

Learning and the Dynamics of Exporting: Theory and Evidence from French Firms

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WIIW Seminar in International Economics

December 3rd, 2009

Idea

- study dynamics of exporting at firm level
- model + empirics
- idea: trade is relationship-specific:
 - exporters need to find an importer (distributor, importer of intermediates, trade intermediary) in each market
 - importer's type is initially unknown, has to be learned through experience
 - importers behave opportunistically if they have the chance (incomplete contracts)

Results

- export-decisions are state dependent (past export status influences today's export status) **without** need for sunk cost
- state-dependence larger in countries with better legal institutions
- export relations start small and grow if successful
- prob. of export relation to be destroyed decreases over time

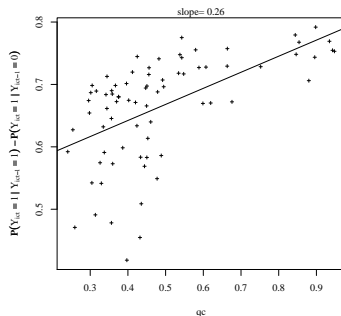
Some stylized facts on export dynamics

- we use a panel of 7172 French exporters in manufacturing
- data from 1993 - 2005
- crucial advantage: observe exports by firm, **destination** and year.

Fact 1

state dependence is larger in destinations with better legal institutions

- state dependence: $\equiv \text{Prob}(Y_{ikt} = 1 | X_{ikt}, Y_{ikt-1} = 1) - \text{Prob}(Y_{ikt} = 1 | X_{ikt}, Y_{ikt-1} = 0)$, $Y_{ikt} \in \{0, 1\}$: indicator for export status of firm i to destination k in period t



Fact 2

export relations start with small values that grow over time

- (reported also by Besedes and Prusa (JIE, 2004), Eaton et al. (2008), Ruhl and Willis (2008))

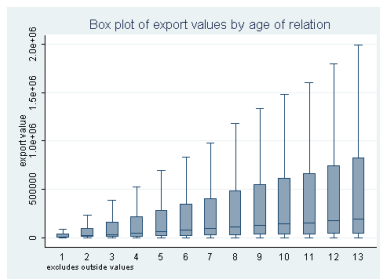
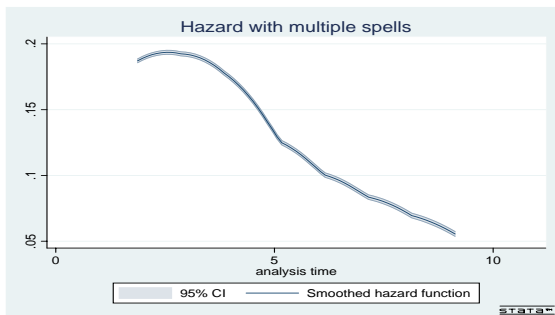


Figure: Export sales by relations' age

Fact 3

hazard (=probability of separation) *decreases with age* of relation



Why our model fits - intuition

- ① **state dependence**: no sunk cost, matching frictions make exporters reluctant to give up partner

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- 2 **state dependence and legal institutions**: better quality of legal system prevents importers from holding up exporters
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- ③ **growing exports:** initially exporters don't want to put too much at stake - as they become more confident, exports grow
- ④ **declining separation probabilities:** in the long run more relations with "patient" importers survive (selection effect)

Related Literature I

- empirical literature on sunk cost of exporting: Roberts and Tybout (1997), Bernard and Jensen (2004), Das, Roberts and Tybout (2007)
 - sunk costs \Rightarrow state dependence
 - observe only aggregate export flows
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- Ruhl and Willis (2008)
 - show that sunk cost model cannot reproduce slow growth of exports and declining hazard
- Eaton et al. (2008): model of exporting and learning
 - potential exporters are initially uncertain whether there is demand for their product
 - learn demand from past sales
 - can invest in marketing to reach more consumers
 - explains why exports start small and why most export flows stop after short time

