The Structure of Export Entry Costs

Andrew H. McCallum

Board of Governors of the Federal Reserve System

January 3, 2016

Firm-Level International Linkages

Econometric Society - ASSA Annual Meetings

Disclaimer

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Motivation

- Entry costs are the friction that makes exporting a rare activity
- Export entry cost complementarities have policy implications
- Welfare due to love of variety depends on the structure of sunk export costs
- Past work
  - Hanson & Xiang (2011) - U.S. movies, mostly global
  - Moxnes (2010) - Norwegian MFG, mostly country specific
  - Morales et al. (2014) - Chilean chemicals, "gravity" and "extended gravity"
  - Chaney (2014) - French firms, networks make entry into countries which are "close" to current partners cheaper than other partners (similar to Morales)

Question

Which entry cost structure is most consistent for U.S. firms?

1. Statistics and reduced form
   - Firms only enter one country when they start exporting
   - General exporting experience does little to help access new markets
   - Past experience does little to help access similar markets today
2. Structural model
   - The global entry cost is $0.02 million
   - Country specific costs are $3.6 to $4.25 million per market

Up front costs faced by U.S. firms are mostly country specific.

- Marketing and market research are likely local

Possible sunk export entry cost structures

- Only country specific (bilateral):

$$
\begin{aligned}
Canada: &\quad b_c \\
Mexico: &\quad b_m \\
Both: &\quad b_c + b_m
\end{aligned}
$$

- Bilateral plus "language complementarity":

$$
\begin{aligned}
Mexico: &\quad b_m + b_{Spanish} \\
Spain: &\quad b_e + b_{Spanish} \\
Both: &\quad b_e + b_m + b_{Spanish}
\end{aligned}
$$

- Only global:

$$
\begin{aligned}
Canada: &\quad g \\
Mexico: &\quad g \\
Both: &\quad g
\end{aligned}
$$

Data: universe of US manufacturing firms

- Customs transactions matched to production data built by Bernard, Jensen, and Schott (2009)
- Arms-length manufacturing exports only
- Values converted to 2000 USD using NBER 4-digit SIC PPI
- Top 50 destinations, 95% of US MFG exports
- 1992-2007: 16 years and about $40k$ firms ($50 \times 16 \times 40k = 32m$)

Participation versus export intensity

$$X_c \equiv N_c \bar{x}_c$$

X_c - Total U.S. exports to destination c in a given year

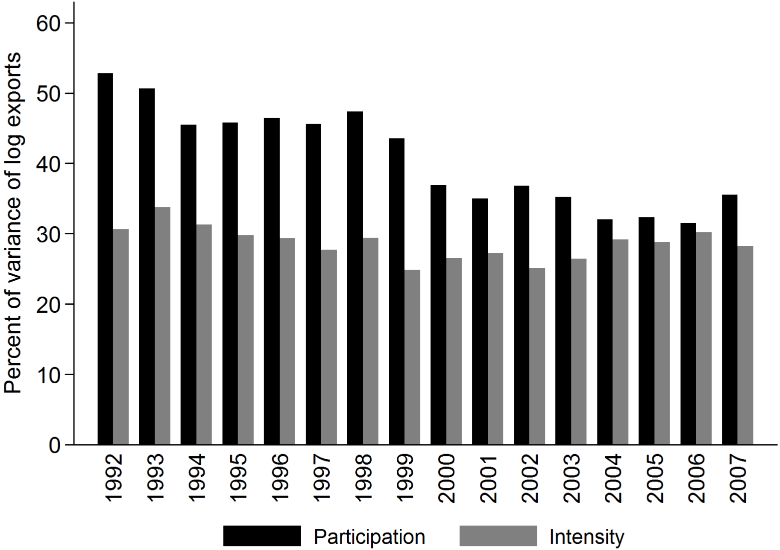
N_c - Number of U.S. firms exporting to destination c in a given year

