Heterogeneous firms and trade costs: a reading of French access to European agro-food markets

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Abstract— **This article offers a new reading of intra-European trade based on recent developments in new international economics (Melitz, 2003; Chaney, 2008). These models take the heterogeneity of firms into account and offer a micro-economic analysis of the process of selection at work for firms entering markets. An exporting firm has to bear certain specific costs to break into a market, and only sufficiently productive firms are able to do so.**

Using individual data for French agro-food firms and the distribution of their exports across European markets, this article shows that access conditions to the various European markets are not identical for French firms: the Belgian market would seem to be a natural extension of the French market, whereas the markets of small, distant countries (Austria, Finland or Sweden) are the least accessible. Econometric analysis based on analysis both of the firm selection process and of the value of their exports shows that the standard geographical variables (distance, country size) affecting the single European market still play a major role in the choice of export markets. Results also reveal that there are still remaining trade costs at entry to the different European markets; but these trade frictions don't matter to all firms in the same way. The higher the firm experience, the lower the impact of trade costs.

Keywords— **firm heterogeneity, trade costs, European Integration.**

I. Introduction

The aim of the implementation of the Single European Market in 1993 was the free, unimpeded circulation of goods between European countries. This implementation was based on the abolition of all technical barriers to trade, implying harmonisation of food regulations.

Beyond the positive impact of this harmonisation as highlighted by Henry de Frahan and Vancauteren [1] or Chevassus-Lozza et al [2], Head and Mayer [3] showed that trade barriers, in 2000, still exist between European (EU) countries, resulting in the persistence of a certain level of market fragmentation. Is this fragmentation still a reality for French agro-food exporters? Do French firms enjoy the same access conditions to all European countries? And if differences do exist, are these due to structural trade conditions (market size, linguistic barriers and distance) or do they arise from trade costs which would suggest that the European market is still fragmented?

There is an abundant literature dealing with trade costs and their components. Anderson and Van Wincoop [4] define the latter as all costs incurred in getting a good to a final consumer other than the production of the good itself. They correspond to a variety of costs ranging from trade related policies (tariffs, non tariff measures such as standards, exchange rates...), to transport and logistics, information and marketing and also cultural barriers. Numerous empirical papers, often based on a gravity equation, attempt to assess, at a macro or sectoral level, the impact of these trade costs on bilateral trade between countries. Most of them focus on specific trade barriers; but some others, using the now well known "Border Effect" methodology ([5] or [6]) attempt to capture a global image of all impediments to trade related to the existence of the national borders.

Even though these studies give a useful measure of these trade impediments, they are based on the hypothesis of a representative firm, and do not explain how these trade costs affect the exchange flows.

At a micro-level, the growing empirical and theoretical literature gives an insight on this issue. Several empirical studies ([7], [8]) have first shown that only more productive firms export. Melitz [9] provided a general equilibrium model showing that firms self-select into export markets. Chaney [10] goes further and analyses the access conditions to different export markets. A market with high entry barriers will be very selective, and only the best performing firms will be able to break into it by selling greater quantities of their product (intensive margins). Inversely, a more open market will be accessible to a larger number of less productive firms exporting smaller quantities (extensive margins). However, whatever the level of observation, trade costs are unobserved.

Referring to Chaney's model, the aim of this article is to assess, from individual firm data, a global image of the trade impediments occurring at entry to the different European markets. Our objective is to analyse the access French firms have on the EU markets. We assume that the heterogeneity of entry costs between markets is revealed by the firms characteristics exporting to these markets.

Moreover, numerous studies ([11], [12]) have pointed out the key role of experience in the firm decision. Using a survey on UK firms, Kneller and Pisu [13] (2007) identify what are the most common barriers to export firms report to face. They show that export experience may change significantly the barriers to exporting perceived by firms. Following this statement, we evaluate in this paper to what extent trade barriers at entry of European markets matter to all firms in the same way.

The remainder of the paper is structured as follows: section 2 presents the contributions of recent models in new international economics, particularly the model of Chaney [10]. This model leads onto an empirical section focusing on the number of firms exporting to a destination market. By this analysis an interpretation of the accessibility of EU markets is put forward. Finally, two sets of econometric estimations are proposed : the first one estimates the value of firms' exports, taking into account the selection at work at entry to different EU markets. The aim is to test the extent to which EU market access heterogeneity is only due to market geography, or instead attributable to other specific costs for each importer, thus potentially revealing that the EU market integration is incomplete. The second one takes into account the export experience of the firms.