Related Literature II

- Rauch and Watson (2003): model of sourcing of industrialized country importer from developing country supplier
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- Araujo and Ornelas (2007): model of trade and reputation
 - exporters have to find importer in foreign market
 - exporters are initially uncertain about importers' reliability and learn from experience
 - focus: impact of legal institutions on firm-level and aggregate trade
 - we adapt their model to heterogeneous firms, incomplete contracts, multiple sectors
 - we add empirics

A Model of Exporting and Learning - Prerequisites

- exporting through an importer empirically important
 - reason: substantial cost of learning local business environment
 - 50% of German exporters use trade intermediators (Felbermayr and Jung (2008))
 - Columbian exporters to the US have on average 1.4 trade relations with the US (Eaton et al (2008))

Model Setup

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- $j=1, \dots, J$ sectors, in each sector j :

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- $j=1, \dots, J$ sectors, in each sector j :
 - in Home: measure M of infinitely lived producers (monopolists), heterogeneous in marginal cost c (drawn from $G(c)$).
 - exporters max NPV of profits from exporting
 - can sell directly at Home (ignore this market), need to find an importer to sell in Foreign,
 - in Foreign: consumers have demand for each domestic product of $q(p) = A * p^{-\epsilon}$
 - in Foreign: measure 1 of importers , fraction θ is impatient
 - in Foreign: 2 types of importers: patient (discount factor β_H), impatient (β_L) with $\beta_L < \beta_H$
 - importers have per period fixed cost f of distribution

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 - exogenous separation prob. s
- ② once a match is formed:
 - one period contracts specify a profit sharing rule
 - importers max NPV of profits - try hold up exporters if rational
 - if try to renegotiate: can extract an additional fraction γ of exporter's part of surplus if successful.
 - if try to renegotiate: successful with prob. $(1 - \lambda)$, λ : quality of legal system

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In each period t :

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- ⑥ having observed the importer's action, each **exporter decides optimally if to continue** the relation

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- 7 having observed the behavior of their partners **exporters update their belief on the type of the importer** at the end of the period using Bayes' rule.

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- ⑦ having observed the behavior of their partners **exporters update their belief on the type of the importer** at the end of the period using Bayes' rule.
- ⑧ **exporters terminate a relation if and only if they observe successful renegotiation.**

Model Predictions - Export Values

Export Values and Age of Relation

Proposition: export values are increasing in the age of the relation as long as $c > \bar{c}$ and constant for $c \leq \bar{c}$.

Intuition:

- if $c \geq \bar{c}$ impatient importers try to renegotiate: if no renegotiation observed, exporters update beliefs and increase subjective prob. that importer is patient \Rightarrow increase export quantity
- if $c < \bar{c}$ learning plays no role

Model Predictions - Export Values

Export Values and Legal Quality

Proposition: Export values are increasing in the quality of the legal system.

Intuition

- direct effect of higher legal quality: prob. of renegotiation $\downarrow \Rightarrow$ exports \uparrow

Model Predictions - State Dependence

State Dependence and Legal System

Proposition:

- I) State dependence is larger in destinations with better legal institutions.
- II) The impact of legal institutions on state dependence is larger in sectors with larger contracting frictions (high γ).

Intuition

- I) if $\lambda \uparrow \Rightarrow$ impatient less likely to renegotiate \Rightarrow prob. that relation survives \uparrow
- II) in sectors with high γ impatient renegotiate with a larger fraction of exporters \Rightarrow : impact of better institutions larger.

Model Predictions - State Dependence

State Dependence and Productivity

Proposition State dependence is larger for more productive exporters.

Intuition

- impatient importers do not hold up productive exporters (opportunity cost too large)
- \Rightarrow cond. prob to continue exporting larger for more productive exporters

Model Predictions - Hazard

Hazard and Age of Relation

Proposition The hazard is decreasing in the age of the relation.

