

Brokers vs. Retailers: Evidence from the French Imports Industry of Fresh Produce¹

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Abstract

There is little discussion in the literature about trade intermediaries because data is rare. Using very original data, our article sheds light on the behavior of trade intermediaries when importing fresh fruit and vegetables in France. To do so, we distinguish the shares of direct and indirect imports of fresh produce respectively operated through French brokers or retailers. Accounting for the bounded nature of the share, we show that brokers are more likely to operate in small countries with high variable costs than retailers.

JEL codes: F23, Q17, Q18

Keywords: Importers, Intermediation, Fresh produce, International Trade

Introduction

In response to recent food scares, countries have strengthened their food safety standards and their oversight. In the US, safety risks associated with the consumption of domestic and imported seafood motivated the introduction of a mandatory Hazard Analysis Critical Control Points (HACCP) in 1997 (Anders & Caswell, 2009). In the same time, private standards have been developed and proliferated, operating alongside public standards to guarantee food quality and/or safety. This has resulted in an increasingly complex network where both public and private standards take prominent role in global food markets and thus in international trade in regulating food product quality and safety. Those private standards have been firstly developed by retailers in order to comply with new regulations and to reinforce their mission of gatekeepers and guarantor of product quality. Private standards are the most well developed in the fresh produce industry, namely fruit and vegetables with the GLOBAL-GAP scheme that has led to the adoption of good agricultural practices in several countries (Henson *et al.*, 2010). As a consequence voluntary private standards have influenced the whole supply chain.

Many scholars have focused on the impact of private standards on transformation of food retailing particularly on producers in developing countries. This literature provides much evidence that increased private food safety standards are appealing protectionist tools and are generally considered to be barriers to trade that disadvantage developing countries (Fulponi, 2006). The impact of private standards on the food supply chain in developed countries has not been assessed yet. However, private standards would also impact trade and food suppliers in developed countries. For instance, private standards would be a new security for direct imports from foreign growers by retailers because they would reduce information asymmetries and transactions costs (search and monitoring costs) as regards compliance to public food quality standards. In the long run, indirect imports (through brokers) should disappear because retailers would directly import produce for their own supply chain.

In this paper, we consider the activity of importing in an active way focusing on the agent who imports. We distinguish among direct and indirect imports respectively operated through brokers or retailers, sticking on the definition of trade intermediaries the business literature provides which refers to the ownership of products (Spulber, 1996). We particularly shed light on the behavior of brokers and retailers when importing fresh fruit and vegetables in France. From 1995 to 2005, we observe the persistence of agricultural imports (country of origin/product) through French brokers which has led us to focus on their specific role and to highlight the differences between direct (through retailers) and indirect imports (through brokers). Brokers who don't buy any products are defined as matchmakers and their economic activity represents the share of indirect imports.

We consider retailers as direct importers purchasing products for their own supply chain in order to be distributed to consumers.

Our approach is original because we look at the flip side of the coin focusing on the trade flows of fresh produce imported in France through two identified channels, direct and indirect imports in France. Indeed, in the new new international economics literature, whereas exporting behavior is well documented there is virtually no research analyzing the decision for firms to import (Bernard *et al.*, 2010). To our knowledge, the few existing theoretical and empirical articles have mostly focused on the decision of exporters to rely or not on trade intermediaries (assumed as a technology) (Ahn *et al.*, 2010; Antràs & Costinot, 2010). The more productive the firm, the less the need for intermediaries. Intermediaries are not at the core of the analysis and their behavior has been considered in a very passive way. Second, our analysis is not constrained by the availability of data such it could be the case in other researches. Indeed, trade intermediaries have a very broad definition leading that results are difficult to compare between researches (Bernard *et al.*, 2010). Moreover, we focus on agricultural commodities which has not been done yet because of the complexity of such an industry. Last but not least, we use two new methods to take into account the bounded nature of the share of imports and provide unbiased estimators coefficients. When the share is neither null nor full, we show that brokers are more likely to operate in small countries with high variable costs than retailers. When the share is full, we show that brokers and retailers have the same pattern of behavior: GDP has a negative impact on the probability to be exclusively present in a specific market product and tariffs have a positive impact on this probability. This suggests that brokers and retailers adopt the same strategy if they can benefit from a market opportunity, that is importing in France a new product country-pair.

This article is organized as follows: The second section presents the related literature on the activity of trade intermediaries and the reading done by the new new international economics literature. In the third section we describe data and highlight empirical facts on the French trade of fresh produce. In the fourth section, we highlight the impact of a set of country variables on the share of imports for retailers (direct imports) and brokers (indirect imports) using zero and one beta regression model and three part fractionnal logistic regression model. We provide some conclusions in the last section.

