



Trade responses to freight rates

Decomposing Latin American Maritime trade

Inmaculada Martinez-Zarzoso & Gordon Wilmsmeier

26th June 2009

IAME 2009 Conference, Copenhagen, Denmark

conceptual framework

Conceptual framework

- How do trade costs affect countries' ability to participate in the global economy?
- What impact do changes in trade costs have on a country's trade?
- Reducing trade costs has direct and indirect benefits:
 - Promoting trade
 - Leading to industrial restructuring in an economy
 - Higher specialisation
 - Changes in factor prices
 - Real income

Relationship between trade and maritime transport costs

- Elasticity of trade with respect to transport costs is in the range between 2-5 (Limao and Venables, 2001)
- We decompose total trade into two margins:
 - **Extensive margin** - Number of unique shipments
 - **Intensive margin** – average value of shipments
- Trade and distance
 - Distance is a poor proxy for transport costs
 - It is not clear whether the effect of distance on trade volumes can be ascribed to transport costs or other type of trade costs (e.g. proximity of business, historical, ties, cultural proximity)

Contribution to literature

- Decomposition of Latin American trade flows in various components
- Influence of transport costs upon these components
- Comparing the effect of distance with the effect of transport costs
- Explaining the impact of spatial friction on maritime trade

data description

Data

- Annual data: 1999-2004 for 277 Latin American trade routes
- Covering trade of: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay and Venezuela with other LAC countries
- Disaggregated data at SITC 5-digit level
- Key fields: cif, fob, freight, insurance, volume
- Source: International Transport Database (BTI) from based on the Foreign Trade Data Bank for Latin America and the Caribbean (BADECEL) at UNECLAC

decomposing maritime trade and main hypothesis

Model development decomposition of trade

- Unique shipments are indexed by s and the total value of shipments from country i to country j is given by

$$T_{ij} = \sum_{s=1}^{N_{ij}} P_{ij}^s Q_{ij}^s$$

where N_{ij} is the number of unique shipments (extensive margin of trade)

\overline{PQ}_{ij} is the average value per shipment (the intensive margin).

- Decomposing total trade value into number of products traded and average value per product:

$$T_{ij} = N_{ij} \overline{PQ}_{ij}$$

where
$$\overline{PQ}_{ij} = \frac{\left(\sum_{s=1}^{N_{ij}} P_{ij}^s Q_{ij}^s \right)}{N_{ij}}$$

Variation of trade varieties and trade costs

1. Goods produced in different location could become homogenous → if production costs become very similar trade costs are sufficiently large to obstruct trading.
2. Goods are differentiated by origin, each country producing a different variety has to incur fixed costs to sell the product in the destination country → varieties will be shipped to each destination and the number of varieties will depend negatively on the size of trade costs
3. Traded varieties are no consumer goods, but intermediate goods → goods are only exported to destinations where the final product is produced.

Two levels of composition

- Decomposing total trade value

$$\ln T_{ij} = \ln N_{ij} + \ln \overline{PQ}_{ij}$$

- Decomposing to SITC level and shipments between two countries

$$\ln T_{ij} = \ln N_{ij}^k + \ln N_{ij}^F + \ln \overline{P}_{ij} + \ln \overline{Q}_{ij}$$

Both equations in logarithmic form

Prediction of co-variation

- The reduction in variable costs has two effects:
 - ↗ size of exports of each exporter + allows for new entrants
- The more homogenous sector exports the more sensitive to changes in transport costs
- The elasticity of exports with respect to variable costs does not depend on the elasticity of substitution between goods, whereas the elasticity of exports with respect to fixed costs is negatively related to the elasticity of substitution
- In presence of firm heterogeneity, the extensive and intensive margin are affected in different ways by the elasticity of substitution. The impact of trade barriers is strong on intensive margin for high elasticities of substitution and mild on the extensive margin

Model

$$\ln M_{ijk} = \alpha_i + \beta_j + \alpha_1 \ln GDP_{it} + \alpha_2 \ln GDP_{jt} + \alpha_3 \ln POP_{it} + \alpha_4 \ln POP_{jt} + \alpha_5 \ln D_{ij} + \gamma_k + \lambda_t + \varepsilon_{ijk}$$

Where:

γ_k and λ_t are industry and year fixed effects

α_i and β_j are importer and exporter fixed effects.

ε_{ijk} is an error term

$\ln(M_{ijk})$ is in turn the log of average value per shipment (intensive margin), and the log of the number of shipments (extensive margin)

Since OLS is linear, the coefficient on total imports will be equal to the sum of the coefficients on the two margins.

A further decomposition can be done, using as dependent variable in equation (11) each of the components of equation (10).

