

How frequently firms export? Evidence from France

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Trade technology and its relationship to exporting

- Intensive versus extensive margin of trade - policy consequences
- Transport industry - about 5% of GDP
- Iceberg trade cost vs transport industry
- Impact of trade technology on margins of trade
- How consumers are served - not only a trade question.

European financial crisis - Trade collapse of 2008/2009

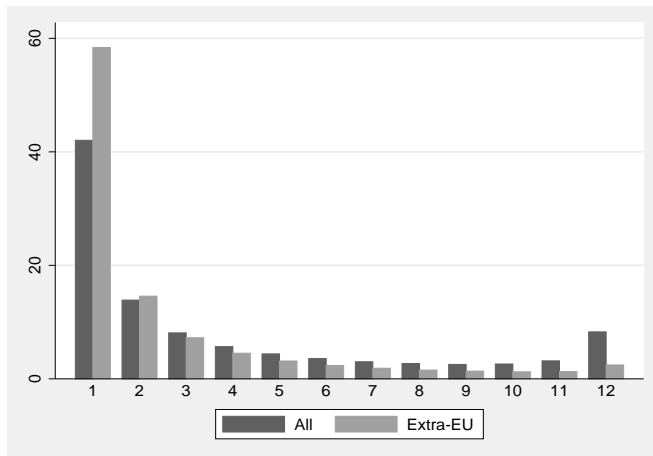
- Trade volume decline
- FC of shipment
- Shipment frequency must have collapsed, too
- It did not. Why?

Export frequency of firms

- Extensive margins of products and destination define the scope of firm's export. Gravity approach (Lawless, 2011 JIE)
- New margin we propose: shipment frequency
- Frequency is determined by sale method choice and cost structure of the trade technology.
- Firms optimize frequency of trade transactions to
 - Save on fixed costs of transactions
 - Gain maximum exposure to clients
- Shipment size and frequency are the simultaneous decision variables.
- Now we focus on how frequently to trade given demand for the firm's product.

- Firm export data from the French Customs,
- Monthly firm export data by destination and product category up to end 2009,
- Products are aggregated at the 4-digit HS level,
- Shipment frequency is defined as number of months with non-zero shipment per firm, product, destination, year, and ranges between 1 and 12.

Frequency of shipments, number of months, 2007



Notes: firm-destination-product (HS4) level.

Source: French Customs, authors' calculation.

Trade technology

- Cost structure of shipment affected by:
 - transport technology,
 - cost of inventories, storage technology, taste of consumers,
 - uncertainty regarding the timing of individual transaction with foreign clients.
- Shipping costs has several components for firms:
 - fixed cost of selling a product in a destination market,
 - the variable cost of transporting goods,
 - the per shipment fixed cost related to administration or distribution or filling a container.

The relative importance of such costs will shape the shipment behavior of companies.

Trade technology 2

- Shipment fixed cost - administrative cost eg as filling in customs documents, waiting time, insurance, brokerage fee, etc.
- Per container fixed costs further lumpiness of trade.
- The total cost (USD 2,435) for shipping a typical container (45'high cube dry container) filled with computers shipped from Rotterdam to New York includes:
 - rental of container,
 - actual shipment,
 - the handling of a container,
 - arrival handling (administrative fees for customs clearance and technical control, or customs broker fees).

Related literature

- Firm heterogeneity: *Bernard, Jensen, Redding and Schott (2007)*
- Intensive vs extensive margin: *Eaton, Eslava, Kugler and Tybout (2004, WP)*, *Bernard, Jensen, Redding and Schott (2007, JEP)*, *Mayer and Ottaviano (2008, Interecon)*
- Explicit trade technology: *Behrens and Picard (2011, JIE)*, *Hummels (2009, JPE)*, *Kleinert and Spies (2011, WP)*
- Transaction margin: *Eaton, Eslava, Kugler and Tybout (2008, WP)*
Colombia, number of transactions per firm-destination
- Per shipment fixed costs *Alessandria, Kaboski and Midrigan (2011, AER)*.

Transposing the Baumol-Tobin cash in advance model to a case when a firm sells goods for a total of Y euros and can decide on how frequently to ship.

- Theory: *Baumol (1952, QJE)* and *Tobin (1956, REStud)*
- The alternative to a shipment is savings of capital spent on transport as well as costs of inventory, I overseas.
- The inventory cost must be paid over shipments assuming that all goods that are sold will be consumed (no return of unsold goods).
- Total shipment transport costs $N * F$ plus inventory cost $I * V$.

