THE IMPACT OF EU AND US AGRO-FOOD NON TARIFF MEASURES ON EXPORTS FROM DEVELOPING COUNTRIES

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Introduction

Controversies are surrounding the emergence and proliferation of agro-food sanitary and phytosanitary (SPS) regulations, and more in general the widespread use of non-tariff measures (NTMs). NTMs represent a heterogeneous class of policy instruments, which may restrict the market access in an importing country[1]. According to a recent report of OECD, the impact on trade of NTMs is the result of four different effects: trade creation, trade reduction, trade prohibition and trade diversion[2]. Trade is created because NTMs may provide public goods to consumers, such as protection of human, animal and plant health [Maskus, Wilson and Otsuki]. In addition, NTMs may reduce the asymmetry of information in the market. For example, labelling requirements can allow an easier comparison of quality attributes of agro-food products, or turn food credence attributes, such as organic or GMO production, into search attributes. Trade may decrease because NTMs raise the overall supplier's production and transaction costs. Production costs may increase because of changes in production process or raw materials requirements, whereas transaction costs may raise because of delays, redundant tests and inspections at the border of importing country.

While undoubtedly importing country´s no-tec NTMs appear to be protectionist measures [Baldwin; Bhagwati], the issue on technical requirements is controversial. On one hand, technical regulations are employed to effectively address market failures characterizing production and distribution of agro-food products [Roberts and DeRemer]. On the other hand, importing countries may use them in a questionable manner. For example, they may discriminate foreign suppliers, they may be stricter than necessary, and they may duplicate exporting firms' operating costs [Wilson].

NTMs penalize developing economies not only because these countries lack in infrastructures, financial resources, know-how and technical skills, but also because they do not have the institutional arrangements necessary to monitor and enforce compliance. Henson *et al* found that SPS requirements in developed countries heavily constrain the market access of agro-food products from developing countries. Gaps and lags in developing countries' technology and infrastructure are the main reasons. Another disadvantage of developing economies is that SPS requirements of industrialized countries may be stricter than necessary. A study highlights how SPS European requirements have an adverse effect on African groundnuts exports, because they are stricter than Codex Alimentarius Commission's standards. Employing a gravity model, it is estimated that for a 10% reduction in the maximum allowable content of aflatoxins there is a 10% decrease in African exports [Otsuki, Wilson and Sewadeh].

Evidence from the literature suggests that the technical measures of developed economies have a perverse effect on developing countries. NTMs raise issues of market access in importing countries. The widespread use of quality product standards may constitute a challenge for developing countries because of their limited capacity of developing, enforcing and complying with product standards. In addition, often authorities of developed economies do not trust inspection procedures in developing countries [Baldwin, 2001; Henson *et al*]. However, to date we lack of empirical studies providing a comprehensive quantitative evaluation of the impact of NTMs on agro-food exports from developing countries. Third world countries represent approximately 20% of the world agro-food trade, and therefore they have an important and growing role for a successful conclusion of multilateral trade negotiations. The quantification of the impact of technical measures on agro-food trade is an important step in future trade negotiations. Besides, in most developing countries agro-food exports are a relevant source of foreign currencies, income and employment. Any impediment to the growth of their agricultural sectors, such as NTMs, may offset their attempts of economic development.

The purpose of this study is to evaluate the impact of EU and US agro-food NTMs on imports from African, Asian, Oceania and Latin American developing countries. In particular the objectives are:

a) to compare agro-food NTMs implemented by US and EU, the two major blocks in world agricultural trade;
b) to evaluate the trade response of developing countries to European and US NTMs;
c) to appraise whether US and EU NTMs have a different impact across agro-food product aggregates;
d) to assess whether US and EU NTMs discriminate the geographic origin of agro-food imports.

The paper is organized as follows: first, we provide an overview of the data employed in this investigation. An evaluation of the US and EU NTMs applied to agro-food products from developing country follows. Next, we describe the methodology and comment the results. Some concluding remarks end the paper.

