THE NAFTA AGREEMENT AND MARKET INTEGRATION AMONG CANADA, US AND MEXICO: THE ROLE OF NON-TARIFF MEASURES

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1. Introduction.

In last decades Canadian, US and Mexican agricultural markets have experienced a growing integration in terms of trade and investment flows following the adoption of the North America Free Trade Agreement (NAFTA). Agrofood trade grew reflecting national comparative advantages. The Canadian agrofood sector tends to export more cold weather crops such as wheat, barley, oats, canola, flax and lentils. The US sector specializes in production and trade of corn and soybean, while in Mexico one observes more labor intensive crops such as fruits, vegetables, and horticultural products [Doan *et al*, 2004]. The agricultural political reform triggered by the NAFTA agreement, leading to the reduction of subsidies and import tariffs, is the main thrust beyond the growing integration of agricultural markets in North America. However, the reduction of tariff measure has stressed trade frictions created by agrofood technical measures. For example, Thilmany and Barrett [1997] noted how in the post NAFTA North American dairy trade: "Mexican dairy-product standards are strict but inconsistently enforced, which poses an obstacles for some dairy producers and processors" [p.105]. Another example is represented by the US-Mexican Avocado trade dispute settled in 1997. Finally, the recent Canadian BSE episode has evidenced the fragility of the economic integration of these markets and the difficulties in managing food risk.

Agrofood technical measures are provisions introduced to regulate quality product attributes. According to a recent report from OECD, the impact on trade of Non-Tariff Measures (NTMs) is the result of four different effects: trade creation, trade reduction, trade prohibition and trade diversion. The notion of trade creation refers to the possibility that NTMs may create trade, because they, addressing market failures, may stimulate the demand. NTMs may provide public goods to consumers, such as protection of human, animal and plant health [Maskus *et al.*, 2001]. In addition, NTMs may reduce the asymmetry of information in the market. For example, labeling requirements can ease the comparison of quality attributes of agro-food products, or turn credence attributes, such as organic or GMO production, into search attributes. 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. 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 countries.

The aim of this study is to evaluate the extent and the impact of non-tariff measures (NTM), major emphasis is on technical measures in the North America agricultural market integration. The paper is organized in six sections. First, trade and welfare markets effects of agrofood technical measures are highlighted. A review of previous studies follows. In this section strengths and weakness of the approach adopted to evaluate the economic impacts are discussed. Next, we illustrate the gravity methods approach. The forth section describes the data used in this investigations. Econometric specifications and results follows. Some concluding remarks end this paper.

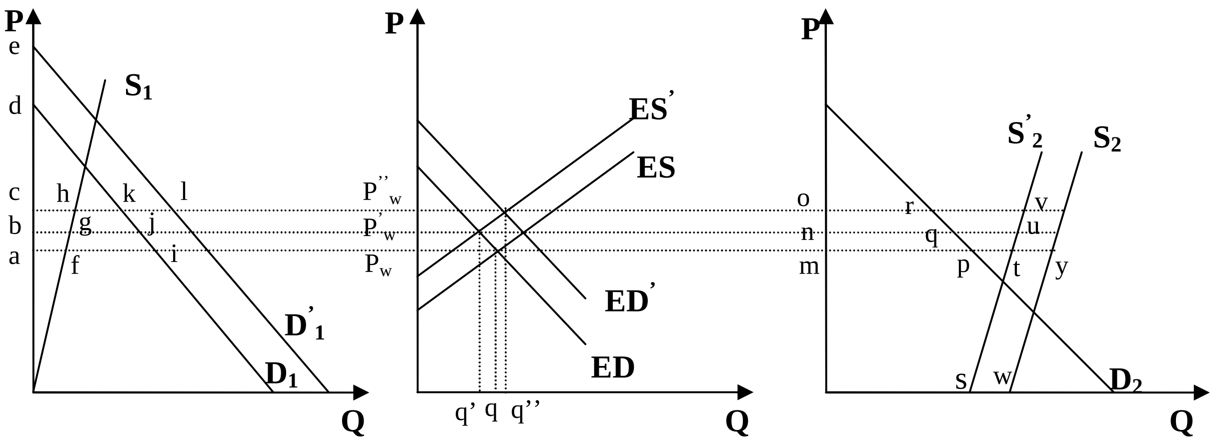
2. Economics of agrofood technical measures.

Complex are the welfare and trade impacts of agrofood technical regulations. In general it is observed that compliance to idiosyncratic technical measures imposes additional costs to exporting firms, increasing unambiguously producer surplus in the importing countries, but at cost of reducing trade and the overall net social welfare. On the other hand, these regulations may stimulate the importing demand addressing specific consumer’s concerns. If this is the case, measures on quality product attributes may create trade and enhance the net social welfare. These instances are illustrated in figure 1 with the help of a three-panel diagram.

When the importing country introduces a technical regulation, the supply of its trading partner shifts on the left from $\mathbf{S_2}$ to $\mathbf{S'_2}$, and the excess of supply from **ES** to $\mathbf{ES'}$, since firms in the exporting nation face additional production costs to comply with the new regulation. Consequently international price raises from P_w to P'_w and trade volume declines from q to q'. In the importing country, consumers lose economic surplus for an amount equal to the area *abji*, while producers see their surplus to increase by *abgf*. In the exporting country, consumers loose the area *mnqp*, whereas the impact on producers depends on size of the trapezoid *mnut* with respect to the area *styw*; if *nutm* is larger than *styw*, producer's surplus increases, otherwise it declines. However, this eventual gain, together with the area *abgf*, is not enough to compensate consumers of both countries. Therefore, unambiguously the introduction of this type of technical measures reduce the aggregate welfare.