1 Intermediaries in trade: Related literature

There are several strands of literature that have focused on the recourse of intermediaries or middlemen in transactions. The two terms have been used interchangeably by authors to define their activities leading to a very broad and vague

definition of what is an intermediary. For some scholars, middlemen are more present in markets where there is some lack of information between buyers and sellers. Rubinstein & Wolinsky (1987) have explained that intermediaries act as matchmakers and reduce transaction costs between buyers and sellers. They also act as "guarantor of quality" or "experts" when it is difficult to judge of the quality of the product (Biglaiser, 1993; Biglaiser and Friedman, 1994). For Spulber (1996) the type of information imperfection in the markets will determine the activities of the intermediary: price setting and market clearing, providing liquidity and immediacy, matching and searching or guaranteeing and monitoring. More recently, Antràs and Costinot (2010) have developed a theoretical model of trade with the presence of a technology of intermediation. They show that the presence of intermediaries facilitates the realization of the gains from trade. Moreover, intermediaries can gain advantages over direct exchanges by pooling and diversifying risk (Spulber, 1996). For Spulber (1996) intermediaries can be defined as "an economic agent who purchases from suppliers for resale or who helps sellers and buyers to meet and transact". Some authors as Hackett (1992) clearly identify two types of intermediaries. On the one hand, matchmakers who never own the product and work on a commission basis and, on the other hand, traders who are merchants. They trade products for their own account. The definition provided by those authors converges and depends on the ownership of the product intermediaries deal with. In transactions costs economics, some scholars have focused on the existence of brokers in transactions (Rindfleisch & Heide, 1997). For instance, Weiss and Anderson (1992) analyse the decision of manufacturer whether to vertically integrate the selling function or to use an outside selling organization. To our knowledge, only few scholars consider trade intermediaries as a governance structure. In other words, trade intermediaries would have a role to play both *ex ante* and *ex post* in transactions. For Williamson (1979), the third party performs *ex post* monitoring and acts as a referee when conflicts might occur between the parties involved in the transactions. However, the relative changeability of the definition provided by scholars leads to some difficulties of identification of middlemen or intermediaries activities in empirical data particularly in international trade data.

In the new new international economics literature, there is a burgeoning literature that explores the great role played by intermediaries in the trade process using firm level data (see Rauch, 2001; Feenstra & Hanson, 2004). Scholars mostly focus on the determinants of the export mode firms choose. Either firms would export directly or they would use an intermediary (Ahn *et al.*, 2010; Blum *et al.*, 2009). But, those settings consider the intermediary in a very passive way and as suggested by Bernard *et al.* (2010) importing behavior has been mostly ignored.

In Bernard *et al.* (2010), intermediaries are non producing or consuming firms

and they are intermediaries of sales. Bernard *et al* (2010) compare manufacturers and intermediaries in all Italian sectors that are respectively assumed to directly/indirectly export. They show that firms have direct profit according to the export mode they choose. Low productivity firms will choose the intermediation technology whereas the more productive ones will export directly. The respective share of indirect vs. direct export will depend on the export destination, as more productive firms will be able to overcome high trade costs. Ahn *et al.* (2011) modify a model of heterogeneous firm *à la "Melitz"* by introducing an intermediation technology. Firms' choice to export would depend on the characteristics of the destination country (size of the foreign country, cultural distance, etc) and on their own characteristics, namely their productivity. The least productive firms would export using importers. The underlying hypothesis is that fixed costs to export using intermediation technology are lower than the direct exporting fixed costs. In their empirical setting they consider intermediary as all Chinese firms which have "trade" in their name and consider that exports that pass through those firms are indirect exports. Based on this assumption, they show that exports via the intermediation technology will be larger in countries with small market size, higher variable costs and higher fixed costs of exporting. In other words, those studies have considered that the activity of intermediaries has been maintained because of firms that are less productive than firms that could directly export. However, results are difficult to compare because none of these papers use the same definition of trade intermediaries (Bernard *et al.*, 2010) and they consider trade intermediaries as an homogeneous type.

In the following, we bring those two strands of literature together. On the one hand, we will consider brokers¹ who don't buy any products and act as matchmakers. Their share of imports would represent the share of indirect imports. On the other hand, we will consider direct imports by retailers (intermediaries that sell directly the products to consumers without any transformation²). This distinction allows us to introduce heterogeneity in the wide definition of trade intermediaries at the product level. Indeed, both are trade intermediaries but for the brokers importing is its main activity whereas for retailers is not. We originally consider the import side of trade and the role of intermediaries (brokers vs. retailers) in importing fresh fruit and vegetable in France which have not been taken into account yet. Most of the time it is because data is rare.

¹Brokers get a commission which is about (in average) 6 or 7% of the total value they import in the French market.

²We rule out of our sample all manufacturers since they are not at the core of our analysis.

2 Data

We have combined three dataset that allow us to provide valuable insights on French direct/indirect import of fresh produce.

2.1 Firm Level Data

First, we use french customs dataset of imports that covers the period 1995-2005 and document all transactions from foreign country to french firms (since we focus on imports). For each firm which has imported we have the annual value and volume of imports disaggregated by country of origin at the 8-digit product level. Second, we must distinguish between trade operators (firms with the main activity is to trade) and other firms that do import produce in French customs data (for instance manufacturers who transforms fresh produce). Using the identification of the firm (SIREN) we merge the customs dataset with the section "Trade" of the "Enquete Annuelle d'Entreprises" that records economical informations for firms (total sales, employees, etc.) for which "trade" is their general activity and that have more than 20 employees. At this step, our dataset contains 1063 french firms which import and trade fresh produce.