$\bar{x}_c$ - Average value of exports among firms exporting to destination c

Decompose variance of total U.S. exports across countries within a year

$$100\% \equiv participation\% + intensity\% + covariance\%$$

U.S. export variance decomposition for top 50 countries



Descriptive evidence for large country specific component

Table: Number of countries entered

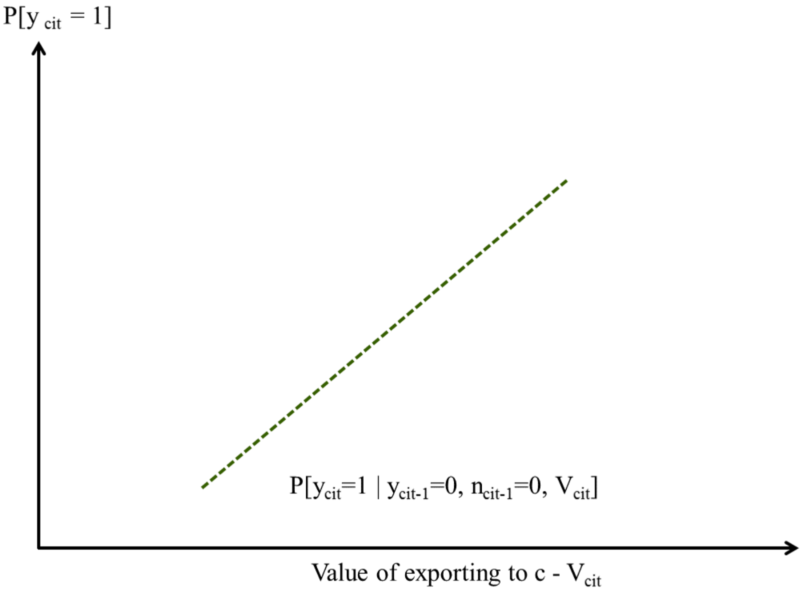
Number entered	Percent	Cumulative
1	89.42	89.42
2	8.26	97.67
3	1.46	99.13
4	0.48	99.62
5+	0.38	100.00

Table: Number of countries entered by firm size

Employees	Mean entered	St. Dev. entered
$[20, 50)$	1.11	0.43
$[50, 150)$	1.18	0.69
$[150, 500)$	1.24	0.93
$[500, 1000)$	1.34	0.98
≥ 1000	1.30	0.83

- Same when Canada is not treated as a foreign market.
- No dramatic increase in the number of countries after initial entry.
- Start by exporting to Canada, Mexico, the United Kingdom, Germany and Japan.

Intuition for identification



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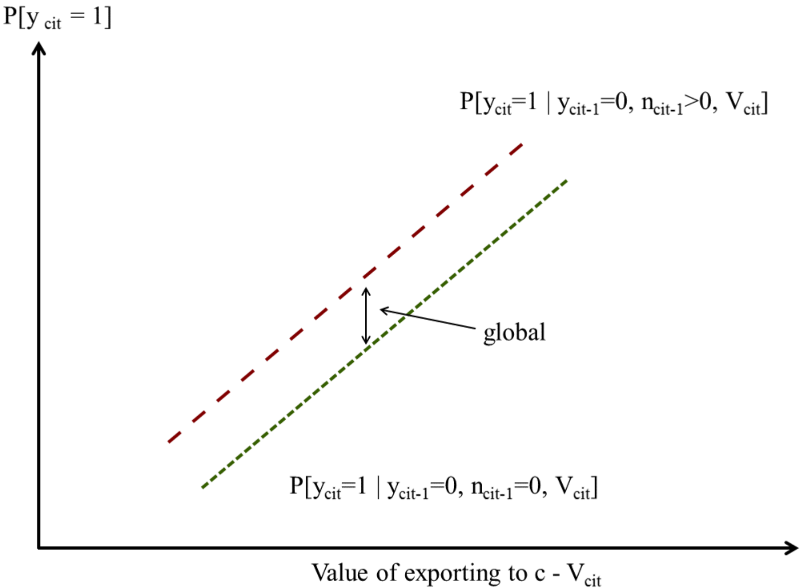