On the other hand, if this measure stimulates consumer's demand in the importing country, it may possible to enhance the net social welfare. For example, a labelling requirement, reducing the asymmetry of information in the market, may shift consumer's demand in the importing country as illustrated in figure 1 by $\mathbf{D'_1}$. In this condition, market price moves from P_w to P''_w, and trade volume increases from q to q''. In the importing country, producers gain a surplus equal to the trapezoid *achf*, while consumers increases their economic surplus of an amount equal to the area *delk* at cost of the trapezoid *achf*. In the exporting country producers gain *movt* at cost of *styw*, while consumers lose the area *morp*. Therefore, a technical measures addressing consumer's concerns may create trade and positive variation of economic surplus at aggregate level.

Figure 1. Trade and welfare effects of agrofood technical measures.



Importing country

Exporting country

3. Previous studies.

Partial equilibrium, computational general equilibrium (CGE) and econometric models are the three main approaches adopted to assess the economic impact of technical measures, and more in general of non-tariff measures, on agrofood trade. Calvin and Krissoff [1998] appraise the welfare effect of Japanese phytosanitary requirements applied to US export of apples in a partial equilibrium model. In their analytical framework the trade impact of Japanese technical regulations is calculated from the observed price difference between the Japanese domestic price and the US landed price after accounting for existing import tariffs. The idea is that non-arbitraged price gaps indicate the presence of trade barriers. Results indicate that Japanese technical regulations have a detrimental effect on US exporting firms. The major strength of this approach is the ability to incorporate in the model specific characteristics of technical measures. On the other hand, the conceptual framework is based on the strong assumption that no other significant factors contribute to the price gaps among trading nations. Indeed, imperfect competition in the international market, pricing-to-market strategy, monopoly price discrimination, and more in general the imperfect transmission of market information can contribute to the observed price gaps across trading partners.

Bradford [2004] evaluates the welfare impact of non-tariff measures affecting world agrofood trade in a general equilibrium framework. The model is build on GTAP data version 5 (1997) considering 16 regions[1] and 33 sectors, 14 of them representing the agrofood industry[2]. The impact of non-tariff measures is evaluated from observed producer price gaps across trading partners. Simulation results indicate that the removal of all agrofood non-tariff measures would generate worldwide an equivalent variation of 91.5 billion of US$. One of the advantages of CGE models is the ability to assess the welfare impact of food non-tariff measure considering the interdependences with other economic sectors. However, the price gap approach is subject to the critiques that non-tariff measures are not the only factor contributing to price wedges in the international markets.

Econometric analysis on the trade impact of standards is based on extension of traditional gravity models, which regress trade flows among trading partners on their respective economic size (i.e. GDP) and geographic distance as proxy of transportation costs. Since this intuition is derived from the Newton's Law of Universal Gravitation, the term 'gravity' is used in the economic literature to recall it. Swann, Temple and Shurmer [1996] investigate the impact of shared and idiosyncratic standards on UK and German bilateral trade over the period 1985-1991. Standards are matched to 3-digit Standard Industrial Classification (SIC) British net exports, exports and imports. The PERINORM database is source of information on standards. Results suggest that British standards have a positive effect on both UK exports and imports, while German standards reduce British exports, suggesting a protective impact. The assumptions underlying the gravity model about perfect international product substitutability, perfect commodity arbitrage and purchasing-power parity among trading partners limits the interpretation of results [Bergstrand, 1985].

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[1] The regions take in consideration are: 1) Australia, 2) Japan, 3) Korea, 4) China, 5) rest of Asia, 6) Canada, 7) United States, 8) Brazil, 9) rest of Latin America, 10) Germany, 11) Italy, 12) Netherlands, 13) United Kingdom, 14) Rest of Europe, 15) Middle East, 16) Rest of World.

[2] The agrofood sector accounted in the analysis are: 1) live animals, 2) other animals products, 3) bovine cattle, sheep, goat, and horse products; 4) other meat products; 5) fish, 6) dairy products, 7) fruits, nuts and vegetables, 8) other crops, 9) vegetable oils and fats, 11) processed rice, 12) sugar, 13) beverage and tobacco products , 14) other agriculture and 15) other food products.

The difficulties associated to the assessment of the economic impacts of agrofood technical measures emerge clearly form this short review of the literature. The price wedge approach is subject to the critique that it may be misleading to attribute residual price differences across trading partners to non-tariff measures, after accounting for transportation costs and import tariffs. In fact, other factors such as imperfect commodity arbitrage, imperfect competition and imperfect transmission of market information can be other relevant factors. On the other hand, the employment of gravity models as they stand is subject to critiques, too. In fact, the assumption underlying these equations limits the interpretation of results. Furthermore, it may be misleading to evaluate the impact of technical measures using simple count variables of all applied provisions, because it is implicitly assumed that each type of measures has the same impact.

4. Gravity model.

In this investigation gravity equations are used to assess the impact of technical measures on agrofood trade within the NAFTA region. In order to address previous concerns, the assumptions on perfect international product substitutability, perfect commodity arbitrage and purchasing-power parity among trading partners are relaxed. Furthermore, different count variables are specified to evaluate the distinct trade impact of the different types of measures. Finally, to assess whether the impact of technical measures depends on the country adopting them, count variables are country-specific.

