

Measuring the price elasticity of import demand in the destination markets of Italian exports

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Outline

- Motivation and related literature
- Basic idea
- Methodology
- Main results
- Sectoral and geographical decomposition

Motivation

- What is the **price elasticity of Italian exports** relative to the main euro-area competitors?
- 'Micro' approach (product-destination pairs) so as to evaluate composition effects
- **Related literature:** only indirectly
 - 1 competitive pressure from emerging countries (Lissovolik, 2008; Moreno-Badia, 2008)
 - 2 diversification within products via quality - proxied by unit values (Monti, 2005; de Nardis and Traù, 1999)
 - 3 market power of Italian exporters (de Nardis and Pensa, 2004)

Basic idea - 1

- Armington (1969) definition of **variety** for **imports**. Imports of good g supplied by different countries are different varieties of good g
- Fix importing country (USA) and product (HS6=111111). As many varieties as origin countries
- Broda, Greenfield and Weinstein (2006, NBER) estimate elasticities of substitution for 171 goods in 73 importing countries. One elasticity for each market (country-product combination)
- With Dixit-Stiglitz CES utility function, **elasticities of substitution among varieties** are also import demand elasticities (wrt price)
- **Idea**: weigh these import **import** demand elasticities to obtain price elasticity for Italian '**exports** of goods'
- Algebra: weights = corresponding market share in Italian exports

Basic idea - 2

- Obtain: average price elasticity of import demand in the destination markets of 'good-exports' by country i ('**export elasticity**'):

$$\eta_{i,t} = \sum_{jk} \sigma_{jk} \frac{EXP_{i,t,jk}}{\sum_{jk} EXP_{i,t,jk}} \quad (J \text{ goods}; K \text{ destinations})$$

- σ_{jk} : estimated by BGW
- $EXP_{i,t,jk}$: values from Eurostat
- From many (**import**) 'demand elasticities' σ_{jk} to one '**export elasticity**' $\eta_{i,t}$
- $\eta_{i,t}$ changes over time only due to composition effects b/c
 - 1 for any product j , σ_{jk} is constant across time...
 - 2 and **origin country** (\leftrightarrow identification)

Preview of main findings

- Overall 'export elasticity' of ITA on average lower than GER, FRA, SPA
- Main driver: sectoral composition, esp. motor-vehicles sector and other transport equipment
- **Net of these two sectors: all export elasticities basically equal**
- Some Italian specialisation sectors have relatively **low** export elasticities (contrary to priors?)
- Hence, sectoral and geographical composition **does not expose** Italian exports to markets (product-destination combos) with more price-elastic demand, contrary to part of the literature

Methodology: summary

- Select importing country and pick one good at a time (all varieties share the same elasticity of substitution)
- Utility from consuming imported good j is a CES function \rightarrow demand function
- Supply equation. From gravity models, not necessarily flat: elasticity constant across supplying countries
- Equilibrium: reduced-form equation
- Feenstra (1994): use panel dimension of trade data to estimate. Between estimation, no need for IV (or, IVs are origin-country dummy variables)
- Consistency if demand and supply shocks are independent. Heteroskedasticity: weigh data
- BGW: if estimated σ_j is not feasible (< 1), GMM using orthogonality condition between error terms (grid-search procedure). Different weighting for heteroskedasticity

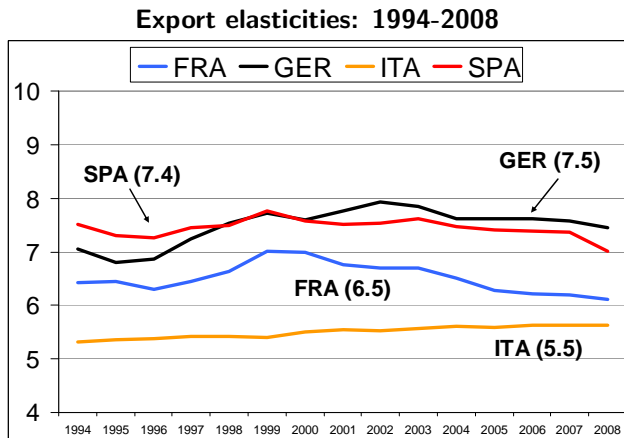
- σ_{jk} : estimated by BGW ('something of an industry standard' - Hummels et al., 2009)
 - 1 Products defined at HS6 levels, but assumed that same σ within same HS3. 171 HS3's
 - 2 UN COMTRADE annual data 1994-2003. 73 countries. Value shares and 'prices' (USD per ton)
- Caveat: no intermediate products!? Add CES **production** function. Each good uniquely identified as final/intermediate provided HS3 or finer
- We trim σ 's to 30 (same results with 50). Mohler (2009)

