Protecting health or trade a dilemma for baby food

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Abstract: This article explores the effect of EU regulation on baby food products. A large number of medical studies have shown that pesticides and contaminants contribute to various health problems including cancer, lung disease or reproductive, endocrinal and immune system disorders. They also agree that children are more vulnerable to the dangers of pesticides and contaminants because as soon as start eating solid, they eat a limited number of food items among which fruits and vegetables hold an important position. This increased children's exposure to substances which they are less capable of metabolizing than adults (Muhlendahl et al. 1996; Koletzko et al. 1999). In order to protect the health of the most vulnerable part of the population, the European Union (EU)'s regulation establishes that no more than 0.01 mg/kg of any single pesticide residue is permitted in baby food products. It creates a difference in regulations between the EU and most of its trading partners, the majority of which do not differentiate food safety regulations according to the population age. The purpose of this paper is to quantify the impact of the specific European regulation on MRL of pesticides on trade of baby food products and compare the EU regulation to the regulations of its major trading partners through a severity index. We introduce this index in an econometric model to assess the trade implications of the standard levels in this emerging sector. The results show that the EU regulation may constrain trade.

JEL Classification: Q17, F13.

Keywords: food safety; pesticides; MRL, baby food products, market access.

1- Introduction

Food safety and food quality are the two sides of the same coin. Food safety is a fundamental requirement of food quality and this is particularly true when children are involved. A large number of medical studies have shown that pesticides and contaminants contribute to various health problems including cancer, lung disease or reproductive, endocrinal and immune system disorders. They also agree that children are more vulnerable to the dangers of pesticides and contaminants because as soon as they start eating solid, they eat a limited number of food items among which fruits and vegetables take an important part. This increased children's exposure to substances which they are less capable of metabolizing than adults (Muhlendahl et al. 1996; Koletzko et al. 1999).

In order to protect the health of the most vulnerable part of its population, the EU's regulation establishes that no more than 0.01 mg/kg of any single pesticide residue is permitted in baby food products. It creates a difference in regulations between the EU and most of its trading partners, the majority of which do not differentiate food safety regulations according to the population age.

Discrepancies in food safety regulations and standards are at the heart of a new approach (Achterbosch *et al*. 2009; Rau *et al.* 2010, Drogué and Demaria 2012; Winchester *et al.* 2012; Li and Beghin 2012) which aims to develop indicators taking into account both the importer and exporter level of stringency in regulations i.e. the (dis)similarities of policies. These differences between importing and exporting countries may constitute an obstacle to international food trade. While the EU has specific regulations on maximum residue level (MRL) of contaminants protecting children from the intake of deleterious substances, most countries do not. Thus the specific European policy, albeit consumer-driven, may be seen as a form of protection of the emerging market of baby food constraining other countries to export primary product rather than processed products to the European markets.

This paper aims to quantify the impact of the specific European regulation concerning MRL of pesticides on trade of baby food products. The EU regulation will be compared to the regulations of its major trading partners through a severity index. Then this index will be introduced in a two stage gravity model aimed at assessing the trade implications of the standard levels in this particularly emerging sector which according to UN COMTRADE data has increased by 30% in the EU these recent years.

The paper is structured as follows. After introducing the EU specific regulation on baby and infant food, we propose an index based on that described in Li and Beghin (Forthcoming) in order to estimate the degree of severity imposed by the EU on contaminants in food for children under the age of three (Section 2). Then we introduce this index as a variable in a gravity model to assess the impact of the EU regulation on its imports of baby food. The database and model specification are described in Section 3. Section 4 presents the estimation results and Section 5 concludes

2- The EU regulation on baby and infant food

In parallel with the increasing women employment rate, the baby and infant food industry has seen its production increase both in terms of quantity and variety. For instance Blédina (leader on the French market) has not less than 96 products in its range of baby foods and Nestlé (another actor on the French market) counts 18 brands[1]. However, parents have become more and more demanding in terms of the quality and safety of the food they give to their children. Maguire and al. (2006) showed that "parents are concerned about the risk posed by pesticides in baby food, and for those who choose to purchase organic foods, the health benefits are a primary motivation." Peterson and Li (2011) found in their study that consumers are ready to pay an extra for organic baby foods not for its organic qualities but because it ensures a restricted use of pesticides and GMO.

