Joint European Commission/Portuguese Presidency
Workshop on
“The Internal Market in the 21st century”

Productivity and Firm Selection: Intra versus international trade

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Presentation based on:

“Productivity and Firm Selection: Intra-National and International Trade”

by

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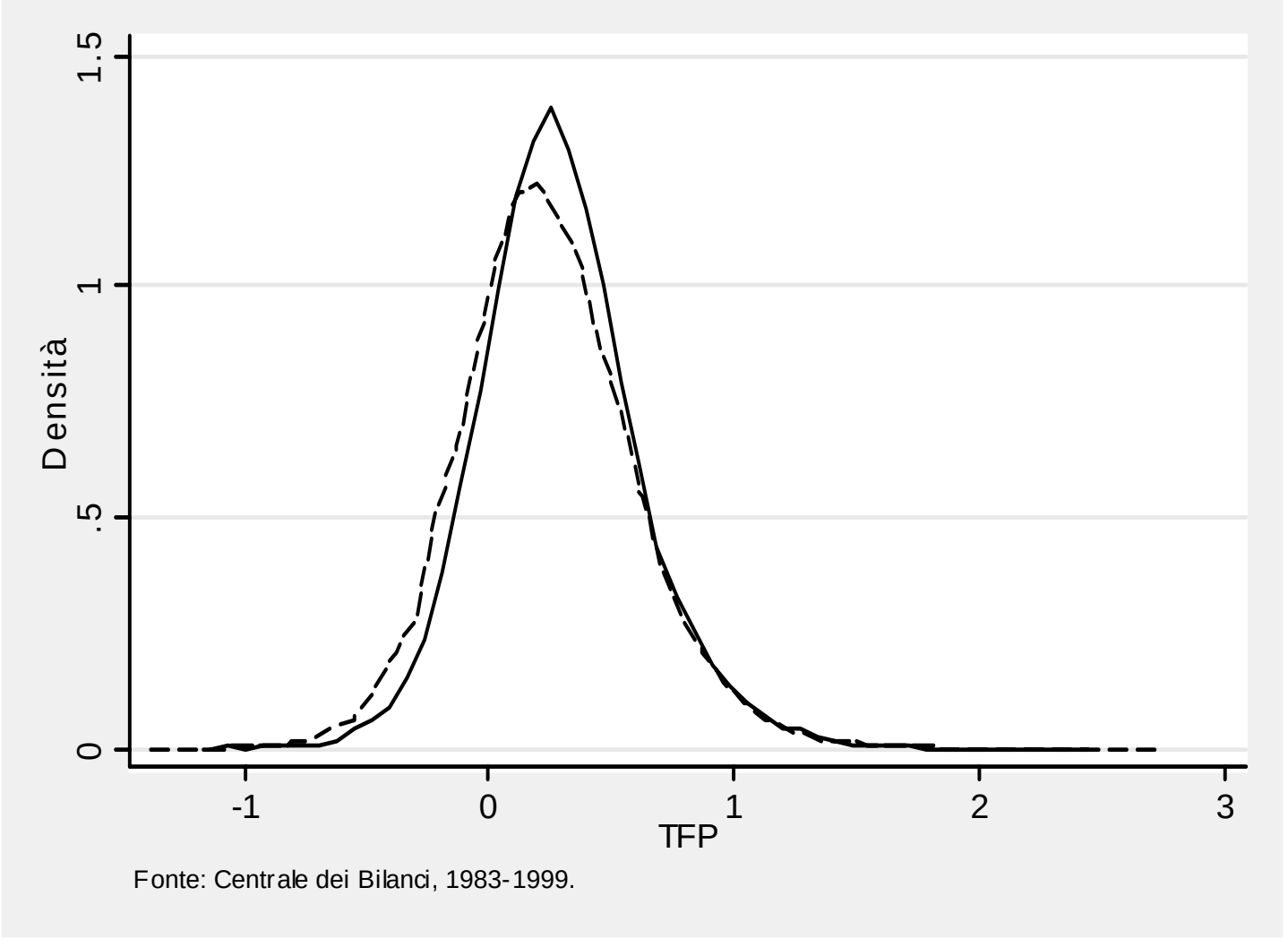
REAL DATA

