

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

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# 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 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. Econometric analyses of the firm selection process and of the value of exports show 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 for 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 :** International economics ; agri-food trade ; firm heterogeneity ; trade costs ; European market

## 1 Introduction

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

Beyond the positive impact of this harmonization as highlighted by Henry de Frahan and Vancauteran (2006) or Chevassus-Lozza et al (2008), Head and Mayer (2000) showed that trade barriers, in 2000, still exist between European countries, resulting in the persistence of a certain level of market fragmentation. Is this fragmentation still a reality for French 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 (2004) define them as all costs incurred in getting a good to a final consumer other than the production of the good itself. They comprise a variety of costs ranging from trade related policies (tariffs, non tariff measures such as standards, exchange rates...), to transport and logistics, to information and marketing but can also include crossborder barriers such as culture and language. Numerous empirical papers, often based on a gravity equation, attempt to assess, at the macro or sector level, the impact of these trade costs on bilateral trade

between countries. More often they focus on specific trade barriers ; but some papers, by using the now well known "Border Effect" methodology (Mac-Callum,1995 ; Mayer and Zignago,2005 ; or Chen, 2004), 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 (Bernard and Jensen, 2007 ; Eaton et al., 2004) have shown that only more productive firms export. Melitz (2003) provided a general equilibrium model showing that firms self-select into export markets. Chaney (2008) goes further and analyses the access conditions to different export markets. A market with high entry barriers will be very exclusive, 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). Hence, when analyzing trade with aggregated data, the same figure may hide two opposite situations : a country may export similar quantities of products to two markets with very different access. For the market with high entry barriers, only a few firms will export ; for the second one with low barriers, a great number of firms will have access. Nevertheless, whatever the level of observation, the full costs of trade are unobserved.

The aim of this study is to assess from individual firm data a global image of the trade impediments occurring at entry to the different European markets by employing the model of Chaney. Taking the anatomy of French agri-food exports as its basis (to use the expression of Eaton, Kortum and Kramartz, 2004), our objective is to analyze the access French firms have in the EU markets. We assume that the heterogeneity of entry costs between markets is revealed by the characteristics of the firms exporting to these markets.

Moreover, numerous studies (Roberts and Tybout, 1997 ; Bernard et al., 2003) have pointed out the key role of experience in the firm decision. For instance, using a survey on UK firms, Kneller and Pisu (2007) identify the most common barriers to export firms reportedly face. They show that these barriers do not matter to all firms in the same way. Export experience may change significantly the perception firms have of barriers to export. In this vein, we evaluate the extent to which trade barriers at entry to European markets impact French agri-food firms.

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 (2008). This model leads to an empirical section focusing on the number of French firms exporting to various EU markets. Based on this analysis an interpretation of the accessibility of EU markets is put forward. Finally, two econometric models are proposed : the first one estimates the value of firms' exports, taking into account the selection mechanism determining entry to different EU markets. The aim is to test whether the access to EU markets can be explained by market geography, or whether it is also attributable to other costs specific 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. The last section concludes.

## **2 Trade costs and firm heterogeneity : Chaney's model (2008)**

Following on from the work by Roberts and Tybout (1997), Bernard, Eaton, Jensen and Kortum (2003), and Melitz (2003), developments in new international economics highlight the entry conditions for firms in export markets from a theoretical point of view. Only the most productive firms are able to bear export-related costs. There is therefore a cost-dependent productivity threshold above which a firm can export.

Chaney (2008) offers a model for bilateral trade between countries which takes this firm heterogeneity into account. Our analysis will be based on this model.

## 2.1 The main hypotheses

Take  $N$  asymmetric countries, each with a population  $L_n$ , producing goods only with the labour factor. There are  $H + 1$  sectors; sector 0 produces a single homogenous good. The  $H$  other sectors produce a continuum of differentiated goods.

The consumer utility of disposing of a set  $\Omega_h$  of products  $h$  (determined in equilibrium) and of consuming  $q_0$  units of good 0 and  $q_h(\omega)$  units of variety  $\omega$  of sector  $h$  may be expressed :

$$U \equiv q_0^{\mu_0} \prod_{h=1}^H \left( \int_{\Omega_h} q_h(\omega)^{\frac{\sigma_h-1}{\sigma_h}} d\omega \right)^{\frac{\sigma_h}{\sigma_h-1} \mu_h} \quad \text{with } \mu_0 + \sum_{h=1}^H \mu_h = 1 \text{ and } \sigma_h > 1 \text{ the elasticity of substitution}$$

between the two varieties of good  $h$  and  $\mu_h$  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 ( $f_{ij}^h$ ) may be all the costs due to product compliance (label, packaging, etc. . .) but also all costs induced by the new distribution networks to invest, the marketing/advertising strategy, etc... Variable costs ( $\tau_{ij}^h$ ) depend on the exchanged quantity of the product and are included in the model as iceberg-type costs.

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

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

The random variable  $\Phi$  which represents firm productivity  $\varphi$  is Pareto distributed on  $[1, +\infty[$  with distribution function written as :

$$P(\Phi < \varphi) = 1 - \varphi^{-\gamma_h}$$

with  $\gamma_h > \sigma_h - 1$ ;  $\gamma_h$  is the shape parameter for Pareto productivity distribution. It is inverse to the

heterogeneity measure for sector  $h$ .