Physicians have alerted policy makers on the health problems posed by pesticide exposure through food intake from the sixties. In 1967 the World Health Organization (WHO) Scientific Group on Procedures for Investigating Intentional and Unintentional Food Additives discussed the effects of age on toxicity and found that *"in general, the young animal is more sensitive to the toxic effects of exposure to chemicals". (…) The Scientific Group stated that "pertinent information derived from reproduction (multi-generation) studies provides some assurance on the safety of compounds that might be present in the diet of babies" but felt that "since babies constitute a special population, close observation of epidemiology in this group is an important practical aspect of the evaluation of the effects of exposure." (…)*The report concluded that *"useful information may be obtained from studies in newborn or young animals,*

[1] Including all types of foods and beverages.

from reproduction studies, and from biochemical studies" and called for further research on "the development of enzyme systems in the human young, with particular emphasis on those enzymes responsible for dealing with foreign chemicals. With respect to the latter research, the Scientific Group concluded that "this information is essential in assessing the safety of additives in baby food." (WHO, 1987).

But this concern has only recently been taken into account. Until 2006 there was no unified European policy regulating pesticide residues in food. MRL of pesticides were set at national levels. But few countries had specific rules on food intended for infants (children under the age of 12 months) and toddlers (between one and three). Mühlendahl et al. (1996) report that in Europe only France, Switzerland, Belgium, Germany and Luxembourg specifically have ruled out lower limits. As for food for babies or toddlers two directives, the former concerning infant formulae and follow-on formulae (91/321/EEC) and the latter on cereal-based foods and baby foods for infants and toddlers (III/5886/94-Rev.2-EN), established in their article 6 that such products "shall not contain any substance in such quantity as to endanger the health of infants and young children. Where necessary, the maximum levels of any such substance shall be stipulated at a later date". The legislation was rather ambiguous and member-states didn't have any obligation to set specific limit. However, in 1993 "attention was drawn to the question of pesticide residues in baby food because excessive lindane concentrations (0.04 ppm) were found in imported vegetables from Spain prepared as baby food. The manufacturer whose product was withdrawn from the market complained to the EC "with the aim of getting the §14 of the German Dietetic Directive – setting the limit at 0.01ppm – revoked on the ground that it constituted an illegal barrier to trade (Mühlendahl et al. 1995). Thus, the EU commissioned a scientific advice on pesticide residue and baby food. On 23 September 1994 the scientific committee for food (SCF) concluded that "it had no reason to believe that a content of 0.04 mg of lindane per kg of baby food would cause reason for concern". But three years later the same committee "concluded that if the maximum residue limit were to be set at 0.01 mg/kg in foods intended for infants and young children, there is a possibility that an infant could exceed the ADI for pesticides having an ADI at 0.0005 mg/kg b.w. (per kilo of body weight) or lower."

Today, Maximum Residue Level of pesticides in baby and infant food in the EU are covered by Directive 2006/125/CE and Regulation CE 1881/2006. Directive 2006/125/CE establishes in article 7 that "Processed cereal-based foods and baby foods shall not contain residues of individual pesticides at levels exceeding 0.01 mg/kg, except for those substances for which specific levels have been set in Annex VI, in which case these specific levels shall apply." Thanks to this very strict rule, a 2010 report from the Canadian Ministry of Agriculture reads "Consumers are becoming aware that under EU regulations pesticide levels are so low in baby food that standard items are virtually the same as organic varieties…" (Agriculture and Agri-Food Canada, 2010).

No other country specifically regulate foodstuff for children. Some countries such as the USA or Canada consider sensitive subpopulations as children in their risk assessment process rather than setting specific MRL for them. The USA incorporated into the Food Quality Protection Act of 1996 many recommendations issued in the National Research Council 1993 publication "Pesticides in the Diets of Infants and Children". This leads as instance to ban the use of organophosphate pesticide from "kid food" like apples (US EPA).

For this reason, the European regulation can be regarded as an unjustified barrier to trade. In this paper we try to assess how severe the regulation on baby food imposed by the EU directive is compared to its major trading paper. Following the methodology described by Li and Beghin (Forthcoming) we develop an index of severity (strictness) in order to compare the regulation put in force in the European Union with the regulations of its major trading partners.