In international trade equation like [1] are commonly used to explain bilateral trade flows

$$X_{ij}=\beta_0(Y_i)^{\beta 1}(Y_j)^{\beta 2}(D_{ij})^{\beta 3}(A_{ij})^{\beta 4}u_{ij} \qquad [1]$$

where X_{ij} is the value of export from country *i* to country *j*, Y_i and Y_j are the dollar value of nominal GDP respectively in country *i* and *j*, D_{ij} is the geographic distance of trading partners, A_{ij} are factors either aiding or resisting trade between *i* and *j*, and u_{ij} is a log-normally distributed error term with $E(\ln u_{ij}) = 0$, β's are parameters to be estimated [Bergstrand, 1985].

Gravity models became quite popular in trade economics because of their success in explaining bilateral trade since their first empirical application by Tinbergen in 1962. However, only recently their microeconomic foundations have been discussed [Anderson, 1979; Bergstrand, 1985 and 1989]. In particular, Bergstrand [1985] shows that equation [1] can be derived by a world trade general equilibrium model of under some restrictive assumptions. It is assumed "perfect substitutability of goods internationally in production and consumption, perfect commodity arbitrage, zero tariffs, and zero transportation costs" [p.477]. These assumptions are often violated in international markets as outlined by empirical findings. Carew [2000] reveals the existence of imperfect transmission of exchange rate across international markets; Kravis and Lipsey [1984], and Richardson [1978] pin point that often commodity arbitrage is imperfect; Fackler and Goodwin [1992], and Milkovic [1999] provide empirical evidence of the violation of the Law of One Price in international agrofood markets.

Relaxing those assumptions and accounting for cross-country differences in factor endowments, Bergstrand [1985, 1989] derives the following generalized gravity equation:

$$X_{ij}=\beta_0(Y_i)^{\beta 1}(Y_i/L_i)^{\beta 2}(Y_j)^{\beta 3}(Y_j/L_j)^{\beta 4}(DF_i)^{\beta 5}(DF_j)^{\beta 6}(Ep)^{\beta 7}(Ip)^{\beta 8}(D_{ij})^{\beta 9}\times$$
$$\times(Exc_{ij})^{\beta 10}(A_{ij})^{\beta 11}u_{ij} \qquad [2]$$

where L is the population in country *i* an *j*, DF is the GDP deflator of country *i* and *j*, Ep is the export price index in county *i*, Ip is the import price index for country *j*, Exc_{ij} is the exchange rate (i.e. *i*-currency value of a unit of *j*'s currency), β's are parameters to be estimated.

Following Swann, Temple and Shurmer [1996], we consider count variables on idiosyncratic standards applied at the border of the importing country as factors either aiding or resisting trade. However, to account for the fact that different technical measures can have different welfare and trade impacts we consider count variables for three different technical measures: product technical standards (STD), labelling requirements (LAB) and tests, inspection and quarantine measures (INSP). Furthermore, since economic effects of these measures may depend on the country adopting them, these count variables are country-specific: STD_{CAN}, LAB_{CAN},

$INSP_{CAN}$, STD_{US}, LAB_{US}, $INSP_{US}$, STD_{MEX}, LAB_{MEX}, $INSP_{MEX}$. The CAN, US and MEX subscripts distinguish the borders where that particular technical measures apply. For example, when the importing country is Canada STD_{CAN}, LAB_{CAN} and $INSP_{CAN}$ variables count respectively the number of technical standards, labelling requirements and tests, inspection and quarantine requirements faced by either US or Mexican agrofood exports, while STD_{US}, LAB_{US}, $INSP_{US}$, STD_{MEX}, LAB_{MEX}, $INSP_{MEX}$ variables are all set equal to zero. The same procedure applies when either USA or Mexico is the importing country. Equation [3] represents the final model adopted in this investigation:

$$\ln X_{ij}=\beta_0+ \beta_1 \ln(Y_i)+ \beta_2 \ln(Y_i/L_i)+ \beta_3 \ln(Y_j)+ \beta_4 \ln(Y_j/L_j)+ \beta_5 \ln(DF_i)+ \beta_6 \ln(DF_j)+$$
$$+ \beta_7 \ln(Ep)+ \beta_8 \ln(Ip)+ \beta_9 \ln(Exc_{ij})+\beta_{10} \ln(D_{ij})+ \beta_{11} STD_{CAN}+ \beta_{12} LAB_{CAN} +$$
$$+ \beta_{13} INSP_{CAN}+ \beta_{14} STD_{US}+ \beta_{15} LAB_{US}+ \beta_{16} INSP_{US}+ \beta_{17} STD_{MEX}+ \beta_{18} LAB_{MEX}+$$
$$+ \beta_{19} INSP_{MEX} + \ln u_{ij} \qquad [3]$$

5. Data.

Information on trade, non-tariff measures and macroeconomic variables have been gathered from different sources of information. The United Nation’s COMTRADE database and the United Nation Conference on Trade and Development’s TRAINS database are sources of information on agrofood trade flows and technical measures in NAFTA countries, while the IMF International Financial Statistics and OECD National Accounts provide information about yearly GDP, GDP deflator, per capita GDP, exchange rate, import unit value indexes and export unit value indexes for Canada, USA and Mexico from 1999 to 2003. Geographical distances among capital cities of NAFTA member countries were obtained from a geographic atlas.