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

$$p_{ij}^h(\varphi) = \frac{\sigma_h}{\sigma_h-1} \times \frac{w_i \tau_{ij}^h}{\varphi} \quad (2)$$

Given firms' optimal prices, consumer demand and their revenue spending  $Y_j$ , exports of sector  $h$  from country  $i$  to  $j$  by a firm of productivity  $\varphi$  are :

$$x_{ij}^h(\varphi) = p_{ij}^h(\varphi) q_{ij}^h(\varphi) = \mu_h Y_j \left( \frac{p_{ij}^h(\varphi)}{P_j^h} \right)^{1-\sigma_h} \quad (3)$$

## 2.2 Definition of the firm's self-selection export process

### 2.2.1 The productivity threshold

The firms able to export to country  $j$  are those which are able to bear the market entry costs. A firm will export only if its profit exceeds 0. The threshold is therefore defined for nil profit.

$$\pi_{ij}^h = (p_{ij}^h(\varphi) - c_{ij}^h(\varphi)) q_{ij}^h(\varphi) - f_{ij}^h$$

Using equation (2) for the optimal price  $p_{ij}^h(\varphi)$  yields the profit expression for a firm exporting from country  $i$  to country  $j$  :

$$\pi_{ij}^h(\varphi) = \frac{\mu_h}{\sigma_h} Y_j \left( \frac{\sigma_h}{\sigma_h - 1} \frac{w_i \tau_{ij}^h}{\varphi} / P_j^h \right)^{1-\sigma} - f_{ij}^h \quad (4)$$

Giving the minimum productivity threshold :  $\bar{\varphi}_{ij}^h$  :

$$\bar{\varphi}_{ij}^h = \lambda_1 \left( \frac{f_{ij}^h}{Y_j} \right)^{\frac{1}{\sigma-1}} \frac{w_i \tau_{ij}^h}{P_j^h} \quad (5)$$

with  $\lambda_1$  being constant.

It is assumed that all trade barriers are sufficiently high :  $\forall i, j, \bar{\varphi}_{ij}^h > 1$ .

Chaney develops this expression by calculating the price index  $P_j$ . He shows that this index depends upon the characteristics of the importing country and is a function of the distribution law for firms entering this market.

$$\text{He thus finds that : } P_j^h = \lambda_2 Y_j^{\frac{1}{\gamma_h} - \frac{1}{\sigma_h - 1}} \theta_j^h \quad (6)$$

$$\text{with } (\theta_j^h)^{-\gamma} \equiv \sum_{k=1}^N (Y_k/Y) \times (w_k \tau_{kj}^h)^{-\gamma} \times (f_{kj}^h)^{-\left(\frac{\gamma_h}{\sigma_h - 1} - 1\right)} \quad (7)$$

and  $\lambda_2$  being constant.  $(\theta_j^h)^{-\gamma}$  is a variant of the remoteness index of Anderson and van Wincoop (2004).

In this way, the productivity threshold to enter in market  $j$  for potential exports is :

$$\bar{\varphi}_{ij}^h = \lambda_4 \left( \frac{Y}{Y_j} \right)^{\frac{1}{\gamma_h}} \left( \frac{w_i \tau_{ij}^h}{\theta_j^h} \right) (f_{ij}^h)^{1/(\sigma_h - 1)} \quad (8)$$

with  $\lambda_4$  being constant

### 2.2.2 The value of exports

Replacing  $p_{ij}^h$  (2) and  $P_j$  (6) with their expression in (3) gives the expression of value exported by a firm of productivity  $\varphi$  to market  $j$  given that it can sell in this market

$$x_{ij}^h(\varphi/\varphi \geq \bar{\varphi}_{ij}^h) = \lambda_3 \left( \frac{Y_j}{Y} \right)^{\frac{\sigma_h - 1}{\gamma_h}} \left( \frac{\theta_j^h}{w_j \tau_{ij}^h} \right)^{\sigma_h - 1} \varphi^{\sigma_h - 1} \quad (9)$$

with  $\lambda_3$  being constant.

This equation (9) depends upon the subjacent selection process operating at market entry. (8) therefore makes it possible to explain nil flows between two countries, something which cannot theoretically be taken into account in traditional gravity models derived, for example, by Anderson and van Wincoop. By shifting to the level of firms, the selection process and the role played by market entry barriers may be better understood.

### 3 Productivity threshold and access to the different EU markets : some stylized facts.

On the basis of the above equations, what picture emerges of the European market ? The problem lies in measuring costs faced by firms entering a market. Nevertheless, it is possible to catch the degree of accessibility of the various European markets for French firms using the selection equation. This section will consider two stylized facts : i) the number of firms per market and the minimum productivity threshold of the firms exporting to a market ; and ii) the number of markets per firm.

To do this, we use data for individual French agri-food 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 (EAE survey - INSEE : 2004), which provides individual information about firms with more than 20 employees (turnover, number of employees, wages, level of productivity calculated as value added per employee, main activity).