Methodology - caveats

$$\eta_{i,t} = \sum_{jk} \sigma_{jk} \frac{EXP_{i,t,jk}}{\sum_{jk} EXP_{i,t,jk}}$$

- Import 'demand elasticities' weighted to get overall **export elasticity**. Conditions:
 - 1 DS-CES utility (or production) fct
 - 2 *Ceteris paribus*: **competitors' prices** remain unchanged, **small share** of exporting country in import volumes of destination countries
 - 3 Domestic production is not a competing variety
- Caveats (\leftrightarrow literature): Armington definition of variety \Rightarrow
 - 1 varieties not distinguished by intrinsic market power
 - 2 varieties not distinguished by their quality (\leftrightarrow unit values)
 - 3 only (sectoral and geographical) composition effect

Main results - 1



Main results - 2

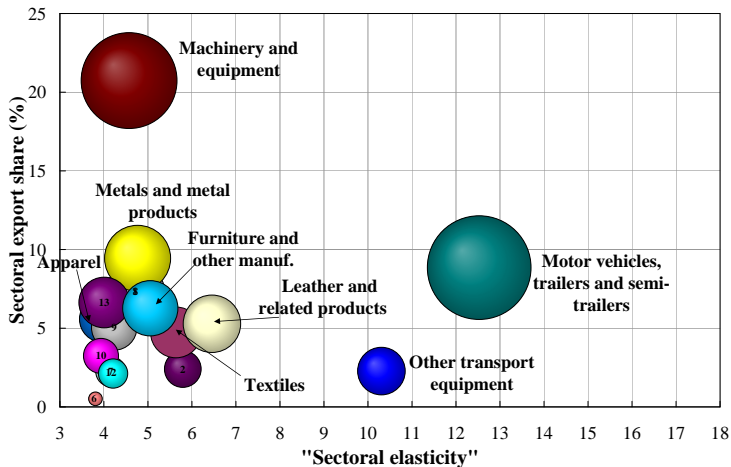
- Italy is the country with the lowest export elasticity (**5.5 on average** in 1994-2008)
- Very slight upward trend for Italy (from 5.3 in 1994 to 5.6 in 2008) - dynamics is only due to the varying composition of exports
- Economic interpretation: price elasticity equal to 5.6 (Italy in 2008) implies a **22% mark-up** over marginal costs
- Consistent with evidence from INVIND (later...)

Sectoral and geographical decomposition

- Contribution of sectors and destination countries to the overall export elasticity
- Time average 1994-2008
- Sectoral elasticities: 171 HS3 products \Rightarrow 17 sectors (sectors in world exports)
- Geographical elasticities: 72 destination countries (no disaggregation by sector)

Sectoral decomposition - 1

Sectoral export shares and elasticities: Italy



Sectoral decomposition - 2

Sectoral export shares

	% share on total exports			
	FRA	GER	ITA	SPA
Agricultural, food, beverages and tobacco	10.8	5.1	7.3	15.4
Textiles	1.9	1.9	4.7	2.4
Wearing apparel	1.8	1.5	5.6	2.1
Leather and related products	1.2	0.6	5.3	2.4
Chemical and pharmaceutical products	12.0	9.3	7.3	8.4
Rubber and plastic products	4.6	4.9	5.0	5.3
Metals and metal products	7.0	8.4	9.4	8.7
Electrical equipment	9.6	11.1	6.6	7.0
Machinery and equipment	14.0	19.7	20.7	9.1
Motor vehicles, trailers and semi-trailers	12.5	21.4	8.8	23.7
Furniture and other manufacturing	2.2	2.5	6.3	2.5
...
TOTAL	100.0	100.0	100.0	100.0

