New Exporter Dynamics

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Exporters are great!

- Exporting plants: larger, pay higher wages, more productive
- Not very many of them
  - 25 percent of manufacturing plants export
  - Lead to models of selection (Melitz 2003)
  - Typical: heterogeneous firms, fixed entry costs
- Estimates of entry costs are large
  - Implication: Being an exporter is great, need big entry costs to keep plants out of foreign markets
  - Implication: Are there policies to decrease entry costs?

The export entry problem

- Expected, discounted future profits versus entry cost

$$\mathop{\mathbb{E}}_{s}\left\{\sum_{t=s} d_{t,t+1}\left(\pi_x\left(\epsilon_{it,q_t,\tau_t}\right)-f_1\right)\right\} > f_0$$

- Export entry cost: f_0
  - Distribution networks, market research, regulatory compliance, product reformulation, search costs, etc.
- Export continuation cost: f_1
  - Per-period fixed costs of maintaining export operations

What do we know about these models?

- Discrete choice models successes
  - Cross-sectional facts
  - Aggregate/macro flows
- Key innovation: export entrants
- This paper:

  How well do these models account for new exporter dynamics?

Overview of results

- Model estimation
  - Export entry costs are large and important
- Standard model cannot account for new exporter dynamics
  - New exporters grow too large to fast
  - Not enough shakeout of new exporters
  - Discreteness of export demand is too strong
- Extend standard model
  - Slow growing export demand + stochastic entry costs
  - Exporting is risky and only pays off in the long run
  - Exporting is not so great: entry costs shrink