Transposing the Baumol-Tobin cash in advance model to a case when a firm sells goods for a total of Y euros and can decide on how frequently to ship.

- For a given revenue Y_{ijk} for firm i in product k to a destination country c with F being a fixed cost of shipment and I standing for inventory cost of unsold goods, the optimal number of shipments, N_{ijk}^* :

$$N_{ijk}^* = (Y_{ijk} I_{ijk} / 2F_{ijk})^{1/2} \quad (1)$$

- The prediction of the model is that demand will have a 0.5 elasticity on frequency.
- Other related theories: larger market allow fine tuning for taste (*Hornok and Koren (2011, WP)*); investment into trade technology lowering per shipment cost (*Békés and Muraközy (2012, JIE)*).

Estimation

Taking logs, and assuming the revenue is function of total demand and variable transport cost being a function of distance we estimate at firm-product-destination level yields:

$$\log N_{ijk} = \alpha + \beta_1 \log Y_k + \beta_2 \log l_k + \beta_1 \log F_k + \epsilon_{ijk} \quad (2)$$

Adding firm-product FE:

$$\log N_{ijk} = \alpha + \beta_1 \log Y_k + \beta_2 \log \bar{l}_k + \beta_1 \log F_k + \theta_{ij} + \epsilon_{ijk} \quad (3)$$

Estimation

- Y — Revenue determined by classic gravity variables, GDP, distance, $\log Y_{ikt} = \log GDP_{ikt} - \log Dist_{ikt} - \log T_t$, T is only time variant.
- F — Per shipment fixed costs may include per container costs, administrative cost at the border, insurance and distribution - it is proxied by World Bank index of doing business to match administrative costs.
- F — may be affected by traditional cost proxy variables such as contiguity and common language - controls.
- I — Inventory cost hard to measure. We add product fixed effects to pick up warehouse costs that are shaped by size and weight, specific conditions for perishable goods, etc.

- Firm export data from the French Customs,
- Monthly firm export data by destination and product category up to end 2009.
- Products are aggregated at the 4-digit HS level.
- Extra EU export shipments over 1000 Euros are to be declared to the French Customs whereas for exports
- EU is complicated. (Total EU exports over 150,000 Euros)
- Shipment frequency, N_{ijk} is defined as the number of months a firm i has non-zero exports in product j to a destination country k within a given year t , and hence, $N_{ijkt}=[1,2,\dots,12]$.
- Censoring is an issue.

Estimation

- OLS
- Add product-firm fixed effects to control for composition effects. This is really important as more productive firms self-select into different countries, as they are the ones that can pay the sunk of exports to harder markets *Mayer, Melitz and Ottaviano (2011, WP)*, *Arkolakis (2010, AER)*.
- Cluster standard errors by destinations to handle the fact that error terms may be correlated at the country level.
- To compare margins - we run the same two regressions on the frequency of shipments and the average shipment size
- Excluding EU countries - statistical reasons in French data + our model is better fit for maritime
- Censoring - Tobit - not much change
- Gravity literature - Poisson pseudo ML (Santos Silva and Tenreyro, 2006 ReStat)
- OLS, FE – easy compare across margins

OLS and FE regressions for transaction frequency and shipment size

	(1)	(2)	(3)	(4)
Extra EU				
Variables	log # shipments		log mean value	
Fixed effects	-	firm/product	-	firm/product
log GDP	0.028*** (0.007)	0.114*** (0.007)	0.056** (0.025)	0.151*** (0.012)
log distance	-0.044 (0.029)	-0.091*** (0.029)	0.029 (0.156)	-0.074 (0.059)
log cost of importing	-0.028* (0.016)	-0.065*** (0.025)	0.022 (0.073)	-0.014 (0.040)
Constant	0.409 (0.369)	-1.296*** (0.350)	7.044*** (1.659)	5.590*** (0.698)
Observations	619,912	619,912	619,912	619,912
R-squared	0.017	0.089	0.011	0.046
Number of id		301,883		301,883

Note: Dummies for contiguity and common language are included.