UNCTAD’s TRAINS database is a source of information on Canadian, US and Mexican technical measures applied to agrofood imports in 1999. This information refers to number and typology of technical measures applied to each tariff line. Since each reporting country has its own national classification criteria for technical measures and merchandises, common classification systems are warranted. In this investigation we adopt the following criteria. First, we re-classify Canadian, US and Mexican agrofood technical measures in three different categories: product standards (STND), labelling (LAB) and inspection (INSP) requirements. Second, we convert national tariff lines in subheadings of the 1996 revision of the harmonized system (HS1996)[3]. This conversion is possible considering that the national tariff line systems refer to HS. Finally, to avoid double counting we standardize the number of technical measures applied for each its subheading with respect to the number of tariff lines within it.

The UN COMTRADE database provides information on export values of agrofood products for Canada, USA and Mexico for the year 1999, 2000, 2001, 2002 and 2003. Agrofood products are identified by all subheadings (6-digit) from chapter 01 to chapter 22 in the 1996 revision of the Harmonized System. A total of 12628 records were collected. We proceed then to concord each record of export from country *i* to country *j* with the respective count variables of technical measures.

6. Econometric specifications.

Our sample is an unbalanced panel data of Canadian, US and Mexican agrofood exports within the NAFTA area over the period 1999-2003. Because of these features, two alternative econometric specifications can be estimated. One can assume that the intercept is constant across

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[3] "The Harmonized System (officially Harmonized Commodity Description and Coding System) was adopted by the Customs Co-operation Council in June 1983, and the International Convention on the Harmonized System (HS Convention) entered into force on 1 January 1988 (HS88). In accordance with the preamble to the HS Convention, which recognized the importance of ensuring that HS be kept up to date in the light of changes in technology or in patterns of international trade, HS is regularly reviewed and revised. The headings and subheadings of HS are accompanied by interpretative rules, and section, chapter and subheading notes, which form an integral part of HS and are designed to facilitate classification decisions in general and to clarify the scope of the particular headings or subheadings. It is recommended that countries use HS for the collection, compilation and dissemination of international merchandise trade statistics" [United Nations Statistics Division, 2005]. The HS1996 contains 5113 subheadings and 1241 headings, grouped into 97 chapters. Agrofood products are from chapter 01 to 22 (see table 1), and 6-digit is the maximum level of product differentiation. For example the subheading HS 010111 indicates the merchandise "horse alive", while HS 220900 stands for "vinegar and other products with acetic acid".

importing countries (equation [4])[4] or under the alternative hypothesis the intercept is country-specific (equation [5]), where b is 1×3 vector of importing country-specific intercepts[5]. A simple F-test can be used to evaluate whether the hypothesis of common intercept is rejected or not. If H_0 is not rejected then a basic pooled or total regression model is estimated (equation [4]), and hence, the panel data structure is ignored.

$$\ln X_{ijt}=\beta_0+ \beta_1 \ln(Y_{it})+ \beta_2 \ln(Y_{it}/L_{it})+ \beta_3 \ln(Y_{jt})+ \beta_4 \ln(Y_{jt}/L_{jt})+ \beta_5 \ln(DF_{it})+ \beta_6 \ln(DF_{jt})+$$
$$+ \beta_7 \ln(Ep_t)+ \beta_8 \ln(Ip_t)+ \beta_9 \ln(Exc_{ijt})+\beta_{10} \ln(D_{ij})+ \beta_{11} STD_{CAN}+ \beta_{12} LAB_{CAN} +$$
$$+ \beta_{13} INSP_{CAN}+ \beta_{14} STD_{US}+ \beta_{15} LAB_{US}+ \beta_{16} INSP_{US}+ \beta_{17} STD_{MEX}+ \beta_{18} LAB_{MEX}+$$
$$+ \beta_{19} INSP_{MEX} + \ln u_{ijt} \qquad [4]$$

Instead if the hypothesis of common intercept is rejected, then a fixed effect model is estimated (equation [5]).

$$\ln X_{ijt}=\beta_0+ \beta_1 \ln(Y_{it})+ \beta_2 \ln(Y_{it}/L_{it})+ \beta_3 \ln(Y_{jt})+ \beta_4 \ln(Y_{jt}/L_{jt})+ \beta_5 \ln(DF_{it})+ \beta_6 \ln(DF_{jt})+$$
$$+ \beta_7 \ln(Ep_t)+ \beta_8 \ln(Ip_t)+ \beta_9 \ln(Exc_{ijt})+\beta_{10} \ln(D_{ij})+ \beta_{11} STD_{CAN}+ \beta_{12} LAB_{CAN} +$$
$$+ \beta_{13} INSP_{CAN}+ \beta_{14} STD_{US}+ \beta_{15} LAB_{US}+ \beta_{16} INSP_{US}+ \beta_{17} STD_{MEX}+ \beta_{18} LAB_{MEX}+$$
$$+ \beta_{19} INSP_{MEX} + \ln u_{ijt} \qquad [5]$$

7. Empirical Results.

Tables 1 - 4 present the coefficient estimates for 23 gravity equations considering all subheadings of 22 agrofood commodity groups according the 1996 revision of the HS, and each single commodity group. For the 23 gravity equations the R^2's range from 0.07 to 0.41. The panel data structure has been ignored in all estimated equations, since the hypothesis of a country-specific intercept has been always rejected at 5% of significant; the F-test upper tail area is reported.