#### 3.1 Number of firms per market and ‘productivity threshold’ : confirmation of the inverse relationship

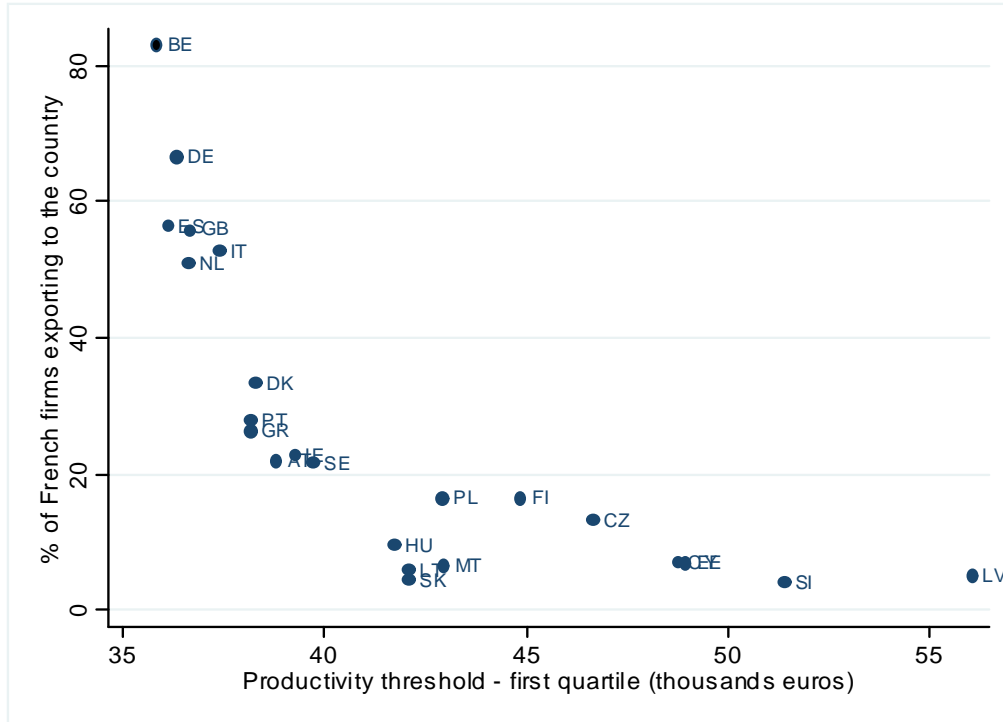
From the above theoretical derivations it follows that the condition for a firm to enter a market depends upon its productivity which must be above a certain level. The number of firms able to break into a market is therefore defined by an inverse relationship to productivity expressed as follows :

$$N_{ij}^h = \text{set of firms with productivity } \varphi \text{ where } \varphi > \bar{\varphi}_{ij}^h$$

$$N_{ij}^h = N_i^h P(\Phi > \bar{\varphi}_{ij}^h) \text{ where } N_i^h \text{ is the total number of exporting firms of country } i \text{ in sector } h.$$

$$\frac{N_{ij}^h}{N_i^h} = (\bar{\varphi}_{ij}^h)^{-\gamma_h}$$

Figure 1 validates this inverse relationship between the percentage of firms and the minimum productivity level of firms exporting to a given market. Here the minimum productivity level has been calculated as the first quartile of the productivity of firms exporting to a given market. This figure gives an overview of the access for French firms to EU markets : from the most accessible market (Belgium) to the less accessible (Latvia or Slovenia). Hence, 82 % of French exporting agrofood firms export to Belgium and the productivity threshold is the lowest. Conversely, firms exporting to the smallest and/or the most distant countries including new member states need to be the most productive to access to these markets. Germany, Spain, Great Britain, the Netherlands and Italy have very similar productivity thresholds but lower than Belgium.



**Figure 1 :** An inverse relation between the number of firms by market and productivity threshold

Source : French Customs (2004) & EAE survey - INSEE : 2004

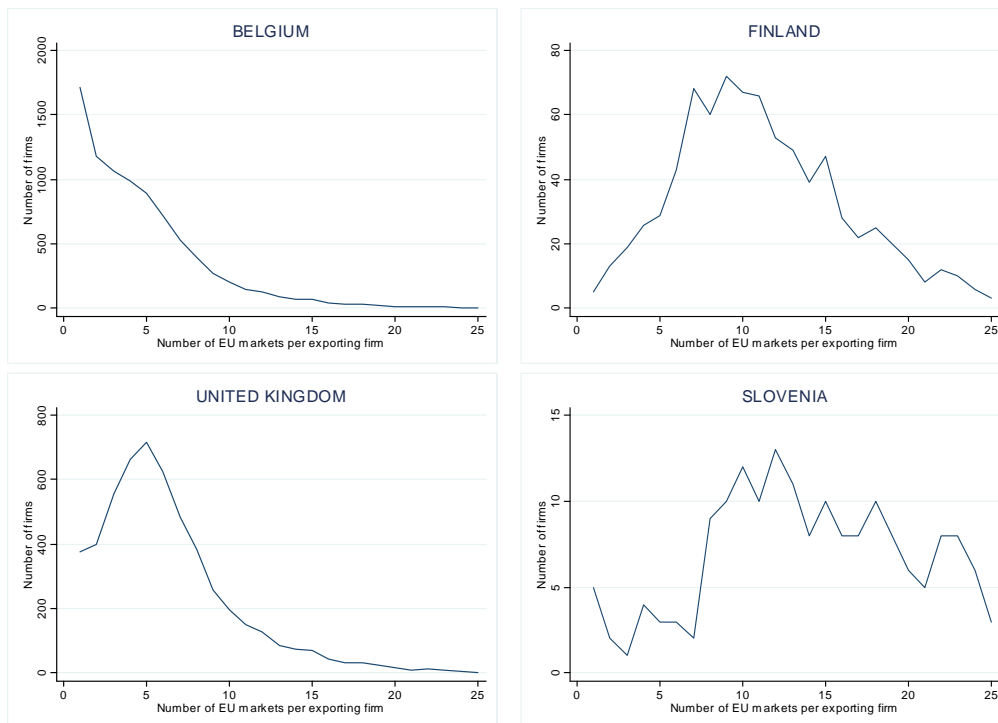
### 3.2 Number of markets per exporting firm

The more productive the firm is, the larger the number of markets it will break into. Further, the greater the degree of similarity in access conditions to certain markets is, the more firms will choose to sell to these markets. It is clear that the export activities of French firms able to sell to the least accessible markets (and thus the most productive firms) are different from those firms with lower productivity levels particularly with regards to choice of export markets.