Gravity of margins of export with FE (extra EU)

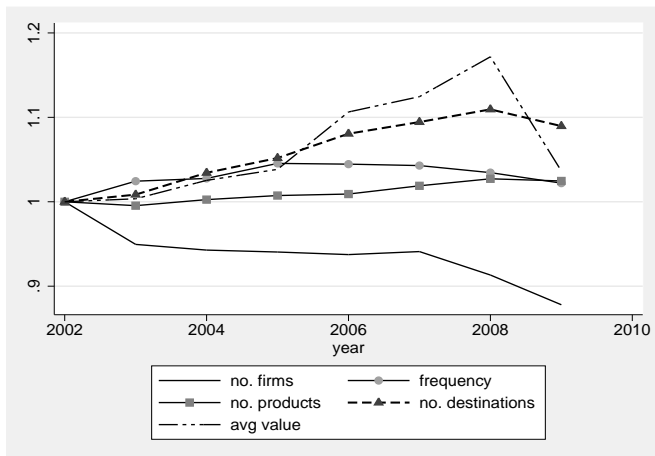
	(1)	(2)	(3)
	Extra EU		
Variables	by firm/dest/prod shipment freq	by firm/dest log # product	by destination log # firm
Fixed effect	(firm)	(firm)	(-)
log GDP	0.114*** (0.007)	0.073*** (0.009)	0.664*** (0.038)
log distance	-0.091*** (0.029)	-0.063*** (0.018)	-0.724*** (0.115)
log cost of importing	-0.065*** (0.025)	-0.051*** (0.018)	-0.463*** (0.107)
Constant	-1.296*** (0.350)	-0.716* (0.384)	-0.175 (1.750)
Observations	619,912	305,781	146
R-squared	0.089	0.070	0.854
Log Lik		-202867	-167.0
Number of id	301,883	86,164	

Note: Dummies for contiguity and common language are included.

Trade collapse is a natural experiment..

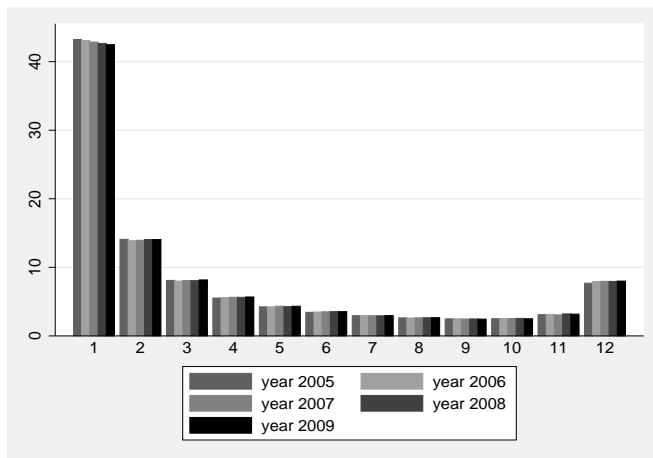
- Export value declined by 17.6% during the crisis (2009).
- Firm exit explain- 4%p, 13.5% is intensive margin
- Due to FC of shipment, frequency should have dropped a great deal
- Model - 50% of drop in demand
- Reality?

Intensive and extensive margins over time



Source: French customs. Authors' calculation.

Frequency of shipments, number of months, 2005-2009, all destinations



Source: French customs. Authors' calculation.

- Selection effects. Filtering it, small decline in frequency
- Check the reaction to change in GDP - should be 50% impact

Panel (5y) estimation of total, average value and frequency of shipments (Extra EU countries)

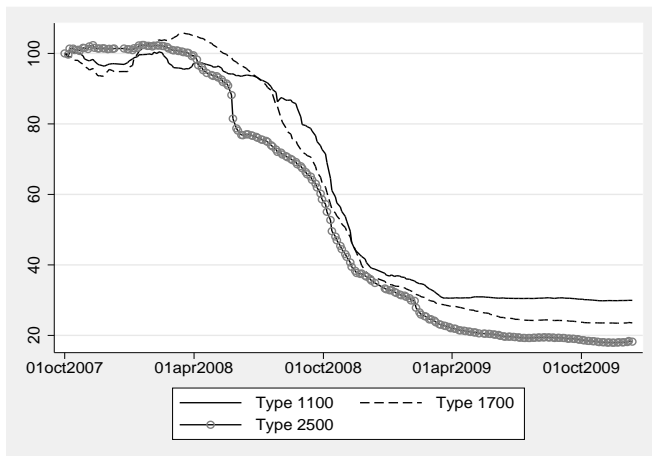
	(1)	(2)	(3)
Variables	Log value	Log mean value	Log # shipments
Fixed effects	by firm*product*year		
log GDP	0.265*** (0.015)	0.152*** (0.012)	0.113*** (0.008)
Crisis*log GDP	-0.008*** (0.003)	-0.005** (0.002)	-0.003*** (0.001)
log distance	-0.155*** (0.047)	-0.061 (0.065)	-0.094*** (0.032)
Crisis*log distance	0.007 (0.008)	0.010 (0.008)	-0.003 (0.003)
log cost of importing	-0.092* (0.051)	-0.027 (0.041)	-0.064** (0.025)
Crisis*log cost of importing	-0.013 (0.020)	-0.006 (0.015)	-0.007 (0.009)
Constant	4.370*** (0.724)	5.556*** (0.760)	-1.186*** (0.376)
Observations	1,810,519	1,810,519	1,810,519
R-squared	0.079	0.044	0.086
Number of id2	876,517	876,517	876,517

Note: Dummies for contiguity and common language are included.

