar everywhere)
- Export are concentrated
  - Large firms serving many markets
  - New entrants to a market sell less than incumbents and exit more frequently
- Use cross-destination variation to identify costs
  - Easy markets (large, rich, close): Lower turnover, more successful entry
  - Hard markets (small, poor, far): Higher turnover, harder to break into
- Successful exporters sell more on entry and have more post-entry growth

Steinberg (2023): market penetration dynamics

- No sunk or fixed costs, initial customer base endogenous
- Customer base evolves according to $m' = n + o$, where
  - $n \in [0, 1-m]$: new customers attracted
  - $o \in [0, m]$ old customers retained
- Attraction/retention costs depend on current customer base:

$$a_n(m,n) = \frac{L^{\alpha_n}(1-m)^{\beta_n}}{\psi_n(1-\gamma_n)}\left[1 - \left(\frac{1-m-n}{1-m}\right)^{1-\gamma_n}\right]$$

$$a_o(m,o) = \frac{L^{\alpha_o} m^{\beta_o}}{\psi_o(1-\gamma_o)}\left[1 - \left(\frac{m-o}{m}\right)^{1-\gamma_o}\right]$$

- Given current customer base m, cost of getting to m' given by

$$f(m,m') = \min_{n,o} \{a_n(m,n) + a_o(m,o)\} \quad \text{s.t.} \quad 0 \le n \le 1-m, \quad 0 \le o \le m, \quad m' = n + o$$

Steinberg (2023): dynamic program

Value function:

$$V(z,m) = \max_{m'}\left\{\pi(z,m') - f(m,m') + \frac{\delta(z)}{1+R}\mathbb{E}\left[V(z',m')|x,z\right]\right\}$$

Solution: $\underbrace{f_2(m,m')}_{\text{marginal cost}} \geq \underbrace{\tilde{\pi}z^{\theta-1}}_{\text{marginal profit}} - \underbrace{\frac{\delta(z)}{1+R}\mathbb{E}\left[f_1(m',m'')|z\right]}_{\mathbb{E}[\downarrow] \text{ in future exporting cost}}$

- If $m = 0$, enter if $z \geq \underline{z}$:

$$f_2(0,0) = \tilde{\pi}\underline{z}^{\theta-1} - \frac{\delta(z)}{1+R}\mathbb{E}\left[f_1(0,m'')|z\right]$$

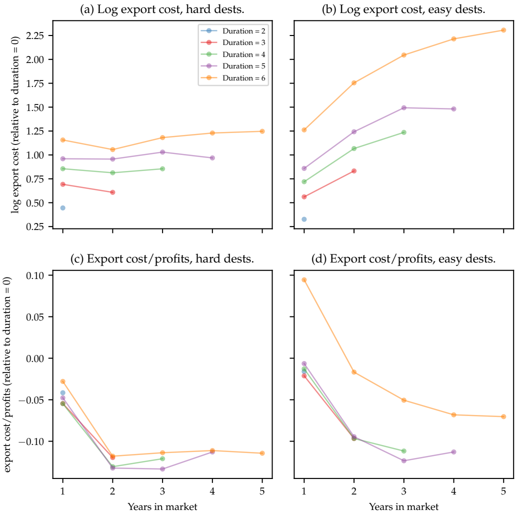
- If $m > 0$, exit if $m \leq \underline{m}(z)$:

$$f_2(\underline{m}(z),0) = \tilde{\pi}z^{\theta-1} - \frac{\delta(z)}{1+R}\mathbb{E}\left[f_1(0,m'')|z\right]$$

Steinberg (2023): key properties

- $f_2(m, 0) > 0$: marginal cost of serving a single customer strictly positive $\Rightarrow$ entry + exit
- $f_{22}(m, m') > 0$: MC increasing in size of new customer base $\Rightarrow$ concentration
- $f_{21}(m, m') < 0$: MC decreasing in size of initial customer base $\Rightarrow$ new exporter dynamics
  - $f_2(0, m') > f_2(m, m')$: Entrant's MC curve higher than incumbent's $\Rightarrow$ entrants start small then grow
  - $f_2(0, 0) > f_2(m, 0)$: Entrant's MC of acquiring single new customer higher than incumbent's MC of keeping single old customer $\Rightarrow$ exit rate $\downarrow$ in m

Steinberg (2023): Calibrated exporting costs



Levels:

- Hard dests: flat w/ time in a market
- Easy dests: $\uparrow$ w/ time in a market
- Higher for more successful exporters

Relative to profits:

- $\downarrow$ w/ time in a market
- More pronounced $\downarrow$ in easy dests.
- $f_2(m, m')/(LY) \downarrow$ in $L, Y \Rightarrow$ variation in exporter dynamics across markets

More models…

- Fixed/sunk costs change with number of destinations served (Albornoz et al., 2012; Albornoz et al., 2016; Morales et al., 2019)
- Fixed costs of importing and exporting are linked (Kasahara and Lapham, 2013)
- Development (Fernandes et al., 2016; Araujo et al., 2016; Kohn et al., 2018)
- Finance (Liu, 2024)

Research Questions. . .