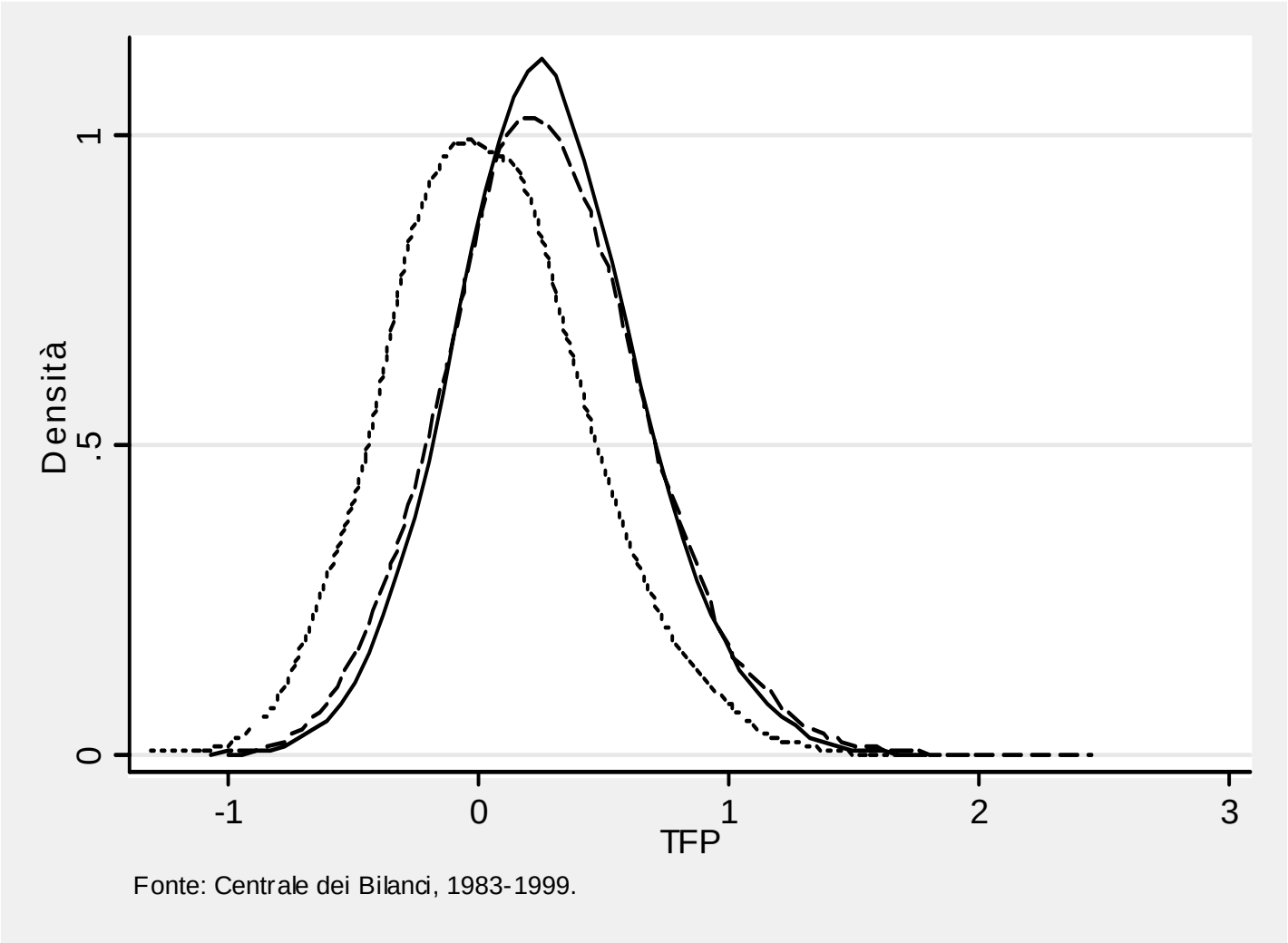


Fonte: Centrale dei Bilanci, 1983-1999.

PRODUCTIVITY AND EXPORT STATUS

(--- NON-EXPORTERS, ___ EXPORTERS)