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[4] The only difference between equation 3 and 4 is that export flow and macroeconomic variables have also a time dimension.
[5] It is worth noting how b may or may not correlated with remaining variables on the right hand side of equation [5]. The Hausman test statistic can be used to assess whether b is correlated or not.

Other two statistical tests have been performed. One evaluates whether cross-country differences in capital and labor endowments can help to explain agrofood trade patterns. In this case, the relevant hypothesis is to test whether the coefficients of per capita GDP of importing and exporting countries are jointly equal to zero or not H_0: $\beta_5 = \beta_6 = 0$. This hypothesis has been rejected for agrofood commodities, and for single commodity groups such as fish and crustacean (HS 03); live trees and other plants (HS06); edible vegetables (HS07); edible fruits and nuts (HS08); coffee, tea and spices (HS09); lac, gums and resins (HS13); vegetable plaiting materials (HS14); animal/vegetable fats and oils (HS15); preparation of fish and meat (HS 16); cocoa and preparations of cocoa (HS18); preparation of cereal, flour, pastrycook products (HS19); preparation of vegetables and fruits (HS20); miscellaneous edible preparations (HS21); beverages, spirits and vinegar (HS22). The estimated coefficient for the importer's per capita GDP (β_5) is always negative and statistically significant for most of these commodity groups predicting that consumers consider these products necessities, while the sign of the exporter's per capita GDP (β_6) is negative and statistically significant for all of them indicating that production of these products tend to be labor intensive. These results seem to be plausible indicating the presence of comparative advantages for the Mexican and Canadian agrofood industries in specific sectors with respect to the US ones.

The other hypothesis appraises whether cross-country differences in prices play a role in trade patterns. The relevant hypothesis is to test whether the coefficients of import unit value index, export unit value index and exchange rate are jointly equal to zero: $\beta_7 = \beta_8 = \beta_9 = 0$. This hypothesis is not rejected for trade in all agrofood commodities, and for the following commodity groups: fish and crustacean (HS03); edible vegetables (HS07); edible fruits and nuts (HS08); cocoa and cocoa preparations (HS18); preparation of cereal, flour, starch/milk, pastrycook products (HS19); preparations of vegetables and fruits (HS20). However, all estimated coefficients are not statistically different from zero. Therefore, we can conclude that cross-country price differences do not play a role in explaining agrofood trade among NAFTA members. This implies that the

NAFTA agreement stimulated the integration of Canadian, US and Mexican economies and the price convergence across their national market, even though, these regional trade agreement involve countries with different degree of development.

The coefficient estimate for importer income (β_1) is positive and statistically significant for trade in all agrofood commodities, and for meat and edible meat offal (HS02); dairy products, birds' eggs, natural honey (HS04); products of animal of origin (HS05); malt, starches, inulin, wheat gluten (HS11); lac, gums, resins (HS13); sugars and sugar confectionery (HS17); beverages, spirits and vinegar (HS22). Thus, export volume increases as importer income raises.

The coefficient estimate for exporter's income (β_2) is positive and statistically significant for trade in all agrofood commodities, and for live animals (HS01); meat and edible meat offal (HS02); products of animal of origin (HS05); malt; starches, inulin, wheat gluten (HS11); lac, gums, resins (HS13); sugars and sugar confectionery (HS17); beverages, spirits and vinegar (HS22), indicating that the elasticity of substitution among importables is greater than 1. Thus, consumers choose among various foreign suppliers according to their relative prices, ruling out the possibility of product differentiation based on country of origin (i.e. the elasticity of substitution among imported products equals 0).

The estimated coefficient for the geographic distance (β_{10}) is not significant for most commodity groups Instead, it is negative and statistically significant for trade in all agrofood commodities, and for preparations of cereals, flours pastrycook products (HS19); miscellaneous edible preparations (HS21), indicating that an increase in the geographic distance, a proxy for transportation costs, reduces trade flows. While this result seems plausible, puzzling may appears the positive and statistically significant relationship between trade flows and the geographic distance for live animals (HS01); meat and edible meat offal (HS02); product of animal origin (HS05); sugars and sugar confectionery (HS17). However, this result is an indication that for these commodity groups a large share of trade occurs along the Canadian/US border rather than along the Canadian/Mexican border or along the US/Mexican border. In fact, the distance variable has been specified considering the geographic distance among capital cities within NAFTA countries, and the distance between Ottawa/Mexico City is larger than Washington, DC/Mexico City, which in turn is larger than Washington DC/Ottawa.

For what concerns the trade impact of agrofood technical measures, the results indicate that Canadian technical measures have a prevalent trade reduction effects. In fact, the estimated coefficients for inspection, testing measures and product standards are negative and statistically significant for trade in all agrofood commodities.

More complex is the picture for technical measures applied at the US border. US product standards (STD_{US}) have a prevalent trade creation effect, that is, the stimulus in the importing demand, because STD_{US} addresses consumer's concerns, outweighs the supply reduction of exporting firms, resulting from higher production costs. In fact, the coefficient estimate (β_{14}) is positive and statistically significant for trade in all agrofood commodities, and for edible vegetables (HS07); lac, gums, resins (HS13).