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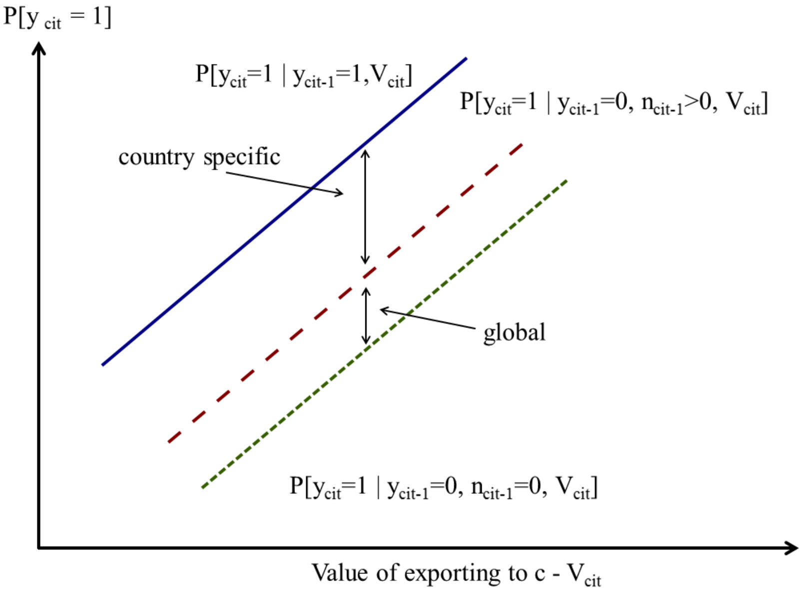
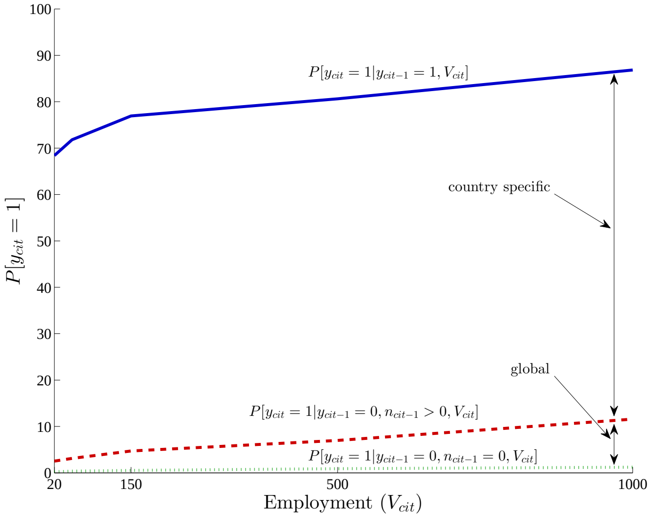


Empirical counterpart



Entry costs are identified by export status persistence

Given exporting status, $y_{cit} = \{0, 1\}$, consider

$$y_{cit} = \rho y_{cit-1} + \varepsilon_{cit}$$

Persistence is the difference in two probabilities

$$\rho = P\left[y_{cit} = 1 \mid y_{cit-1} = 1\right] - P\left[y_{cit} = 1 \mid y_{cit-1} = 0\right]$$

- Due to real option value, $P\left[y_{cit} = 1 \mid y_{cit-1} = 1\right]$ rises as export entry costs rise.
- Intuitively, $P\left[y_{cit} = 1 \mid y_{cit-1} = 0\right]$ falls as export entry costs rise.
- Hence, persistence rises as entry costs rise.

State dependence vs. heterogeneity

Simple example

- Consider two firms, one makes parkas the other sunglasses
- It is likely the parka firm never exports to Mexico
- It is likely the sunglasses firm always exports to Mexico
- These firms exhibit high export status persistence (high entry costs)
- Omitting heterogeneity **overestimates** persistence (entry costs)
- The sunglasses firm is also likely to export to Guatemala

Estimates of export entry costs will be biased if we do not adequately control for observed and **unobserved** heterogeneity.

Discussed at length in Heckman (1981)

Econometric issues

- Panel datasets allow removing non-parametric unobserved heterogeneity via fixed effects.
- The specification must be dynamic and include fixed effects.
- Dynamic panel fixed effect models estimated by first differences (FD) or within-group (WG/LSDV) have downward biased persistence estimates, see Nickell (1981) and Hahn & Kursteiner (2002).
- Arellano and Bond (1991) provide a consistent GMM estimator.

Persistence bias: $OLS \geq AB \geq WG$

Interpreting the linear probability model

$$P\left[y_{cit}=1 \mid \cdot\right] \quad = \quad \beta_1 y_{cit-1}+\gamma_1 n_{cit-1}+\lambda_1 X_{cit-1}+\delta_t+\delta_{ci}$$

Regressors

y_{cit-1} - country specific export status

$n_{cit-1} \equiv \sum_{k \neq c} y_{kit-1}$ - number of export destinations other than c

X_{it-1} - firm size, labor productivity

X_{ct-1} - foreign market size, exchange rate

δ_t - any common time effect

δ_{ci} - fixed costs, industry, distance, country's taste, etc.