REAL DATA

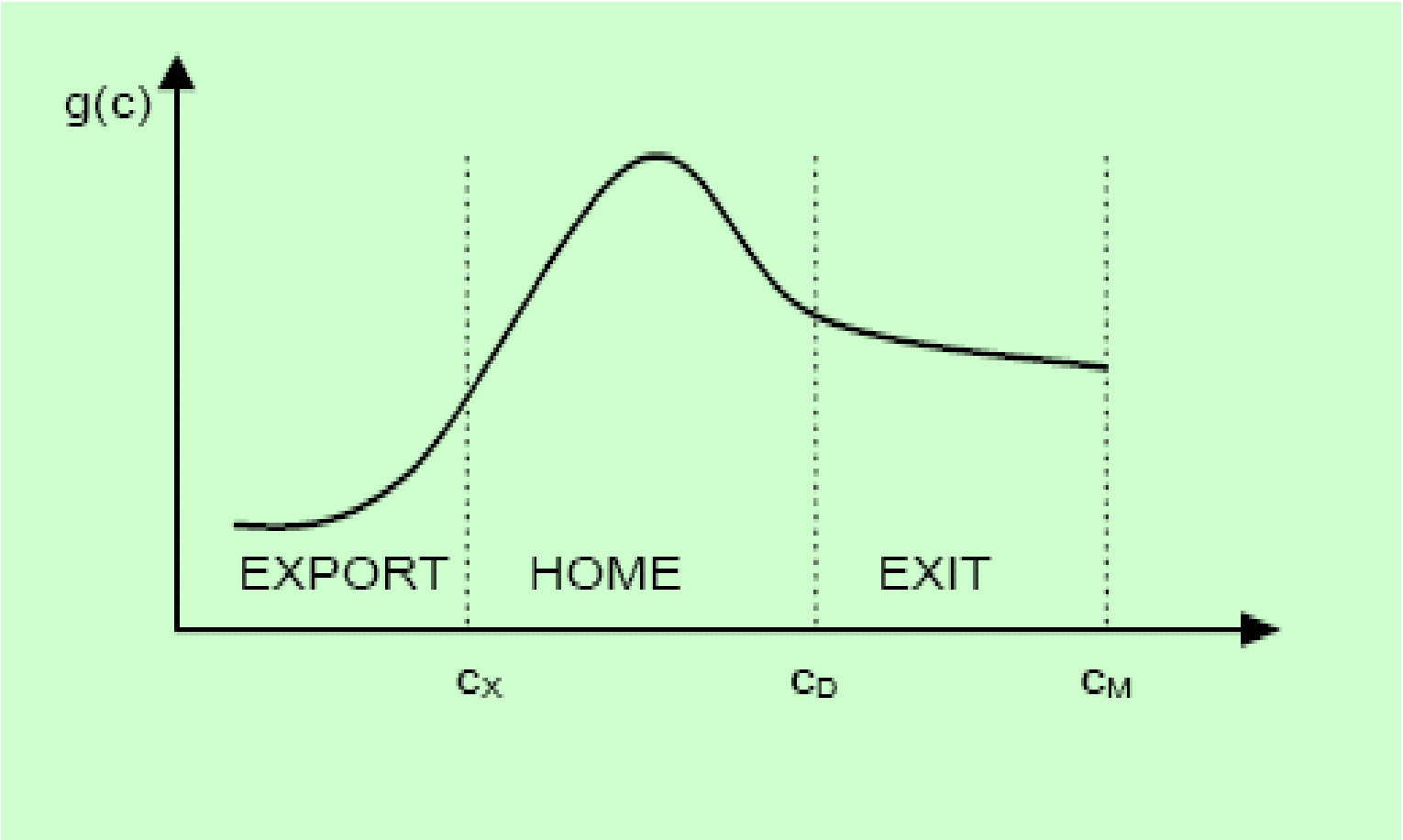


Fonte: Centrale dei Bilanci, 1983-1999.

PRODUCTIVITY AND GEOGRAPHY

(……. SOUTH, ----- CENTRE, _____ NORTH)

THEORETICAL MODEL



COST, SURVIVAL AND EXPORT STATUS

Overview

Objective:
Quantify the productivity gains from inter- and intra-national trade.

What we do in this paper:

- model the effect of trade frictions on productivity distributions
- estimate these frictions using gravity equations
- estimate TFP at the firm level
- simulate a change in trade costs, and infer counterfactual productivity distributions
- perform a number of robustness checks

Taking the case of France, we find that:

- intra-national trade raises TFP by more than intra-European trade
- 'eliminating' border effects further increases TFP by a similar amount
- gains vary substantially across regions

Motivation

Assess the empirical relevance of the gains from trade predicted by heterogenous firm models.

Understand how different inter-regional and inter-national trade are.

Evaluate European market integration 15 years after the Cecchini report on the "costs of non-Europe".

Complement trade and productivity studies that lack coverage of Europe (cf Trefler 2004, Bernard et al. 2003).