From this statement, one may assume that the firm distribution per number of markets is different from one importing country to another. Differences are explained by the degree of access of this importing country for the firms. For instance, Figure 2 compares four different EU importing countries chosen from Figure 1 : Belgium which is considered as the most accessible market for French firms, Great-Britain whose access is similar to the access to 4 other EU countries (Germany, Italy, Spain and the Netherlands), Finland a "new" old EU member whose access for French firms is rather limited (high threshold of productivity and few number of firms exporting to this market) and finally, Slovenia a small new member state, close to France but apparently closed to French firms (at least not very accessible).

Thus, concerning the behaviour of firms exporting to Belgium, it appears that most of them only export to this market. Conversely, the great majority of firms exporting to Finland export to ten other EU markets (which are the other "old" EU members) : they can serve a large number of markets as they are highly productive. The British market appears as "an intermediate" market for French firms. As above mentioned, the productivity threshold is similar on this market to that of other 4 EU markets. Consequently, most of French firms exporting to Great Britain export also on 4 other markets. Finally, given these first three results, one could assume that

firms exporting to Slovenia export also to all the 26 markets because they are the most productive of the French firms. This is without taking into account the heterogeneity of entry costs across the EU markets. Still, among the small group of firms exporting to Slovenia, very few (nearly 12%) export to less than 8 markets.



**Figure 2 :** Conditionnal distribution of French firms by number of EU destination markets per exporting countries. Some examples.

Source : French Customs (2004)

To sum up, it would seem that the Belgian market is by far the most accessible, and it may be considered as the natural "extension" of the French market. Nevertheless, many of the French firms exporting to this market don't go elsewhere. Does this mean that entry costs of the other EU markets are too high for a large number of French firms that only export to Belgium? Conversely, we can't conclude that because firms are highly productive they can serve all the EU markets. Heterogeneity of entry costs and structure of demand may explain this result.

Language and geographical or cultural proximity may largely explain the Belgium orientation of French firms. Inversely, the most distant and smallest markets appear to be the least accessible. Does this warrant the conclusion that accessibility is uniquely due to market geography (size, language, distance), or are there other elements which explain these differences?

## 4 Econometric results

### 4.1 Does only geography matter for French exporters to European markets? An assessment of trade costs for French exporters

Equations 8 and 9 give the economic specification of the two main steps of the export process : first, the decision of the firm to export towards the market  $j$  and second, its traded volume. As only data for French firms exporting to European countries in the agri-food sector will be examined, hereafter, the subscript  $i$  will not refer anymore to the exporting country - which is always France in our case - but to the exporting firm of productivity  $\varphi$ .  $h$  corresponds to a French agro-food sub-sector. In order to take the self-selection process into account, we implemented a Heckman procedure defined as follows :

$$\begin{cases} \ln[x_j^h (\varphi_i/\varphi_i \geq \bar{\varphi}_j^h)] & \text{[regression of the exported value]} \\ \text{for } \varphi_i \geq \bar{\varphi}_j^h \iff \log \varphi_i - \log \bar{\varphi}_j^h \geq 0 & \text{[selection equation]} \end{cases}$$

The selection equation (probability to export toward market  $j$ ) follows from the productivity threshold equation. The volume equation is then estimated, taking the selection bias into account.

Coming from the two structural equations 8 and 9, the model to be estimated is then :

$$\begin{cases} \ln [x_{ij}^h (\varphi_i/\varphi_i \geq \bar{\varphi}_j^h)] = \beta_1 \ln \varphi_i + \beta_2 \ln \left( \frac{Y_j^h}{Y^h} \right) + \beta_3 \ln d_{ij} + \beta_4 \ln(\Theta_j^h) + \sum_j \beta_5^j T_j + \sum_k \beta_6^k T_k + \epsilon_{1jh} & \text{[Value equation]}^1 \\ \alpha_1 \ln \varphi_i + \alpha_2 \ln \left( \frac{Y_j^h}{Y^h} \right) + \alpha_3 \ln d_{ij} + \alpha_4 \ln(\Theta_j^h) + \sum_j \alpha_5^j T_j + \sum_h \alpha_6^k T_k + \epsilon_{2ijh} > 0 & \text{[Selection equation]}^2 \end{cases}$$

with  $\epsilon_{1jh} \sim N(0, \sigma)$  and  $\epsilon_{2jh} \sim N(0, 1)$  and  $\rho = \text{corr}(\epsilon_{1ijh}, \epsilon_{2ijh})$ . If  $\rho \neq 0$ , then the use of the Heckman procedure and selection correction is justified.

$\varphi_i$  is the productivity of firm  $i$  calculated using the INSEE firms survey as the ratio value added / number of employees of the firm.