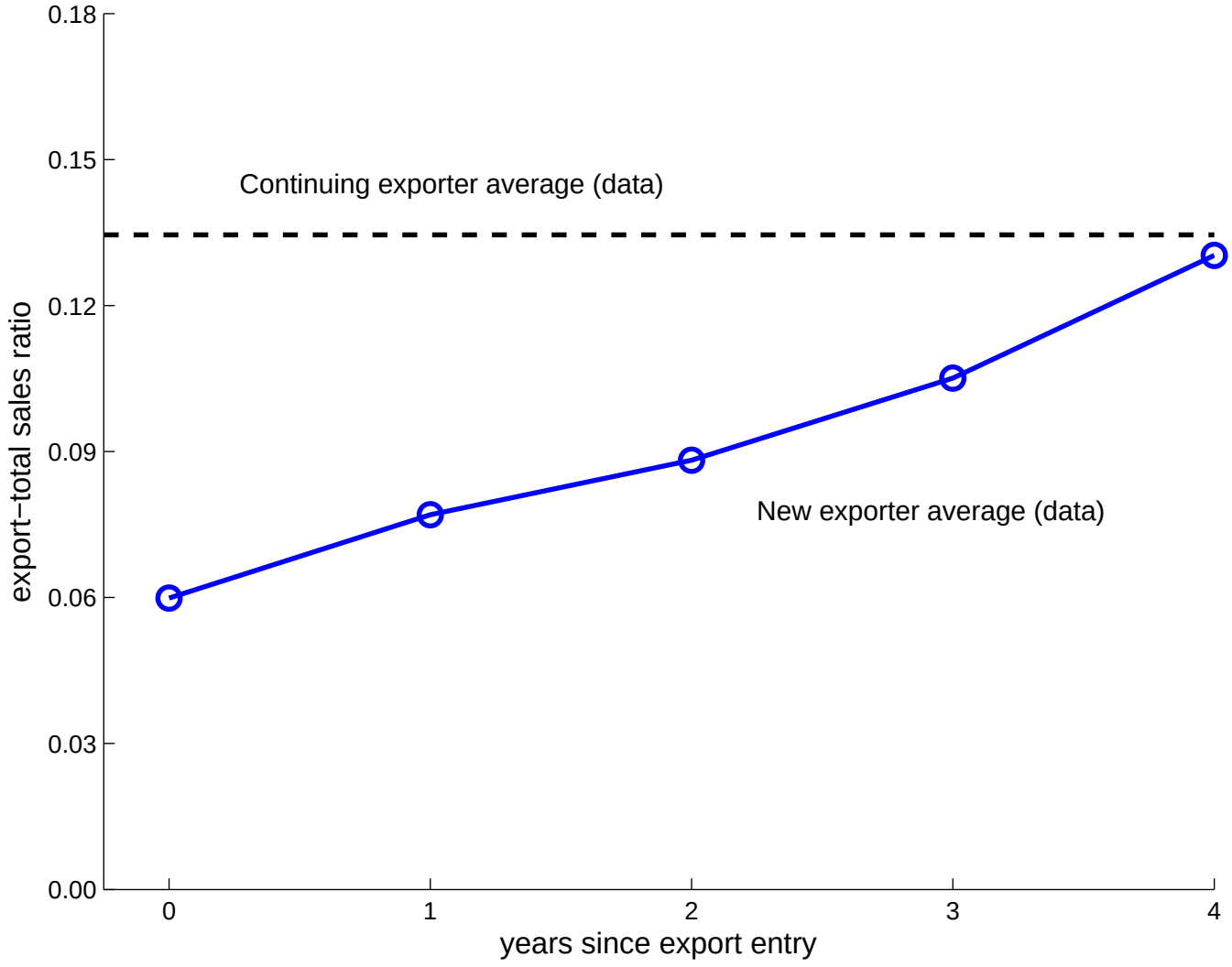
Evidence from Colombia: 1981–1991

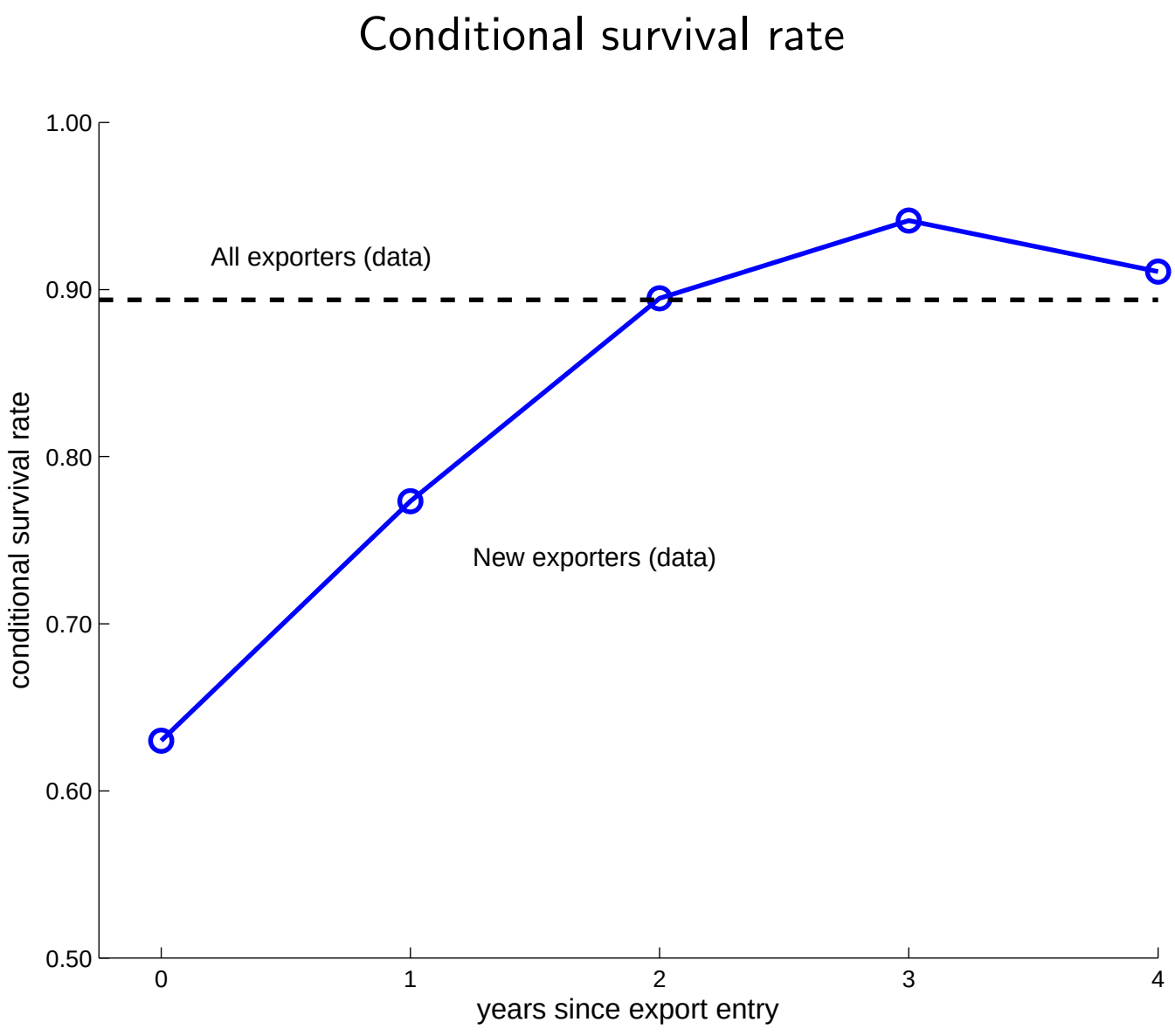
- Colombian census of manufacturing
  - Plants with more than 15 employees
  - Employment, sales, exports, investment
  - Same time period sample as Das, Roberts, and Tybout (2007)
- Balance panel (no plant birth/death), accounts for
  - 75 percent of sales
  - 65 percent of employment
  - 66 percent of exports