3- Data and model specification

In 2010 the global baby food market represented 36.7 billion of US$ where dried baby food account for 3.7 billion, milk formula 25.2 billion, prepared baby food 6.5 billion and other baby food 1.4 billion. This sector is forecast to reach 55 billion of US$ in 2015. According to Euromonitor International the Asia Pacific region accounts for 37%, Western Europe 22%, North America 18%. The baby food sector is very competitive and dominated by multinationals among which the leading companies are Nestlé, Danone, Heinze and Kraft.

The baby food global market involves both developed and emerging countries, however few actors are involved. Our sample includes on the export side Argentina, Australia, Brazil, Canada, Chile, China, India, Korea, Japan, Mexico, New Zealand, Philippines, Russia, South Africa, Switzerland and USA. Whereas the importing countries' group includes all EU27' member state. Countries are chosen on the basis of the trade indicators and on the availability of the MRLs data. We collect data covering imports of 6 commodities disaggregated at NC8 digit level: 16021000 homogenized preparation of meat; 20051000 homogenized vegetables; 20071010 and

20071099 homogenized preparation of fruits; 21041000 soups and broth preparations; 21042000 homogenized composite food preparations. The time dimension is limited to the period 2008-2009. We have chosen our raw products based on the various recipes in the range of baby and infant 'ready-to-eat' meals. However we do not consider milk and dairy products into account. Overall we consider 24 raw products. Four fruits: apples, apricots, bananas and pears; eleven vegetables eggplants, green beans, carrots, leek, peas, pepper bell, potatoes, spinach, squash, tomatoes, zucchini; five cereals: barley, corn, oats, rice, wheat and four meats: bovine, hog, poultry and turkey. We aggregate the raw products in mixes of meat (160210), vegetables (200510), fruits (200710), cereals/vegetables, cereals/fruits, meat/vegetables, meat/vegetables/cereals (210410) corresponding to the HS6 tariff codes.

The difficulty of building our index of strictness stems from the fact that we consider processed products rather than raw ones, indeed, no MRL for processed products does exist. Furthermore, the number of substances and the MRL vary by country and product. For instance: the EU has established 449 pesticides in the case of fruits, 338 in cereals and 246 in meat; the USA has established 106 pesticides on fruits, 111 on vegetables, 77 in cereals and 76 in meat, while Korea regulated 83 pesticides on fruits, 40 for cereals etc, with legal limits varying from 0 to 2000 ppm. The comparison of the regulations contrast what Li and Beghin (2012) call regulatory intensity. In fact, each country holds its own list of pesticides but the absence of a pesticide from a list may have diverse interpretation: the "missing" substance may be either unregulated (when the country considers it innocuous), or regulated by default (a default limit applies) or it may just be "missing" for various reasons (such as a problem in data collection). To tackle this issue Li and Beghin (2012) use a list of substances common for all countries, the one drawn up by the Codex. We think that using this list produces a loss of information because the Codex does not regulate many substances. Thus following Drogué and DeMaria (2012) we proceed as follow: when the country has information on the default value, we replace the missing value by the default value; if the pesticide is not regulated and information on default limit is missing we replace the missing value with the maximum value found in the data.

Our data on MLR come from DG Sanco for EU and from FAS USDA for other countries. But since limits vary across countries, and country policies regarding the implementation of international standards are not always transparent, we have checked, as far as possible, all limits with the domestic regulations. Once established our database on MLR of pesticide for all countries and products previously defined we develop our index of strictness (see equation 1).

First, this index is calculated by country, substance and class of products (fruits, vegetables, meat and cereals). Then to determine the index value for a particular mix (meat, vegetables, fruits, vegetables/cereals, fruits/cereals, vegetables/meat, vegetables/meat/cereals) we take the minimum value from all classes of product inside a mix. Our index is computed as follows:

$$severity_{EU-ROW}^{k} = \frac{1}{N}\left(\sum_{p=1}^{N} I_{(MRL_{EUp}^{k}<MRL_{ROWp}^{k})} * exp\left(\frac{|MRL_{EUp}^{k}-MRL_{ROWp}^{k}|}{MRL_{MAX}^{k}}\right)\right) \quad (1)$$

Where MRL_{EUp}^{k} is the MRL set in the EU for pesticide p and product k; MRL_{ROWp}^{k} stands for the MRL of exporting countries for pesticide p and product k; MRL_{MAX}^{k} is the maximum MRL found in all regulations for products k and substance p, N is the total number of substances and it is equal to 894.