Data

The Trade Analysis Information System (Trains, 2002 version 9) from UNCTAD is our source of data. It reports information on trade flows among UN member countries from 1995 to 1999. For any importing country, import volume and value of a specific good from any origin are provided. Traded goods are classified according to the main international standards (Harmonized System, HS, Standard International Trade Codes, SITC). The maximum level of product detail is 6-digit level[3].

The database provides also information on NTMs applied at the border of an importing country in 1999. Table 2 provides a description of the NTMs considered in this investigation. In the case of non-tariff provisions, however, traded goods are classified according to a national system (national tariff lines), for which product classification could go further than the 6-digit level. In fact, 10-digit is the level followed by the US national tariff lines, while the European national lines follow a 9-digit level. To match observations containing trade values and NTMs, both for the year 1999, we have reclassified the UNCTAD data on NTMs for both EU and US according to the HS system at 6-digit level. We have excluded duplications (when the same measure is applied to several tariff line within the same 6-digit product category) and therefore consider only the effective number of NTMs applied to each agro-food product.

To model the impact of NTMs on EU and US agro-food imports from developing countries, we consider also those agro-food products (HS 6-digit) facing either US or EU NTMs for which we did not observe trade flows. In fact, this could reflect the negative impact of NTMs or a zero import demand from that developing country. Since we do not know why the export value is equal to zero, we need to specify an econometric model addressing this issue. Finally, to minimise the error of including countries without competitive advantage in agro-food production, we take into consideration only those countries with a value of agro-food exports greater than $100 in 1999.

Incidence of Non-Tariff Measures on EU and US agro-food import from developing country

To compare the incidence of NTMs on EU and US agro-food imports from developing countries, we evaluate the distribution of NTMs across agro-food aggregates[4] according to the inventory approach[5]. Tables 3 and 4 show the total number of NTMs faced by agro-food exports from developing countries at the EU and US borders in 1999 classified by measure type and product category.

Structural differences emerge comparing the incidence of US and EU NTMs on agro-food imports from developing countries. Table 3 shows that the majority of NTMs applied to European agro-food imports are no-tec NTMs. The remaining 23% concern quality product attributes (tec NTMs). For example, import prohibitions for safety issues represent 61% of all tec NTMs enforced at the EU border. The opposite is true for the US border (table 4). In fact, in 1999 72% of the NTMs applied to agro-food imports from developing countries are tec NTMs. Testing, inspection and quarantine measures, and technical requirements for safety matters represent respectively 42% and 34% of all tec NTMs.

From the distribution of NTMs across agro-food product aggregates, it is worth noting how in the EU the imports of “Fish and derivates” and in the US the imports of “Meat and derivates” are the two aggregates facing the largest incidence of NTMs. Instead, at both borders the imports of “Coffee, cocoa, tea and spices” from developing countries appear to be the less regulated, the reason being that these products do not compete directly with the domestic agro-food production.

Finally, comparing the stacking number[6] of the NTMs applied at both borders across the 6 commodity groups, a difference stands out. At the EU border, on average less than a NTM (0.9) is applied at each agro-food import, while the average stacking number becomes 1.5 in the US. Thus, the US border appears to be more regulated than the European one.

Gravity Models

Traditionally gravity models have been used to appraise the overall trade impact of free trade areas. [Swan, Temple and Shurmer; Wall; Cheng and Wall; Zahniser, *et al*]. However, recently they have been successfully employed to evaluate the border's trade response to agro-food imports, if NTMs are in place [Maskus, Wilson and Otsuki; Otsuki, Wilson and Sewadeh]. Equation 1 represents the general form of a gravity model:

$$Y_{kijt} = \alpha + \beta_i M_{it} + \beta_j M_{jt} + \pi_i Pop_{it} + \pi_j Pop_{jt} + \delta_{ij} dist_{ij} + 1'\mathbf{B} + \varepsilon_{ijt} \quad (1)$$

where $Y_{kijt} = \ln(1+exp^k_{ijt})$ and exp^k_{ijt} is the export value of good *k* from country *i* to *j* at time *t*; *k* is a code of product identification according to international standard codes (HS or SITC). M_{it} e Pop_{it} are respectively wealth and population in the exporting country *i* at time *t*, while M_{jt} and Pop_{jt} are the same economic variables in the importing country *j;* $dist_{ij}$ is the geographic distance among country *i* and *j*, given a fixed arbitrary criterion; **B** is a matrix of exogenous variables with a potential impact on export flows. Finally ε_{ijt} is the error term in equation 1. The Greek letters represent the estimated parameters.