The discrete nature of entry

- 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)

Average export to total sales ratio




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

An exporting choice model

- Plant level, partial equilibrium
- Idiosyncratic shocks, ϵ
- Real exchange rate shocks, Q
- Export fixed costs
  - Export entry, f_0
  - Export continuation, f_1

Uncertainty

- Idiosyncratic shock process

$$\ln \epsilon_t = \rho_\epsilon \ln \epsilon_{t-1} + \omega_{\epsilon,t}, \qquad \omega_\epsilon \sim N\left(0, \sigma_\epsilon^2\right)$$

- Real exchange rate shock process

$$\ln Q_t = \rho_Q \ln Q_{t-1} + \omega_{Q,t}, \quad \omega_Q \sim N\left(0, \sigma_Q^2\right)$$

Households

- Domestic household

$$\max_{c_j} C = \left(\sum_{j=1}^{J} c_j^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}$$

$$\text{s.t.} \quad \sum_{j=1}^{J} c_j p_j = I$$

- Demand functions (foreign variables with *)

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

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

Plant's problem

- A plant makes two decisions
  1. Within period: prices, labor, capital, sales in each market
  2. Dynamic: export status
- Technology

$$f(\tilde{\epsilon_j}, n_j, k_j) = \tilde{\epsilon_j} n_j^{\alpha_N} k_j^{\alpha_K}$$

- Profits (measured in units of C)

$$\Pi_j = \frac{p_j}{P} y_j + I\left(X_j = 1\right) Q \frac{p_j^*}{P^*} y_j^* - w n_j - r k_j$$

Static problem

- Given export status: $X_j = 1$ if exporting, 0 otherwise

$$\max_{y_j, y_j^*} \Pi_j = \frac{p_j}{P} y_j + I\left(X_j = 1\right) Q \frac{p_j^*}{P^*} y_j^* - w n_j - r k_j$$

$$\text{s.t. } y_j + y_j^* = \tilde{\epsilon}_j n_j^{\alpha_N} k_j^{\alpha_K}$$

- Policy functions (Q shifts sales across markets)

$$y_j^* = \frac{1}{1 + Q^{-\theta} \frac{C}{C^*}} \tilde{\epsilon}_j n_j^{\alpha_N} k_j^{\alpha_K}$$

$$y_j = \frac{Q^{-\theta} \frac{C}{C^*}}{1 + Q^{-\theta} \frac{C}{C^*}} \tilde{\epsilon}_j n_j^{\alpha_N} k_j^{\alpha_K}$$