Persistence bias: $OLS \geq AB \geq WG$

▸ AB details   ▸ Summary statistics

Results: number of other destinations

Table: dependent variable y_{cit}

	OLS	AB	WG2	WG3
y_{cit-1}	41.40***	26.19***	19.50***	18.75***
	(0.09)	(0.14)	(0.12)	(0.12)
y_{cit-2}	20.33***	9.10***	4.54***	4.36***
	(0.08)	(0.10)	(0.08)	(0.08)
y_{cit-3}	15.30***	3.16***	-0.78***	-0.98***
	(0.07)	(0.10)	(0.07)	(0.08)
n_{cit-1}	0.68***	0.73***	0.69***	
	(0.01)	(0.02)	(0.01)	
n_{cit-2}	-0.07***	0.08***	0.11***	
	(0.01)	(0.01)	(0.01)	
n_{cit-3}	-0.15***	0.06***	0.09***	
	(0.01)	(0.01)	(0.01)	
controls	x_{it-1}, x_{ct-1}	x_{it-1}, x_{ct-1}	x_{it-1}, x_{ct-1}	
controls	x_{it-2}, x_{ct-2}	x_{it-2}, x_{ct-2}	x_{it-2}, x_{ct-2}	
controls	x_{it-3}, x_{ct-3}	x_{it-3}, x_{ct-3}	x_{it-3}, x_{ct-3}	
FE	δ_t	δ_t, δ_{ci}	δ_t, δ_{ci}	$\delta_{it}, \delta_{ci}, \delta_{ct}$
Observations	19,696,400	19,696,400	19,696,400	19,696,400
Overall R^2	0.611	-	0.525	0.564

Firm clustered standard errors in parentheses.
Significant at 1% *** 5% ** and 10% *

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Complementary entry cost specification

Instead of number of other export destinations, count countries with

- past colonial relationship
- contiguous border
- same currency
- similar distance from the U.S.
- same language
- same legal origin
- similar per capita income
- common geographic region (almost continent)
- common regional trade agreement

Results: number of complementary destinations

Table: dependent variable y_{cit}

	OLS	AB	WG2	WG3
y_{cit-1}	41.08***	26.08***	19.33***	18.76***
	(0.093)	(0.132)	(0.115)	(0.122)
y_{cit-2}	20.02***	9.04***	4.36***	4.22***
	(0.079)	(0.103)	(0.077)	(0.082)
y_{cit-3}	14.95***	3.13***	-0.94***	-1.11***
	(0.070)	(0.103)	(0.072)	(0.076)
n^{coly}_{cit-1}	0.11***	1.64***	-0.13***	-0.08**
	(0.032)	(0.172)	(0.038)	(0.041)
n^{ctig}_{cit-1}	0.51***	-0.08	0.51***	0.73***
	(0.038)	(0.132)	(0.045)	(0.047)
n^{curr}_{cit-1}	-0.69***	-0.42***	-0.26***	-0.21***
	(0.035)	(0.045)	(0.037)	(0.038)
n^{dist}_{cit-1}	0.40***	0.82***	0.49***	0.21***
	(0.018)	(0.079)	(0.021)	(0.021)
n^{lang}_{cit-1}	0.36***	0.55***	0.38***	0.28***
	(0.018)	(0.130)	(0.021)	(0.022)
n^{legl}_{cit-1}	0.44***	0.22***	0.45***	0.09***
	(0.016)	(0.072)	(0.018)	(0.018)
n^{pcap}_{cit-1}	0.38***	0.49***	0.24***	0.12***
	(0.012)	(0.030)	(0.013)	(0.014)
n^{regn}_{cit-1}	0.73***	-0.41***	0.72***	0.66***
	(0.021)	(0.113)	(0.025)	(0.026)
n^{rtag}_{cit-1}	0.08***	0.57***	0.10***	-0.02
	(0.017)	(0.039)	(0.018)	(0.019)
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Overall R^2	0.611	-	0.530	0.565

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Reduced form results are robust

Instead of number of other destinations

- Indicator for exported elsewhere ▸ elsewhere indicator
- Indicator for complementary destinations ▸ gravity indicator
- Indicator if ever exported ▸ ever exported

Change sample

- Re-estimate by firm size categories
- Balanced panel
- Allowing for firm birth and death

Why do we need a structural model?

- Only way to invert probabilities into dollar values
- Compare structural to reduced form
- Explicilty model forward looking behavior by firms
- Compare country specific entry costs across countries
- Counterfactual simulations:
  - "What if every country was as inexpensive to enter as Canada?"

