Analyzing trade liberalization effect in egg sector using a dynamic gravity model

Tamini, Lota D. and Doyon, Maurice and Simon, Rodrigue

CREATE, Laval University

7 June 2012

Analyzing trade liberalization effect in egg sector using a dynamic gravity model

Lota D. Tamini* Maurice Doyon Rodrigue Simon

Department of Agricultural Economics and Consumer Science and CREATE
Laval University

June 7, 2012

Abstract

This study analyzes the effects of different liberalization scenarios in the international trade of eggs and egg products. We use a dynamic gravity model that takes into account the observed persistence of trading partners. The estimated parameters of the gravity model serve to quantify the impact of various liberalization scenarios on the probability of importing (extensive margin) and on trade volumes (intensive margin). The results indicate that even in the context of aggressive trade liberalization, trade gains at the extensive margin will be modest. Gains at the intensive margin of trade are present even in the context of partial liberalization - Doha-type - of trade.

Key words: Eggs and eggs products, Persistence in trade, Trade liberalization, Doha Round, Gravity model, Random-effects dynamic Probit, Autoregressive panel.

J.E.L. Classification: Q17, F13

*Corresponding author: Pavillon Paul-Comtois, 2425, rue de l'Agriculture, local 4412, Québec (QC), G1V 0A6, Canada. Email: lota.tamini@eac.ulaval.ca.

1 Introduction

Despite broad globalization pressures, import tariffs in agricultural and food industries remain particularly high compared with the industrial sector. The Organization for Economic and Co-operation Development (OECD) estimated that the average tariff for agricultural and agri-food products in OECD countries was 36% (OECD, 2003). The peaks of agricultural tariffs are also a cause for concern. Bchir *et al.* (2005, p. 21) show that the shares of products with an average bound tariff in excess of 100% are 5.8% and 12.1% for developed and developing countries, respectively, but there is much variation between countries. Anderson (2009) provides a detailed account of the evolution of agricultural distortions in different parts of the world. Domestic support policies (e.g. input and output price subsidies) are ubiquitous in agriculture; their reduction represents one of the greatest challenges in the current round of WTO negotiations.[1]

The World Trade Organization's (WTO) 2004 trade report shows a major structural change in the composition of agricultural trade, with trade in processed products growing more rapidly and surpassing trade in primary agricultural goods. This trend is observed across countries and agricultural product groups in spite of evidence of tariff escalation (Elamin and Khaira, 2003). In addition, data on international trade of agricultural products shows that there is persistence in trading partners. First, data features indicate that a large majority of partners do not trade with one another. Second, the growth of trade was due more to the growth of the volume of trade among countries with each other than to trade with new partners.

These features of agricultural trade are consistent with the recent work of Meltiz (2003), Chaney (2008) and Helpman, Melitz and Rubinstein (2008) implying that exports to a given destination incur a fixed cost and variable cost. The first cost justifies the phenomenon of learning by firms historically active in the markets, and gives them an advantage over potential new entrants. Nonetheless, other variables in the gravity models (proximity, bilateral agreements, etc..) can explain the phenomenon of persistence of trade flows. De Benedictis and Vicarelli (2005) speak of "inertia in trade flows." Kandilov and Zheng (2011) show that sunk costs are economically and statistically important for trade in major agricultural commodities even if access to export markets has improved in the years following the Uruguay Round. Taking persistence into account, Olivero and Yotov (2012) suggest a dynamic gravity equation based on capital accumulation. The authors introduce a term that encompasses two intuitive elements: a trade persistence effect and a protection persistence effect. The protection persistence effect

[1] Uruguay Round negotiations resulted in an agreement on agriculture; one of the basics was the conversion of all non-tariff barriers (including QRs) into tariff equivalents. This was done to ensure that the pricing of trade barriers is not completely protectionist, hence the introduction of a combination system of tariff and quota (TRQ). This allows the entry of a limited amount of products at a low price. The quantities that exceed the minimum provided are subject to a very high, even prohibitive, rate. In Canada, this mechanism is effective for several agricultural products: milk, poultry, hatching eggs and table eggs.

accounts for the fact that, because of domestic capital accumulation, trade barriers can lead to an increase in trade flow through a positive effect on output and country size. Olivero and Yotov's main conclusion (2012: p. 3) is that "persistence in trade flows should be accounted for by including lagged trade regressor in gravity models." However, Olivero and Yotov's approach does not take into account firms behavior or their entry into foreign markets, contrarily to the firm heterogeneity model of Helpman *et al.* (2008). Following the seminal work of Melitz (2003), Helpman *et al.* (2008) assume that trade costs vary depending on the level of trade. They are also fixed, determining firms' ability to export, and hence the extensive trade margin.[2] Egger and Pfaffermayr (2011) follow HMR when specifying their structural gravity models with market entry dynamics. Their key assumption is that firms consider the role of path dependence for market entry. The implication of this approach is that sunk entry costs are time-declining for firms that are present in a given market.