The value of exp^k_{ijt} may be equal to zero. Since it is not possible to distinguish whether exp^k_{ijt} is zero because of the impact of the variables in **B** or not, equation 1 is estimated with the following tobit model:

$$Y^*_{kijt} = \alpha + \beta_i M_{it} + \beta_j M_{jt} + \pi_i Pop_{it} + \pi_j Pop_{jt} + \delta_{ij} dist_{ij} + 1'\mathbf{B} + \varepsilon_{kijt} \quad (2)$$

where Y^*_{kijt} is a latent variable; $Y_{kijt}=0$ if $Y^*_{kijt} \leq 0$, otherwise $Y_{kijt} = Y^*_{kijt}$ if $Y^*_{kijt} > 0$ [Zahniser *et al*]. Thus, Y_{kijt} has a truncated normal distribution and ε_{kijt} is distributed with mean zero and variance σ^2. The specification of a tobit model allows to estimate both equation's parameters and the error variance σ^2 [Maddala, p.339].

In presence of cross-sectional observations eq.[1] is simplified since the temporal dimension of the data is lost. Variables accounting for population in both importing and exporting countries are dropped because of the perfect collinearity with their respective GDPs:

$$Y_{kij} = \alpha + \beta_i M_i + \beta_j M_j + \delta_{ij} dist_{ij} + 1'\mathbf{B} + \varepsilon_{ij} \quad (3)$$

Moreover, if trade flows are evaluated only for either an exporting or an importing country, then equation 3 is further simplified because either M_{it} and Pop_{it} or M_{jt} and Pop_{jt} together with $dist_{ij}$ will be cross-sectionally constant. For example, if we evaluated trade flows for the same importing country, then equation 3 would be rewritten as:

$$Y_{kij} = \kappa + \beta_i M_i + 1'\mathbf{B} + \varepsilon_{ij} \quad (4)$$

where κ accounts simultaneously for the importing country's border effect and wealth; $dist_{ij}$ is dropped because of the perfect collinearity with M_i.

To achieve our objectives, we estimated three different gravity models in which **B** is specified in three different ways[7]. To evaluate whether different types of NTMs have the same impact, regardless which country (i.e. US or EU) adopts them, then **B** is specified as:

$$\mathbf{B} = [pro_{k,i,j}\ tec1_{k,i,j}\ tec2_{k,i,j}\ tec3_{k,i,j}\ tec4_{k,i,j}\ mark1_{k,i,j}\ mark2_{k,i,j}\ lab1_{k,i,j}\ lab2_{k,i,j}\ ins1_{US,k,i}\ ins2_{US,k,i}\ ins3_{US,k,i}]$$

where each component (see table 2) is a count variable for a given NTM faced by the developing countries *i* exporting the agro-food product *k* (HS 6-digit level) to the importing country *j* (US, EU).

To assess whether the impact of a) non-technical (nt) NTMs, b) technical NTMs for safety matters (ts) and c) technical NTMs for non-safety matters (tns), differs across commodity groups, **B** is defined as:

B = [*nt*MEA *ts*MEA *tns*MEA *nt*VEG *ts*VEG *tns*VEG *nt*CER *ts*CER *tns*CER *nt*FIS *ts*FIS *tns*FIS *nt*COF *ts*COF *tns*COF *nt*OTH *ts*OTH *tns*OTH]

where *nt*, *ts* and *tns* are respectively count variables of for the previous three NTMs' groups, while MEA, VEG, CER, FIS, COF and OTH are the 6 aggregates of agro-food products considered in the analysis[8].