Structural model overview

- Representative consumer with Cobb-Douglas utility over sectors
- Sectors are CES aggregate over varieties
- Monopolistic competition and CRS production
- No "round about" access to a country or goods arbitrage
- Only observe exporting and revenue level jointly (selection problem)
- Dynamic entry decision

Period profit per country

Parametrize log potential revenue as

$$r^*_{cit} = \alpha_c + \beta_c w_{it} + \gamma_c x_t + \eta_{cit}$$

where

w_{it} - log of full-time employment

x_t - log of U.S. manufacturing exports

$\eta_{cit} \sim N\left(0, \sigma^2_{c\eta}\right)$

This implies that

$$E\left[R_{cit} \mid w_{it}, x_t\right] = \exp\left(\alpha_c + \beta_c w_{it} + \gamma_c x_t + \frac{1}{2}\sigma^2_{c\eta}\right)$$

Before accounting for sunk entry cost, define gross operating profits as

$$\pi^g_{cit} = \varepsilon_c^{-1} E\left[R_{cit} \mid w_{it}, x_t\right] - f_c$$

Period profit for multiple destinations

Period profit

$$\pi\left(\mathbf{y_{it}}, \mathbf{y_{it-1}}, w_{it}, x_t\right) = \sum_c \left(\varepsilon_c^{-1} E\left[R_{cit} \mid w_{it}, x_t\right] - f_c\right) y_{cit} - \mathbf{b} \cdot \mathbf{e_{it}} - g \cdot e_{it}^g$$

- Expected revenue is a function of firm size, w_{it}, and demand, x_t
- Operating profit is a fraction of expected revenue minus fixed cost
- Choose vector of possible destinations, $\mathbf{y_{it}}$
- Pay country specific cost for every country entered, $\mathbf{e_{it}}$
- Pay global cost if enter any country, e_{it}^g

Selection problem (type II Tobit/"Heckit")

Simple static bilateral only example

$$\pi\left(y_{cit}\right)=\begin{cases}\epsilon\left(0\right) & y_{cit}=0\\ \varepsilon_c^{-1}E\left[R_{cit}\mid w_{it},x_t\right]-f_c-b_d\left(1-y_{cit-1}\right)+\epsilon\left(1\right) & y_{cit}=1\end{cases}$$

written as familiar Heckman selection/type II Tobit

$$\begin{aligned}y_{cit}^* &= \varepsilon_c^{-1}E\left[R_{cit}\mid w_{it},x_t\right]-f_c-b_d\left(1-y_{cit-1}\right)+\epsilon\left(1\right)-\epsilon\left(0\right)\\ r_{cit}^* &= \alpha_c+\beta_c w_{it}+\gamma_c x_t+\eta_{cit}\\ y_{cit} &= 1\left(y_{dit}^*>0\right)\\ r_{cit} &= r_{cit}^* 1\left(y_{cit}^*>0\right)\end{aligned}$$

Two sources of identification:

- y_{cit-1} affects participation but does not directly affect revenue
- $\alpha_c, \beta_c, \gamma_c$ enter participation exponentially but enter revenue linearly

The dynamic problem

Bellman equation

$$V\left(\mathbf{y_{it-1}}, w_{it}, x_t, \epsilon_{it}\right) = \max_{\mathbf{y_{it}}} \left\{\pi\left(\mathbf{y_{it}}, \mathbf{y_{it-1}}, w_{it}, x_t\right) + \epsilon\left(\mathbf{y_{it}}\right) + \delta E\left[V\left(\mathbf{y_{it}}, w_{it+1}, x_{t+1}, \epsilon_{it+1}\right)\right]\right\}$$

Integrating ϵ out defines the expected value function

$$V\left(\mathbf{y_{it-1}}, w_{it}, x_t\right) \equiv E_\epsilon\left[V\left(\mathbf{y_{it-1}}, w_{it}, x_t, \epsilon_{it}\right)\right]$$

Assuming unobserved state, $\epsilon\left(\mathbf{y_{it}}\right)$, is T1EV $i.i.d.$ across firms, time, and choices provides closed form $E_\epsilon\left[\cdot\right]$ and the contraction that defines the expected value function. Use Chebyshev polynomials to find coefficients $\lambda_{\mathbf{y_{it-1}}}$ that approximate the value function in the contraction

$$\lambda_{\mathbf{y_{it-1}}} \Lambda\left(w_{it}, x_t\right) = \ln\left(\sum_{\mathbf{y^*_{it}}} \exp\left[\pi\left(\mathbf{y^*_{it}}, \mathbf{y_{it-1}}, w_{it}, x_t\right) + \delta E_{t+1}\left[\lambda_{\mathbf{y^*_{it}}} \Lambda\left(w_{it+1}, x_{t+1}\right)\right]\right]\right) + \gamma$$