$\frac{Y_j^h}{Y^h}$  is the share of  $j$  in total EU imports of sub-sector  $h$  (Comext database).  $\left( \frac{Y_j^h}{Y^h} = \mu_h \frac{Y_j}{Y} \right)$  where  $\mu_h$  is the consumer preference coefficient for product  $h$ .

$d_{ij}$  the distance from the place of the firm's head office to the capital of country  $j$ . Location of the firm is extracted from the annual survey of firms (INSEE) and distances have been downloaded from the Michelin database.

$\Theta_j^h$  is a proxy of the index  $(\theta_j^h)^{-\gamma}$  given by equation 6.1 :

$$\left( \theta_j^h \right)^{-\gamma} \equiv \underbrace{\sum_{k=1}^N (Y_k^h / Y^h) \times (w_k \tau_{kj}^h)^{-\gamma}}_{[1]} \times \underbrace{(f_{kj}^h)^{-\left(\frac{\gamma}{\sigma_n - 1} - 1\right)}}_{[2]}$$

where  $Y_k^h$  is the total output of country  $k$  for the subsector  $h$ , and  $Y^h$  are the world output of subsector  $h$ . This index reflects the trade resistances of all the potential trading partners  $k \neq \text{France}$ , at entry to market  $j$ , weighted by their share in the world market (Inward Multilateral Trade Resistance of Anderson and Van Wincoop, 2004). By construction, this index is difficult to formulate, because these trade impediments are unknown.

In order to proxy and to simplify  $(\theta_j^h)^{-\gamma}$  we propose to decompose this index in two parts :

– part [2] : we propose to replace  $(f_{kj}^h)$  by the average of the fixed costs at entry of market  $j$ , i.e  $(\bar{f}_j)$ . These average fixed costs will be included in importing country fixed effects  $T_j$ , defined below.

– part [1] :  $\tau_{kj}^h$  is proxied here by  $d_{kj}^{(1-\frac{B_{kj}+L_{kj}+Col_{kj}}{3})}$  where  $d_{kj}$  is the distance between the capitals of the two countries  $k$  and  $j$ ,  $B_{kj} = 1$  if the two countries  $k$  and  $j$  share a common border (0 otherwise),  $L_{kj} = 1$  if the two countries  $k$  and  $j$  share a common language (0 otherwise), and  $Col_{kj} = 1$  if the two countries  $k$  and  $j$  share a common history (0 otherwise). All these variables are given by the CEPII database. This formulation allows to take into account the impact of the common border, language or history in the trade costs. Such a structure for the exponent implies that when one of these three dummies is equal to 1, distance is "forced" to be reduced. Moreover, following Balgati et al (2008) in order to scale all these  $\tau_{kj}^h$  from 0 to 1, we propose to transform  $\tau_{kj}^h$  in the following way :

$$1/\tau_{kj}^h = \left(1/(d_{kj}^{(1-\frac{B_{kj}+L_{kj}+Col_{kj}}{3})})\right) / \sum_k \left(1/(d_{kj}^{(1-\frac{B_{kj}+L_{kj}+Col_{kj}}{3})})\right) = a_{kj}^h .$$

Thus, we calculate  $\Theta_j^h = \sum_{k=1}^N (Y_k^h/Y^h) \times a_{kj}^h$ .

It is worth noting that we made two other simplifications. First we consider  $\gamma = 1$  and second because of lack of data on productivity of the different country  $k$ , we do not include directly the productivity in the index. However, because also of lack of data about the production of all the countries, we have considered in the calculation  $Y_k^h$  as the total exports of country  $k$  for the subsector  $h$ , and  $Y^h$  as the world exports of subsector  $h$ . To a certain extent, the average productivity of country  $k$  is taken into account in its total exports.

Finally, as a result,  $\Theta_j^h$  is a new index catching the potential supply on market  $j$ , which may compete with French exporters. This potential supply is weighted by the trade costs. We expect a negative impact on the firm exports.

$T_j$  are importing country fixed effects, intended to bring together all of the entry costs for  $j$ .

$T_k$  are products fixed effects (measured in the French Classification of Products at 3 digits level) taking into account product specificities and in particular product price differences.

The exported value regression is run in cross section for the year 2004, on the French exporting firms with more than 20 employees (1733 firms) which export to the 24 EU markets; 8 subsectors are included in the estimations (Table 1).