Dynamic problem

- State: (ϵ, X, Q)
- Exporting costs

$$f_X\left(X_j, X_j'\right) = f_0 I\left(X_j' = 1 | X_j = 0\right) + f_1 I\left(X_j' = 1 | X_j = 1\right)$$

- Bellman equation

$$V(X_j, \epsilon_j, Q) = \max_{X_j'} \left\{ \Pi\left(X_j', \epsilon_j, Q\right) - f_X\left(X_j, X_j'\right) + R \mathop{\mathbb{E}}_{\epsilon_j', Q'} V\left(X_j', \epsilon_j', Q'\right) \right\}$$

- Policy function

$$X_j'\left(0, \epsilon_j, Q\right) = \begin{cases} 1 & \text{if } \Pi\left(X_j', \epsilon_j, Q\right) + R\,\mathbb{E}_{\epsilon_j', Q'} V\left(X_j', \epsilon_j', Q'\right) - f_0 \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

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:

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

Identification strategy

- Strategy:
  - Use cross-sectional moments to estimate model
  - Check how well model matches new exporter dynamics
- No analytical mapping of parameters to moments
- Numerically explore sensitivity of moments to parameters

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

Moments

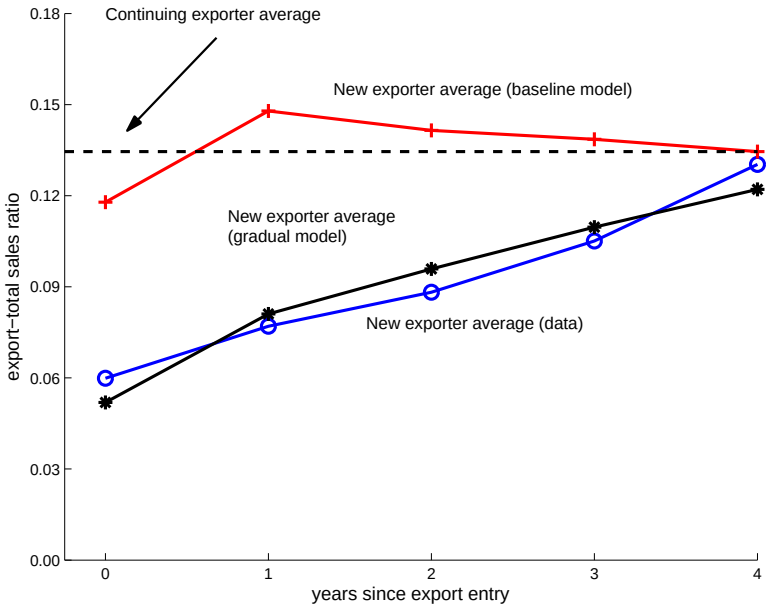
Moment	Data	Baseline
Starter rate	0.0517	0.0517
Stopper rate	0.1062	0.1062
Average export-sales ratio	0.1346	0.1346
Coef. of variation, domestic sales	0.2090	0.2090
Slope, domestic sales reg.	0.6482	0.6482
Non-targeted moments		
Export size prem., employment	1.238	1.286
Export size prem., domestic sales	1.150	1.218

Estimates

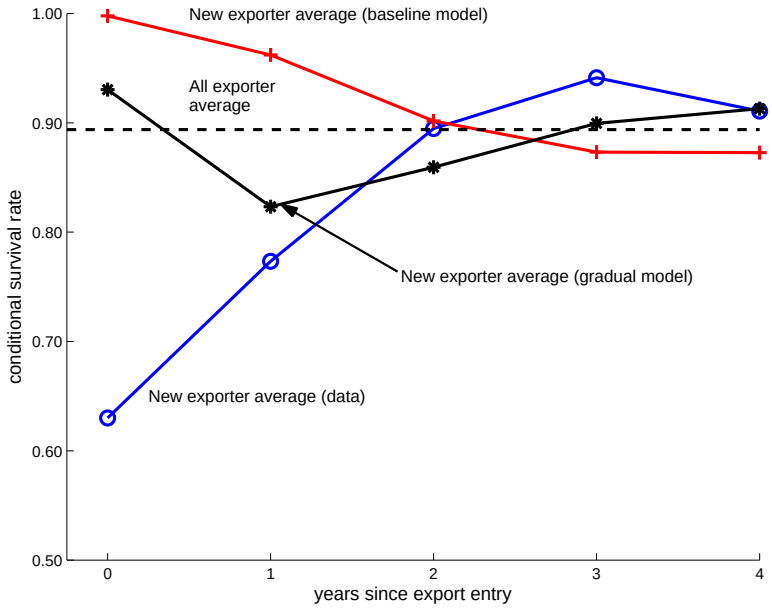
	f_0	f_1	C^*	σ_ϵ	ρ_ϵ
Baseline	0.961	0.047	0.146	0.116	0.873
	(0.102)	(0.005)	(0.010)	(0.011)	(0.023)