Intuition

- selection effect
- both types have constant hazard, only relations with patient survive in long run for $c \leq \bar{c}$

Hazard and Legal System

Proposition

- I) The hazard is decreasing in the quality of the legal system for sufficiently young relations
- II) Moreover, the impact of the legal system is larger in sectors with larger contracting frictions (high γ)

intuition

- I) initially: higher $\lambda \Rightarrow$ less renegotiation
- I) long run: more impatient survive \Rightarrow more renegotiation
- II) in high γ sectors impatient renegotiate with a larger fraction of exporters \Rightarrow larger impact of better legal system

Hazard and Productivity

Proposition The hazard is decreasing in firm productivity

Intuition

for exporters with $c < \bar{c}$ only exogenous separations occur

for exporters with $c \geq \bar{c}$ exogenous and endogenous separations

Empirics - Data

- panel of 7132 French manufacturers - export at least once between 1993 and 2005
- DOUANES database: exports by firm and destination
- BRN database: balance sheet information (size, productivity...)
- legal institutions
 - "**rule of law**" (Kaufman et al.)
 - "**legal quality**" (Gwartny et al.)
 - "**number of procedures**" to collect overdue debt (World Bank)
 - "**cost**" to collect overdue debt (World Bank)
 - "**time**" to collect overdue debt (World Bank)
- contracting frictions
 - sectoral measures of differentiation of output (Rauch 2003)
 - sectoral measures of differentiation of input (Nunn 2007)

Empirics - State Dependence I)

- **Specification 1:** linear probability model (dependent variable is indicator variable $Y_{ikt} \in \{0, 1\}$)
- $Prob(Y_{ikt} = 1|X, Y_{ikt-1}) = \beta_0 + \beta_1 Y_{ikt-1} + \beta_2 Y_{ikt-1} * IQ_k + \beta_3 Y_{ikt-1} * Z_k + \beta_4 Y_{i,kt-1} * Prod_{it} + \delta_{it} + \delta_{kt} + \varepsilon_{ikt}$
 - IQ_k : legal institutions, $Prod_{it}$: firm productivity, Z_k : controls
 - δ_{kt} : destination-time fixed effects (demand shocks)
 - δ_{it} : firm-time fixed effects (productivity shocks)

Predictions

- 1 state dependence is *larger* if *institutions* are *better* ($\beta_2 > 0$)
- 2 state dependence is *larger* for *more productive* firms ($\beta_4 > 0$)

State Dependence - Econometric Identification

- identification is from cross-section: don't need dynamic panel estimation
- taking differences across firms i for a given destination k :
- $\Delta_i Y_{ikt} = \beta_1 \Delta_i Y_{ikt-1} + \beta_2 \Delta_i Y_{ikt-1} * IQ_k + \dots + \Delta_i \delta_{it} + \Delta_i \varepsilon_{ikt}$
- taking differences across destinations k in firm differences:
- $\Delta_k \Delta_i Y_{ikt} =$
 $\beta_1 \Delta_k \Delta_i Y_{ikt-1} + \beta_2 \Delta_k \Delta_i Y_{ikt-1} * IQ_k + \dots + \Delta_k \Delta_i \varepsilon_{ikt}$

Table: Linear Probability Model: State Dependence and Legal System/Firm Productivity

variables	1	2	3	4	5
Y_{ikt-1}	0.417*** (0.002)	0.424*** (0.002)	0.431*** (0.002)	0.413*** (0.002)	0.409*** (0.002)
*VA/worker	0.039*** (0.0004)	0.039*** (0.0004)	0.039*** (0.0004)	0.039*** (0.0004)	0.039*** (0.0004)
<i>*GDP</i>	0.012*** (0.0001)	0.007*** (0.0001)	0.007*** (0.0001)	0.008*** (0.0001)	0.009*** (0.0001)
<i>*GDPpercapita</i>	-0.001*** (0.0005)	0.027*** (0.0003)	0.023*** (0.0003)	0.024*** (0.0003)	0.011*** (0.0004)
<i>*distance</i>	-0.031*** (0.0002)	-0.038*** (0.0002)	-0.036*** (0.0002)	-0.038*** (0.0002)	-0.033*** (0.0002)
*rule of law	0.169*** (0.002)				
*time		0.00001*** (9.168e-7)			
*num proc			0.001*** (0.00002)		
*cost				0.011*** (0.0005)	
*legal					0.011*** (0.0002)
<i>Country – time FE</i>	YES	YES	YES	YES	YES
<i>Firm – time FE</i>	YES	YES	YES	YES	YES
Cluster	firm-time	firm-time	firm-time	firm-time	firm-time
R^2	0.45	0.45	0.45	0.45	0.45
<i>Number observations</i>	7,659,696	7,659,696	7,659,696	7,659,696	7,659,696