Inspection and testing measures applied at the US border ($INSP_{US}$) show both trade creation and trade reduction effects. The estimated coefficient (β_{15}) is positive and statistical significant for trade in single commodity groups such as live animals (HS01); fish and crustacean (HS03); oil seed, oleaginous fruits (HS12); sugars and sugar confectionery (HS17), indicating that the expansion of importing demand outweighs the supply reduction of exporting firms. On the other hand, β_{15} is negative statistically significant for edible vegetables (HS07); coffee, tea and spices (HS09); preparations of cereals, flour, starch/milk, pastrycook products (HS19). In these instances the trade reduction effect prevails.

The coefficient estimate of US labeling requirement (β_{16}) is positive and statistically significant only for trade in all agrofood commodities, suggesting the prevalence of the trade creation effect. However, when the attention is focused on agrofood trade of single commodity group the trade reduction effect is predominant. In fact, β_{16} is negative and significant for meat and edible meat offal (HS02); dairy products, birds'eggs, natural honey (HS04); preparation of meat and fish (HS16).

Complex is also the impact of Mexican technical measures on agrofood trade. In fact, it is not possible to generalize unambiguously their impact since trade creation and reduction effects depend on the commodity groups to which they are applied. Mexican product standards (β_{17}) have positive and statistically significant impact for trade in all agrofood commodities, and for live animals (HS01); meat and meat edible offal (HS02); products of animal origin (HS05); live tree and other plants, cut flowers (HS06); edible vegetables (HS07); coffee, tea and spices (HS09); cocoa and coca preparations (HS18); preparations of vegetables and fruits (HS20). Thus, trade creation prevails impact for these commodity groups. On the other hand, β_{17} is negative and statistically significant for trade in fish and crustacean (HS03); edible fruits and nuts (HS08); vegetable planting materials (HS14); animal/vegetal fats and oil (HS15); preparation of meat and fish (HS16); preparations of cereal, flour, starch/milk, pastrycook product (HS19); miscellaneous edible preparations (HS21); beverages, spirits and vinegar (HS22).

Mexican inspection and testing measures have a trade creation effect when they are enforced on the following product categories: dairy products, birds' eggs, natural honey (HS04); cereals (HS10); malt, starches, inulin, wheat gluten (HS11); animal/vegetables fats and oil (HS15); preparation of meat and fish (HS16); cocoa and cocoa preparations (HS18); preparation of cereal, flour, starch/milk, pastrycook products (HS19); miscellaneous edible preparations (HS21); beverages, spirits ad vinegar (HS22). Instead, a trade reduction effect prevails when they are applied to live animals (HS01); product of animal origin (HS05); vegetables plaiting materials (HS14).

Mexican labeling requirements have a statistically significant trade creation impact on preparation of fish and meat (HS16); preparation of cereal, flour, starch/milk, pastrycook products (HS19); miscellaneous edible preparations (HS21). Instead, the trade reduction effect is prevalent for live tree and other plants, cut flowers (HS06); edible vegetables (HS07); cereals (HS10); cocoa and cocoa preparations (HS18); preparation of vegetables and fruits (HS20).

7. Concluding remarks

This study models the agrofood trade among NAFTA countries over the period 1999-2003 using gravity models in order to assess the trade impact of agrofood technical measures. Cross-country variations in labor and capital endowments are the major shaping agrofood trade. In fact, production and trade specialization tend to be labor intensive. Furthermore, estimated elasticity among importables suggests that consumers choose among various foreign suppliers according to their relative prices, ruling out the possibility of product differentiation with respect to the country of origin.

The rejection of the hypothesis that cross country price differences play a role in NAFTA agrofood trade, and when this hypothesis is not rejected the non significance of estimated parameters, indicate that NAFTA agreement stimulated the integration of Canadian, US and Mexican economies and the convergence of prices across their national market even though, this regional trade agreement involves developed and developing countries.

Complex is the picture emerging from the evaluation of the trade impact of technical agrofood technical measures. Overall a trade creation effect seems to prevail, even though trade creation and reduction effects from technical measures cannot be unambiguously generalized, since these effects depend on the commodity groups to which they apply. Therefore, consumer's concerns, rather than protectionist reasons, fuel the demand of agrofood technical measures within NAFTA trade area.