One step further is to distinguish among the different types trade intermediaries, that is brokers who do not buy the product and retailers who buy and resale produce in their own supply chain. In the French nomenclature, brokers have not got a specific APE code and as a consequence we are not able to isolate them in the main dataset. To do so, we use data that come from a survey that has been conducted by one of the author in the French import industry during the summer 2006. Brokers were asked questions, face-to-face, about the firm situation in 2005, and particularly about characteristics such as total amount of sales, main produce, specialization. From this survey³, we are able to identify 100 firms which operate as brokers of imported fresh produce. It is important to note that most of time those brokers are small firms with less than 20 employees and as a consequence are not present in the "EAE annual survey". Indeed, from our survey, we can observe that the mean number of employee is of 18.8 with a median at 10. Among our sample of 100 brokers, only 43 firms have been identified in the "Enquete Annuelle d'Entreprises". For the 58 other importers data come from the on-site survey. In other word, isolated data for brokers of fresh produce are not available elsewhere. Then we identify 90 firms which concern "retailers supply chain".⁴

³The survey gathers data on almost all brokers located in the Perpignan and Rungis market which are the main imports market of fresh fruit and vegetables in France.

⁴We have compiled data from firms with the French APE code (main activity) 511P, 521D, 521F.

Our final dataset is thus built on the first sample of 1063 firms from which we have extracted 190 French firms (100 brokers and 90 retailers) who import and trade fresh fruit and vegetables in France. For all of those 190 firms we have the total volume and value of fresh produce imported from 1995 until 2005 and their economic characteristics (total sales, number of employees, value added) for the year 2005.

2.2 Product Level Data

Product characteristics are expected to play a great role in determining the share of direct or indirect imports since products are at the core of the transactions. In France, the definition of food safety for fresh fruit and vegetables relies on the Maximum Residue Limits for pesticides (MRLs) set by the European authorities (Regulation (EC) No 396/2005) or French law (Decree 04/08/1992, as amended). Residues found in or on produce are judged, according to these laws, as being above, at or below the limit. French food operator (producers and importers) must comply with a "performance standard", as defined in Henson and Caswell (1999): the food product they market should reach the prescribed product quality standards and/or safety levels. How they do reach the standard is left to the discretion of the food operators. In French law, importers of fresh produce are considered as producers, because they are the very first to introduce foreign produce into the national market.⁵ As producers, first importers of fresh produce are thus liable under criminal law if produce do not comply with the regulations in force (Rouvière *et al.*, 2010).

In the fresh produce industry an important characteristic of fresh fruit and vegetables, at least in Europe, is that these products are very sensitive to pesticides. In order to take into account this sensitivity of fresh produce, we refer to the list of the most sensitive products to pesticides published by the Environmental Working Group (<http://www.ewg.org/>). According to this list, we are able to classify fruit and vegetables according to their sensitivity to pesticides. We have distinguished two classes of products. 12 are the most sensitive products⁶ and all others that we have considered as sensitive.

We expect that sensitivity would impact positively/negatively the share of imports made by brokers/retailers.

Fresh fruit and vegetables are perishable and fragile products that need care when they are imported. As Emlinger *et al.* (2008) point out, we must take into account of the degree of perishability of the product that could impact transport

⁵Art. L 221-1 ; Art. L 212 -1, French Consumption Law.

⁶Tomatoes, Strawberries, Citrus, Grape, Canteloupe, Sweet Pepper, Green Salads, Peaches, Celery, Carott, Coliflower, Pears.

costs. We use the index of perishability provided by Emlinger *et al.* (2008) to build four groups of perishability from the least perishable (group1) to the most perishable (group 4), perishability being a combination of conservation time, respiratory intensity and fragility of the goods.

We expect that perishability would impact positively/negatively the share of imports made by brokers/retailers.

2.3 Country Level Data

To characterize the country from which firms import products we use the usual four gravity variables. Growth Domestic Product - GDP - is used to approximate market size and comes from World Bank World Development Indicators Database. We also proxy variable and fixed costs of trade with distance, the number of documents to export from the country of origin and tariffs. Geographical distance approximate transportation costs between the country of origin and France. As suggested by Ahn *et al.* (2010) and Bernard *et al.* (2010) we also approximate the country-level fixed costs using the number of documents for exporting from a country of origin and that is available from the World Bank Doing Business dataset. We use tariffs at the product level applied by France to country of origin. This data is available from the TARIC database (DG Taxation and Customs Union). We also consider the level of development of exporting countries on the basis of the Human Development Index provided by the United Nations.

We expect that fixed and variable trade costs would impact positively/negatively the share of imports made by brokers/retailers.

French imports of fresh produce gathers 218 products that come from 130 different countries and represents a possible combination of 2240 product-countries pair.

3 Retailers and Brokers in the fresh produce trade

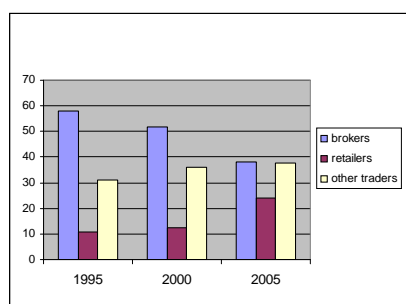
During the year 2005, trade firms (that is all the trading firms - 1063 firms) represent 58% of total French imports of fresh fruit and vegetables (in value). Among them, brokers and retailers, i.e. 190 identified firms in our sample represent 64% of value made by trade intermediaries that represents 37% of whole French imports (still in value) whereas others trading firms (873 firms) than brokers and retailers represent 21% of the total value of imports. Brokers and retailers are main players in importing fresh produce in France while they are very different type of firms.