Trade Liberalization and Firm Selection

Evidence:

- Self-selection into export activities
  Bernard and Jensen, 1999; Tybout, 2002
- Exit of the least productive firms
  Clerides, Lach and Tybout, 1998; Bernard and Jensen, 1999; Aw, Chung and Roberts, 2000
- Market share reallocation towards the most productive firms
  Pavcnik, 2002; Bernard, Jensen and Schott, 2003

Theory

- Melitz (2003), Bernard et al. (2003), Melitz and Ottaviano (2005).
- Combination of greater import competition and easier market access:
  - ★ losses at home compensated by new profits abroad for some firms only
  - ★ the other exit or restrict themselves to domestic sales
  - ★ reallocation of productive resources towards survivors creates an aggregate productivity gain

Quantifying the Gains from Trade Due to Firm Selection

This paper:

- quantifies productivity gains from intra- and inter-national trade
- evaluates the gains from eliminating 'border effects' in EU trade

Antecedents:

- CGE literature (e.g. Smith and Venables, 1988).
  We introduce endogenous productivity distributions.
- Bernard et al. (2003) simulate the effect of a 5% trade cost reduction on US firm productivity.
  Our model endogenizes the number of firms. We exploit comparable firm-level data on 11 European countries. We have sunk entry costs.
- Del Gatto et al. (2006) calibrate the Melitz-Ottaviano model to estimate the gains from international trade.
  We extend their analysis to the gains from intra-national trade and 'behind-the-border' trade barriers.

The Model

Based on Melitz and Ottaviano (2005):

- similar to Melitz (2003) but with non-CES (linear) demand
- distinctive features:
  - ⋆ more productive firms set higher markups
  - ⋆ larger markets exhibit larger firms with lower markups and lower prices, and less dispersion overall
  - ⋆ supportive evidence: Hopenhayn and Campbell (2002), Syverson (2004ab) for the retail, cement, construction industries in the US

Here:

- We generalize the model to many sectors and allow for different sunk entry costs.
- We calibrate the model to give magnitudes.

The model maps trade costs into ex-post productivity distributions.

From Theory to the Data: Methodology

We apply our framework to 31 economies: 10 EU countries and 21 French regions. We focus on the year 2000.

STEP 1: estimate the sectoral freeness of trade matrix P_s running a gravity regression with trade and geographical data.

STEP 2: estimate productivity distributions (shape parameters k_s and cutoffs c_s^{II}) using firm-level data.

STEP 3: (Calibration) solve for the absolute advantage and entry costs parameters (ψ_s^I / f_s^I) in (1), up to a sector-specific constant (due to the unobservable γ_s).

STEP 4: recompute c_s^{II} for counterfactual trade freeness matrices P_s:

- "**Costs of non-Europe**": no international (EU) trade
- "**Costs of non-France**": no intra-national (France) trade
- "**United Europe**": no border effects between EU countries.

Data

Gravity. CEPII, 2000. Data are used to recover trade freeness ρ_s^{lh}:

- international trade data at the 3-digits ISIC rev 2 disaggregation
- common language indicator
- distances: calculated at the NUTS3 level using a GIS software based on the formulas provided by Head and Mayer (2002).

TFP. Firm-level data for the year 2000:

- 11 EU countries: Amadeus (Bureau Van Dijk) + MIP (ZEW) $\Longrightarrow$ 22,820 firms classified in 18 manufacturing sectors, used to recover k_s and national cut-offs (c_s^{ll})
- 21 French regions: EAE (SESSI & SCEES) $\Longrightarrow$ 23,203 French firms, used to recover French regional cut-offs (c_s^{ll})

Population. New Cronos, EUROSTAT, 2000

STEP 1: Gravity

We run a gravity regression using *international* trade data.

We use the distance elasticity to compute *intra*-national trade costs.

Rewriting (2) in logs yields:

$$\ln(EXP_s^{lh}) = EX_s^l + IM_s^h + \delta_s \ln(d^{lh}) + \beta^h \, Border^{lh} + \lambda \, Lang^{lh} Border^{lh} + \epsilon_s^{lh} \tag{3}$$

- $Border^{lh}$: border dummy (equals one if l and h belong to $\neq$ countries).
- $Lang^{lh}$: common language dummy.
- $d^{lh} = \left(\sum_{p \in l} \sum_{r \in h} (pop^p / pop^l)(pop^r / pop^h) \, (d^{pr})^\theta \right)^{1/\theta}$ where pop^p (pop^r) is the population of agglomeration p (r) belonging to country l (h). $\theta = 1$ gives the arithmetic mean, $\theta = -1$ the harmonic mean.
- We use data on trade flows for 1999, 2000, and 2001.