Finally, to evaluate whether the impact of these different groups of NTMs have a different impact across geographic continents, we specify **B** as:

B = [*nt*AF *ts*AF *tns*AF *nt*AS *ts*AS *tns*AS *nt*OC *ts*OC *tns*OC *nt*AM *ts*AM *tns*AM]

where *nt*, *ts*, and *tns* follow the previous definitions, whereas AF, AS, OC and AM identify the geographic continent of origin: Africa, Asia, Oceania and Latin America.

The empirical results according these specifications follow. In all the above **B** specifications, the estimated coefficients evaluate the trade impact of one additional measure.

Empirical Results

Table 5 reports the estimated coefficients and elasticity of equation 3, following the first specification of **B** in the previous paragraph. Rather than estimating the model with the constant term α, we employed a dummy variable to evaluate whether US and EU borders have a different impact on agro-food imports from developing countries independently from the NTMs enforced: d_{EU}, d_{EU}=0 if the US is importing country, and d_{EU}=1 if it is the EU. The estimated coefficient d_{EU} indicates that EU would import *ceteribus paribus* more agro-food products than US, because in EU transaction costs are on average 1.97% lower[9]. From the other estimated parameters, it emerges how geographic distance and importing country's GDP do not play a role in explaining agro-food trade flows, while the estimated elasticity of the trade response with respect to the GDPs of exporting countries is significant at the 0.01 level. According to the results, an increase in the exporting country's GDP would increase more than proportionally its export (1.7 times). For a given exporting developing country, we expect a positive relationship between its agro-food export and its GDP[10].

Significant differences emerge comparing the impact that the same NTM would have if implemented either at the US or EU border (table 5). Firstly, the results indicate that US and EU no-tec NTMs ($ntec_{US}$ and $ntec_{EU}$) have a negative impact at both borders. However, the estimated effect of the EU measures is 4.5 times more severe than the one at the US border. Secondly, US and EU technical product requirements for safety matters ($tec1_{US}$ and $tec1_{EU}$) have a different impact on the imports of agro-food products from developing countries. In the US, one additional measure would increase imports by 1.79%. Instead, in EU the estimated impact is –0.16%. However, since in our sample the

EU has implemented a technical requirements for safety matters always in conjunction with a marking requirement, the estimated impact accounts for both. Thirdly, US and EU inspection and testing measures for safety matters ($ins1_{US}$ and $ins1_{EU}$) have a different effect on imports. On one hand, one additional European measure would not affect agro-food imports. On the other hand, an additional US measure would decrease import by 2.79%. Finally, US and EU marking requirements for safety matters ($mark2_{US}$ and $mark2_{EU}$) have both a slightly negative impact on agro-food imports. An additional measure would reduce the import by 0.08% in the EU and by 0.06% in the US. However, since in our sample the US has implemented a marking requirement for safety matters always in conjunction with a labelling requirement, the estimated impact accounts for both.

Table 6 reports the empirical results on the impacts of NTMs across commodity groups, estimating eq.4 with the second **B** specification in the previous paragraph.   Results suggest that NTMs reduce the level of agro-food imports from developing countries. NTMs penalize some commodity groups, such as meat products, cereals and their derivates, and vegetables and fruits, more than others. Furthermore, some differences emerge comparing the NTMs impacts between the two borders.

Imports of meat products from developing countries are penalized in the US as well as in the EU. At the US border, one additional no-tec NTM would raise import by 1.69%. On the other hand, one additional tec NTMs reduces imports by 2.20%, if it is applied to preserve human health; otherwise the import reduction is only 1.59%. Instead, at the EU border no-tec NTMs penalize meat import from developing countries more than ts NTM. In fact, one additional no-tec NTMs, such as import license and authorization, would decrease import by 1.52%, whereas the impact of technical measures concerning human health is –0.42%.

In the US, vegetables and fruits imports from developing countries is the second most penalized agro-food category. One additional no-tec NTM would reduce imports by 1.21%, while the impact of technical measures for safety matters is –0.31%. Instead, in the EU cereals and their derivates are ranked second with respect to the negative trade impact of NTMs. One additional no-tec NTM would reduce their imports from developing countries by 1.54%, while –0.26% is the estimated trade response for one additional European ts NTM.