3.1 The Persistency of brokers in imports flows

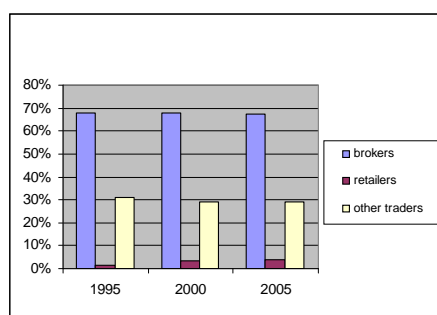
First, we provide evidence that brokers are still present in trade flows whereas we could have expected they would have disappeared because of the development of private standard of quality. Second, we would show that flows from brokers and retailers are not identical as regards to activity, size and then, countries of origin or products imported.

As we have noticed in the introduction, the development of private standards, mostly imposed by supermarkets in the fresh produce industry, could have led brokers' activity to disappear from the economic activity because private standards would have reduced the asymmetry of information on produce between producers and retailers. Private standard would have act as a security between growers and retailers weakening the need for brokers as "guarantor of quality" as suggested by Biglaiser (1993).

From Graph 1 and Graph 2, we can observe that brokers are more likely to import products from countries outside of the EU whereas retailers would be more likely to directly import product for the EU countries. We can also observe that brokers' share in the EU is decreasing between 1995 and 2005 whereas they maintain their activity outside the EU where retailers are mostly absent.



Graph 1: Imports from EU by trade intermediaries



Graph 2: Imports from non-EU by trade intermediaries.

To deepen this observation, we have considered the share of the 2005 total

french imports directly imported by retailers and by brokers from the 10 most important exporter countries of fresh produce in value in France (Table 1).

In Table 1, we provide the share made by trade firms (1063 firms) in 2005 and the respective share of retailers (direct imports) and brokers (indirect imports). From Table 1 we can observe that brokers mostly import products from less developed countries and distant (Morocco, Israel, Argentina) than retailers (Spain, Belgium, Netherlands). Moreover from Table 1 we observe that brokers cannot be ignored in flows of fresh produce imported from South Africa (66% in 2005), Israel (98% in 2005) or Ivory Coast (91% en 2005). As suggested by Graph 1, retailers are dominant in flows of produce that come from Europe (In 2005: Belgium 23%, the Netherlands 22% and Germany 33%). Table 1 shows that imports from Spain and Morocco are mostly dominated by brokers. However, we observe that the share of retailers in the flow of produce from Spain is about 25% in 2005 but they do not directly import produce from Morocco whereas the two countries exports more or less similar produce and they are not too far away one from each other. In 2005, flows from Morocco are mostly captured by brokers whom represent 90% of the total value.

Country	HDI ₍₂₀₀₅₎	Total	Tde Intrm (%)	Retailer (%)	Broker (%)
Spain	0.949	1642837	1141502 (69%)	283435 (25%)	585651 (51%)
Morocco	0.640	441552.2	270606.7 (61%)	7543 (3%)	241550.8 (89%)
Belgium	0.947	361464.8	193433.6(54%)	43614 (23%)	5193,238 (3%)
Italy	0.947	302102.2	161024.6 (53%)	18985 (12%)	43150 (27%)
Netherlands	0.958	269452.4	141932.3 (53%)	48447.86 (34%)	9532 (7%)
Israel	0.929	223405.1	208287 (93%)	850.478 (0%)	204519.6 (98%)
United States	0.955	184070.5	67070.3 (36%)	14.686 (0%)	8544 (13%)
Ivory Coast	0.480	168858.8	118986.2 (70%)	1316.506 (1%)	107887 (91%)
Turkey	0.796	105385.8	57646 (55%)	398.215 (1%)	6692 (12%)
South Africa	0.678	98551.3	68407 (69%)	2678 (4%)	45264 (66%)
Germany	0.942	88859.77	48478 (55%)	16184 (33%)	4622 (10%)
Argentina	0.855	67010.5	51803 (77%)	6524 (13%)	28654 (55%)
Chile	0.872	67691.09	51803 (61%)	1499 (4%)	20210 (49%)

Table 1: Imports from trade intermediaries by country of origin in 2005

In the same way, we have considered the product sensitivity effect when considering either brokers or retailers. In 2005, the share of sensitive products imported by them was of 59,50%. The share of sensitive products imported by retailers was respectively of 7,76% of value in 1995 and 8,15% in 2005.

Descriptive statistics show us a persistence of some agricultural imports through French brokers but for particular product from particular country. Taking note of this allows us to hypothesize a specific role for brokers: they act as a filter to enter the French market and would support some kind of "*risk*" directly link to the product imported and the country of origin. Indeed, importers and retailers are not the same type of firms. The main activity of brokers is to import whereas selling food items to consumers is the first aim of retailers. As regards to size of the firms, brokers are smaller than retailers. As noted, over the 100 brokers, brokers have an average number of employees of 18 with a median at 10 whereas for retailers the mean is at 3072 with a median at 344 employees. The same trend is observable looking at the magnitude of sales. In 2005, importers made 22133 thousands € whereas the 90 retailers made 1176073 thousands €.