The likelihood

The T1EV assumption also implies multinomial logit conditional choice probability

$$P\left[\tilde{\mathbf{y}}_{\mathbf{it}} \mid \mathbf{y}_{\mathbf{it-1}}, w_{it}, x_t\right] = \frac{\exp\left[\pi\left(\tilde{\mathbf{y}}_{\mathbf{it}}, \mathbf{y}_{\mathbf{it-1}}, w_{it}, x_t\right) + \delta E_{t+1}\left[V\left(\tilde{\mathbf{y}}_{\mathbf{it}}, w_{it+1}, x_{t+1}\right)\right]\right]}{\sum_{\mathbf{y}^*_{\mathbf{it}}} \exp\left[\pi\left(\mathbf{y}^*_{\mathbf{it}}, \mathbf{y}_{\mathbf{it-1}}, w_{it}, x_t\right) + \delta E_{t+1}\left[V\left(\mathbf{y}^*_{\mathbf{it}}, w_{it+1}, x_{t+1}\right)\right]\right]}$$

Combining this with the revenue distribution and an initial conditions correction gives the likelihood

$$L\left(\theta \mid \mathbf{y}, \mathbf{w}, \mathbf{x}, \mathbf{r}\right) =$$

$$\prod_{i=1}^{N}\prod_{t=2}^{T}\left(P\left[\tilde{\mathbf{y}}_{\mathbf{it}} \mid \mathbf{y}_{\mathbf{it-1}}, x_t, w_{it}\right]\prod_{c} f\left(r_{cit} \mid y_{cit} = 1, w_{it}, x_t\right)\right)^{1\left(\tilde{\mathbf{y}}_{\mathbf{it}} = \mathbf{y}_{\mathbf{it}}\right)} P\left[\tilde{\mathbf{y}}_{\mathbf{i1}} \mid w_{i1}\right]^{1\left(\tilde{\mathbf{y}}_{\mathbf{i1}} = \mathbf{y}_{\mathbf{i1}}\right)}$$

$\mathbf{y}, \mathbf{w}, \mathbf{x}, \mathbf{r}$ - all participation, employment, total exports, and revenue data

MPEC Mathematical Programming with Equilibrium Constraints

Su and Judd (ECTA, 2012) and Dubé, Fox and Su (ECTA, 2012)

Estimate parameters and solve for expected value function in one step

$$\begin{aligned}
\max_{\theta,\lambda} \quad & \ln\left[L\left(\theta \mid \mathbf{y},\mathbf{w},\mathbf{x},\mathbf{r}\right)\right] \\
\textit{subject to} \quad & \\
\lambda_{\mathbf{y_{it-1}}}\Lambda\left(w_{it},x_t\right) = \quad & \ln\left(\sum_{\mathbf{y_{it}^*}}\exp\left[\pi\left(\mathbf{y_{it}^*},\mathbf{y_{it-1}},w_{it},x_t\right)+\delta E_{t+1}\left[\lambda_{\mathbf{y_{it}^*}}\Lambda\left(w_{it+1},x_{t+1}\right)\right]\right]\right)
\end{aligned}$$

θ - structural parameters including country specific and global entry costs
λ - Chebyshev coefficients

Results: Main partners

SIC 346

Table: Structural estimates: top 5 destinations

Metal Forgings and Stampings (SIC 346)

	Canada	Japan	Mexico	U.K.	Germany
			Net profit parameters ($m)		
global entry cost (g)			0.02		
country entry cost (b)	3.70	4.16	3.58	4.22	3.63
			Percent of firms that export		
data	58.76	9.94	21.55	21.47	16.77
model	58.07	10.06	20.82	19.94	16.45
			Model correctly predicts country-firm-year export status		
percent	57.75	84.74	71.99	72.72	74.72
			Export revenue ($m), mean (standard deviation)		
data	0.94 (2.76)	0.60 (1.92)	0.55 (1.85)	0.61 (3.44)	0.41 (1.10)
model	1.31 (2.90)	0.57 (0.58)	0.63 (0.74)	0.51 (0.39)	0.50 (0.36)