Sectoral decomposition - 3

Sectoral elasticities

	"Sectoral elasticity"			
	FRA	GER	ITA	SPA
Agricultural, food, beverages and tobacco	5.2	5.5	4.7	5.5
Textiles	5.7	6.1	5.6	5.1
Wearing apparel	3.8	3.4	4.0	3.5
Leather and related products	4.4	5.0	6.5	4.6
Chemical and pharmaceutical products	4.1	4.4	4.7	4.6
Rubber and plastic products	4.8	4.4	4.2	4.7
Metals and metal products	4.7	5.1	4.8	4.8
Electrical equipment	4.2	4.2	4.0	4.2
Machinery and equipment	4.0	4.4	4.6	5.1
Motor vehicles, trailers and semi-trailers	15.1	16.2	12.5	14.5
Furniture and other manufacturing	5.4	5.3	5.1	5.3
...
TOTAL	6.5	7.5	5.5	7.4

Sectoral decomposition - 4

Sectoral elasticities, export shares and contributions

	"Sectoral elasticity" (A)				Percentage share on total exports (B)				Percentage contribution to the overall "export elasticity" η_i (A·B / η_i)			
	FRA	GER	ITA	SPA	FRA	GER	ITA	SPA	FRA	GER	ITA	SPA
Agricultural, food, beverages and tobacco products	5.2	5.5	4.7	5.5	10.8	5.1	7.3	15.4	8.6	3.7	6.2	11.4
Minerals and mineral products	5.3	7.9	5.8	6.6	3.1	1.6	2.4	2.9	2.6	1.7	2.5	2.6
Textiles	5.7	6.1	5.6	5.1	1.9	1.9	4.7	2.4	1.6	1.5	4.8	1.6
Wearing apparel	3.8	3.4	4.0	3.5	1.8	1.5	5.6	2.1	1.1	0.7	4.0	1.0
Leather and related products	4.4	5.0	6.5	4.6	1.2	0.6	5.3	2.4	0.8	0.4	6.2	1.5
Wood and of products of wood (except furniture)	3.9	4.3	3.8	4.3	0.6	0.7	0.5	0.8	0.4	0.4	0.4	0.5
Paper and paper products, printing	3.7	4.2	4.2	4.4	2.3	2.8	2.2	2.8	1.3	1.6	1.7	1.7
Chemical and pharmaceutical products	4.1	4.4	4.7	4.6	12.0	9.3	7.3	8.4	7.5	5.4	6.3	5.2
Rubber and plastic products	4.8	4.4	4.2	4.7	4.6	4.9	5.0	5.3	3.4	2.8	3.9	3.4
Non-metallic mineral products	3.5	4.2	3.9	3.4	1.4	1.2	3.2	2.8	0.8	0.7	2.3	1.3
Metals and metal products	4.7	5.1	4.8	4.8	7.0	8.4	9.4	8.7	5.1	5.6	8.1	5.6
Computer, electronic and optical products	4.2	3.7	4.2	3.9	3.0	4.2	2.1	1.0	1.9	2.0	1.6	0.5
Electrical equipment	4.2	4.2	4.0	4.2	9.6	11.1	6.6	7.0	6.2	6.3	4.8	3.9
Machinery and equipment	4.0	4.4	4.6	5.1	14.0	19.7	20.7	9.1	8.7	11.6	17.2	6.3
Motor vehicles, trailers and semi-trailers	15.1	16.2	12.5	14.5	12.5	21.4	8.8	23.7	29.0	46.1	20.1	46.1
Other transport equipment	10.5	18.3	10.3	14.8	12.0	3.2	2.3	2.8	19.3	7.7	4.2	5.6
Furniture and other manufacturing	5.4	5.3	5.1	5.3	2.2	2.5	6.3	2.5	1.8	1.8	5.7	1.8
TOTAL¹	6.5	7.5	5.5	7.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sectoral decomposition - 5

- High elasticities for motor vehicles and other transport equipment
- Technological intensity not clearly correlated with elasticities
- Some of **Italian** specialisation industries show low elasticities
- Consider overall export elasticity net of motor vehicles and other transport equipment (4.7)
 - 1 Above: leather product (6.5), textiles (5.6), furniture (5.1)
 - 2 Middle: machinery (4.6)
 - 3 Below: wearing apparel (4.0) and non-metallic mineral products (tiles...; 3.9)
- Broadly consistent with priors