Table: Distance elasticities of trade flows by sector

Industry	δ_s
Food beverages and tobacco	-1.8739
Textiles	-1.1218
Wearing apparel except footwear	-1.4483
Leather products and footwear	-1.1913
Wood products except furniture	-2.1968
Paper products	-1.5381
Printing and Publishing	-2.6793
Chemicals	-1.5035
Rubber and plastic	-1.7645
Other non-metallic mineral products	-1.8935
Metallic products	-1.5784
Fabricated metal products	-1.8642
Machinery except electrical	-1.6296
Electric machinery	-1.2096
Professional and scientific equipment	-1.6514
Transport equipment	-1.6065
Other manufacturing	-1.8721
Average	**-1.6837**

STEP 2: TFP estimation

Simple OLS regression for firm i :

$$\ln(VA_i) = const + a\ln(CAP_i) + b\ln(EMPL_i) + \varepsilon_i$$

- VA_i is value added
- CAP_i is capital (fixed assets)
- $EMPL_i$ is the number of employees

Productivity of firm i:

$$\hat{Prod}_{i,OLS} = \exp(\hat{const} + \hat{\varepsilon}_i)$$

Country averages of OLS productivities are highly correlated to GDP ($Corr = 0.61$, or 0.88 without Germany).
The same applies to French regions ($Corr = 0.87$).

STEP 2: Recovering the Pareto parameters

Use $\hat{Prod}_{i,OLS}$ to recover k_s and the cutoff costs c_s^{hh}

Properties of the Pareto distribution:
if X is distributed Pareto with shape parameter k_s and one runs:

$$\ln(1 - F(X)) = a + b \ln(X)$$

where $F(X)$ is the observed cumulative distribution of X, then the OLS estimator $-\hat{b}$ is a consistent estimator of k_s *and the associated* R^2 *is close to one.*. The the cutoff c_s^{hh} is then just a simple scaling (once you know k_s) of the mean.

Table: Sectoral k_s and the R^2 from the regression method

Industry	k_s	R^2
Food beverages and tobacco	2.004	0.898
Textiles	2.248	0.872
Wearing apparel except footwear	1.804	0.904
Leather products and footwear	2.345	0.893
Wood products except furniture	2.454	0.871
Paper products	1.966	0.827
Printing and Publishing	1.988	0.898
Chemicals	1.811	0.848
Rubber and plastic	2.372	0.868
Other non-metallic mineral products	2.156	0.826
Metallic products	2.206	0.848
Fabricated metal products	2.450	0.875
Machinery except electrical	2.346	0.898
Electric machinery	1.930	0.881
Professional and scientific equipment	1.844	0.856
Transport equipment	2.062	0.861
Other manufacturing	2.128	0.900
Average	**2.124**	0.872

STEP 3: Competitiveness (Absolute Advantage and Entry Costs)

Taking the log of (1) yields:

$$\ln(c_s^{hh}) = \ln(a_s) + \frac{1}{k_s + 2} \left[\ln(b_{sh}) + \ln\left(\frac{\sum_{l=1}^{M} |C_s^{lh}|}{|P_s|} \frac{1}{(\psi_s^l / f_s^l)} \right) \right] \quad (4)$$

where $a_s = \gamma_s$ and $b_s = 2(k_s + 1)(k_s + 2)/L^h$

(ψ_s^l / f_s^l), an ex-ante absolute advantages and entry costs are unobservable.

but a_s cancels out when comparing different trade cost scenarios.

(4) generates a non-linear system of 31 equations (10 countries plus 21 French regions). We solve for the 31 (ψ_s^l / f_s^l), setting $a_s = 1$.

STEP 4: Counterfactual scenarios

We simulate productivity changes induced by changes in trade frictions.

We compute c_s^{hh} for several freeness-of-trade matrices P_s:

"**Costs of non-Europe**": no international (EU) trade

"**Costs of non-France**": no intra-national (France) trade

"**United Europe**": no border effects between EU countries (equivalent to a 31% decrease in trade costs).

