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

Romain Aeberhardt (CREST-INSEE)
Ines Buono (Banca d’Italia)
Harald Fadinger (Univ. of Vienna)

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

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The figure shows correlation between country averages of estimated marginal effects of past export status on current export decisions with institutional quality.
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

\[ \text{Prob}(Y_{ikt} = 1|X_{ikt}, Y_{ikt-1} = 1) - \text{Prob}(Y_{ikt} = 1|X_{ikt}, Y_{ikt-1} = 0) \] is larger in destinations with good legal institutions
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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

  - sunk costs $\Rightarrow$ state dependence
  - observe only aggregate export flows
  - Das et al. (2007): sunk cost around 400,000 $ US for Colombian exporters

- 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
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- Rauch and Watson (2003): model of sourcing of industrialized country importer from developing country supplier
  - initial uncertainty whether supplier can satisfy large order
  - importers "test" exporters by initially placing small orders that reveals exporter’s type
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  - importers "test" exporters by initially placing small orders that reveals exporter’s type
- 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
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

- 2 countries: Home, Foreign
- \( j=1, \ldots, J \) sectors, in each sector \( j \):
Model Setup

- 2 countries: Home, Foreign
- $j=1,...,J$ 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 $q(p) = A \times p^{-\epsilon}$
  - in Foreign: measure 1 of importers, fraction $\theta$ is impatient
  - in Foreign: 2 types of importers: patient (discount factor $\beta_H$), impatient ($\beta_L$) with $\beta_L < \beta_H$
  - importers have per period fixed cost $f$ of distribution
exporters and importers must find a partner (whose type is not observed - match is random)
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- exporters and importers meet with prob. \( x \) (exogenous)
- type of exporter \((c)\) revealed after match occurs
- type of importer private information also after match
- exogenous separation prob. \( s \)
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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 \( \gamma \) of exporter’s part of surplus if successful.
- if try to renegotiate: successful with prob. \( (1 - \lambda) \), \( \lambda \) : quality of legal system
Timing

In each period t:

1. unmatched exporters & importers decide whether to start searching given their types

2. if exporters find a partner they decide optimally if to accept the partner or to continue searching (given their beliefs about the types and the strategies of the importers.)

3. if importers find a partner they decide optimally if to accept a match or to continue searching (given their beliefs...)

4. exporters choose the optimal export quantity given their marginal cost, the profit sharing rule, and their beliefs.

5. importers decide if they want to try to renegotiate contract (success depends on legal institutions)

6. having observed the importer's action, each exporter decides optimally if to continue the relation.
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A Perfect Bayesian Nash Equilibrium

1. all importers accept any match.
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2. impatient importers try to hold up unproductive exporters but honor contracts with productive exporters (they try to renegotiate if and only if \( c > \bar{c}_t \)).
A Perfect Baysian Nash Equilibrium

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3. patient importers always honor their contracts with any type of exporter.
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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.
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
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 $\gamma$).

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

intuition

- I) initially: higher $\lambda \Rightarrow$ less renegotiation
- I) long run: more impatient survive $\Rightarrow$ more renegotiation
- II) in high $\gamma$ 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 \( Y_{ikt} \in \{0,1\} \))

  \[
  \text{Prob}(Y_{ikt} = 1|X, Y_{ikt-1}) = \beta_0 + \beta_1 Y_{ikt-1} + \beta_2 Y_{ikt-1} \ast IQ_k + \beta_3 Y_{ikt-1} \ast Z_k + \beta_4 Y_{i,k,t-1} \ast Prod_{it} + \delta_{it} + \delta_{kt} + \epsilon_{ikt}
  \]

  - \( IQ_k \): legal institutions, \( Prod_{it} \): firm productivity, \( Z_k \): controls
  - \( \delta_{kt} \): destination-time fixed effects (demand shocks)
  - \( \delta_{it} \): 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 $k$:
  \[
  \Delta_i Y_{ikt} = \beta_1 \Delta_i Y_{ikt-1} + \beta_2 \Delta_i Y_{ikt-1} \ast IQ_k + \ldots + \Delta_i \delta_{it} + \Delta_i \varepsilon_{ikt}
  \]
- taking differences across destinations $k$ in firm differences:
  \[
  \Delta_k \Delta_i Y_{ikt} = \\
  \beta_1 \Delta_k \Delta_i Y_{ikt-1} + \beta_2 \Delta_k \Delta_i Y_{ikt-1} \ast IQ_k + \ldots + \Delta_k \Delta_i \varepsilon_{ikt}
  \]
### Table: Linear Probability Model: State Dependence and Legal System/Firm Productivity

<table>
<thead>
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<td>$Y_{ikt} - 1$</td>
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Country — time FE: YES  YES  YES  YES  YES  YES  YES  YES  YES  YES
Firm — time FE: 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
Number observations: 7,659,696  7,659,696  7,659,696  7,659,696  7,659,696
Pr(Y_{ikt} = 1| Y_{ikt-1}, X_{ikt}) = 
\beta_0 + \beta_1 Y_{ikt-1} + \beta_2 Y_{ikt-1} \ast IQ_k + \beta_3 Y_{ikt} \ast RD_j + \beta_4 Y_{ikt} \ast IQ_k \ast RD_j + \beta_5 Y_{ikt-1} \ast X_k + \beta_6 Y_{ikt} \ast X_k \ast RD_j + \delta_{it} + \delta_{kt} + \varepsilon_{ikt},

- \text{IQ}_k$: legal institutions, \( RD_j \): contracting frictions of sector \( j \), 
- \( Z_k \): controls
- \( \delta_{kt} \): destination-time fixed effects (demand shocks)
- \( \delta_{it} \): 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: \( \beta_2 > 0; \beta_4 > 0 \)
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**Table:** State dependence: sectoral regressions

Notes: Robust standard errors are in parentheses denoting *** 1%, ** 5%, and * 10% significance. Sample excludes EU countries.
Empirical Analysis: Hazard

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

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Table: Cox duration model: sectoral regressions.

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Empirics - Export Values

\[
\log(\text{Export}_{ikt}) = \beta_0 + \beta_1 \text{Age}_{ikt} + \beta_2 X_{it} + \delta_{kt} + \epsilon_{ikt}
\]

\[
\log(\text{Export}_{ikt}) = \beta_0 + \beta_1 \text{Age}_{ikt} + \beta_2 Z_k + \beta_3 IQ_k + \delta_{it} + \epsilon_{ikt}
\]

- \text{Age}_{ikt}: age of relation,
- \text{X}_{it}: firm controls,
- \text{IQ}_k: institutions
- \text{Z}_k: country controls,
- \delta_{kt}: destination-time effects,
- \delta_{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

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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