3.2 Imports flows from brokers and retailers: Customs data & descriptive statistics

Using imports transactions across products and countries for both brokers and retailers we provide summary statistics in Table 2 to describe the distinct flows of imports (in thousand euros) from brokers and retailers. As noted, brokers and

	Brokers	Retailers
# Firms	100	90
Total Imports Value	1459810	456946
	Mean(Median)	Mean(Median)
Products	28(28)	20(10)
Countries	7.5(3)	5.6(2)
Prod_Country	43.3(38)	32(10)

Figure 1: Firm-level summary statistics for imports firms

retailers make more than 35% of French imports and more than 60% of flows from firms that import and trade fresh produce (1063 firms in our first sample). From Table 2, we can observe that the average value of imports by brokers is three time larger than the average value of imports made by retailers for whom trading is not their main activity. In the same trend, brokers work in average with more products, import from more country and deal with more product-country pairs.

We deepen this statement going through the 1454 product-country pairs worked by retailers and brokers. Among those pairs, 372 are exclusive to brokers and 597 exclusive to retailers. According to countries, retailers and brokers share 62 countries of origin while they have respectively 16 and 22 exclusive countries of origin. As regards to products, we notice that retailers and brokers share 130 products and exclusively deal with 16 and 9 products. In others word, while brokers are more specialized in countries of origin retailers are specialized in products. In 2005 brokers worked with 139 products and the mean value imported by products was 10501 thousands € whereas retailers worked more products (187) but the mean value by product was 3 times smaller (2408 thousands €). We can observe the same looking at the mean value imported by country. In 2005, brokers and retailers respectively imported from 84 and 78 different countries. However, for brokers, the average value imported by country was 3 times larger (17376 thousands €) than retailers' mean value imported by country (5774 thousands €).

4 Importing behavior: Brokers vs. Retailers

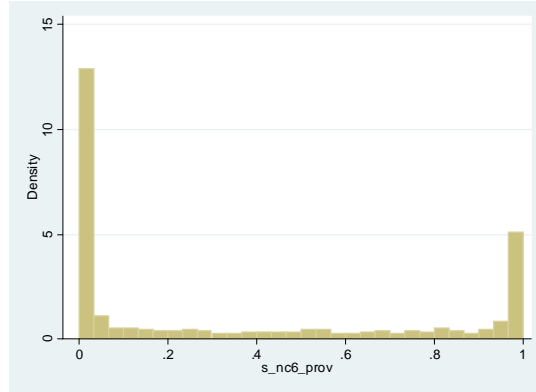
In section 3, we have shown that brokers differ from retailers in terms of country of origin and products. In this section, we investigate the impact of country level data and product data on the share (in value) of imports by country of origin at the 6-digit⁷ that enter the French market through brokers or retailers. The

⁷In this section, all the statistics and data are given at the nc6 level. This choice has been made in order to be able to compare our results with the previous results provided by Anh et al

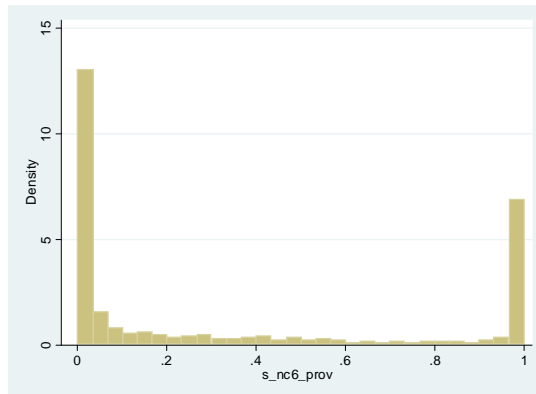
share of brokers or retailers is given by s_{ik}^{Fj} where j represents either brokers or retailers and i the country of origin in product k (6 digit level).

4.1 Brokers and Retailers share of imports

Graph 3 and Graph 4 give the distribution of the share of imports made in 2005 by both brokers (Graph 3) and retailers (Graph 4).



Graph 3: Brokers' share of imports - country-product level (nc6)



Graph 4: Retailers' share of imports - country-product level (nc6)

For each country-product pairs⁸, we can easily observe the importance of null and exclusive share for both types of agents. Brokers only import from 63% of the available country pairs whereas retailers import product from 74.53% of those. Brokers import exclusively (share of imports = 1) from 12.11% of the country-product pair. Retailers import exclusively from 20.66%.

(2011) and Bernard et al (2010).

⁸1123 country-product pairs in total at the nc6 level.

4.2 Alternative approaches to model proportions

To our knowledge, the few existing studies that have examined how explanatory variables (countries variables) influence the share of firms exports model the share of exports as a linear function of the explanatory variables (see Ahn *et al*, 2010; Bernard *et al*, 2010). However, linear models might be inappropriate since assuming a linear function between shares (that are restricted to the interval $[0; 1]$) and explanatory variables may yield that fitted values for the variable of interest would exceed its lower and upper bounds. Moreover, the closer the mean to one of the extreme, the lower the variance. When modeling proportions, normality and homoskedasticity are more often violated and make OLS biased (Paolino, 2001).

As a consequence the inconsistency of the estimates of the regression coefficients raises then issues about the conclusions of such analysis.⁹ Ramalho *et al*. (2011) and Ramalho and Silva (2008) review the technical solutions provided by scholars to deal with this methodological issue. Some scholars use logistic transformation through linearization of the estimation equation to model proportions and infer that $0 < E(Y|X) < 1$. Papke and Wooldridge (1996) and Cox (1996) in their seminal papers propose to use fractional regression model to deal with bounded variables. However, implementing fractional regression need practitioners to assume that ones and zeros occur through the same process than others proportions. A less known alternative, as suggested by Ospina and Ferrari (2010; 2011) is to consider mixed continuous-discrete distributions when modeling proportions observed on $[0, 1)$, $(0, 1]$ or $[0, 1]$.