$I_{(MRL_{EUp}^{k}<MRL_{ROWp}^{k})}$ is an indicator function which is equal to 0 when $MRL_{EUp}^{k} \geq MRL_{ROWp}^{k}$ and equal to 1 when $MRL_{EUp}^{k} < MRL_{ROWp}^{k}$.

Table 1 shows the index values: they range between 0 and 1.33; a value equal to 0 means that the EU regulation is equally as or less stringent than the exporter's regulation; conversely a high value implies that the EU applies a stricter regulation. Our feeling is that a higher index value should reduce trade. South Africa and Switzerland report an index value of the index equal to zero because they apply the same regulation as the EU. Argentina, Australia, China, Korea, Mexico, Russia and USA report a value of severity close to 0, which means that in general their regulations are very close to that of the EU, this is due to the fact that these countries apply zero tolerance provisions or a very low maximum level for those substances. On the contrary Brazil, Chile, India, Japan and Philippines display larger values between 0.77 and 1.25.

Table 1 Severity index by product at HS6-digit level

	160210	200510	200710	210400
Argentina	0.015	0.009	0.020	0.009
Australia	0.021	0.002	0.025	0.002
Brazil	0.819	1.086	1.251	0.819
Canada	0.300	0.407	0.491	0.300
Switzerland	0	0	0	0
Chile	0.773	1.096	1.231	0.773
China	0	0	0.003	0
India	0.798	1.095	1.256	0.798
Japan	0,299	0,400	0,478	0,299
Korea	0,030	0,015	0,033	0,015
Mexico	0,015	0,003	0,018	0.003
New Zealand	0.302	0.408	0.487	0.302
Philippines	0.773	1.096	1.233	0.773
Russia	0.013	0.004	0.019	0.004
USA	0.037	0.022	0.034	0.022
South Africa	0	0	0	0

Data on EU imports are collected from Eurostat Comext database. Data on GDP and total population are from World Bank Developed Indicators (WBDI); data on infants population come from United Nations Population Information Network (UNPIN). EU's Tariff comes from Taric database finally distance, common language and colony are from Cepii dataset.

The standard gravity equation can be written as follows:

$$\begin{aligned}\ln (M_{ijt}^{k}) = {} & \beta_0 + \beta_1 \ln(y_{it}) + \beta_2 (y_{jt}) \\ & + \beta_4 \ln(InfantPop_{it}) + \beta_5 \ln(InfantPop_{jt}) + \beta_3 \ln(Dist_{ij}) + \beta_5 \ln(t_{ijt}^{k}) \\ & + \beta_6 \ln(\upsilon_{ij}^{k}) + \beta_7 lang_{ij} + \beta_8 conlony_{ij} + fe_i + fe_j + fe_t + fe_{product} \\ & + \varepsilon_{ijt}^{k} \qquad (2)\end{aligned}$$

where M_{ijt}^{k} is the EU imports from country *j* at time *t* for product *k*. As suggested by De Bendicts and Taglioni (2011) this term is in nominal values. The *GDP* is the Gross Domestic Products in current US dollar of importing country *i* and exporting country *j* at time *t*; y_{it} =

$\frac{GDP_{it}}{POP_{it}}$ and $y_{jt} = \frac{GDP_{jt}}{POP_{jt}}$. Per capita GDP of exporting countries is a proxy for its capital-labor ratio; whereas the importing GDP per capita represents its per capita income (Bergstrand 1990). A positive and statistically significant coefficient for the per capita GDP of exporting countries suggests that the sector is capital intensive in production. Data on infant population include the population of infants between 0 and five years (available at http://www.un.org/popin/data.html). $Dist_{EUj}$ reflects the impact of transport costs, they are proxied by the distance between countries. $t^{k}_{EUjt} = 1 + tarif^{k}_{EUjt}$, is the tariff applied by the EU; υ^{k}_{ij} is a measure identifying the severity between EU and its partners.

$lang_{ij}$ and $colony_{ij}$ are binary variables having value 1 if two countries speak the same language and have had a colonial relation and zero otherwise, in the specification importing, exporting, products and time fixed effects are included. Finally ε^{k}_{ijt} is the error term.