Model 1 : all firms						
Value equation				Sect equation		
	Coef.	Std. Err.	p.val	Coef.	Std. Err.	signif.
ln(productivity)	0,992	0,049	0,000	0,221	0,0119	0,000
ln(size of country)	0,183	0,035	0,000	0,079	0,0108	0,000
ln(distance of the firm)	-0,608	0,079	0,000	-0,241	0,0225	0,000
ln(theta <sub>j</sub> )	-0,102	0,056	0,065	-0,009	0,0147	0,528
Country fixed effects - Reference : Belgium						
The Netherlands	-0,814	0,138	0,000	-0,942	0,037	0,000
Germany	-0,317	0,107	0,003	-0,566	0,037	0,000
Italy	0,108	0,138	0,436	-0,693	0,042	0,000
United Kingdom	-0,319	0,132	0,016	-0,868	0,037	0,000
Ireland	-1,593	0,232	0,000	-1,434	0,046	0,000
Denmark	-0,887	0,196	0,000	-1,154	0,046	0,000
Greece	-0,535	0,238	0,025	-1,066	0,062	0,000
Portugal	-0,657	0,216	0,002	-1,103	0,053	0,000
Spain	-0,137	0,125	0,271	-0,544	0,041	0,000
Sweedden	-1,115	0,232	0,000	-1,352	0,052	0,000
Finland	-1,133	0,277	0,000	-1,442	0,062	0,000
Austria	-1,585	0,235	0,000	-1,501	0,045	0,000
Malta	-2,065	0,385	0,000	-1,969	0,068	0,000
Estonia	-1,779	0,377	0,000	-1,934	0,070	0,000
Latvia	-1,986	0,412	0,000	-2,122	0,071	0,000
Lithuania	-2,413	0,390	0,000	-1,981	0,070	0,000
Poland	-1,512	0,263	0,000	-1,559	0,053	0,000
Czech Republic	-2,149	0,287	0,000	-1,818	0,049	0,000
Slovak Republic	-2,056	0,435	0,000	-2,294	0,065	0,000
Hungary	-1,781	0,324	0,000	-1,810	0,058	0,000
Slovenia	-2,846	0,437	0,000	-2,321	0,065	0,000
Cyprus	-1,833	0,371	0,000	-1,861	0,071	0,000
Sub sector fixed effects - Reference : sea food products						
Meat products	1,896	0,123	15,40	0,205	0,0334	0,000
Processed F&V	0,410	0,159	2,58	0,171	0,0359	0,000
Oil & fats products	-0,557	0,200	-2,79	0,016	0,0495	0,745
Dairy products	2,301	0,149	15,45	0,273	0,0425	0,000
Processed cereals	0,941	0,144	6,52	0,049	0,0384	0,200
Animal prepared feeds	2,758	0,186	14,80	0,468	0,0499	0,000
Other foodstuffs	0,944	0,179	5,28	0,207	0,0351	0,000
Beverages	1,355	0,141	9,62	0,568	0,0347	0,000
Log likelihood = -54245,76						
Number of obs = 61962						
Censored obs = 49299						
Uncensored obs = 12663						
LR test of indep. eqns. (rho = 0): chi2(1) = 12,46 Prob > chi2 = 0,0004						

Table 1 : Estimation results for French firms with more than 20 employees exporting to EU24 - 2004

Econometric results (Table 1) confirm the expected effects of firm productivity, importing country size and distance. Thus, firm productivity and the size of the importing country positively (and significantly) impact the exporting probability and the value of the firm's exports. On the other hand, distance has a significant negative impact both on the firm's decision to export to a given market and on its exported volume. The "Potential Supply" for the importing country ( $\Theta$ ) has the expected impact on the value of exports<sup>3</sup>. The higher the potential supply of the other trading partners of the importing country, the lower the value of exports of the French firms on this market. This variable is not significant on the probit part.

This specification permits testing whether the  $\alpha_5^j$  and  $\beta_5^j$  coefficients are significant. In the event that these two sets of coefficients are significantly different from zero, and differ from each other, the heterogeneity of costs at entry to the European markets is confirmed, once geographical factors have been accounted for. From Table

<sup>3</sup>Following Aiken and West (1996), the variable  $\Theta_j$  was mean-centred to eliminate the colinearity with the distance variable.

1, it appears that most of the coefficients are different from 0 ; validating the better access for French firms to Belgian market than to most of the other EU markets. Moreover, results of a  $\chi^2$  test <sup>4</sup> and of a Likelihood-ratio test in which we compare our full model with one without importing country dummies <sup>5</sup>, lead us to accept the assumption that the coefficients of country fixed effects are all significantly different. This should indicate that specificities linked to each European country still exist, despite the implementation of the Single European Market. The hierarchy of the coefficients is quite similar in the two steps (select and value equation), except for Spain and Italy. The probability of exporting towards these two countries is much lower than towards Belgium, while there is no statistically significant difference in the value equation for either country. From equations 8 and 9, we could conclude that fixed entry costs are higher at entry to Spain and Italy than at entry to Belgium (fixed costs explained productivity only and not the value of exports). To a lesser extent a similar result is obtained for Great Britain.

From these first results, we can conclude that distance and importing country size are not the only determinants of trade relations between countries ; other trade costs - caught here by importing country fixed effects - explain trade and differ widely within the European market.

## 4.2 Does the export experience of the firm decrease the impact of trade barriers ?

Using a survey on UK firms, Kneller and Pisu (2007) show that trade barriers do not matter to all firms in the same way : the export experience of the firm may change its perception of trade barriers. According to these two authors, export market experience is likely to involve three main dimensions : the length of time the firm has been exporting, the number of markets it serves and the intensity with which it serves those markets.

We focus here only on the export intensity measured by the share of exports in the total sales of the firm. As Kneller and Pisu , we distinguish three categories for the export intensity : less than 15% (Low Export Intensity -Low EI) ; 15-50% (medium Export Intensity - Medium EI) ; more than 50% (High export Intensity - High EI).

In this part, our first model aims at assessing the differentiated impact of trade costs according to export experience. Thus 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 (the country fixed effects are not presented here, they are very similar to those in table 1) . It appears that as experience rises the impact of distance falls. Hence, distance has an attenuated impact on the export levels of the more export oriented firms.