Table 7 reports the estimated trade response of US and EU borders with respect to the geographic provenience of agro-food products. In this case, **B** in equation 4 reflects the third specification in the previous paragraph. From the results it is possible to conclude that the impact of NTMs varies according to the geographic provenience of agro-food products. Tables 8 and 9 indicate the value of imports from developing countries located in the four continental areas considered.

Agro-food products from Latin America are the most penalized both at the US and EU borders. In fact, one additional no-tec NTM would reduce US imports by 0.77%, one additional technical measures for safety issues would reduce agro-food imports by -1.19% and finally –0.21% is the imports reduction if US adopted one additional no-safety technical measures. The negative impact of the European measures is distributed differently across NTMs. In fact, one additional no-tec NTM, such as import authorization or license, will reduce European agro-food imports by 2.12%, while –

0.25% and +0.02% are the impacts of one additional measure for safety and non-safety matters respectively.

In the EU, imports from Africa are penalized as much as the ones coming from Latin America. In fact, one additional no-tec NTM would reduce the EU agro-food imports from Africa by 2.15%. The estimated impacts of one additional technical measure for safety and non-safety matters are -0.25% and +0.01% respectively.

Concluding remarks

Controversies are surrounding the emergency and proliferation of agro-food SPS regulations, and more in general the widespread use of NTMs. Evidence from the literature suggests that technical measures enforced at the border of developed economies have a perverse effect on developing countries, raising issues regarding market access. However, beside some exceptions, most of those studies were based on a qualitative assessment. This study highlights three important aspects.

Firstly, structural differences arise comparing the trade impact of European and US NTMs. European technical requirements on quality product attributes have a detrimental impact on agro-food imports from developing country. Instead, in the case of US, a trade creation effect is predominant. EU and US labelling and marking requirements have a comparable negative impact on imports. Finally, inspection, quarantine requirements, and non-technical NTMs have a negative impact at both borders. Nevertheless, comparing the estimated effects at the European and US border, significant discrepancies emerge. Secondly, the impact of technical measures differs across typologies of agro-food products. Comparing the estimated effect of US and EU NTMs, there is no evidence of a clear pattern. However, it emerges how the US does not apply any NTM to typical colonial products such as coffee, cocoa, tea and spices, with one additional measure decreasing imports of such product by 0.06%. Thirdly, the origin of the agro-food products affects the estimated trade impact.

These results suggest that in general developing countries would gain market access in developed economies by negotiating bilateral trade agreements rather than multilateral, since the impact of NTMs not only depends on the type of measures applied, but also on the agro-food products regulated and their origin.

Tables

Table 1. Agro-food products according to the Harmonized System (HS) at 2-digit level

Description	**HS (2-digit)**
Live animals	01
Meat and edible meat offal	02
Fish & crustacean	03
Dairy product; birds' eggs; natural honey	04
Products of animal origin	05
Live tree & other plants; cut flowers	06
Edible vegetables	07
Edible fruits and nuts	08
Coffe, tea and spices	09
Cereals	10
Malt; starches; inulin; wheat gluten	11
Oil seed, oleag. Fruits	12
Lac; gums, resins	13
Vegetable plaiting materials	14
Animal/veg fats & oil	15
Prep of meat and fish	16
Sugars and sugar confectionery	17
Cocoa and cocoa preparations	18
Prep. of cereal, flour, starch/milk; pastrycooks prod.	19
Prep of vegetable and fruits	20
Miscellaneaous edible preparations	21
Beverages, sprits and vinegar	22

Source: Trains (ver. 9, 2002), UNCTAD.

Table 2. Technical non-tariff measures

Typology of technical non-tariff measure	**Abbreviations**
Prohibition (Safety)	pro
Techn.reqts. (Health)	tec1
Techn.reqts. (Plants)	tec2
Techn.reqts. (Drugs)	tec3
Tech.requirements n.e.s.	tec4
Marking requirements	mark1
Marking reqts. (Health)	mark2
Labelling requirements	lab1
Labelling reqts. (Health)	lab2
Inspec.quarant. (Health)	ins1
Inspec.quarant. (Animals)	ins2
Inspec.quarant. (Plants)	ins3

Source: Trains (ver. 9, 2002), UNCTAD.