Table 1. Estimated results

		HS 01	HS 02	HS 03	HS 04	HS05
Product Category	**All agrofood product**	**Live animals**	**Meat and edible meat offal**	**Fish and crustacean**	**Dairy product; birds' eggs; natural honey**	**Products of animal origin**
Obs	12628	304	939	1495	538	285
R^2	0.12	0.24	0.07	0.21	0.22	0.12
H_0: pooled vs panel (upper tail area)	0.12	0.83	1.00	0.92	0.72	0.50
H_0: $b_3 = b_4 = 0$ (upper tail area)	0.00	0.09	0.12	0.04	0.14	0.48
H_0: $b_7 = b_8 = b_9 = 0$ (upper tail area)	0.98	0.30	0.05	0.01	0.40	0.80
c (b_0)	-32.95	-355.26 ***	-250.73 ***	72.98	-115.71	-241.88 **
Y_i (b_1)	1.33 ***	3.10	4.69 ***	-1.19	2.47 *	3.77 *
Y_j (b_2)	1.09 ***	7.94 ***	4.09 ***	0.00	2.16	4.62 **
DF_i (b_3)	-0.04	-5.33 *	-2.43	1.68	-2.30	-3.16
DF_j (b_4)	-0.81	-3.48	-6.68 **	-0.47	-1.47	-5.95
Y_i/L_i (b_5)	-0.69 ***	-	-	0.25	-	-
Y_j/L_j (b_6)	-0.45 ***	-	-	-0.39 **	-	-
Ip_i (b_7)	-	-	-	-2.13	-	-
Ep_j (b_8)	-	-	-	1.27	-	-
Exc_{ij} (b_9)	-	-	-	-0.12	-	-
D_{ij} (b_{10})	-0.77 *	5.46 ***	2.88 ***	-1.89	0.28	3.07 *
STD_{CAN} (b_{11})	-1.22 **	n.a.	n.a.	n.a.		n.a.
$INSP_{CAN}$ (b_{12})	-2.78 **	-0.54	n.a.	n.a.		n.a.
LAB_{CAN} (b_{13})	n.a.	n.a.	n.a.	n.a.		n.a.
STD_{US} (b_{14})	0.66 ***	n.a.	§	§	§	n.a.
$INSP_{US}$ (b_{15})	0.10	3.57 ***	0.07 §	2.26 ***	0.26 §	0.55
LAB_{US} (b_{16})	0.16 **	n.a.	-0.53 ***	n.a.	-0.33 **	n.a.
STD_{MEX} (b_{17})	0.32 ***	9.25 **	1.31 ***	-0.53 *	-0.50	4.97 ***
$INSP_{MEX}$ (b_{18})	0.09	-10.85 ***	n.a.	0.54	1.88 **	-4.99 ***
LAB_{MEX} (b_{19})	0.03	n.a.	n.a.	n.a.	0.33	-0.13
Estimation	pooled regression	pooled regression	pooled regression	pooled regression	pooled regression	pooled regression

§ The estimated coefficient represents the join effect of product standard and testing, inspection requirements.
***, ** and * indicate respectively a significant level of 1%, 5% and 10%.

Table 2. Estimated results

	HS06	**HS 07**	**HS 08**	**HS 09**	**HS 10**	**HS11**
Product Category	**Live tree and other plants; cut flowers**	**Edible vegetables**	**Edible fruits and nuts**	**Coffee, tea and spices**	**Cereals**	**Malt; starches; inulin; wheat gluten**
Obs	250	1218	1051	611	301	588
R^2	0.36	0.18	0.22	0.19	0.27	0.26
H_0: pooled vs panel (upper tail area)	0.72	0.95	0.39	0.93	0.91	0.12
H_0: $b_3 = b_4 = 0$ (upper tail area)	0.01	0.00	0.00	0.00	0.27	0.24
H_0: $b_7 = b_8 = b_9 = 0$ (upper tail area)	0.75	0.00	0.00	0.20	0.92	0.10
c (b_0)	-6.49	-33.92	18.04	-21.36	-37.07	-205.88 ***
Y_i (b_1)	3.13	2.74	1.02	1.55	2.42	3.18 ***
Y_j (b_2)	0.65	0.33	0.45	1.17	0.52	3.90 ***
DF_i (b_3)	-3.09	-2.07	0.35	-1.77	-1.28	0.90
DF_j (b_4)	-0.73	2.41	1.15	-0.69	-1.75	-5.57 **
Y_i/L_i (b_5)	-2.35	-0.59 **	-0.70 ***	-0.75 ***	-	-
Y_j/L_j (b_6)	-1.12 **	-1.26 ***	-2.44 ***	-0.98 ***	-	-
Ip_i (b_7)	-	-1.50	1.55	-	-	-
Ep_j (b_8)	-	-0.73	0.51	-	-	-
Exc_{ij} (b_9)	-	0.68	0.42	-	-	-
D_{ij} (b_{10})	-2.62	-1.18	-2.17	-1.35	-2.09	1.79
STD_{CAN} (b_{11})	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
$INSP_{CAN}$ (b_{12})	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
LAB_{CAN} (b_{13})	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
STD_{US} (b_{14})	-3.49	2.77 ***	§	n.a.	n.a.	n.a.
$INSP_{US}$ (b_{15})	n.a.	-1.85 ***	0.09 §	-2.01 ***	n.a.	n.a.
LAB_{US} (b_{16})	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
STD_{MEX} (b_{17})	1.44 **	0.66 ***	-0.36 ***	0.67 ***	-0.42	0.29
$INSP_{MEX}$ (b_{18})	-1.02	0.15	0.30	0.12	5.21 ***	0.74 ***
LAB_{MEX} (b_{19})	-1.22 **	-0.71 ***	-0.04	-0.02	-0.76 ***	-0.21
Estimation	pooled regression	pooled regression	pooled regression	pooled regression	pooled regression	pooled regression

§ The estimated coefficient represents the join effect of product standard and testing, inspection requirements.
***, ** and * indicate respectively a significant level of 1%, 5% and 10%.