Sectoral decomposition - 6

Differences in overall export elasticity entirely due to 2 sectors: motor vehicles and other transport equipment (where Italy has the smallest sectoral elasticities and the smallest export shares)

Export elasticity	FRA	GER	ITA	SPA
Total	6.5	7.5	5.5	7.4
Total (with same share in motor vehicles as Italy's)	6.1	6.1	5.5	6.0
Total (no motor vehicles)	5.3	5.2	4.8	5.2
Total (no motor vehicles and other transport equipment)	4.5	4.6	4.7	4.9

Détour on motor vehicles sector

- Blonigen and Soderbery (2009) compare the price elasticity of import demand in the U.S. automobile market. Two different definitions of variety:
 - 1 Trade-based (as in BGW and Broda and Weinstein 2006)
 - 2 Market-based (variety is a specific car model, e.g. Honda Civic, Toyota Corolla, etc.)
- Estimation: very similar - and relatively high - elasticities of substitution
 - 1 With trade-based varieties: **11.4**
 - 2 With market-based varieties: **11.7**

Détour: perceived elasticity (INVIND firms)

Détour on perceived elasticity - 1

- In two waves of INVIND survey (1996 and 2007), firms were asked to report the (perceived) price elasticity of demand for their products
- *Hypothetically, assuming your firm raised its prices by 10% today, what percentage change would there be in turnover in nominal terms [...]?*
- Answers by about 900 firms in each year
- Caveats:
 - 1 Elasticity refers to *total* demand, i.e. the sum of foreign demand (exports) and domestic demand
 - 2 Sample includes only firms with 50 employees or more
 - 3 Misreporting issues (sales increase by more than 10% in few cases)
 - 4 Sectors only available with a different aggregation wrt our analysis

Détour on perceived elasticity - 2

Price elasticity of demand perceived by Italian firms

	1996	2007	Both years
Agricultural, food and beverages	3.7	3.9	3.8
Textiles and wearing apparel	3.9	4.9	4.3
Leather and related products	2.9	2.5	2.6
Wood and of products of wood	5.1	2.9	3.5
Paper and paper products, printing	5.3	7.1	6.4
Chemical and pharmaceuticals	2.9	4.9	4.0
Rubber and plastic products	4.9	4.0	4.2
Non-metallic mineral products	4.8	3.9	4.2
Metals and metal products	5.5	6.2	6.0
Machinery and equipment	4.3	5.0	4.7
Electrical and electronical equip.	4.8	5.0	4.9
Motor vehicles and other transport equipment	6.3	6.8	6.4
Furniture and other manufacturing	3.5	3.6	3.6
TOTAL	4.8	5.2	5.0

End of détour - Back to geographical elasticities

Geographical decomposition - 1

Geographical export shares

	% share on total exports			
	FRA	GER	ITA	SPA
France	---	11.8	14.1	21.6
Germany	18.1	---	17.1	13.6
Italy	10.4	7.9	---	10.0
Spain	10.3	5.0	7.4	---
Netherlands	4.8	7.3	3.0	3.8
United Kingdom	10.7	8.8	7.6	9.4
Portugal	1.8	1.1	1.4	10.4
Sweden	1.6	2.5	1.2	1.1
Austria	1.1	6.2	2.7	1.0
Switzerland	4.3	4.8	4.6	1.4
Turkey	1.4	1.6	2.0	1.6
Poland	1.3	3.3	2.0	1.1
Hungary	0.6	1.8	1.1	0.5
Romania	0.5	0.7	1.6	0.3
USA	10.5	13.7	10.2	5.4
Mexico	0.6	0.9	0.8	1.6
TOTAL¹	78.0	77.4	76.8	82.8