Table 3. Non-tariffs measures, by type of measure and product group, applied in the EU to all agro-food imports from developing countries in 1999

Product category	no-tec NTMs	Prohib. (Safety)	Techn. reqts. (Health)	Techn. reqts. (Plants)	Techn. reqts. (Safety)	Tech. reqts.	Marking reqts.	Marking reqts. (Health)	Labelling reqts.	Labelling reqts. (Health)	Inspec. quarant. (Health)	Inspec. quarant. (Anim)	Inspec.quarant. (Plants)	stk
Meat & derivates	2,949	1,610	-	-	-	.	-	-	-	-	-	-	-	1.6
Fish & derivates	1,369	474	-	-	-	-	-	-	-	-	-	-	-	0.9
Cereal & derivates	2,191	-	618	-	-	-	-	618	-	-	-	-	-	1.2
Coffee, cocoa, tea and spices	100	-	-	-	-	-	-	-	-	-	-	-	-	0.4
Vegetables and fruits	1,434	-	-	-	-	59	-	-	-	-	59	-	-	0.6
Other agro-food products	3,489	-	-	-	-	-	-	-	-	-	-	-	-	0.7
	11,532	2,084	618	-	-	59	-	618	-	-	59	-	-	0.9

Source: Trains (ver. 9, 2002), UNCTAD.

Table 4. Non-tariffs measures, by type of measure and product group, applied in the US to all agro-food imports from developing countries in 1999

Product category	**no-tec NTMs**	**Pro. (Safety)**	**Techn. reqts. (Health)**	**Techn. reqts. (Plants)**	**Techn. reqts. (Safety)**	**Tech. reqts.**	**Marking reqts.**	**Marking reqts. (Health)**	**Labelling reqts.**	**Labelling reqts. (Health)**	**Inspec. quarant. (Health)**	**Inspec. quarant. (Anim)**	**Inspec.quarant. (Plants)**	**stk**
Meat & derivates	1,451	-	289	-	-	-	-	520	-	520	1,677	931	-	1.8
Fish & derivates	435	-	2,703	-	-	-	-	-	-	-	2,703	-	-	2.1
Cereal & derivates	542	-	479	-	-	-	-	-	-	-	479	-	-	1.5
Coffee, cocoa, tea and spices	-	-	-	-	-	-	-	-	-	-	-	-	140	0.0
Vegetables and fruits	3,131	-	1,767	-	-	-	-	-	-	-	1,767	-	247	1.6
Other agro-food products	1,946	-	1,225	330	127	-	493	130	527	130	1,225	78	391	1.8
	7,505	-	6,463	330	127	-	493	650	527	650	7,851	1,009	778	1.5

Source: Trains (ver. 9, 2002), UNCTAD.

Table 5. Generic gravity model (eq. 3) estimates

Variables	Coefficient	elasticity	
d_{US}	3.78		***
gdp_{EXP}	0.10	1.68	***
gdp_{IMP}	-0.02	-0.45	
dis	0.02	0.18	
$ntec_{EU}$	-9.68	-3.65	***
pro_{EU}	-2.00	-0.14	***
$tec1_{EU}$ §	-7.94	-0.16	***
$tec4_{EU}$ §§	7.30	0.02	***
$mark2_{EU}$ §	-	-	
$ins1_{EU}$ §§	-	-	
$ntec_{US}$	-3.22	-0.79	***
$tec1_{US}$	8.15	1.72	***
$tec2_{US}$	0.34	0.00	
$tec3_{US}$	3.15	0.01	***
$mark1_{US}$	-3.10	-0.05	***
$mark2_{US}$ §§§	-5.58	-0.12	***
$lab1_{US}$	2.02	0.03	*
$lab2_{US}$ §§§	-	-	
$ins1_{US}$	-10.85	-2.79	***
$ins2_{US}$	-3.16	-0.10	***
$ins3_{US}$	-3.71	-0.09	***
σ^2	5.71		***
log-likelihood	-40180		
obs	30547		
obs>0	9969		

§ Since the vector $tec1_{EU}$ is equal to $mark2_{EU}$, we have dropped one of them. The estimated coefficient represents the cumulate effect of those variables.