- 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



Export-sales ratio



Conditional survival rate

- Export sales growth too discrete
- Survival rates counterfactual

Modifying the standard model

- Standard model cannot capture new exporter dynamics
- How important is it to get new exporter dynamics right?

- Modify model to generate new exporter dynamics
- Not a deep model of plants, instead
  - Force model to fit data
  - Quantitatively asses importance of entrant dynamics

Slow growth in export demand

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

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

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

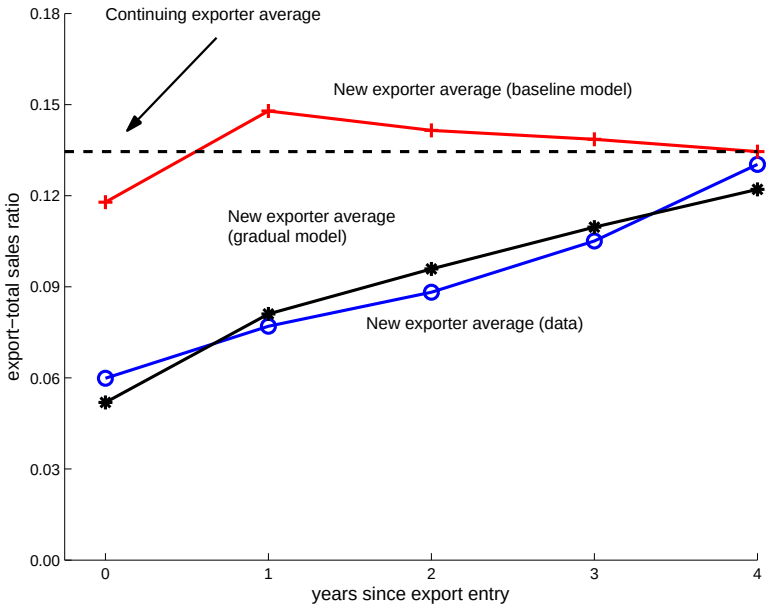
- Estimate γ_0 and γ_1 to match slow growth in data
- I-O literature: demand, not supply key for new firms (Foster, Haltiwanger, Syverson 2012)

Estimates: gradual demand model

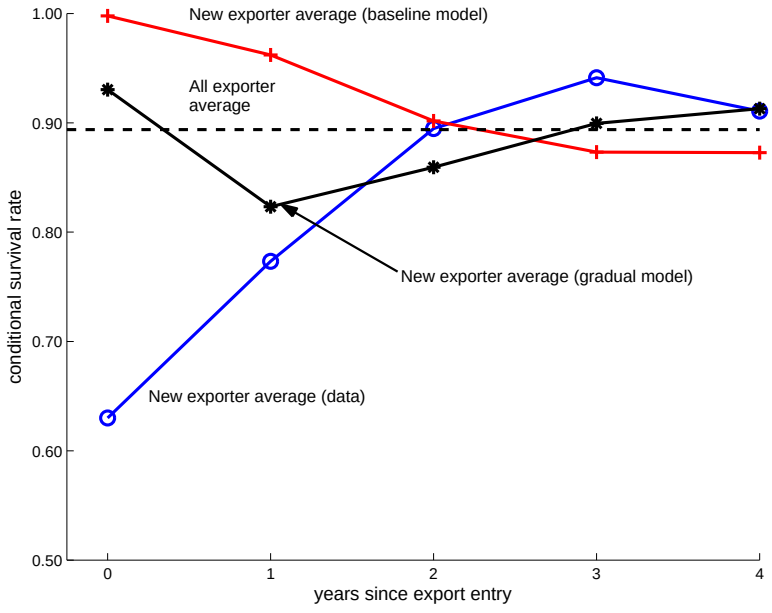
	f_0	f_1	C^*	σ_ϵ	ρ_ϵ	γ_0	γ_1
Baseline	0.961	0.047	0.146	0.116	0.873		
	(0.102)	(0.005)	(0.010)	(0.011)	(0.023)		
Gradual demand	0.286	0.064	0.198	0.116	0.873	0.258	0.024
	(0.126)	(0.008)	(0.019)	(0.011)	(0.023)	(0.082)	(0.006)