Conclusions and extensions

Conclusions

- For US firms, export entry costs are mostly country specific
- Anecdotal explanation: marketing likely to be mainly local
- Global entry costs are around $0.02 million while country specific are $3.6-$4.25 million for SIC 346

Extensions (in progress)

- Add unobserved heterogeneity to the structural model
- Estimate structural model on additional industries
- Counterfactual simulations

Results: elsewhere indicator

back

Table: dependent variable y_{cit}

	OLS	AB	WG2	WG3
y_{cit-1}	44.12***	25.66***	20.92***	18.77***
	(0.09)	(0.14)	(0.13)	(0.13)
y_{cit-2}	22.17***	9.06***	5.57***	4.39***
	(0.08)	(0.11)	(0.09)	(0.08)
y_{cit-3}	17.20***	3.34***	0.17***	-0.99***
	(0.08)	(0.10)	(0.08)	(0.08)
$\max_{j\neq c}(y_{jit-1})$	0.69***	-1.94***	0.09***	0.25
	(0.01)	(0.03)	(0.01)	(0.25)
$\max_{j\neq c}(y_{jit-2})$	0.51***	-0.95***	0.03***	0.44**
	(0.01)	(0.02)	(0.01)	(0.21)
$\max_{j\neq c}(y_{jit-3})$	0.69***	-0.41***	0.02	-0.17
	(0.02)	(0.02)	(0.02)	(0.20)
controls	x_{it-1}, x_{ct-1}	x_{it-1}, x_{ct-1}	x_{it-1}, x_{ct-1}	
controls	x_{it-2}, x_{ct-2}	x_{it-2}, x_{ct-2}	x_{it-2}, x_{ct-2}	
controls	x_{it-3}, x_{ct-3}	x_{it-3}, x_{ct-3}	x_{it-3}, x_{ct-3}	
FE	δ_t	δ_t, δ_{ci}	δ_t, δ_{ci}	$\delta_{it}, \delta_{ci}, \delta_{ct}$
Observations	19,696,400	19,696,400	19,696,400	19,696,400
Overall R^2	0.603	-	0.522	0.566

Firm clustered standard errors in parentheses.
Significant at 1% *** 5% ** and 10% *

Results: indicator of extended gravity destination

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Table: dependent variable y_{cit}

	OLS	AB	WG2	WG2
y_{cit-1}	42.65***	26.35***	20.47***	18.73***
	(0.093)	(0.133)	(0.123)	(0.123)
y_{cit-2}	21.05***	9.38***	5.19***	4.33***
	(0.081)	(0.103)	(0.083)	(0.082)
y_{cit-3}	16.02***	3.46***	-0.20**	-1.00***
	(0.075)	(0.102)	(0.078)	(0.076)
$\max_{j\neq c}\left(1(coly_{jc})y_{jit-1}\right)$	1.51***	0.47***	1.09***	-0.08
	(0.040)	(0.087)	(0.048)	(0.047)
$\max_{j\neq c}\left(1(ctig_{jc})y_{jit-1}\right)$	2.42***	1.97***	2.43***	1.42***
	(0.048)	(0.110)	(0.059)	(0.055)
$\max_{j\neq c}\left(1(curr_{jc})y_{jit-1}\right)$	-0.54***	2.10***	0.53***	0.06
	(0.066)	(0.144)	(0.074)	(0.077)
$\max_{j\neq c}\left(1(dist_{jc})y_{jit-1}\right)$	0.86***	-1.47***	0.38***	0.15***
	(0.026)	(0.058)	(0.030)	(0.032)
$\max_{j\neq c}\left(1(lang_{jc})y_{jit-1}\right)$	0.02	-0.98***	0.01	0.04
	(0.024)	(0.064)	(0.028)	(0.032)
$\max_{j\neq c}\left(1(legl_{jc})y_{jit-1}\right)$	0.27***	-0.75***	0.09***	-0.03
	(0.020)	(0.048)	(0.024)	(0.029)
$\max_{j\neq c}\left(1(pcap_{jc})y_{jit-1}\right)$	0.29***	0.31***	0.36***	0.05**
	(0.018)	(0.047)	(0.021)	(0.024)
$\max_{j\neq c}\left(1(regn_{jc})y_{jit-1}\right)$	0.57***	-0.69***	0.51***	0.23***
	(0.030)	(0.077)	(0.035)	(0.038)
$\max_{j\neq c}\left(1(rtag_{jc})y_{jit-1}\right)$	0.25***	1.68***	0.23***	0.01
	(0.028)	(0.090)	(0.031)	(0.036)
controls	x_{it-1}, x_{ct-1}	x_{it-1}, x_{ct-1}	x_{it-1}, x_{ct-1}	
controls	x_{it-2}, x_{ct-2}	x_{it-2}, x_{ct-2}	x_{it-2}, x_{ct-2}	
controls	x_{it-3}, x_{ct-3}	x_{it-3}, x_{ct-3}	x_{it-3}, x_{ct-3}	
FE	δ_t	δ_t, δ_{ci}	δ_t, δ_{ci}	$\delta_{it}, \delta_{ci}, \delta_{ct}$
Observations	19,696,400	19,696,400	19,696,400	19,696,400
Overall R^2	0.607	-	0.526	0.574