Our second model test whether the country fixed effect vary according to the experience of the firms. Thus we cross the country fixed effects with the three categories of export intensity. The full tables are presented in details in Annex1 (table A1 for the selection step ; table A2 for the regression step). In Table 3, we propose a synthesis of annex 1 : the table indicates whether country fixed effects are significantly different from an experience category to the other. Columns L/M test wheter country fixed effects are different between firms with low export intensity and firms with medium export intensity ; columns L/H test wheter country fixed effects are different between firms with low export intensity and firms with high export intensity ; columns M/H test whether country fixed effects are different between firms with medium export intensity and firms with high export intensity .

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<sup>4</sup>for the value equation :  $\chi^2(21)=163.02$ ,  $\text{prob} > \chi^2 > 0$  ; and for the select equation :  $\chi^2(21)=3502.52$ ,  $\text{prob} > \chi^2 > 0$

for the value equation :  $\chi^2(21)=163.02$ ,  $\text{prob} > \chi^2 > 0$  ; and for the select equation :  $\chi^2(21)=3502.52$ ,  $\text{prob} > \chi^2 > 0$

<sup>5</sup>L-R test : LR  $\chi^2(40)=912.77$   $\text{Prob} > \chi^2=0.000$

	Value Equation			Select Equation		
	Coef.	Std. Err	P.val	Coef.	Std. Err	P.val
ln(firm productivity)	0,753	0,045	0,000	0,142	0,012	0,000
ln(size of country)	0,237	0,034	0,000	0,092	0,011	0,000
distance impact for Low EI	-0,625	0,076	0,000	-0,222	0,023	0,000
distance impact for Medium EI	-0,412	0,076	0,000	-0,193	0,024	0,000
distance impact for High EI	-0,381	0,081	0,000	-0,215	0,027	0,000
ln(theta <sub>j</sub> )	-0,110	0,054	0,042	-0,013	0,015	0,402
Country fixed Effects : see below						
Sub sector fixed effects - yes						
Log likelihood = -52642.27						
Number of obs = 61916						
Censored obs = 49256						
Uncensored obs = 12660						
LR test of indep. eqns. (rho = 0): chi2(1) = 8.43 Prob > chi2 = 0.0037						

FIG. 1 – Table 2 : A differentiated impact of distance on firms exports according to their export experience

	value regression			select		
	L/M	L/H	M/H	L/M	L/H	M/H
The Netherlands	NS	***	**	***	***	***
Germany	**	***	**	***	***	NS
Italy	**	NS	**	***	***	NS
United Kingdom	NS	***	**	***	***	***
Ireland	***	***	***	***	***	NS
Denmark	NS	NS	NS	***	***	***
Greece	**	NS	NS	***	***	NS
Portugal	***	**	NS	***	***	NS
Spain	**	NS	NS	***	***	NS
Sweeden	NS	**	***	***	***	***
Finland	NS	NS	***	***	***	***
Austria	NS	NS	***	***	***	***
Malta	***	***	NS	***	***	***
Estonia	***	NS	**	***	***	***
Latvia	**	NS	NS	***	***	***
Lithuania	***	***	NS	***	***	***
Poland	NS	NS	**	***	***	***
Czech Republic	NS	NS	NS	***	***	***
Slovak Republic	NS	NS	NS	***	***	***
Hungary	NS	NS	NS	***	***	***
Slovenia	NS	NS	NS	***	***	***
Cyprus	***	**	NS	***	***	***

\*\*\* significant at 1%; significant at 5%;\* significant at 10%;  
NS: non significant

Table 3 : Significant differences in country fixed effects in selection and volume equations according to the experience of the firm.

Results show that :

- The export intensity of the firm decreases the country fixed effect. This decrease is especially strong in the selection equation. Country fixed effects are significantly lower for firms with high export intensity.
- In the selection equation, the global range of coefficients (i.e. the maximum value of country fixed effects) decreases with the category for the export intensity : -0.27 for low export intensity firms, -0.23 for medium intensity firms and -0.16 for high export intensity firms. Thus, the higher the experience of the firm, the lower the heterogeneity of the European markets.
- In the volume equation, the impact of export intensity is lower but still exists. It is worth noting that for high export intensity firms, the access to Belgium, the Netherlands, Germany, Italy, the United Kingdom, Spain and Finland is equivalent. Nevertheless, to export to small countries or new member states export intensity has no impact. This could suggest that from french exporter points of view, the main hindrance to increase volume toward these countries is more a problem of lack of existing demand than a problem of trade costs.

These results, especially the impact induced by export intensity on country fixed effects, are not surprising. Belonging to the high export intensity category means that the firm can specialize in export and invest in this function (export specialized services, market knowledge, compliance of the products with regulation, etc...) limiting fixed costs. However these results confirm those obtained by Kneller and Pisu in their survey : firms are not impacted in the same way in respect with their market export intensity.

Another inference regarding export intensity can be drawn. With increasing export intensity, the productivity of the firm also increases. Hence the most productive firms are able to export wherever they want. Moreover the heterogeneity of European markets is less a factor in their export decisions..

## **5 Conclusion : Towards a better understanding of trade determinants**

Trade barriers have traditionally been analyzed using gravity models, theoretically defined using the hypothesis of a representative firm and based on aggregated data of trade flow between countries.

Developments in "new international economics" taking the heterogeneity of firms into account offer a micro-economic approach for the analysis of such firms' behaviour. A new reading of trade results from the use of these models, as in this article.

More specifically, the aim of this study 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 : 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 analyses of the firm selection process to enter a market and of the value of their exports shows that access conditions to the various European markets are not identical for French companies. Distance and size of the importing country partly explain 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.