Main hypothesis

- New theory suggests that international trade with imperfect competition and heterogeneous firms and lower trade costs increases bilateral trade costs through are reflected in both margins of trade.

main results

Extensive and intensive margins for Latin American maritime trade flows

Country	Value	Nij	Average Value
Argentina	9 705 055	106.701	117 584.3
Bolivia	41 809	10.307	6 510.6
Brazil	6 152 345	104.636	102 297.9
Chile	2 186 648	35.161	86 494.2
Colombia	3 625 897	255.318	41 095.3
Ecuador	3 685 330	126.920	35 877.6
Mexico	5 241 092	18.884	278 440.5
Peru	2 447 187	35.246	102 030.2
Uruguay	206 142	13.263	29 462.6
Venezuela	3 993 809	146.725	51 066.9

Explaining extensive and intensive margins with distance

- Dependent variables:

- Total value of imports
- N_{ij}
- N_{ij}^k
- N_{ij}^f
- Average value/shipment
- Average price
- Average quantity per shipment

- Results:

- Shipment distance corresponds to increases in average price/ton
- 71% of the distance effect works through the extensive margin

	m1	m2	m3	m4	m5	m6	m7
	Value	Nij	Nijk	Nijf	avPrice	AvQ	Av(P*Q)
LD	-0.562**	-0.399***	0.011	-0.410***	0.175***	-0.338***	-0.163***
	-4.128	-16.746	0.451	-26.845	8.54	-7.937	-4.978
IGDPLN	2.294***	0.532***	-0.063	0.594***	0.637***	1.125***	1.762***
	34.059	10.457	-1.498	24.923	14.075	13.539	27.081
EGDPLN	0.485***	0.348***	-0.04	0.388***	0.033	0.105	0.137*
	5.582	6.915	-0.972	9.184	1.086	1.552	2.442
IPOPULN	1.336***	0.792***	0.004	0.787***	-0.066***	0.611***	0.545***
	14.167	26.717	0.199	42.343	-3.504	14.94	15.334
EPOPULN	0.424**	0.015	0.043	-0.028	0.052**	0.357***	0.408***
	4.68	0.448	1.78	-1.962	2.945	11.709	15.117
Y2000	0.297*	0.268***	0.012	0.256***	-0.132***	0.160***	0.029
	2.346	14.801	0.809	28.763	-8.864	6.486	1.393
Y2001	0.302*	0.151***	0.009	0.142***	-0.110***	0.261***	0.151***
	3.008	9.612	0.672	20.105	-6.186	7.557	5.594
Y2002	0.173	0.135***	0.006	0.128***	-0.167***	0.205***	0.038
	0.995	7.217	0.386	17.636	-8.458	6.095	1.465
Y2003	0.134	0.306***	-0.006	0.312***	-0.233***	0.061	-0.172***
	0.665	12.958	-0.336	34.024	-10.109	1.794	-5.737
Y2004	0.302	0.375***	-0.008	0.383***	-0.136***	0.063	-0.073*
	1.526	13.668	-0.36	40.718	-6.011	1.606	-2.264
CONSTANT	-38.44***	-17.70***	-2.659**	-15.04***	1.971**	-22.71***	-20.74***
	-23.661	-18.29	-3.301	-31.095	3.01	-18.474	-22.415
R-SQUARED	0.33	0.485	0.401	0.476	0.571	0.563	0.518
N	860986	860986	860986	860986	860986	860986	860986
LL	-1721049	-1283085	-973961	-1061089	-892378	-1474909	-1376281
RMSE	1.786261	1.074062	0.750071	0.829949	0.682261	1.34211	1.196847
AIC	3442116	2566204	1947957	2122212	1784791	2949851	2752595
BIC	3442221	2566402	1948155	2122411	1784989	2950050	2752794

Explaining extensive and intensive margins with distance (2)

- Proximate geographic countries see a greater number of unique shipments per commodity
- The number of shipped commodities does not seem to vary with distance
- The average value changes with distance
- Increase in distance corresponds to increased product values and decreasing shipment volumes

→ Explanation: goods with low value to weight ratios are imported from closer locations than goods with high value to weight ratios

Explaining extensive and intensive margins with freight rates

- Results:
 - Higher effect of transport costs on the intensive margin
 - 29% of the trade cost effect works through the extensive margin
 - 71% work through the intensive margin
 - Decline in the number of shipments derives almost entirely from the first component (Nijk)
 - The number of commodities shipped decreases as transport costs are higher, the number of shipments per commodity plays no role
- Comparison
 - 10% increase in shipping costs is associated with a 30% drop in trade. (OECD (2009))
 - In our sample a 10% increase in shipping costs is associated with a 2.4% drop in trade.

Explaining extensive and intensive margins with freight rates

- 87% of the variation in average imported value works through changes in average prices per ton,
- 13% works through changes in average quantities shipped.

Comparison: Spatial friction

- the main pattern remains unchanged
- the only difference:
 - adding shipping costs slightly reduces the estimated coefficient for distance
 - the percentage of variation in distance explained through the extensive margin of maritime trade increases from 71 percent to 77 percent.

conclusions

Conclusions

- Focus: relationship between maritime trade and transport costs in Latin America
- First paper to evaluate the effect of maritime transport costs on the two margins of trade
- Findings:
 - 71% of the distance effect in trade works through the extensive margin → the number of shipments reduces sharply with distance
 - Spatial frictions are less important to the intensive margin
 - Opposite for add-valorem freight rates
 - 29% works through the extensive margin
 - 71% works through the intensive margin

Outlook

- Expand geographical coverage
- Expand time series
- Comparison between transport modes



Questions?

Inmaculada Martínez-Zarzoso & Gordon Wilmsmeier
martinei@eco.uji.es g.wilmsmeier@napier.ac.uk