II. TRADE COSTS AND FIRM HETEROGENEITY : CHANEY'S MODEL

A. The main hypotheses

The consumer utility of disposing of a set Ωh of products h (determined in equilibrium) and of consuming q_o units of good O (single homogeneous good) and q_h (ω) units of variety ω of sector h (H+1 sectors with H sectors producing a continuum of differentiated goods) may be expressed:

$$U \equiv q_o^{\mu_o} \prod_{h=1}^{H} \left(\int_{\Omega_h} \left(q_{h(\omega)} \right)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma-1}{\sigma}\mu}$$

with σ the elasticity of substitution between the two varieties of good h and μ is the preference coefficient of the subjacent Cobb-Douglas function, between the homogenous good and the differentiated goods h.

All countries have access to the same technology. Countries differ by size (L_n) and productivity (w_n). To deliver products to country j, firms from country i face various trade barriers generating fixed or variable costs.

Fixed costs (f_{ij}) may be all the costs due to product compliance (label, packaging…) but also induced by the new distribution networks to invest, the marketing/advertising strategy…Variable costs (τ_{ij}) depend on the exchanged quantity of product and are included in the model as iceberg-type costs.

Firms work using technology with increasing returns to scale due to the fixed costs. Each firm has a labour productivity φ. The cost of producing and of selling q_{ij} units of good to market j for a firm with productivity φ is:

$$c_{ij}(\varphi) = \frac{w_i \tau_{ij}}{\varphi} q_{ij} + f_{ij} \qquad (1)$$

The random variable Φ which represents firm productivity φ follows a Pareto distribution on [1,+∞[with distribution function written as:

$P(\Phi < \varphi) = 1 - \varphi^{-\gamma}$ where γ is inverse to heterogeneity measure.

Given that demand is isoelastic, the optimal price fixed by a firm with productivity φ in country j is a constant mark-up over the unit cost:

$$p_{ij}(\varphi) = \frac{\sigma}{\sigma - 1} \frac{w_i \tau_{ij}}{\varphi} \qquad (2)$$

Thus, given (1) and (2), the export value from i to j, by a firm of productivity φ is :

$$x_{ij} = p_{ij}(\varphi) \times q_{ij}(\varphi) = \mu Y_j \left(\frac{p_{ij}(\varphi)}{P_j} \right)^{1-\sigma} \qquad (3)$$

B. *Definition of the firm's self-select export process*

- <u>The productivity threshold</u>.

The firms able to export to j are those which are able to bear the market entry costs. A firm will export only if profit exceeds 0. The productivity threshold ($\overline{\varphi}_{ij}$) is therefore defined for nil profit condition.

Thus given (1), (2) and (3), $\overline{\varphi}_{ij}$ is :

$$\overline{\varphi}_{ij} = \lambda_1 \left(\frac{f_{ij}}{Y_j} \right)^{\frac{1}{\sigma-1}} \frac{w_{ij} \tau_{ij}}{P_j}$$ with λ_1 being a constant.

Chaney shows that the price index Pj depends upon the characteristics of the importing country and is a function of the distribution law for firms entering this market. Hence, he obtains the following expression of the productivity threshold.

$$\overline{\varphi}_{ij} = \lambda_2 \left(\frac{Y}{Y_j} \right)^{\frac{1}{\gamma}} \left(\frac{w_i \tau_{ij}}{\theta_j} \right) f_{ij}^{1/\sigma - 1} \quad (4)$$

where Y is the world revenue and $\theta_j^{-\gamma}$ is a variant of the trade remoteness of Anderson and van Wincoop [4].

$\theta_j^{-\gamma} = \sum_{k=1}^{N} (Y_k / Y)(w_k \tau_{kj})^{-\gamma} f_{kj}^{-(\frac{\gamma}{\sigma-1}-1)}$ where k represent all the potential trading partners of j

- The value of exports.