According to the theoretical model, these differences in market access are largely due to different entry costs for the various markets. Identifying frictions in a model mediated by productivity, distance and the size effect of the importing country is the first stage in better understanding these cost structures, both in terms of the characteristics of the exporting company and of the importing country's market structure.

More generally, this initial empirical analysis shows that these micro-economic developments are a promising alternative for analyzing the role of non-tariff trade barriers.

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ANNEX1 : Results of estimation with interaction between country fixed effects and the export intensity of the firm in selection and volume equations.

Country fixed effects - Reference : Belgium						
	low export intensity		Medium export intensity		High export intensity	
The Netherlands	-1,131	0,047 ***	-0,778	0,070 ****	-0,449	0,118 ****
Germany	-0,731	0,046 ***	-0,363	0,070 ***	-0,166	0,120 NS
Italy	-0,909	0,052 ***	-0,480	0,075 ****	-0,254	0,127 **
United Kingdom	-1,082	0,047 ***	-0,629	0,069 ****	-0,322	0,117 ****
Ireland	-1,689	0,061 ***	-1,200	0,077 ****	-1,048	0,126 ****
Denmark	-1,406	0,059 ***	-0,973	0,078 ****	-0,643	0,127 ****
Greece	-1,351	0,074 ***	-0,875	0,091 ****	-0,640	0,142 ****
Portugal	-1,260	0,064 ***	-0,980	0,083 ****	-0,781	0,134 ****
Spain	-0,678	0,050 ***	-0,393	0,074 ****	-0,269	0,125 **
Sweeden	-1,645	0,067 ***	-1,257	0,084 ****	-0,695	0,133 ****
Finland	-1,729	0,078 ***	-1,361	0,092 ****	-0,803	0,139 ****
Austria	-1,868	0,062 ***	-1,308	0,077 ****	-0,775	0,123 ****
Malta	-2,269	0,095 ***	-1,863	0,100 ****	-1,431	0,147 ****
Estonia	-2,223	0,098 ***	-1,957	0,106 ****	-1,283	0,149 ****
Latvia	-2,459	0,107 ***	-2,091	0,108 ****	-1,523	0,152 ****
Lithuania	-2,321	0,100 ***	-1,896	0,103 ****	-1,425	0,150 ****
Poland	-1,790	0,069 ***	-1,536	0,086 ****	-0,932	0,132 ****
Czech Republic	-2,129	0,070 ***	-1,709	0,082 ****	-1,179	0,127 ****
Slovak Republic	-2,639	0,105 ***	-2,283	0,105 ****	-1,646	0,144 ****
Hungary	-2,067	0,078 ***	-1,726	0,090 ****	-1,271	0,138 ****
Slovenia	-2,680	0,108 ***	-2,348	0,107 ****	-1,585	0,140 ****
Cyprus	-2,155	0,096 ***	-1,860	0,106 ****	-1,251	0,150 ****

Table A1 : Country fixed effects in the selection equation

Country fixed effects - Reference : Belgium						
	low export intensity		Medium export intensity		High export intensity	
The Netherlands	-1,211	0,183 ***	-0,884	0,184 ***	-0,273	0,280 NS
Germany	-0,700	0,140 ***	-0,300	0,161 **	0,373	0,264 NS
Italy	0,082	0,181 NS	-0,372	0,187 **	0,317	0,300 NS
United Kingdom	-0,636	0,175 ***	-0,447	0,173 ***	0,212	0,269 NS
Ireland	-1,460	0,316 ***	-2,172	0,259 ***	-1,030	0,375 ***
Denmark	-1,101	0,262 ***	-1,155	0,234 ***	-0,778	0,333 ***
Greece	-0,353	0,306 NS	-1,101	0,272 ***	-0,981	0,389 **
Portugal	-0,294	0,264 NS	-1,147	0,258 ***	-1,118	0,375 ***
Spain	-0,090	0,156 NS	-0,508	0,180 **	-0,097	0,298 NS
Sweeden	-1,576	0,323 ***	-1,660	0,280 ***	-0,635	0,352 *
Finland	-1,337	0,379 ***	-1,838	0,328 ***	-0,618	0,391 NS
Austria	-1,796	0,347 ***	-2,121	0,269 ***	-1,236	0,332 ***
Malta	-0,969	0,588 NS	-2,837	0,453 ***	-2,397	0,521 ***
Estonia	-1,065	0,576 *	-2,877	0,485 ***	-1,781	0,486 ***
Latvia	-1,347	0,682 **	-2,813	0,520 ***	-2,028	0,540 ***
Lithuania	-0,951	0,617 NS	-3,328	0,465 ***	-2,891	0,529 ***
Poland	-1,783	0,354 **	-1,999	0,327 ***	-1,155	0,377 ***
Czech Republic	-2,094	0,419 ***	-2,660	0,339 ***	-2,013	0,390 ***
Slovak Republic	-2,141	0,735 ***	-2,422	0,562 ***	-2,215	0,548 ***
Hungary	-1,505	0,454 ***	-2,075	0,383 ***	-2,303	0,453 ***
Slovenia	-2,550	0,754 ***	-3,383	0,587 ***	-2,918	0,522 ***
Cyprus	-1,055	0,557 **	-2,498	0,464 ***	-2,456	0,491 ***

Table A2 : Country fixed effects in the volume equation