Equation (2) can be estimated using ordinary least squares (OLS). The most common empirical gravity specification was developed by Anderson and van Wincoop (2003) who introduced multilateral resistance term, often proxied by importer-exporter fixed effects. In the estimation of the gravity equation, a first problem arises because of the zeroes. This trouble arises when sector level data are used. Excluding zero observations creates a selection bias and adding a small constant to trade flows introduces a measurement error. This matter has already been discussed extensively, several alternative approaches have been used to handle zero trade, recent literature suggests the use of Two-Part Models and Zero-Inflation model (ZIM). These models encompasses a set of different estimators. We use the Heckman two step procedure, which corrects the possible biases and allows us to investigate the effects of MRL of pesticides on both extensive and intensive margin, while the full marginal effects of this variable is the sum of the two effects (extensive and intensive margin). The procedure includes two equations: the selection equation incorporating the binary decision whether or not to trade and the outcome equation determining the intensity of trade.

The selection equation is given by

$$d^{*}_{ij} = z_{ij}\,\gamma' + u_{ij} \qquad (3)$$

Where d_{ij} is a latent variable and it is not observed but we observe whether countries trade or not, therefore:

$$d_{ij} = \begin{cases} 1\ if\ d^{*}{}_{ij} > 0 - there\ is\ trade\ or\ no \\ 0\ if\ d^{*}{}_{ij} \leq 0 - no\ trade\ occurs \end{cases}$$

z_{ij} is a vector of explanatory variables influencing d_{ij}^* and u_{ij} is the error term. The second equation (outcome) determines the value of trade:

$$M_{ij}^* = x_{ij}\beta' + \varepsilon_{ij} \qquad (4)$$

x_{ij} is a vector of independent variables determining the natural logarithm of M_{ij}, it is observed if d = 1; the error terms u_{ij} and ε_{ij} are independently across observations and jointly normally distributed with covariance $\rho\sigma_e$: $u_{ij}, \varepsilon_{ij} \sim N\left(0, \begin{bmatrix} 1 & \rho\sigma_e \\ \rho\sigma_e & \sigma_\varepsilon^2 \end{bmatrix}\right)$. The variance of u is normalized to 1 because only d is observed and not d^*. The selection equation is estimated by a probit, both the equations can be estimated simultaneously, through the maximum likelihood method, or successively. The expected value of M_{ij} is conditional expectation of M_{ij}^* conditionated on it being observed ($d_{ij} = 1$):

$$E\left(M_{ij} \middle| x_{ij}, z_{ij}\right) = E\left(M_{ij}^* \middle| d_{ij} = 1, x_{ij}, z_{ij}\right) = x_{ij}\beta + \rho\sigma_\varepsilon \frac{\phi(z_{ij}\gamma)}{\Phi(z_{ij}\gamma)} = x_{ij}\beta + \rho\sigma_\varepsilon\lambda(z_{ij}\gamma) \quad (5)$$

Where $\lambda(\alpha) \equiv \frac{\phi(\alpha)}{\Phi(\alpha)}$ is the Inverse Mill Ratio.

For robust identification, Helpman, Melitz and Rubisten (2008) suggest that both the selection and outcome equations may include the same independent variables except one, that is, a variable influencing the fixed costs, not the costs of trade, of EU and trading partners. In our case the selection equation, in addition to other variables includes common language. Exclusion of common language from the outcome equation provides the exclusion restriction.

Our empirical versions are:

$$\begin{aligned} d_{ij}^* = {} & \beta_0 + \beta_1 \ln(y_{it}) + \beta_2(y_{jt}) + \beta_4 \ln(\text{InfantPop}_{it}) + \beta_5 \ln(\text{InfantPop}_{jt}) + \beta_3 \ln(\text{Dist}_{ij}) \\ & + \beta_5 \ln(t_{ijt}^k) + \beta_6 \ln(\upsilon_{ij}^k) + \beta_7\, \text{colony}_{ij} + \beta_8\, \text{lang}_{ij} + fe_i + fe_j + fe_t + fe_{product} \\ & + u_{ijt}^k \qquad (6) \end{aligned}$$

$$\begin{aligned} \ln(M_{ijt}^k) = {} & \beta_0 + \beta_1 \ln(y_{it}) + \beta_2(y_{jt}) + \beta_3 \ln(\text{Dist}_{ij}) + \beta_4 \ln(t_{ijt}^k) + \beta_5 \ln(\upsilon_{ij}^k) + \beta_6 \text{colony}_{ij} \\ & + \beta_\lambda \text{IMR}_{ijt}^k + fe_i + fe_j + fe_t + fe_{product} + \varepsilon_{ijt}^k \qquad (7) \end{aligned}$$

The equation 7 includes the inverse mill ratio; the description of the variables included in the equations is given in appendix table 3.