- Pushing export profits to the future decrease value of exporting
- Export entry cost 3X smaller than baseline

New exporter dynamics



Export-sales ratio



Conditional survival rate

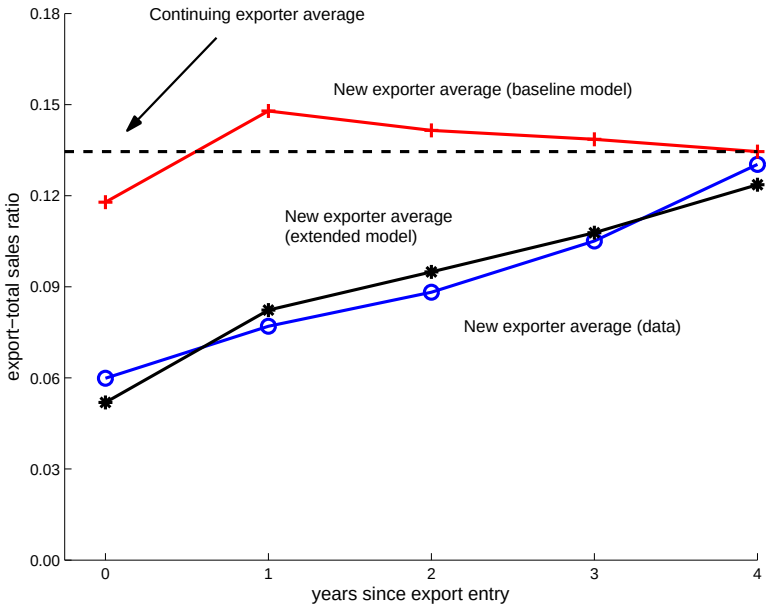
Stochastic export entry costs

- Gradual demand model doesn't capture survival rates
- 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)

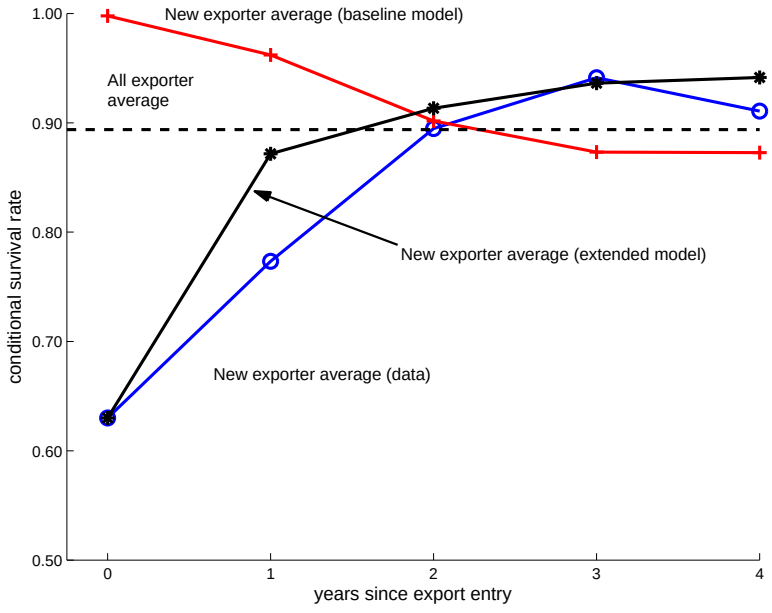
Estimates

	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)