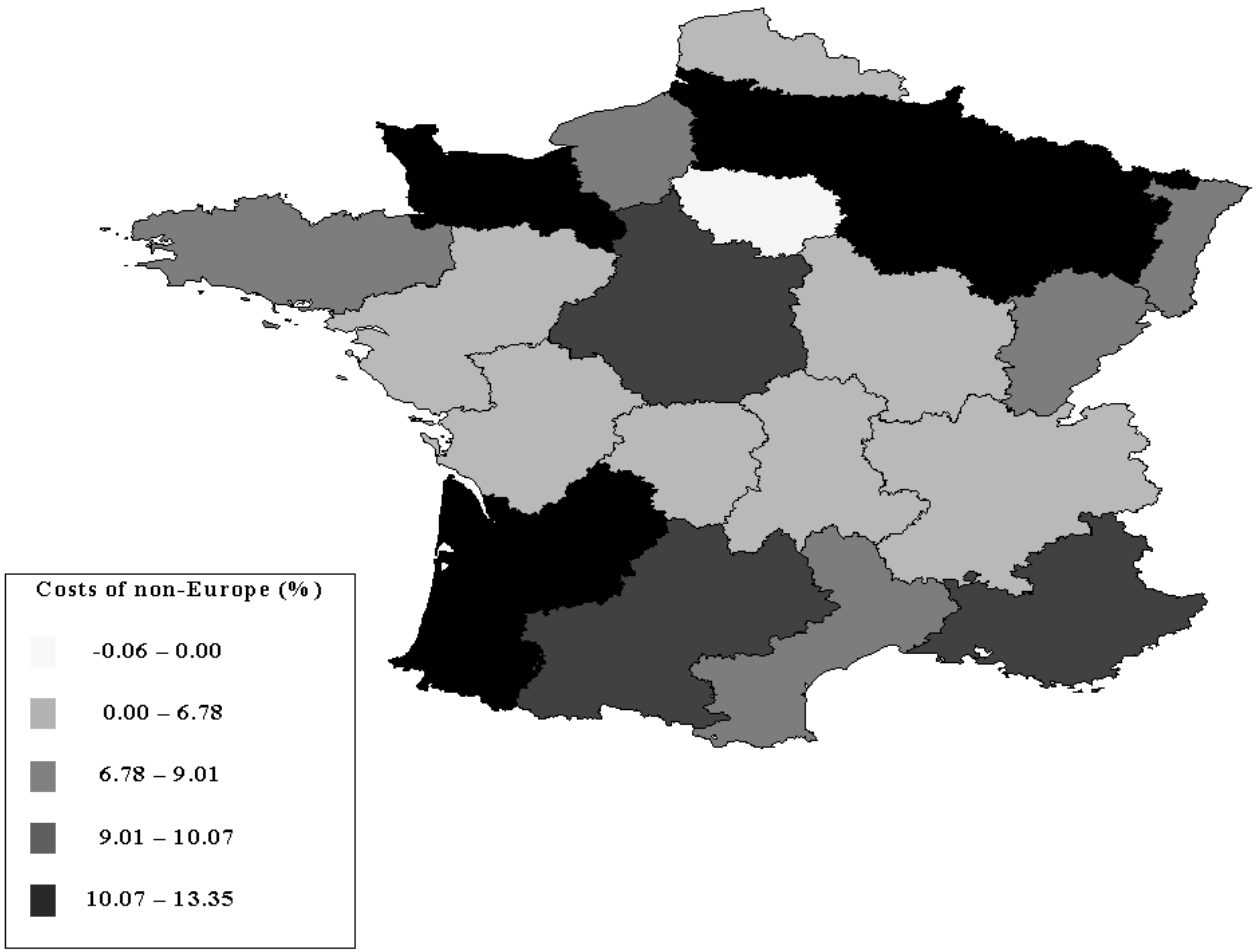
In the model, a fall in intra-national trade costs expands international trade
[Increase in domestic productivity dominates ambiguous effect on number of firms]

STEP 4: "Costs of non-Europe vs Costs of non-France"