The objective of the paper is therefore to explore potential change in trade induced by different liberalization scenarios when taking into account the phenomenon of persistence in trading partners. Our application focuses on the egg sector, where the persistence in trading partners is acute. Table eggs, eggs for processing (albumin and eggs not in shell) and egg products are analyzed to capture potential differences in structural parameters by the type of eggs.

Our methodological approach is based on a gravity model.[3] In its simplest form, the gravity equation explains trade volume by supply and demand factors (GDP and population), trade resistance factors (distance, tariffs, etc.) and trade preference factors (common language and border, preferential trade agreements, etc.). As mentioned by De Benedictis and Vicarelli (2005:1) "its relative independence from (or ability to mirror) different theoretical models...have

[2] The impacts of firms' heterogeneity on international trade are now well documented (see for example Bernard and Jensen, 1999). However, relatively few studies account for this feature when estimating gravity equations. Tamini, Gervais and Larue (2010) and Kandilov and Zheng (2011) are recent applications of the HMR framework to agricultural products.

[3] Rude and Gervais (2006) and Rafajlovic and Cardwell (2010) use a partial equilibrium model and numerical simulations when analyzing trade policy in the Canadian chicken sector. The advantage of this approach is that it is not too demanding in terms of modelling and data. However, it identifies and analyzes very few variables influencing international trade. Further, it is suitable for the analysis of the situation of only one country at a time. Computable general and partial equilibrium models are also common when studying the impacts of change in trade policies. This approach is demanding in terms of data: difficulties emerge when one tries to study a small sector of the economy like the egg sector. A recent example is Abassi, Bonroy and Gervais (2008), who use a partial equilibrium model in the Canadian dairy sector. Grant, Hertel and Rutherford (2009) extend this approach by associating partial equilibrium and general equilibrium models to analyze the impacts of liberalization of imports of specialty cheeses in the United States through the expansion of bilateral quotas. These approaches are data consuming, and depend on the structural parameters used to calibrate the model. The egg sector has very little information on such parameters, which limits the relevance of such approaches.

made the gravity model *the* empirical model of trade flows."[4] Consistent with Vijay and Shahid (2011), we use a panel estimation approach to control for unobserved heterogeneity of trading partners. Given the inertia in trade flow, we follow Kim *et al.* (2003), De Benedictis and Vicarelli (2005) and Campbell (2010) and use a panel dynamic model. Campbell (2010) shows that taking into account the dynamic nature of trade flows also helps solve the puzzle of distance the elasticity of distance does not diminish over time (see also Disdier and Head, 2008).[5] Because of zero trade flows, estimations are done with a double correction, as suggested by Helpman *et al.* (2008).

Our estimations strongly support the panel dynamic specification compared with the panel model without dynamic features. The dynamic specification can therefore shed new light on the effects of trade agreements. It can help explain why trade liberalizations often increase trade creation between countries that had already been trading partners. Using the estimated parameters, an aggressive liberalization and a Doha-type compromise outcome are simulated to assess the importance of extensive and intensive margin effects of these trade liberalization scenarios. Overall, simulations indicate that our trade scenarios would result in an increase in the intensity of trade, but very few emerging trading partners (extensive margin). For the two liberalization scenarios, the impact is greater for eggs in shell.

The remainder of the paper is structured as follows. The next section presents the conceptual approach of the trade model underlining the implications of persistence in trading partners. The third section introduces the econometric procedure used to estimate the structural parameters of the model. The fourth section presents the estimation results, and section 5 analyzes various liberalization scenarios and their implications in the context of the current Doha Round. The last section concludes the paper.

2 A glance at the data

As mentioned, we analyze four products to capture differences in structural parameters by level of transformation: Eggs in shell, Fresh eggs not in shell, Albumin and Egg preparations.

Figure 1 shows that about 70% of trade flow in a given year is likely to be present in the next year. When considering a five-year interval, the mean of the persistence phenomenon is around 60%. More important, less than 1% of "zeros" are not zeros in the two following years, implying

[4] Applications of gravity models in the agricultural sector at the aggregated level include Paiva (2005) and Koo, Kennedy and Skripnitchenko (2006). Sarker and Jayasinghe (2007) and Susanto, Rosson and Adcock, (2007), Tamini, Gervais and Larue (2010) and Ghazalian *et al.* (2011) are recent applications at a disaggregated level.