New exporter dynamics



Export-sales ratio



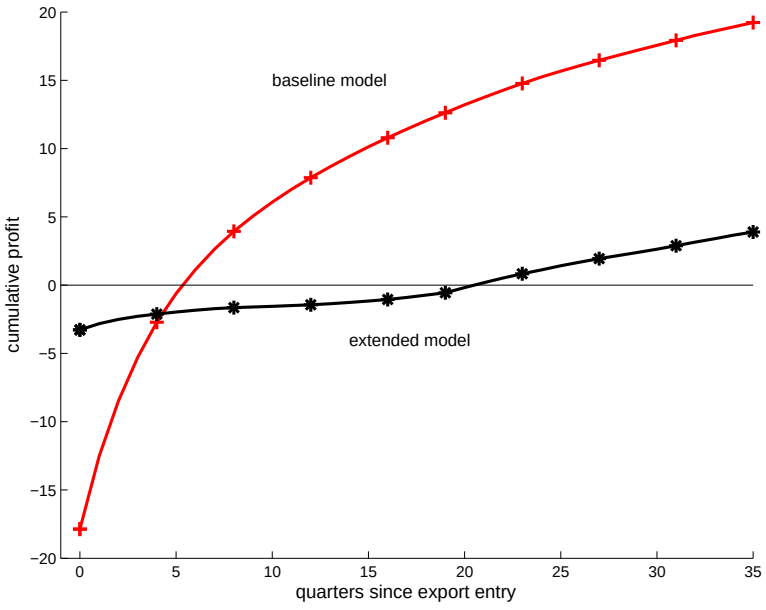
Conditional survival rate

What's happening?

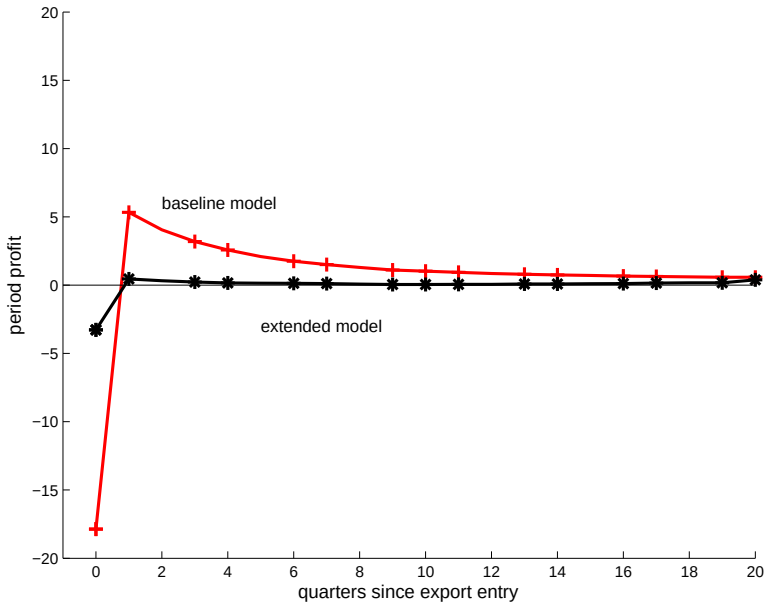
- In the extended model
  - Profits are earned only after several periods
  - Takes almost 20 quarters for average firm to break even
  - Early exit from exporting is probable
- Discounted, expected value of exporting falls significantly
- Lower expected value generates lower estimated entry costs
- Policy function

$$X_j'\left(0,\epsilon_j,Q\right)=\begin{cases}1 & \text{if } \Pi\left(X_j',\epsilon_j,Q\right)+R\,\mathbb{E}_{\epsilon_j',Q'}\,V\left(X_j',\epsilon_j',Q'\right)-f_0\geq 0\\ 0 & \text{otherwise}\end{cases}$$

Average new exporter profits



Cumulative profits



Flow profits