Trade collapse is a natural experiment..

- Export value declined by 17.6% during the crisis (2009).
- Firm exit explain- 4%p, 13.5% is intensive margin
- Due to FC of shipment, frequency should have dropped a great deal
- Model - 50% of drop in demand. Yes, but this explains only partially
- BUT maybe T changed?

Price index for three types of containers (Oct. 2007- May 2010)



Note: The smallest category (1100 TEU) corresponds to 150m long vessels of 10,000 tons (gross tonnage). Source: Hamburg Shipbrokers' Association.

Trade collapse is a natural experiment..

- Export value declined by 17.6% during the crisis (2009).
- Firm exit explain- 4%p, 13.5% is intensive margin
- Due to FC of shipment, frequency should have dropped a great deal
- Model - 50% of drop in demand. Yes, but this explains only partially
- Reality - no change/very small change in frequency
- BUT: T must have changed
- Perceived demand fell less as a drop of T brought countries "closer".
- Importance of transport industry

Conclusions

Conclusions

- We showed a simple way to think about frequency of shipment
- We could partially explain no change in frequency of trade

More work

- Merge with firm balance sheet, add firm level variables
- Extend model to include uncertainty a la Miller and Orr (1966, QJE) model
- Better measure inventory cost
- Later ... see post crisis

Thanks for the attention. bekes@econ.core.hu

Gravity of margins of export without FE (extra EU)

	(1)	(2)	(3)
	Extra EU		
Variables	by firm/dest/prod shipment freq	by firm/dest log # product	by destination log mean value
log GDP	0.028*** (0.007)	0.019*** (0.006)	0.322*** (0.028)
log distance	-0.044 (0.029)	-0.045*** (0.017)	-0.220*** (0.080)
log cost of importing	-0.028* (0.016)	-0.018 (0.015)	0.099 (0.082)
Constant	0.409 (0.369)	0.376 (0.297)	5.495*** (1.106)
Observations	619,912	305,781	146
R-squared	0.017	0.007	0.680
Log Lik		-295380	-117.2

Note: Dummies for contiguity and common language are included.

The margins of French exports (2002/2009)

	Total exports (bn EUR)	Shipments (th EUR)*	No. of flows	
2003	-2.2%	-1.1%	-1.1%	
2004	5.0%	-0.4%	5.4%	
2005	5.1%	0.4%	4.7%	
2006	9.1%	5.2%	3.7%	
2007	4.2%	0.4%	3.8%	
2008	2.5%	3.0%	-5.0%	
2009	-17.6%	-13.0%	-5.4%	
	No. of firms	Dest**	Prod/dest**	Ship/dest*prod**
2003	-5.0%	0.8%	0.1%	3.2%
2004	-0.7%	2.6%	2.8%	0.8%
2005	-0.2%	1.7%	0.9%	2.3%
2006	-0.3%	2.7%	0.4%	1.0%
2007	0.4%	1.3%	2.0%	0.0%
2008	-3.0%	1.4%	0.8%	0.4%
2009	-3.9%	-1.8%	0.1%	0.1%

* Average value ** Average number

Poisson PML on extra EU exports

Variables	(1)	(2)	(3)	(4)
	log mean value		log # shipments	
Fixed effects	-	firm/product	-	firm/product
log GDP	0.213*** (0.015)	0.475*** (0.025)	0.043*** (0.010)	0.137*** (0.001)
log distance	-0.139* (0.081)	-0.370*** (0.039)	-0.067* (0.039)	-0.120*** (0.003)
log cost of importing	-0.071 (0.107)	-0.155*** (0.057)	-0.043* (0.023)	-0.078*** (0.003)
Constant	8.261*** (1.052)		0.689 (0.500)	
Observations	619,912	399,417	619,912	399,417
Number of id		81,388		81,388

Note: Dummies for contiguity and common language are included.