4- Estimation results

The empirical analysis involves 24 raw products aggregated into 4 mixes. The coefficient for importer, exporter time and product fixed effects are not reported. Table 4 Column 1 presents results from OLS regression. The results from the selection equation are reported in column 3, the outcome equation in column 5. The coefficient of per capita GDP of importing and exporting country are not reported, their coefficient is not significant in all estimated regressions. The selection equation shows a negative and significant impact of distance, tariff and strictness. The effects of distance and strictness are quite similar: -0.27 and -0.20. Focusing on the variable of interest of the present study we can say that the effect of strictness measure can increase the cost of a country to exports to the EU market because of additional costs to comply with the EU regulation, which confirms our intuition. Tariff displays a higher coefficient -0.50 than strictness. This result is not surprising because EU's applied very high tariff on baby-food. Positive and significant effects of colonial links and common language on the probability of trade are found. The results suggest that the decision whether to trade is affected by the distance, tariff and regulatory strictness. The estimated selection coefficient ($\hat{\lambda}$) is statistically significant, confirming that the absence of control for zero flows generates biased results.

The amount of trade is affected by the distance by -1.63. Tariff and severity do not show significant impact on the volume of trade. If a country is able to comply with the standards imposed by the EU, then the severity measure does not impact on the volume of trade. Furthermore, results also show that this amount is positively and significantly influenced by colonial links. One of the problem regarding the Heckman selection model is that the estimated parameters of the variables in the probit part cannot be interpreted as conventional marginal effects, in table 5 we report them.

Ramsey specification test (Ramsey 1969) is used to detect whether the outcome equation is correctly specified, the significance of the test suggests that mis-specification does not exist (0.182). As for the robustness check of our results, we have estimated different specifications of the gravity model and each specification confirms our results. We have also have checked for GSP Preferential Trade Agreements by including in the gravity equation a dummy variable accounting for[2] them. Results are not reported but are available upon request. GSP dummy

[2] According to COUNCIL REGULATION (EC) No 732/2008 Argentina, China, India, Mexico, Philippines, Russia and South Africa benefit from the EU GSP ordinary preferential scheme. Brazil has been removed from the GSP for

variable exhibits positive effects and the severity measure is still negative. Furthermore, we have run the gravity equation by ZIMs and Hurdle Double Models, results are quite similar to the Heckman procedure and are still confirmed. From a policy perspective, this study provides evidence that the EU regulation on MRL of pesticides acts as barrier to trade of baby food products, being the EU regulation on food safety crucial on the decision of trade.

5- Conclusion

In this study we assess the impact of food safety regulation on EU imports of baby food products using a gravity analysis. In the first section of the paper we describe the EU regulation compared with the exporter ones. The scientific literature agrees on the fact that pesticides and contaminants contribute to numerous health problems including cancer, lung disease or reproductive, endocrinal and immune system disorders, by stressing the idea that children are more vulnerable to the dangers of pesticides and contaminants than adults (Muhlendahl et al. 1996; Koletzko et al. 1999). Following the recent literature on food safety regulations and standard (Achterbosch *et al*. 2009; Rau *et al.* 2010, Drogué and Demaria 2012; Winchester *et al.* 2012; Li and Beghin 2012) we build and index that measuring the strictness of the EU regulations compared to its major trading partners. While the EU has specific regulations on maximum residue level (MRL) of contaminants protecting children from deleterious substances intake, most of exporting countries do not. The EU's regulation can be interpreted as a form of protection of the emerging market of baby food constraining other countries to export primary product rather than processed one to the European markets. After describing the EU regulation we show the severity's measure for 4 baby food products and include it in the gravity equation. The index captures the relative stringency of EU's regulation. The index ranges between 0 and 1.33: the higher the index the stricter the EU regulation. The sample covers on the importing side each of the EU 27 members states, on the exporting sides 16 main exporting countries: Argentina, Australia, Brazil, Canada, Chile, China, India, Japan, Korea, Mexico, New Zealand, Philippines, Russia, South Africa, Switzerland and USA.