§§ Since the vector $tec4_{EU}$ is equal to $ins1_{EU}$, we have dropped one of them. The estimated coefficient represents the cumulate effect of those variables.

§§§ Since the vector $mark2_{US}$ is equal to $lab2_{US}$, we have dropped one of them. The estimated coefficient represents the cumulate effect of those variables.

Obs are the total observation in the sample, while obs>0 are the observation with import greater than zero.

*, ** and *** indicate significance at .10, .05, and .01 level.

Table 6. Commodity gravity model (eq. 4) estimates

	US border		EU border	
Variables	**coefficient**	**elasticity**	**coefficient**	**elasticity**
constant	0.60		2.74	***
GEXP	0.06	1.09 ***	0.15	2.45 ***
ntMEA	16.97	1.69 ***	-8.24	-1.52 ***
tsMEA	-10.63	-2.20 ***	-4.18	-0.42 ***
tnsMEA	-24.82	-1.59 ***	-	-
ntVEG	-5.64	-1.21 ***	-7.29	-0.65 ***
tsVEG	-1.26	-0.31 ***	5.38	0.02 ***
tnsVEG	-0.29	0.00	-	-
ntCER	-6.64	-0.25 ***	-11.28	-1.54 ***
tsCER	-0.82	-0.05 ***	-3.40	-0.26 ***
tnsCER	-	-	-	-
ntFIS	3.40	0.10 ***	-5.84	-0.50 ***
tsFIS	-2.68	-0.99 ***	-0.32	-0.01
tnsFIS	-	-	-	-
ntCOF	-	-	-10.11	-0.06 ***
tsCOF	-	-	-	-
tnsCOF	-7.90	-0.08 ***	-	-
ntOTH	-2.63	-0.35 ***	-8.54	-1.86 ***
tsOTH	-2.21	-0.43 ***	-	-
ntsOTH	-2.08	-0.26 ***	-	-
σ^2	6.94	***	4.55	***
log-likelihood	-18365		-20922	
obs	14543		16004	
obs>0	4129		5840	

Obs are the total observation in the sample, while obs>0 are the observation with import greater than zero.
*, ** and *** indicate significance at .10, .05, and .01 level.

Table 7. Geographic gravity model (eq. 4) estimates

	US border			EU border		
Variables	**coefficient**	**elasticity**		**coefficient**	**elasticity**	
constant	-1.73		***	3.89		***
GEXP	0.07	1.16	***	0.07	1.22	***
ntAF	-2.00	-0.05	***	-8.84	-2.15	***
tsAF	-1.79	-0.09	***	-3.53	-0.25	***
tnsAF	0.06	0.00		8.43	0.01	***
ntAS	-3.94	-0.70	***	-7.73	-1.62	***
tsAS	-0.94	-0.35	***	-2.13	-0.13	***
tnsAS	-1.31	-0.10	***	2.80	0.00	
ntOC	3.26	0.00		-10.57	-0.16	***
tsOC	2.56	0.01	***	-4.62	-0.02	***
tnsOC	1.12	0.00		-	-	
ntAM	-2.49	-0.77	***	-8.37	-2.12	***
tsAM	-1.82	-1.19	***	-3.32	-0.25	***
tnsAM	-1.64	-0.21	***	13.92	0.02	***
σ^2	7.38		***	4.70		***
log-likelihood	-18974			-21344		
obs	14543			16004		
obs>0	4129			5840		

Obs are the total observation in the sample, while obs>0 are the observation with import greater than zero.
*, ** and *** indicate significance at .10, .05, and .01 level.