Firm clustered standard errors in parentheses.
Significant at 1% *** 5% ** and 10% *

Results: ever exported indicator

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Table: dependent variable y_{cit}

	OLS	AB	WG2	WG3
y_{cit-1}	44.26***	25.98***	20.91***	18.75***
	(0.09)	(0.14)	(0.13)	(0.12)
y_{cit-2}	22.27***	9.18***	5.56***	4.36***
	(0.08)	(0.11)	(0.09)	(0.08)
y_{cit-3}	17.25***	3.35***	0.16***	-0.98***
	(0.08)	(0.10)	(0.08)	(0.08)
$ever_{it-1}$	-0.11***	-3.72***	-0.62***	
	(0.02)	(0.05)	(0.03)	
$ever_{it-2}$	0.05***	-0.14***	-0.18***	
	(0.03)	(0.03)	(0.02)	
$ever_{it-3}$	1.19***	-0.28***	-0.35***	
	(0.03)	(0.04)	(0.03)	
controls	x_{it-1}, x_{ct-1}	x_{it-1}, x_{ct-1}	x_{it-1}, x_{ct-1}	
controls	x_{it-2}, x_{ct-2}	x_{it-2}, x_{ct-2}	x_{it-2}, x_{ct-2}	
controls	x_{it-3}, x_{ct-3}	x_{it-3}, x_{ct-3}	x_{it-3}, x_{ct-3}	
FE	δ_t	δ_t, δ_{ci}	δ_t, δ_{ci}	$\delta_{it}, \delta_{ci}, \delta_{ct}$
Observations	19,696,400	19,696,400	19,696,400	19,696,400
Overall R^2	0.602	-	0.517	0.564

Firm clustered standard errors in parentheses.
Significant at 1% *** 5% ** and 10% *

Arellano and Bond (1991) details

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- GMM not 2SLS so no “first stage” to report.
- Instruments are deeper lags of the covariates (all possible using 4-7 periods ago)
- The moment conditions in AB are valid only if there is no serial correlation in the idiosyncratic errors.
- The AB AR(2) test has a null of no autocorrelation in the second lag of the first differenced errors with $p - value = 0.289$ for the “global” specification and $p - value = 0.153$ in the “complementary” specification.

Summary Statistics ▸ back

Table: Summary Statistics

Variable	Mean	St. Dev.
Export status times 100 ($y_{cit} \times 100$)	7.16	25.78
Number of other countries served (n_{it-1})	3.37	7.08
Log real wage (w_{it-1})	-3.43	0.39
Log employment (e_{it-1})	4.35	1.11
Log real average U.S. exports ($\bar{x}_{ct-1}$)	-0.36	0.60
Log number of U.S. exporting firms (N_{ct-1})	8.03	0.70
Log real U.S. exchange rate (rer_{ct-1})	2.43	2.32

Metal Forgings and Stampings (SIC 346)

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3462 Iron and Steel Forgings

- Aircraft forgings, ferrous: not made in rolling mills
- ...
- Wheels, car and locomotive: forged-not made in rolling mills

3463 Nonferrous Forgings

- Aircraft forgings, nonferrous: not made in hot-rolling mills
- ...
- Titanium forgings, not made in hot-rolling mills

3465 Automotive Stampings

- Automotive stampings: e.g., fenders, tops, hub caps, body parts, trim
- ...
- Moldings and trim, automotive: stamped

3466 Crowns and Closures

- Bottle caps and tops, stamped metal
- ...
- Tops, jar: stamped metal

3469 Metal Stampings, Not Elsewhere Classified

- Appliance parts, porcelain enameled
- ...
- Wastebaskets, stamped metal