Ospina and Ferrari (2011) use the beta law to define the continuous component of the distribution and a degenerate distribution or a Bernoulli distribution at zero or at one. When the distributions combined are a Beta and a Bernoulli distribution, Ospina and Ferrari (2010; 2011) refer to zero-one inflated beta distributions. When the mixed distributions are a Beta and a degenerate distribution, they refer to zero- or one- inflated beta distribution, respectively when only zeros or ones appear in the data set.

The beta distribution with parameters μ and ϕ ($0 < \mu < 1$ and $\phi > 0$), denoted by $B(\mu, \phi)$ has the density function such as:

$$f(y; \mu, \phi) = \frac{\Gamma(\phi)}{\Gamma(\mu\phi)\Gamma((1-\mu)\phi)} y^{\mu\phi-1} (1-y)^{(1-\mu)\phi-1}, \quad y \in (0, 1) \quad (1)$$

where $\Gamma(\cdot)$ is the gamma function, μ and ϕ being respectively a location parameter and a scale parameter which corresponds to Generalized Linear Models convention (Ospina and Ferrari, 2011). This allows us to write the distribution mean such

⁹This methodological issue widely occurs in empirical works (see Cook et al (2008) for a discussion in the corporate finance literature.).

as, $E(y) = \mu$ and the variance of y , $Var(y) = \frac{\mu(1-\mu)}{(\phi+1)}$. The larger ϕ , the dispersion parameter the smaller $Var(y)$.

As Ospina and Ferrari (2011) suggest, we assume that the probability density function of y is given by

$$bi_1(y; \alpha, \mu, \phi) = \begin{cases} \alpha, & \text{if } y = c \\ (1 - \alpha)f(y; \mu, \phi), & \text{if } y \in (0, 1) \end{cases} \quad (2)$$

where $f(y; \mu, \phi)$ is a beta density (see (1)) and α the probability mass at c and represents the probability of observing zero ($c = 0$) or one ($c = 1$), with $E(Y) = \alpha c + (1 - \alpha)\mu$ and $Var(Y) = (1 - \alpha)\frac{\mu(1-\mu)}{\phi+1} + \alpha(1 - \alpha)(c - \mu)^2$.

Zero-one inflated beta regression Since observations at the boundaries are a natural consequence of individual choices and not of any type of censoring we can assume that when $s_{ik}^{Fj} = 1$ or $s_{ik}^{Fj} = 0$ the share is not governed by the same process as the other proportions, that is when $0 < s_{ik}^{Fj} < 1$.

As suggested by Ospina and Ferrari (2011), we consider a zero-one inflated beta regression to study the effect of endogenous variables on the share of imports made by brokers and retailers.

Let y_t be an independent variable such as for each y_t , $t = 1, 2, \dots, n$ has a probability function (2) with parameters α_t, μ_t, ϕ_t and α_t, μ_t, ϕ_t are defined as

$$\begin{aligned} h_1(\alpha_t) &= v_t^T \rho = \eta_1 \\ h_2(\mu_t) &= x_t^T \beta = \eta_2 \\ h_3(\phi_t) &= z_t^T \gamma = \eta_3 \end{aligned} \quad (3)$$

where $\rho = (\rho_1, \dots, \rho_p)^T$, $\beta = (\beta_1, \dots, \beta_k)^T$, $\gamma = (\gamma_1, \dots, \gamma_k)^T$ are vectors of unknown regression parameters, v_t, x_t, z_t are observations on explanatory variables. η_1, η_2, η_3 are predictor parameters. $h_1(\cdot), h_2(\cdot), h_3(\cdot)$ being strictly increasing and twice differentiable link functions. Our task, then, is to form a regression model that is to use three link functions, linking the linear predictor and the observations. The estimation of model parameter is done by the maximum likelihood technique.

Ospina and Ferrari (2011) give the likelihood function for $\theta = (\rho^T, \beta^T, \gamma^T)^T$ in a sample of n independent observations

$$L(\theta) = \prod_{t=1}^n bi_1(y; \alpha_t, \mu_t, \phi_t) = L_1(\rho)L_2(\beta, \gamma),$$

The log-likelihood function is then given by

$$l(\theta) = l_1(\rho) + l_2(\beta, \gamma) = \sum_{t=1}^n l_t(\alpha_t) + \sum_{t:y \in (0,1)}^n l_t(\mu_t, \phi_t)$$

Ospina and Ferrari (2011) propose to use a logistic link for μ and α because they must be positive and a log function for ϕ . From those hypothesis we can write our estimation equations as

$$\begin{aligned}\text{logit}(\alpha) &= \rho_0 + \rho_1 X + \rho_2 Z \\ \text{logit}(\mu) &= \beta_0 + \beta_1 X + \beta_2 Z \\ \log(\phi) &= \gamma_0 + \gamma_1 X + \gamma_2 Z\end{aligned}\tag{4}$$

4.3 Comparing approaches: Results

To illustrate the methodological issue raised by the fact that the endogenous variable is bounded between 0 and 1 and to contribute to the empirical literature on trade we present results of an empirical model for the share of imports estimated by four different methods: OLS, one and three part fractional regression model and Zero-One Inflated Beta regression. Data we use to explain the share of imports are the classical variables used by scholars to approximate country characteristics, that is the log Growth Domestic Product - GDP, the tariffs and the distance between France and the export countries.