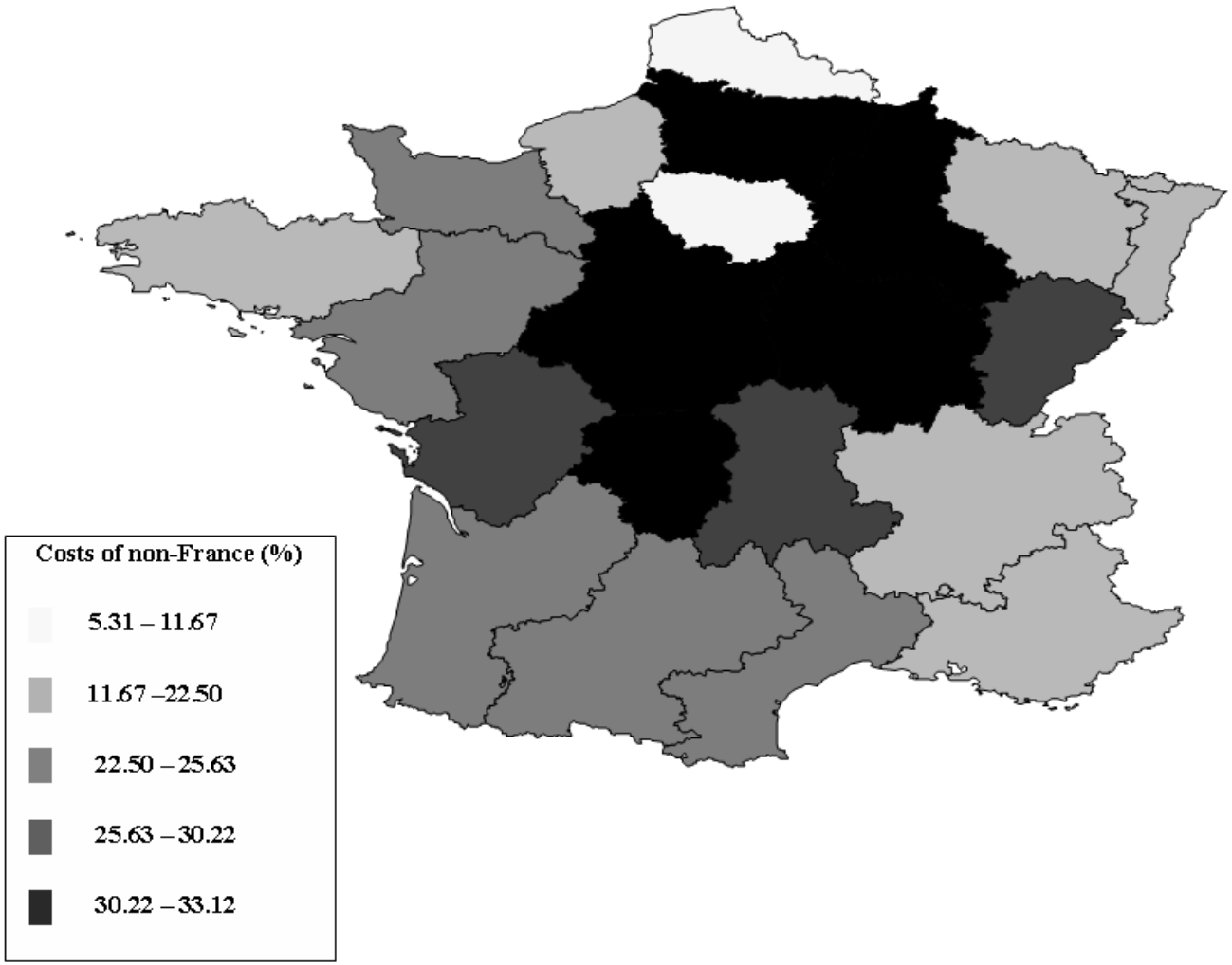
Table: Intra vs. inter-national trade: by region (OLS).

Region name	c_s^{hh} obs.	c_s^{hh} no EU trade	Variation(%) **cost of non-Europe**	c_s^{hh} no FR trade	Variation (%) **cost of non-France**
Ile de France	0.042	0.044	-0.06	0.046	5.31
Champagne-Ardennes	0.052	0.063	13.35	0.081	32.99
Picardie	0.053	0.064	12.42	0.080	31.76
Haute-Normandie	0.051	0.056	8.04	0.067	21.10
Centre	0.053	0.061	10.07	0.079	31.80
Basse-Normandie	0.059	0.067	12.58	0.078	23.77
Bourgogne	0.053	0.056	5.48	0.081	33.12
Nord-Pas de Calais	0.052	0.057	6.78	0.060	11.67
Lorraine	0.052	0.058	11.87	0.067	22.50
Alsace	0.05	0.054	8.84	0.064	21.95
Franche-Comté	0.054	0.058	8.9	0.077	29.87
Pays de la Loire	0.052	0.055	5.61	0.070	25.50
Bretagne	0.053	0.062	8.15	0.069	22.39
Poitou-Charentes	0.055	0.058	5.32	0.079	30.06
Aquitaine	0.051	0.059	13.09	0.069	25.63
Midi-Pyrénées	0.051	0.056	9.31	0.069	24.75
Limousin	0.056	0.06	2.63	0.085	32.34
Rhône-Alpes	0.049	0.051	4.52	0.062	20.17
Auvergne	0.053	0.055	4.34	0.078	30.22
Languedoc-Roussillon	0.053	0.058	9.01	0.070	25.48
PACA	0.047	0.052	9.45	0.059	20.02
Average	0.052	0.057	**8.08**	0.071	**24.88**

Costs of non-Europe



Costs of non-France



STEP 4: "Costs of non-Europe vs Costs of non-France"

Table: Intra vs. inter-national trade: by sector (OLS).