Thus, the export value depends upon the above select process : $x_{ij}(\varphi / \varphi > \overline{\varphi}_{ij}) = \lambda_3 \frac{Y_j}{Y} \left(\frac{\theta_j}{w_i \tau_{ij}} \right)^{\sigma-1} \varphi^{\sigma-1}$ (5)

with λ_3 being a constant.

III. Productivity threshold and access to the different EU markets : some stylised facts.

On the basis of the above equations, what picture emerges of the European market? The problem resides in measuring costs faced by firms entering a market. Nevertheless, it is possible using the selection equation to catch the degree of accessibility of the various European markets for French firms. According to equation (4), the heterogeneous entry costs generate an inverse relationship between the productivity threshold for exporting to this market and the number of exporting firms to a market.

In fact, the number of firms able to break into a market is the set of firms N_{ij} with productivity φ where $\varphi > \overline{\varphi}_{ij}$. Thus, $N_{ij} = N_i P(\Phi > \overline{\varphi}_{ij}) \Leftrightarrow \frac{N_{ij}}{N_i} = (\overline{\varphi}_{ij})^{-\gamma}$ where Ni is the total number of exporting firms of country i.

To validate this relationship, we have used data for individual French firms from two sources:

- The register of French Customs (2004), which identifies, for each exporting firm located in France, the destination of its exports per product, by value and quantity.

- The file of the annual surveys of enterprises (INSEE: 2004), which provides individual information about the firms with more than 20 employees (main activity, location, turnover, number of employees, level of productivity calculated as value added per employee).

Figure 1 validates this inverse relationship between the percentage of firms and the minimum productivity level of firms exporting to a country. Markets with the highest productivity thresholds are those with the smallest number of exporting firms.

There are four groups of countries for French firms:

- Unsurprisingly, Belgium is the most accessible market. 82 % of French exporting agrofood firms export to Belgium and the productivity threshold is the lowest.

- Germany, Spain, Great Britain, the Netherlands and Italy have very similar productivity thresholds

- The two other groups gather the smallest and/or most distant countries including new member states. For the latter exporting firms need to be the most productive in order to access to these markets.

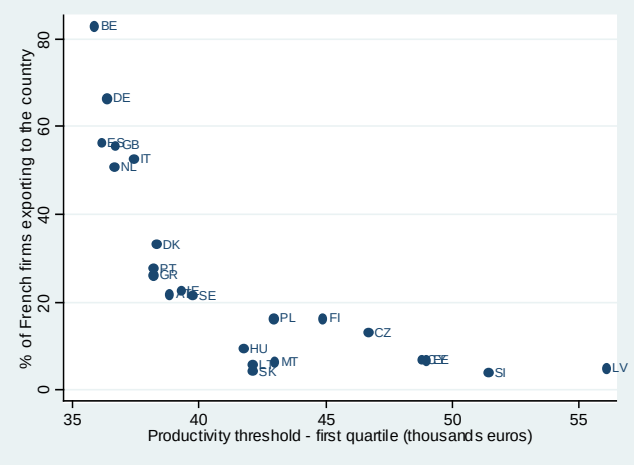

Fig. 1 Number of French firms per EU markets and productivity threshold.

These results give an overview of the differences in European market accessibility for French exporting firms. However, this market hierarchy seems to reflect both the EU geography for French firms and the EU history. Can we conclude then that the EU market is still fragmented?

IV. Econometric results: the global image of trade costs for French exporters.

A. Does only geography matter for French exporters to European markets?

Equations 4 and 5 give the two main steps of the exporting process[1]: first, the decision of the firm *i* to export towards the market *j* and second, the traded volume. In order to take the self-select process into account, we implemented an Heckman procedure defined as follows :

[1]Contrary to other authors ([7], [14],[15]) who analyse the decisions of firms to export or not, we have taken this decision as exogenous. We only analyse the trade pattern of exporting firms.

$\ln\left[x_{ij}^h\left(\varphi_i/\overline{\varphi}_j^h\right)\right]$ *[regression of the exported value]*

for $\varphi_i > \overline{\varphi}_j^h \Leftrightarrow \ln\varphi_i - \ln\overline{\varphi}_j^h > 0$ *[selected equation]*

Explicative variables come from the structural equations 4 and 5.