Geographical decomposition - 2

Geographical elasticities

	"Demand elasticity" by destination country			
	FRA	GER	ITA	SPA
France	---	9.4	6.1	7.5
Germany	6.0	---	5.8	7.1
Italy	9.7	10.8	---	12.0
Spain	6.3	5.4	4.4	---
Netherlands	6.2	4.9	4.7	6.8
United Kingdom	5.1	6.5	4.4	7.3
Portugal	6.4	6.5	5.5	6.6
Sweden	8.1	7.1	6.9	7.7
Austria	6.8	5.1	5.1	5.4
Switzerland	9.8	6.1	6.3	7.2
Turkey	6.4	6.9	6.4	7.6
Poland	6.2	6.4	6.5	6.7
Hungary	9.9	9.3	8.6	15.1
Romania	14.1	12.9	14.1	12.2
USA	4.0	11.6	3.8	3.6
Mexico	3.7	3.6	4.9	5.4
TOTAL	6.5	7.5	5.5	7.4

Geographical decomposition - 3

Geographical elasticities, export shares and contributions

	"Demand elasticity" by destination country (A)				Percentage share on total exports (B)				Percentage contribution to the overall "export elasticity" η_i ($A \cdot B / \eta_i$)			
	FRA	GER	ITA	SPA	FRA	GER	ITA	SPA	FRA	GER	ITA	SPA
France	---	9.4	6.1	7.5	---	11.8	14.1	21.6	---	14.8	15.7	21.8
Germany	6.0	---	5.8	7.1	18.1	---	17.1	13.6	16.7	---	18.0	12.9
Italy	9.7	10.8	---	12.0	10.4	7.9	---	10.0	15.6	11.3	---	16.1
Spain	6.3	5.4	4.4	---	10.3	5.0	7.4	---	10.0	3.6	5.9	---
Netherlands	6.2	4.9	4.7	6.8	4.8	7.3	3.0	3.8	4.5	4.7	2.5	3.5
United Kingdom	5.1	6.5	4.4	7.3	10.7	8.8	7.6	9.4	8.4	7.6	6.0	9.2
Portugal	6.4	6.5	5.5	6.6	1.8	1.1	1.4	10.4	1.7	0.9	1.4	9.3
Sweden	8.1	7.1	6.9	7.7	1.6	2.5	1.2	1.1	1.9	2.3	1.5	1.1
Austria	6.8	5.1	5.1	5.4	1.1	6.2	2.7	1.0	1.2	4.2	2.5	0.7
Switzerland	9.8	6.1	6.3	7.2	4.3	4.8	4.6	1.4	6.5	3.9	5.3	1.3
Turkey	6.4	6.9	6.4	7.6	1.4	1.6	2.0	1.6	1.4	1.5	2.3	1.6
Poland	6.2	6.4	6.5	6.7	1.3	3.3	2.0	1.1	1.3	2.8	2.4	1.0
Hungary	9.9	9.3	8.6	15.1	0.6	1.8	1.1	0.5	0.9	2.2	1.7	1.1
Romania	14.1	12.9	14.1	12.2	0.5	0.7	1.6	0.3	1.1	1.3	4.0	0.5
USA	4.0	11.6	3.8	3.6	10.5	13.7	10.2	5.4	6.4	21.0	6.9	2.6
Mexico	3.7	3.6	4.9	5.4	0.6	0.9	0.8	1.6	0.3	0.4	0.7	1.2
TOTAL¹	6.5	7.5	5.5	7.4	78.0	77.4	76.8	82.8	77.9	82.5	76.8	83.9

Geographical decomposition - 4

- Geographical composition of exports more similar than sectoral composition
- Geographical elasticities not strongly correlated with importing country's income per capita
 - 1 High elasticities for Romania, Hungary and Sweden
 - 2 Low elasticities for Mexico, U.S. and U.K.
- **Asymmetric effects** (e.g. German imports affects Italy's $\eta_{i,t}$, but not Germany's $\eta_{i,t}$)
 - 1 Significant for Spain (11% of total elasticity, 0.8 out of 7.4), not for the other countries

Conclusions

- What is the **price elasticity of Italian exports** relative to main euro-area competitors?
- Methodology: **elasticity of substitution** among varieties = **price elasticity** of **import** demand → weighted average: **export elasticity**
- Results: the sectoral and geographical composition of Italian exports **does not expose** them to more price-elastic markets (relatively to other euro-area countries)
 - 1 contrary to part of the literature
 - 2 in fact, Italy has the lowest elasticity if motor vehicles and other transport equipment are not excluded
- Consistency with other sources (price elasticity in the U.S. automobile sector, perceived elasticity in a sample of Italian firms)
- Sectors: high elasticities in motor vehicles and other transport equipment. Low elasticities in some traditional sectors (tiles, wearing apparel) and machinery