Industry	Cost of non-Europe (%)	Cost of non-France (%)
Food beverages and tobacco	6.63	23.82
Textiles	15.93	28.71
Wearing apparel except footwear	15.07	33.02
Leather products and footwear	22.68	27.03
Wood products except furniture	5.45	17.54
Paper products	8.86	29.45
Printing and Publishing	2.31	13.01
Chemicals	6.92	30.84
Rubber and plastic	3.06	20.32
Other non-metallic mineral products	8.26	22.51
Metallic products	7.16	28.19
Fabricated metal products	2.63	17.06
Machinery except electrical	5.03	20.66
Electric machinery	5.2	32.44
Professional and scientific equipment	9.04	27.89
Transport equipment	9.93	27.78
Other manufacturing	7.92	22.63
Average	8.08	24.88

Costs of non-Europe and non-France: Summary

On average, French regions benefit more from **intra**-national trade:

- 8.8% productivity loss from losing trade with European countries. This maps into an increase in prices and markups by 10.31% and a decrease of average profits (quantities) of 13.64% (14.63%)
- 24.88% productivity loss from losing trade with other French regions. This maps into an increase in prices and markups by 36.03% and a decrease of average profits (quantities) of 43.94% (56.24%)

Yet export and intranational trade shares of output are roughly equal (22% and 22.5%).

Substantial heterogeneity

- across regions: geography (moderate), competitiveness (very important)
- across sectors: gains strongly correlated with distance-elasticities. $Corr = 0.59$ for non-Europe and $Corr = 0.83$ for non-France.

STEP 4: Gains from "United Europe"

Table: Gains from eliminating border effects: OLS estimations.

Region name	Gains from no border effect (%)	Country name	Gains from no border effect (%)
Ile de France	0.06	Belgium	42.30
Champagne-Ardennes	-7.18	Germany	60.18
Picardie	3.52	Denmark	35.98
Haute-Normandie	13.91	Spain	18.37
Centre	9.62	Finland	15.01
Basse-Normandie	23.04	France	8.86
Bourgogne	6.66	Great Britain	3.61
Nord-Pas de Calais	-2.46	Netherlands	9.66
Lorraine	-2.22	Italy	6.37
Alsace	1.83	Portugal	1.17
Franche-Comté	5.37	Sweden	16.28
Pays de la Loire	8.57		
Bretagne	16.32		
Poitou-Charentes	5.12		
Aquitaine	38.23		
Midi-Pyrénées	15.24		
Limousin	2.86		
Rhône-Alpes	6.07		
Auvergne	4.32		
Languedoc-Roussillon	17.13		
PACA	19.98		
French average	8.86	European average	19.80

Border Effects and Non-tariff Trade Barriers

Are border effects illusory?

- Hillberry (1999), Head and Mayer (2000): tariffs, NTBs, regulation costs don't explain border effects. Agglomeration patterns?
- Chen (2004) finds the sectoral structure of border effects to be correlated with that of TBTs and product-related information costs.
- Wolf (1999), Combes et al. (2005) suggest border effects exist in intra-national trade.

Legal dissimilarity costs can partly explain these effects:

- 43% of European retailers think their cross-border sales would increase with the harmonization of laws regulating consumer transactions.
- Turrini and van Ypersele (2006) find legal dissimilarity to reduce trade between and within countries (24% for French regions).

We re-run gravity equations with a legal similarity variable and a common jurisdiction-of-appeal dummy.

[To be extended in future work with product market regulation indices...]

Gains from Legal Harmonization

Table: Gains from elimating legal dissimilarity effects: OLS estimations.

Region name	Gains from legal harmonization (%)	Country name	Gains from legal harmonization (%)
Ile de France	0.00	Belgium	3.67
Champagne-Ardennes	2.47	Germany	6.59
Picardie	1.79	Denmark	7.85
Haute-Normandie	1.57	Spain	3.80
Centre	1.94	Finland	2.17
Basse-Normandie	3.18	France	1.88
Bourgogne	0.78	Great Britain	0.43
Nord-Pas de Calais	0.68	Netherlands	2.69
Lorraine	0.69	Italy	0.98
Alsace	0.72	Portugal	2.18
Franche-Comté	6.23	Sweden	2.37
Pays de la Loire	1.00		
Bretagne	5.80		
Poitou-Charentes	1.11		
Aquitaine	3.98		
Midi-Pyrénées	2.95		
Limousin	0.30		
Rhône-Alpes	0.52		
Auvergne	0.62		
Languedoc-Roussillon	1.23		
PACA	1.89		
French average	1.88	European average	3.15

Conclusions

We have calibrated a multi-economy multi-sector model on firm-level data and trade figures for 10 EU countries and 21 French regions.

Intra-national French trade has a more important effect on French productivity than trade with 10 EU partners.

- "Costs of non-Europe": productivity loss (8.08%).
- "Costs of non-France": productivity loss (24.88%).

Substantial gains from eliminating border effects:

- Productivity gain for European countries (19.80%), for France (8.86%). Big changes in prices, markups, profits and quantities.
- Caveat: not all border effects can be attributed to trade frictions.
- Still, 15% of these effects can be eliminated by legal harmonization.

Our results are robust to various alternative measures of TFP and distance-elasticities of trade.