Y_j^h/Y^h is the share of *j* in total EU imports of sub-sector *h* (Comext database). φ_i is the firm productivity calculated using the INSEE-EAE database as the ratio value added / number of employees of the firm. τ_{ij} and f_{ij} catch the variable and fixed costs. Except transport costs which are approximated by the distance, trade costs are in fact unobserved. Distance d_{ij} is calculated from the place of the firm's head office to the capital of country j. The location of the firm is extracted from the annual survey of firms (INSEE) and the distances have been downloaded from the Michelin database. To catch the global image of all other trade costs at entry of market j, importing country fixed effects are including in our estimation. θ_j, the trade remoteness is approximated by $\theta_j = \sum_{k=1}^{N}\left(Y_k^h/Y_h\right)\left(1/d_{kj}\right)$, where Y_k^h are the total exports of country *k*, and Y^h are the world exports of sub sector *h* (COMTRADE). d_{kj} is the distance between the capitals of the two countries *k* and *j* given by the CEPII. Finally, 9 sub-sector fixed effects are introduced to take sectoral specificities into account.

This estimation aims at testing the significance of the importing country dummies coefficients in the two steps (value and select equation). In the event that these two sets of coefficients vary greatly from zero, and vary amongst themselves, a heterogeneity of costs on entry to European markets can be concluded, once geographical factors have been accounted for.

The econometric results (Table 1) show the expected effects of firm productivity, importing country size and distance. Thus, the greater the firm's productivity, the greater its exporting probability and the higher the value exported. Equally, the larger the importing country, the greater the probability that French firms export there and the higher the value of their sales. Distance has a significant impact both on the firm's decision to export to a given market and on its exported volume. θ_j has either a non significant impact in the volume equation or a significant negative impact in the probit equation.

Furthermore, the results show that importing country fixed effects, independent of size and distance, differ widely within the European market. This seems to indicate that specificities linked to each European country continue to exist, despite the implementation of the Single Market.

The coefficients for these country fixed effects follow the market hierarchy observed in Figure 1. Thus, once country size and distance from France is taken into account, French exporters appear to experience the most difficulty in accessing the New Member States Market and especially Slovak Republic and Slovenia.

Table 1: Econometric results for all French exporting firms towards EU27 – year 2004

	Value eq	Select eq.
ln(firm productivity)	0.999 ***	0.224***
$\ln(Y_j^h/Y^h)$	0.203***	0.111***
ln(distance)	-0.582***	-0.218***
ln(θj)	-0.056^{NS}	-0.085***
Country fixed effects : Reference Belgium		
The Netherlands	-0.840***	-0.955***
Germany	-0.335***	-0.573***
Italy	0.145^{NS}	-0.610***
United Kingdom	-0.332**	-0.848***
Ireland	-1.564***	-1.336***
Denmark	-0.885***	-1.092***
Greece	-0.460^{NS}	-0.945***
Portugal	-0.591***	-0.974***
Spain	-0.070^{NS}	-0.438***
Sweeden	-1.096***	-1.278***
Finland	-1.089***	-1.327***
Austria	-1.570***	-1.430***
Malta	-2.026***	-1.820***
Estonia	-1.758***	-1.829***
Latvia	-1.956***	-2.019***
Lithuania	-2.378***	-1.866***
Poland	-1.502***	-1.483***
Czech Republic	-2.157***	-1.766***
Slovak Republic	-2.071***	-2.241***
Hungary	-1.774***	-1.721***
Slovenia	-2.850***	-2.237***
Cyprus	-1.806***	-1.718***
Sub sector fixed effects : yes		
Log likelihood = -54285.98		Prob > chi2 = 0.0000
Number of obs = 62100		
Censored obs = 49437		
Uncensored obs = 12663		

*** signi. at 1% level; ** signi. at 5 % level; NS non signi

Their probability of exporting to one of these markets is greatly inferior to that of exporting to other markets. Can such differences be explained by French firms' lack of knowledge of these markets, by specific market requirements, by language barriers...which result in higher entry costs?

Inversely, Belgium is the most accessible market for French exporters. However, the country fixed effect on the exported value is not significantly different in comparison with Italy, Spain or Greece.