Thank you for your attention

Extra slides in case of need

Extra slides in case of need

Methodology - estimating the σ 's - 1

- Utility from consuming imported good j is a CES function of d (taste parameter) and m (imports of variety c of good j)

$$M_{jt} = \left(\sum_{c \in C} d_{jct}^{\frac{1}{\sigma_j}} m_{jct}^{\frac{\sigma_j - 1}{\sigma_j}} \right)^{\frac{\sigma_j}{\sigma_j - 1}}$$

- Demand equation for imports of variety c of good j (in nominal terms):

$$\Delta \ln s_{jct} = \varphi_{jt} - (\sigma_j - 1) \Delta \ln p_{jct} + \epsilon_{jct}$$

- Supply equation. From gravity models, not necessarily flat ($\omega_j > 0$, but constant across supplying countries):

$$\Delta \ln p_{jct} = \psi_{jt} + \frac{\omega_j}{1 + \omega_j} \Delta \ln s_{jct} + \delta_{jct}$$

Methodology - estimating the σ 's - 2

- Demand and supply simultaneous equations (independent error terms).
- Feenstra (1994): use panel dimension of trade data to estimate. Between estimation, no need for IV (or, IVs are origin-country dummy variables).
- Fix importing country and good j . Pick reference country r :

$$(\Delta^r \ln p_{ct})^2 = \theta_1 (\Delta^r \ln s_{ct})^2 + \theta_2 (\Delta^r \ln p_{ct} \Delta^r \ln s_{ct}) + u_{ct}$$

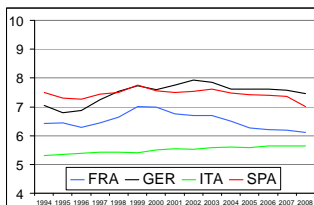
- Feenstra (1994): formulas to get σ from θ_1 and θ_2
- Panel regression: between estimator is consistent (u proportional to $\epsilon\delta$, independent)
- Heteroskedasticity: weigh the data. Measurement error in prices (unit values): can be taken care of by adding an extra term, inversely related to quantities (a constant in Feenstra)
- BGW: If estimated σ_j is not feasible (< 1), GMM using orthogonality condition between error terms (grid-search procedure)

Robustness - 1

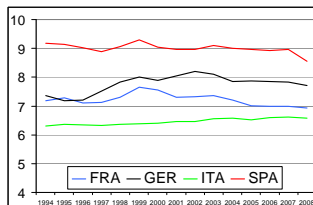
- **Robustness.** Re-estimate some of the 11300 elasticities. Focus on asymmetric effects. Re-estimate **import demand elasticities** for ITA, FRA, GER, SPA (4 countries out of 73). 3 different methods (Eurostat data):
 - 1 BGW on sample 1994-2005 (HS6-HS3)
 - 2 Feenstra's original method, HS6 (pooled)
 - 3 Feenstra's original method, HS3
- Some variability across methods (less dispersion with Feenstra and higher aggregation - HS3)
- **Country ranking is generally consistent:** Italy is always the country with the lowest export elasticity

Export elasticities: 1994-2008

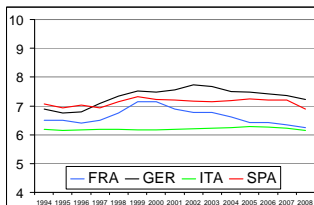
1.A : BGW elasticities



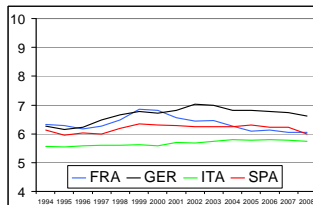
1.B : BGW_9405 elasticities



1.C : Feenstra_HS6 elasticities



1.D : Feenstra_HS3 elasticities



Sectoral decomposition - 2

Sectoral export shares and elasticities: Germany