Empirics - State Dependence II)

- $Pr(Y_{ikt} = 1 | Y_{ikt-1}, X_{ikt}) =$
 $\beta_0 + \beta_1 Y_{ikt-1} + \beta_2 Y_{ikt-1} * IQ_k + \beta_3 Y_{ikt} * RD_j + \beta_4 Y_{ikt} * IQ_k * RD_j + \beta_5 Y_{ikt-1} * X_k + \beta_6 Y_{ikt} * X_k * RD_j + \delta_{it} + \delta_{kt} + \varepsilon_{ikt},$
 - IQ_k : legal institutions, RD_j : contracting frictions of sector j , Z_k : controls
 - δ_{kt} : destination-time fixed effects (demand shocks)
 - δ_{it} : firm-time fixed effects (productivity shocks)
- $\frac{\partial Pr(Y_{ikt}=1 | Y_{ikt-1}=1, X_{ikt}) - Pr(Y_{ikt}=1 | Y_{ikt-1}=0, X_{ikt})}{\partial IQ_k} = \beta_2 + \beta_4 RD_j$
- expect: $\beta_2 > 0$; $\beta_4 > 0$

variables	1	2	3	4	5	6	7
Y_{ikt-1}	0.653*** (0.008)	0.608*** (0.006)	0.459*** (0.031)	0.43*** (0.022)	0.640*** (0.009)	0.596*** (0.007)	0.495*** (0.026)
*rule of law	0.091*** (0.011)	0.143*** (0.008)	-0.036* (0.021)	0.023*** (0.015)			
*legal					0.011*** (0.001)	0.016*** (0.001)	0.001 (0.002)
<i>*Nunn</i>	-0.222*** (0.013)		-0.28*** (0.047)		-0.228*** (0.014)		-0.375*** (0.041)
<i>*Rauch</i>		-0.138*** (0.008)		-0.223*** (0.031)		-0.147*** (0.009)	
*rule of law*Nunn	0.196*** (0.018)		0.149*** (0.033)				
*rule of law*Rauch		0.105*** (0.011)		0.05** (0.021)			
*legal*Nunn					0.02*** (0.002)		0.076*** (0.003)
*legal*Rauch						0.012*** (0.001)	
<i>*log(GDP p.c.)</i>			0.031*** (0.005)	0.028*** (0.003)			0.024*** (0.004)
<i>*log(GDP p.c.)*Nunn</i>			0.01 (0.007)				0.026*** (0.006)
<i>*log(GDP p.c.)*Rauch</i>				0.013*** (0.005)			
N	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300
Country-time FE	YES	YES	YES	YES	YES	YES	YES
Firm-time FE	YES	YES	YES	YES	YES	YES	YES
Cluster	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time
R^2 (within)	0.468	0.468	0.468	0.468	0.468	0.468	0.468

Table: State dependence: sectoral regressions

Empirical Analysis: Hazard

- duration analysis: Cox proportional hazard model (non-parametric)
 - $h(t, X\beta) = h(t)\exp(\beta_1 IQ_k + \beta_2 Prod_i + \beta_4 X_k + \delta_t + \delta_s)$
 - δ_t : year dummies, δ_s : sector dummies