- Account for destinations with transaction data
- Interaction between modes (direct, intermediated)
- Interaction with adjustment frictions on costs or prices.
- Import intensity dynamics
- Macroeconomic implications (next)

References I

Albornoz, Facundo, Sebastián Fanelli, and Juan Carlos Hallak (2016). “Survival in export markets.” *Journal of International Economics* 102, pp. 262 –281.

Albornoz, Facundo et al. (2012). “Sequential exporting.” *Journal of International Economics* 88 (1), pp. 17–31.

Alessandria, George and Oscar Avila (2020). “Trade Integration in Colombia: A Dynamic General Equilibrium Study with New Exporter Dynamics.” *Journal of Economic Dynamics and Control* 115. St. Louis Fed -JEDC-SCG-SNB-UniBern Conference, titled ”Disaggregate Data and Macroeconomic Models”, p. 103871.

Alessandria, George and Horag Choi (2007). “Do sunk costs of exporting matter for net exports dynamics?” *Quarterly Journal of Economics* 122 (1), pp. 289–336.

— (2014a). “Do falling iceberg costs explain recent U.S. export growth?” *Journal of International Economics* 94 (2), pp. 311–325.

— (2014b). “Establishment heterogeneity, exporter dynamics, and the effects of trade liberalization.” *Journal of International Economics* 94 (2), pp. 207–223.

Alessandria, George, Horag Choi, and Kim J. Ruhl (2021). “Trade adjustment dynamics and the welfare gains from trade.” *Journal of International Economics* 131, pp. 1034–58.

Araujo, Luis, Giordano Mion, and Emanuel Ornelas (2016). “Institutions and export dynamics.” *Journal of International Economics* 98, pp. 2–20.

Bernard, Andrew B. and Bradford J. Jensen (2004). “Entry, Expansion and Intensity in the U.S. Export Boom, 1987-1992.” *Review of International Economics* 12 (4), pp. 662–675.

Bernard, Andrew B. et al. (2014). “Exporter dynamics, firm size and growth, and partial year effects.” Unpublished manuscript.

References II

Bernard, Andrew J. and J. Bradford Jensen (1999). “Exceptional exporter performance: cause, effect, or both?” *Journal of International Economics* 47 (1), pp. 1 –25.

Das, Sanghamitra, Mark J. Roberts, and James R. Tybout (2007). “Market entry costs, producer heterogeneity, and export dynamics.” *Econometrica* 75 (3), pp. 837–873.

Drozd, Lukasz A. and Jaromir B. Nosal (2012). “Understanding international prices: Customers as capital.” *The American Economic Review* 102 (1), pp. 364–395.

Fernandes, Ana M., Caroline Freund, and Martha Denisse Pierola (2016). “Exporter behavior, country size and stage of development: Evidence from the exporter dynamics database.” *Journal of Development Economics* 119, pp. 121–137.

Fitzgerald, Doireann, Stefanie Haller, and Yaniv Yedid-Levi (2023). “How exporters grow.”

Kasahara, Hiroyuki and Beverly Lapham (2013). “Productivity and the decision to import and export: Theory and evidence.” *Journal of international Economics* 89 (2), pp. 297–316.

Kohn, David, Fernando Leibovici, and Michal Szkup (2018). “Financial Frictions and Export Dynamics in Large Devaluations.” Unpublished manuscript.

Krolikowski, Pawel M and Andrew H McCallum (2021). “Goods-market frictions and international trade.” *Journal of International Economics* 129 (1).

Liu, Chang (2024). “”Foreign Currency Borrowing and Exporter Dynamics in Emerging Markets” (Job Market Paper).” Unpublished manuscript.

Morales, Eduardo, Gloria Sheu, and Andrés Zahler (2019). “Extended gravity.” *The Review of Economic Studies*.

References III

Piveteau, Paul (2021). “An empirical dynamic model of trade with consumer accumulation.” AEJ: Macro, forthcoming.

Roberts, Mark J. and James R. Tybout (1997). “The decision to export in Colombia: An empirical model of entry with sunk costs.” *American Economic Review* 87 (4), pp. 545–564.

Rodrigue, Joel and Yong Tan (2019). “Price, product quality, and exporter Dynamics: Evidence from China.” *International Economic Review* 60 (4).

Ruhl, Kim J. and Jonathan L. Willis (2017). “New exporter dynamics.” *International Economic Review* 58 (3), pp. 703–726.

Steinberg, Joseph B. (2023). “Export Market Penetration Dynamics.”