Table 3. Estimated results

	HS 12	HS13	HS 14	HS 15	HS 16	HS 17
Product Category	**Oil seed, oleag. fruits**	**Lac; gums, resins**	**Vegetable plaiting materials**	**Animal/vegetable fats and oil**	**Prep. of meat and fish**	**Sugars and sugar confectionery**
Obs	697	204	143	805	504	325
R^2	0.11	0.29	0.20	0.18	0.27	0.26
H_0: pooled vs panel (upper tail area)	0.98	0.48	0.95	0.81	0.90	0.82
H_0: $b_3 = b_4 = 0$ (upper tail area)	0.70	0.00	0.00	0.00	0.00	0.07
H_0: $b_7 = b_8 = b_9 = 0$ (upper tail area)	0.38	0.07	0.13	0.40	0.19	0.47
c (b_0)	-11.90	-198.49	-49.22	28.24	-47.54	-245.87 **
Y_i (b_1)	0.03	3.76 *	1.78	-0.26	5.45	4.08 **
Y_j (b_2)	1.03	4.48 *	1.72	1.03	-0.10	4.71 ***
DF_i (b_3)	1.46	-0.70	3.42	1.42	-0.26	-4.93 *
DF_j (b_4)	-1.95	-4.10	-3.58	-0.01	-0.96	-6.61 *
Y_i/L_i (b_5)	-	-1.23 ***	-1.25 ***	-0.80 ***	-3.18	-
Y_j/L_j (b_6)	-	-1.70 ***	-2.01 ***	-0.97 ***	-1.17 ***	-
Ip_i (b_7)	-	-	-	-	-	-
Ep_j (b_8)	-	-	-	-	-	-
Exc_{ij} (b_9)	-	-	-	-	-	-
D_{ij} (b_{10})	-0.40	1.26	-0.49	-1.83	-3.31	3.40 **
STD_{CAN} (b_{11})	-0.99	0.01	n.a.	n.a.	n.a.	n.a.
$INSP_{CAN}$ (b_{12})	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
LAB_{CAN} (b_{13})	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
STD_{US} (b_{14})	1.14	1.73 **	n.a.	n.a.	§	§
$INSP_{US}$ (b_{15})	0.93 ***	n.a.	n.a.	n.a.	-5.10	4.46 ***
LAB_{US} (b_{16})	n.a.	n.a.	n.a.	n.a.	-0.63 ***	n.a.
STD_{MEX} (b_{17})	0.36	-0.19	-1.27 **	-2.34 ***	-1.94 ***	0.24
$INSP_{MEX}$ (b_{18})	-0.26	0.18	-0.52 *	3.02 ***	2.61 ***	n.a.
LAB_{MEX} (b_{19})	-0.24	n.a.	n.a.	n.a.	1.18 ***	-0.12
Estimation	pooled regression	pooled regression	pooled regression	pooled regression	pooled regression	pooled regression

***, ** and * indicate respectively a significant level of 1%, 5% and 10%.

Table 4. Estimated results

	HS 18	HS 19	HS20	HS 21, at 6-digi	HS 22
Product Category	**Cocoa and cocoa preparations**	**Prep.of cereal, flour, starch/milk; pastrycook prod.**	**Prep. of vegetable and fruits**	**Miscellaneous edible preparations**	**Beverages, sprits and vinegar**
Obs	232	361	942	376	459
R^2	0.41	0.37	0.27	0.31	0.27
H_0: pooled vs panel (upper tail area)	0.96	0.76	0.59	0.46	0.84
H_0: $b_3 = b_4 = 0$ (upper tail area)	0.00	0.00	0.00	0.00	0.00
H_0: $b_7 = b_8 = b_9 = 0$ (upper tail area)	0.00	0.01	0.00	0.11	0.10
c (b_0)	-28.90	8.39	-65.26	39.28	-237.77 *
Y_i (b_1)	-2.53	8.77	3.58	7.27	4.53 **
Y_j (b_2)	6.17	3.61	2.79	-2.29	4.62 **
DF_i (b_3)	2.49	9.19	0.84	-1.21	-2.63
DF_j (b_4)	-3.63	-8.12	-1.77	2.48	-3.21
Y_i/L_i (b_5)	-1.17 ***	-18.15 **	-5.22	-6.53	-1.31 ***
Y_j/L_j (b_6)	-1.65 ***	-2.30 ***	-1.72 ***	-1.71 ***	-0.90 ***
Ip_i (b_7)	-0.72	9.94	2.09	-	-
Ep_j (b_8)	1.48	3.66	1.39	-	-
Exc_{ij} (b_9)	-4.10	-9.73	-1.93	-	-
D_{ij} (b_{10})	-2.54	-13.57 **	-3.06	-5.99 *	2.08
STD_{CAN} (b_{11})	n.a.	n.a.	n.a.	n.a.	n.a.
$INSP_{CAN}$ (b_{12})	n.a.	n.a.	n.a.	n.a.	n.a.
LAB_{CAN} (b_{13})	n.a.	n.a.	n.a.	n.a.	n.a.
STD_{US} (b_{14})	n.a.	§	§ §	§	n.a.
$INSP_{US}$ (b_{15})	n.a.	-38.54 § *	-8.74 §	-12.92 §	n.a.
LAB_{US} (b_{16})	n.a.	n.a.	n.a.	n.a.	-0.73 ***
STD_{MEX} (b_{17})	4.84 ***	-1.78 ***	0.67 **	-1.02 **	-2.53 ***
$INSP_{MEX}$ (b_{18})	0.28 *	1.98 ***	n.a.	2.01 ***	9.30 ***
LAB_{MEX} (b_{19})	-4.64 ***	1.72 ***	-0.72 **	0.81 ***	0.10
Estimation	pooled regression	pooled regression	pooled regression	pooled regression	pooled regression

§ The estimated coefficient represents the join effect of product standard and testing, inspection requirements.
***, ** and * indicate respectively a significant level of 1%, 5% and 10%.

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