First, we follow the classical specification of Ahn *et al.* (2010) to study the share of intermediaries in French imports flows. The estimated equation is

$$s_{ik}^{Fj} = \alpha + \beta X_i' + \varepsilon_{ik}$$

with s_{ik}^{Fj} the share in French imports of intermediaries j from country i in product k (6 digit level) ; j represents either brokers or retailers. The variables X_i describes the country of origin of the product. We integrate a product-level fixed effect. We regress the share of brokers and retailers for each product-country pair.

Then, we estimate a fractional logit model as suggested by Papke and Wooldridge (1996):

$$E(Y|X) = G(x\theta)$$

where $G(\cdot)$ is a known non linear function such as $0 \leq G(\cdot) \leq 1$. The most appropriate function to use for $G(\cdot)$ is the logistic function (Ramalho *et al.*, 2011). Papke and Wooldridge (1996) propose then to use a Quasi-maximum likelihood estimation based on a log-likelihood function given by

$$LL_i(\theta) = y_i \log[G(x_i\theta)] + (1 - y_i) \log[1 - G(x_i\theta)]$$

Following Ramalho *et al.* (2011) we also provide results from a three part fractional regression model which consists in two standard binary choice models when $s = 0$ and $s = 1$ and a fractional logit when $s \in (0, 1)$.

We have also estimated a zero-one inflated beta regression model from the equation of estimation (4). Results from the above estimations are respectively given for brokers and retailers in Table 3 and Table 4 in which we have calculated first differences for each variable.¹⁰

Share of brokers	Regression (OLS)	Fractional Logit (GLM)	Zero and One inflated model
	Coefficient	Marginal effects at mean point	Marginal effects at mean point
Constant	0.06 (0.22)	-	-
Ln GDP	-0.008 (0.007)	-0.008 (0.007)	-0.03*** (0.007)
Ln Tariffs	0.05*** (0.015)	0.05*** (0,02)	0.03** (0.02)
Ln distance	0.05*** (0.011)	0.05***(0,01)	-0.008 (0.01)
Subsector fixed effects	YES	YES	YES
No. Observations	1100	1100	1100
R2	0.11	-	-
LPLikelihood	-	-634.26	-800.72
R2 mc Fadden	-	0.08	0.13

*** significant at 1%level; ** significant at the 5% level; * significant at 10 % level.

Table 3: Brokers imports share at the HS6 level

Share of retailers	Regression (OLS)	Fractional Logit (GLM)	Zero and One inflated model
	Coefficient	Marginal effects at mean point	Marginal effects at mean point
Constant	1.68*** (0.23)	-	-
Ln GDP	-0.03*** (0.007)	-0.03*** (0,008)	-0.008 (0.009)
Ln Tariffs	0.01 (0.016)	0.01 (0.02)	0.05 *** (0.017)
Ln distance	-0.06*** (0.01)	-0.06*** (0.01)	0.01 (0.014)
Subsector fixed effects	YES	YES	YES
No. Observations	1100	1100	1100
R2	0.04	-	-
LPLikelihood	-	-634.26	-411.91
R2 mc Fadden	-	0.05	0.32

*** significant at 1%level; ** significant at the 5% level; * significant at 10 % level.

Table 4: Retailers imports share at the HS6 level

From the above tables, we can observe that the influence of country characteristics is not the same from an estimation to another. We need to consider that the estimated variable is bounded and that OLS might be inconsistent. From Graph 3 and Graph 4, we have also noticed the importance to consider the bounded characteristic of the share of imports and the distribution at the extremes. Then and on the basis of Graph 3 and Graph 4, it seems to us that we need to deepen the analysis of full and null shares of imports by both agents.

4.4 Accounting for null and full shares of imports

In this section, we compare two three part models. First, we use the estimation suggested by Ramalho et al (2011) who propose fractional logit on the continuous

¹⁰*** significance at 1% level; ** significance at 5% level; * significance at 10 % level.

part of the share and two binary choice models. Second, we use the estimation proposed by Ospina and Ferrari (2011) where the continuous part of the share is estimated through a beta regression¹¹. Results¹² for the two estimations are provided in Table 5 and Table 6 for brokers and Table 7 and Table 8 for retailers.

¹¹We use the new routine -zoib- provided by Buis (<http://www.maartenbuis.nl/software/zoib.html>) in order to consider that ones and zeros are governed by different processes as the other proportions. ZOIB runs a beta model for proportions between zero and one and a logistic regression model for proportions that are zero and one.

¹²*** significant at 1%level; ** significant at the 5% level; * significant at 10 % level.