The results across estimators are quite robust; the coefficient has a negative and strongly significant sign. The estimated results show, that EU's regulation may constrain trade, however

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the following products: Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes.

the effect of tariff is higher than the strictness' measure. We acknowledge that these findings need further research, this should be considered as the starting point of a deeper analysis which should involve the changing of the MRLs in EU and its trading partners in 2011.

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Appendix

Table 2: Rules on missing value of pesticides

	Rule when a pesticide is not registered
Argentina	1- Codex 2- Zero-tolerance
Australia	Zero-tolerance
Brazil	Codex
Canada	Default limit of 0.1 mg/kg
Chile	Codex
China	1- Codex 2- Limits applied by reference countries (EU, USA)
EU	Default limit of 0.01 mg/kg
India	No default limit
Japan	Default limit of 0.01 mg/kg
Korea	1- Codex 2- Limit of most similar group of product 3- Default limit of 0.01 mg/kg
Mexico	Zero-tolerance
New Zealand	1- Codex recognized for imported food 2- Australian MRLs recognized for food imported from Australia. 3- Default limit of 0.1 mg/kg applies
Philippines	No default limit
Russia	1- Codex 2- Memorandum with Chile and the EU 3- MRL of the most similar product 4- MRL of the country of origin
South Africa	EU limit
Switzerland	EU limit
USA	Zero-tolerance

Table 3: description of the Variables

Variables	Description
M_{ijt}^{k}	Value of EU imports from country j in product k in year t
d_{ij}^{*}	A binary variable such that $z_{ij}^{*} = 1$ if $M_{ijt}^{k} > 0$
$fe_i, fe_j, fe_t, fe_{product}$	Respectively importing, exporting, year and product fixed effects
$Dist_{ij}$	Distance between partners
t_{ijt}^{k}	EU's applied tariff for country *j*, products *k* and year *t*
υ_{ij}^{k}	measure identifying the severity between EU and its partners *j* for product *k*.
y_{jt} and y_{jt}	Respectively Per Capita Gross Domestic product of country *i* and *j* in year *t*
$InfantPop_{it}$ and $InfantPop_{jt}$	Is the infant population in EU country *i* and its trading partners *j*
$colony_{ij}$	Binary variable which is equal to 1 if trading partners have had a colonial link and zero otherwise
$lang_{ij}$	Binary variable which is equal to 1 if trading partners share the same language and zero otherwise
u_{ijt}^{k} and ε_{ijt}^{k}	Error term of the selection and outcome equation
IMR_{ijt}^{k}	Inverse Mills Ratio

Table 4: Heckman Results

	OLS		*Selection*		*Outcome*	
	Beta	*SE*	*Beta*	*SE*	*Beta*	
Infant Pop Importer	0.64	14.40	2.06	(3.33)	2.52	(13.55)
Infant Pop Exporter	24.53	17.40	4.75	(3.77)	27.77*	(16.53)
Distance	-0.56	0.66	-0.27*	(0.15)	-1.63*	(0.63)
Tariff	-0.55***	0.20	-0.50***	(0.05)	-0.39	(0.52)
Severity Index	-0.58***	0.20	-0.20***	(0.05)	-0.46	(0.28)
Colony	0.69*	0.77	0.67***	(0.14)	2.31*	(0.91)
Language	0.29	0.50	0.42***	(0.13)		
mills lambda			2.02*	(1.22)		
Observations	559		5184			
R^2	0.36					
Reset Test	YES		Yes			

Note: Selection Equation: dependent variable Prob(M_{ijt}^{k}>0); Outcome Equation: dependent Variable ln(M_{ijt}^{k}). Product, Importer, Exporter and time fixed effect (not reported); Intercept (not reported). Standard errors in parentheses: (*) significant at 10% level; (**) significant at 5% level; (***) significant at 1% level. Common Language is the excluded variable.

Table 5: Probit Regression Marginal Effects

	Probit Marginal	
	Beta	*SE*
Distance	-0.03*	(0.01)
Tariff	-0.05***	(0.004)
Severity Index	-0.02***	(0.004)
Colony	0.10***	(0.03)
Language	0.05*	(0.02)
Observations	5184	
Pseudo R^2	0.277	

Note: Selection Equation: dependent variable Prob(M_{ijt}^{k}>0); Product, Importer, Exporter and time fixed effect (not reported); Intercept (not reported). Standard errors in parentheses: (*) significant at 10% level; (**) significant at 5% level; (***) significant at 1% level.