Predictions

- 1 hazard is **lower** in destinations with **better legal institutions** ($\beta_1 < 0$)
- 2 hazard is **lower** for **more productive** firms ($\beta_2 < 0$)

Table: Cox duration model

variables	1	2	3	4	5
log(VA/worker)	-0.072*** (0.09)	-0.10*** (0.005)	-0.10*** (0.005)	-0.10*** (0.005)	-0.10*** (0.005)
log(GDP)		-0.04*** (0.001)	-0.04*** (0.001)	-0.04*** (0.001)	-0.04*** (0.001)
log(GDP cap.)		-0.05*** (0.005)	-0.06*** (0.003)	-0.05*** (0.004)	-0.05*** (0.004)
log(dist.)		0.11*** (0.003)	0.11*** (0.003)	0.10*** (0.003)	0.11*** (0.003)
log(rule of law)		-0.06*** (0.013)			
log(number procedures)			-0.03*** (0.004)		
log(legal)				-0.08*** (0.013)	
log(cost)					-0.04*** (0.005)
Obs.	117.982	117.982	117.982	117.982	117.983
cluster	firm	country	country	country	country
robust	YES	YES	YES	YES	YES
start	YES	YES	YES	YES	YES
sector FE	YES	YES	YES	YES	YES

Table: Cox duration model: sectoral regressions.

variables	1	2	3	4
log(rule)	-0.32*** (0.029)	-0.32*** (0.042)	-0.01 0.039	-0.01 0.028
log(rule)*Nunn	-0.08 * (0.046)		-0.09 * (0.05)	
log(rule)*Rauch		-0.08 (0.064)		-0.08 ** (0.033)
<i>log(GDP)</i>			-0.05*** (0.002)	-0.05*** (0.003)
<i>log(GDP p.c.)</i>			-0.05*** (0.007)	-0.05*** (0.009)
<i>log(distance)</i>			0.11*** (0.004)	0.11*** (0.004)
<i>log(VA/worker)</i>			-0.1*** (0.006)	-0.1*** (0.006)
N	117458	117458	117458	117458
cluster	country-sector	country-sector	country-sector	country-sector
start	YES	YES	YES	YES
sector FE	YES	YES	YES	YES

Empirics - Export Values

- $\log(\text{Export}_{ikt}) = \beta_0 + \beta_1 \text{Age}_{ikt} + \beta_2 X_{it} + \delta_{kt} + \varepsilon_{ikt}$
- $\log(\text{Export}_{ikt}) = \beta_0 + \beta_1 \text{Age}_{ikt} + \beta_2 Z_k + \beta_3 IQ_k + \delta_{it} + \varepsilon_{ikt}$
- Age_{ikt} : age of relation, X_{it} : firm controls, IQ_k : institutions
 Z_k : country controls, δ_{kt} : destination-time effects, δ_{it} :
 firm-time effects

Predictions

- 1 exports increase in age of relation ($\beta_1 > 0$)
- 2 for a given age exports increase if institutions are better ($\beta_3 > 0$)

Table: Value Regressions

	(1)	(2)	(3)
age	0.25*** (0.03)	0.25*** (0.0009)	0.25*** (0.0009)
productivity	0.42*** (0.006)		
capital	0.20*** (0.006)		
workers	0.32*** (0.005)		
GDP		0.36*** (0.001)	0.36*** (0.001)
distance		-0.30*** (0.002)	-0.30*** (0.002)
rule of law			0.12*** (0.015)
Number Observations	1.160.241	1.095.972	1.047.429
R^2	0.26	0.18	0.18
Fixed Effects	country-time	firm-time	firm-time

Conclusion

- have developed and tested a model of relationship-specific trade
- trade flows increase slowly (informational frictions)
- hazard decreases over time
- state dependence is linked to productivity/ legal institutions
- state dependence not related to sunk fixed cost
- **Policy Implications**
 - subsidizing exports not effective in increasing export flows
 - policies should target at facilitating information (trade fares, export agencies...)
 - policies should target specific markets