Table 8. Value of US agro-food imports from developing countries in 1999 (1,000 US$)

Imports of Agro-food Products	Africa	Latin America	Asia	Oceania
Meat & derivates	6,391	812,471	43,509	366
Vegetables and fruits	62,210	6,575,575	1,117,248	174
Cereals & derivates	2,539	335,953	322,019	-
Coffee, cocoa, tea and spices	481,703	2,552,414	818,954	53,487
Fish & derivates	35,064	2,541,743	2,686,225	17,827
Other agro-food products	100,169	3,387,027	1,265,957	5,719
	688,076	16,205,183	6,253,912	77,573

Source: Trains (ver. 9, 2002), UNCTAD.

Table 9. Value of EU agro-food imports from developing countries in 1999 (1,000 US$)

Imports of Agro-food Products	Africa	Latin America	Asia	Oceania
Meat & derivates	178,094	1,381,531	501,968	2,116
Vegetables and fruits	1,527,067	4,384,111	2,957,995	26
Cereals & derivates	17,222	329,851	358,013	-
Coffee, cocoa, tea and spices	3,032,902	2,938,535	919,190	132,406
Fish & derivates	1,775,329	1,548,006	1,421,083	13,596
Other agro-food products	1,248,884	3,848,861	2,303,434	212,841
	7,779,498	14,430,895	8,461,683	360,985

Source: Trains (ver. 9, 2002), UNCTAD.

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Footnotes

[1] There are four different classes of NTMs: quantitative restriction to importations, countervailing and antidumping measures, para-tariff measures and technical regulations on quality product attributes. Hereafter, no-tec NTMs will individuate any measure belonging to the first three classes, while tec NTM will indicate the class of technical provisions on quality product attributes.
[2] The notion of trade creation refers to the possibility that NTMs may create trade, because they, addressing market failures, may stimulate the demand. Trade reduction and prohibition refer to the negative impact of NTMs on the production function of foreign suppliers; however if production costs increase to a prohibitive level, trade is inhibited. Finally, NTMs may impose different compliance costs on importing countries to an extent that trade is diverted from one country to another.
[3] For example with a 6-digit level of disaggregation and following the HS system, the entire set of agro-food products ranges from the good HS 010111, "horse alive", to the good 220900, "vinegar and other products with acetic acid". Table 1 provides a list of agro-food products according to the HS system at 2-digit level.
[4] From the 22 HS agro-food product categories at 2-digit level (table 1), we define the following 6 groups: <u>Meat and its derivates</u>, including all products in HS 01 and 02, and the ones from HS 160000 to HS 160290; <u>Fish and its derivates</u>, including all products belonging to the group HS 03 and the ones from HS 160300 to HS 160590; <u>Cereal and its derivates</u>, including all products in HS 10, 11 and 19; <u>Coffee, cocoa, tea and spices</u>, including all products within the category HS 09 and 18; <u>Vegetables and fruits</u>, including all products in HS 07, 08, 20; <u>Other agro-food products</u>, including all products belonging to the categories HS 04, 05, 06, 12, 13, 14, 15, 17, 21 and 22.
[5] Ndayisenga and Kinsey used this approach to evaluate the use of NTMs in the international agro-food trade. Their source of data was the UNCTAD Trade Control Measures, which reports information on all NTMs implemented from 1980 to 1991 among UN members.
[6] The stacking number indicates the number of NTMs applied simultaneously.
[7] In our gravity model the geographic distance is calculated as the linear distance between either Brussels in EU or Kansas City in US and the Capital city of each exporting developing country.
[8] The aggregate of agro-food products: 1) Meat & derivates (_MEA); 2) Vegetables and fruits (_VEG); 3) Cereals & derivates (_CER); 4) Fish & derivates (_FIS); 5) Coffee, cocoa, tea and spices (_COF); 6) Other agro-food products (_OTH). Details on their HS codes are in footnote 4.
[9] Since the estimated coefficients $\partial Y/\partial d_{EU}*(1/Y)$ is 3.78 and the mean value of d_{EU} is 0.52, the estimated difference in transaction costs is 0.0197.
[10] Since in developing countries the economy is generally based on agriculture, on average their GDPs can be considered a proxy of the size of the overall agro-food industry.