Share of brokers	Zero and One inflated model		
	Proportion between 0 and 1	Probability to be 0	Probability to be 1
	Marginal effects at mean point	Marginal effects at mean point	Marginal effects at mean point
Ln GDP	-0.02*** (0.01)	-0.05*** (0.01)	-0.03*** (0.01)
Ln Tariffs	0.06*** (0.02)	0.04 (0.02)	0.07*** (0.02)
Ln distance	0.06*** (0.01)	-0.06*** (0.02)	-0.004 (0.02)
Subsector fixed effects	YES		
No. Observations	1100		
R2	-		
LPlikelihood ou LLikelihood	-800.72		
R2 mc Fadden	0.13		
Pseudo R2	-		

*** significant at 1% level; ** significant at the 5% level; * significant at 10 % level.

Table 5: Brokers share ZOIB estimation

Share of brokers	Fractional logit and logit on 0 and 1		
	Proportion between 0 and 1	Probability to be 0	Probability to be 1
	Marginal effects at mean point	Marginal effects at mean point	Marginal effects at mean point
Ln GDP	-0.03*** (0.01)	-0.04*** (0.01)	-0.01** (0.005)
Ln Tariffs	0.06*** (0.02)	0.006 (0.02)	0.04*** (0.01)
Ln distance	0.07*** (0.02)	-0.05*** (0.01)	0.005 (0.009)
Subsector fixed effects	YES	YES	YES
No. Observations	564	1100	1100
R2	-	-	-
LPlikelihood ou LLikelihood	-292.37	-701.29	-379.70
R2 mc Fadden	0.10	-	-
Pseudo R2	-	0.03	0.06

*** significant at 1% level; ** significant at the 5% level; * significant at 10 % level.

Table 6: Retailers share fractional logit estimation

Share of retailers	Zero and One inflated model		
	Proportion between 0 and 1	Probability to be 0	Probability to be 1
	Marginal effects at mean point	Marginal effects at mean point	Marginal effects at mean point
Ln GDP	0.02*** (0.006)	-0.05*** (0.01)	-0.12*** (0.01)
Ln Tariffs	0.004 (0.01)	0.07*** (0.02)	0.05* (0.02)
Ln distance	-0.05*** (0.01)	0.04*** (0.02)	-0.008 (0.02)
Subsector fixed effects	YES		
No. Observations	1100		
R2	-		
LPlikelihood ou LLikelihood	-411.91		
R2 mc Fadden	0.32		
Pseudo R2	-		

*** significan at 1%level; ** significant at the 5% level; * significant at 10 % level.

Table 7: Retailers share ZOIB estimation

Share of retailers	Fractionnal logit and logit on 0 and 1		
	Proportion between 0 and 1	Probability to be 0	Probability to be 1
	Marginal effects at mean point	Marginal effects at mean point	Marginal effects at mean point
Ln GDP	0.030*** (0.01)	-0.02** (0.008)	-0.06*** (0.01)
Ln Tariffs	0.003 (0.02)	0.04** (0.02)	0.02* (0.01)
Ln distance	-0.07*** (0.01)	0.04*** (0.01)	-0.01 (0.01)
Subsector fixed effects	YES	YES	YES
No. Observations	598	1100	1100
R2	-	-	-
LPlikelihood ou LLikelihood	-268.28	-589.45	-505.44
R2 mc Fadden	0.08	-	-
Pseudo R2	-	0.05	0.09

*** significan at 1%level; ** significant at the 5% level; * significant at 10 % level.

Table 8: Retailers share fractionnal logit estimation

For brokers and retailers, we can observe the same signs and significance of classical trade variables in both kind of estimations.¹³ Now, we are able to analyze the three parts of the estimations. First, we analyse null share for both agents. For brokers and retailers, the size of export market reduces the probability not to import from this country. However, for retailers tariffs and distance increase this probability whereas for brokers only distance is significant and has negative effect. In other word, for a given GDP level, brokers are more likely to import from a more distant country than retailers. Second, we consider full shares ($s = 1$) for brokers and retailers. When $s = 1$ they are the only ones to import a specific

¹³Results hold using data at the NC8 level.

country-product pair. In this part of the estimations, brokers and retailers have the same pattern of behavior: GDP has a negative impact the probability to be the only ones and tariffs have a positive impact on this probability. This suggests that brokers and retailers adopt the same strategy if they can benefit from a market opportunity, that is importing in France a new product country-pair.

Last, we consider the continuous part of the distribution of the share, that is when $s \in (0,1)$. Brokers are more present in countries with low level GDP, high tariffs and high distance from France. In others word, the brokers' share of imports is higher in small country with high variable costs. Conversely, the share of imports by retailers increase with GDP and decrease with distance from France. The closer and the larger the country, the higher the retailers' share of imports. From this result, we highlight the great difference between direct and indirect imports, brokers having a specificity regarding country characteristics.

5 Conclusion

Using very original data, we consider the activity of trade intermediaries who imports in an active way. And particularly, we shed light on the behavior of trade intermediaries when importing food and particularly fresh fruit and vegetables in France. To do so, we follow the definition of intermediaries provided in the literature, distinguishing between two ways of importing. First, we consider brokers that won't buy products they deal with. Second, we consider retailers that would directly purchase products for their own supply chain to be distributed to consumers. Retailers are more likely to develop private standards on their own. We assume that those intermediaries would not play the same role in trade because of this difference in ownership of products. To stick on the recent development of the new new international economics literature we assume that brokers would be considered as a channel of indirect imports. They are matchmakers and imports product in the name of a customer and they get a commission to do so. As for retailers, they represent the direct imports channel highlighted in the literature.

We have thus established that brokers and retailers can not play the same role in trade depending . Brokers act as a filter for some country-product pairs to enter the market. Especially for fruit and vegetables that come from small and distant countries. Retailers do not follow the same pattern.

Further work need to be done to better understand specificities in the behaviour of brokers as economic agents especially the link between characteristics of the brokers (as productivity or size) and the country-product pair imported.

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