These results seem to suggest that differing market structure characteristics exist amongst EU members in 2004, in addition to geographic proximity and the size of these commercial partners.

B. Does the export experience decrease the impact of trade barriers?

According to Kneller and Pisu [13], export market experience is likely to contain three main dimensions, the length of time the firm has been exporting, the number of market it serves and the intensity with which it serves those markets. Due to length constraints, we focus here only on the export intensity measured by the share of exports in the total turnover of the firm. As Kneller and Pisu [13], we suggest to distinguish three categories for the export intensity : less than 15%; 15-50%; more than 50%.

In the second set of estimations, in order to assess the differentiated impact of the trade costs according to export experience, we cross the trade costs variables (i.e distance and country fixed effects) with these three categories of export intensity. In Table 2, we report results for distance.[2] It appears that as experience rises the impact of distance falls. Hence, distance has no impact on the export decision for the more export oriented firms. While distance still has a significant impact on the value of export, this impact is significantly lower than for less experienced firms. Concerning the country fixed effects in the selection process, results show that remaining trade costs matter less for the most export oriented firms than for the other firms whatever the destination market.

Table 2: Impact of distance on the export of firms according to their export experience – year 2004

ln(distance of the firm)	Value eq	Select eq.
low export intensity < 15%	-0.588***	-0.133***
medium export intensity16-50%	-0.396***	-0.055***
high export intensity > 50%	-0.283***	-0.023NS

V. Conclusion

The aim of this article was to provide an analysis of French exports to European markets using data for individual French firms (from customs and EAE sources). It sought to ascertain to what extent the European market is fragmented for French exporters. Our analysis shows that access conditions to the various European markets are not identical for French companies. Distance and size of the importing country explain partly these differences : other trade costs remain. These results should support the idea that the EU market is still fragmented for French firms. But these trade frictions don't matter to all firms in the same way. The higher the firm experience, the lower the impact of trade costs.

2. All the other results are available upon request.

REFERENCES

1. Henry de Frahan B, Vancauteren M (2006) Harmonisation of food regulations and trade in the single market: Evidence from disaggregated data. ERAE 33: 337-360.
2. Chevassus-Lozza E, Latouche K, Majkovic D, Unguru M, (2007) How much do tariff and non-tariff measures explain the border effect at entry to the EU market? AAEA Proc, Annual meeting of the American Agricultural Economics Association , Portland, Oregon.
3. Head K, Mayer T (2000) Non-europe: The magnitude and causes of market fragmentation in the EU. Review of World Economics 136: 286-314.
4. Anderson JE, van Wincoop E (2004) Trade costs, Journal of Economic Litererature, 43(3): 961-751.
5. Mac Callum J (1995) National Borders Matter: Canada-U.S. Regional Trade Patterns. The American Economic Review 85(3):615-623.
6. Mayer T, Zignago S (2005) Market Access in Global and Regional Trade. CEPII Working Paper No 2005-02, January
7. Bernard A, Jensen B, Redding S, Schott P (2007) Firms in international trade. Journal of Economic Perspectives 21: 105-130.
8. Eaton J, Kortum S, Kramartz F (2004) Dissecting trade: Firms, industries, and export destinations. American Economic Review. Papers and Proceedings, 94: 150-154
9. Melitz M J (2003) The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71: 1695-1725.
10. Chaney T (2008) Distorted gravity : The intensive and extensive margin of international trade. American Economic Review forthcoming: 19.
11. Roberts MJ, Tybout JR (1997) The decision to export in colombia: An empirical model of entry with sunk costs. American Economic Review 87: 545-564.
12. Bernard A, Eaton J, Jensen JB, Kortum S (2003) Plants and productivity in international trade. American Economic Review, 93:1268-1290.
13. Kneller and Pisu (2007) Export barriers : What are they and who do they matter to? Research paper series, 2007/12, Leverhulme Centre, The University of Nottingham.
14. Greenaway D, Kneller R (2007) Exporting, productivity and agglomeration. European Economic Review In Press, Corrected Proof.
15. Chevassus-Lozza E, Galliano D (2003) Export Spillovers, Firm Organization and Export Behaviour : Evidence from the French Food Industry. Regional Studies 37 : 147-158.

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