[5] This is important for international trade of table eggs because they are mainly a convenience store product, at least with respect to eggs in shell. Available at http://www.agr.gc.ca/poultry/ prinde2_fra.htm#sec27. Accessed August 17, 2011).

"incapacity" in creating new trade flows. Figure 2 shows that a small proportion of countries trade in both directions. The exception is egg preparations, where trade in both directions is present in about 50 of trading partners. Disregarding theses features could result in selection and/or asymmetry bias.

Despite this inertia in trading relationships, Figure 3 indicates that at the end of the period, the aggregate trade value was about 32 times larger than the aggregate trade value of the beginning of the period. Combining Figure 1-4 suggests that the growth in world trade must have been much larger due to the increase in the volume of existing bilateral trade.

The finding of Kandilov and Zheng (2011) that market access improved in the years following the Uruguay Round seems to be refuted in the egg industry. Figures 5-6 show a very slow decrease in the average applied *ad valorem* tariffs.

3 Theoretical model

The theoretical model draws from the framework developed by Anderson and van Wincoop (2003). Assume that there are Z $(z = 1, ..., i, j..., Z)$ countries with consumers endowed with identical preferences over consumption. Consumers' preferences are captured by a CES-type utility function over varieties. Let $q_i(\omega)$ be country i's consumption of one product variety with indexing varieties. The parameter η measures the elasticity of substitution between varieties and hence $\eta > 1$. The utility function in country i is: :

$$U_i = \left(\int_{\omega \in \Xi} q_i(\omega)^{(\eta-1)/\eta} \right)^{\eta/(\eta-1)} \tag{1}$$

where Ξ_i is the set of variables available in country i.

Each firm within a country produces a different variety, with N_j. being the (fixed) number of varieties in country j Assume that the technology for production in country j can be represented by a constant returns to scale Cobb-Douglas production function: $TFP_j(\omega) I_j^{\psi} K_j^{1-\psi}$; where $TFP_j(\omega)$ is a total factor productivity index specific to a firm in country j, I_j and K_j, respectively, denote specific input and capital used in production and ψ the specific input cost share. The specific input and capital factor prices are denoted by h_j and r_j, respectively and are perceived to be constant. Under these assumptions, the marginal cost is: $c_j = \varpi_j(\omega) r_j^{1-\psi} h_j^{\psi}$, where $\varpi_j(\omega) \equiv \left((1-\psi)^{-(1-\psi)} (\psi)^{-\psi} \right) / TFP_j(\omega)$. The variable $\varpi_j(\omega)$ is a firm-specific productivity parameter with country-specific support $\varpi_j(\omega) \in \left[\underline{\varpi}_j; \overline{\varpi}_j \right]$.[6]

[6] Following Helpman et al. (2008), it is assumed that the distribution function of ϖ is identical across countries, but the support of the distribution is country specific.

Profit maximisation implies:

$$p_i/s_i = \eta\left(\eta-1\right)^{-1} c_j \tag{2}$$

where p_j is the price received by firms in country j and s_j represents prices and distorting domestic support policies in country j with $.s_j < 1$

From the consumers' standpoint, two-stage budgeting allows for conditional expenditures on varieties. The effective price paid by consumers for a given variety is p_j multiplied by *net* trade costs $\mathbf{t}_{ij}$ between countries i and j. Using (2), the country i's demand function for a variety supplied by country j is as in Feenstra (2004:152-153):

$$q_{ij} = \alpha Y_i \frac{\left(\mathbf{t}_{ij}c_j\right)^{-\eta}}{\sum_z \left(\mathbf{t}_{iz}c_z\right)^{1-\eta} N_z} \tag{3}$$

where Y_i represents income in country i and $\mathbf{t}_{ij}$ as defined before. We follow Helpman *et al.* (2008) and assume that only a fraction of firms in country j , (V_j)export to a particular destination i. This fraction is determined by a threshold productivity shock defined by the existence of a destination-specific fixed export cost. Firms will export to a destination if they earn positive profits. Assumptions about productivity and the existence of fixed export costs imply that only a fraction of firms export to a particular destination. Country i's imports from j are equal to the consumption of each variety defined in (3) multiplied by the fraction (V_j) of the number of varieties (N_j) that are exported, thus capturing the impact of the firm-specific productivity shock. We can write total imports as:

$$M_{ij} = V_{ij}N_j q_{ij} = \alpha Y_i \frac{\left(\mathbf{t}_{ij}c_j\right)^{-\eta} V_{ij}N_j}{\sum_z \left(\mathbf{t}_{iz}c_z\right)^{1-\eta} N_z} \tag{4}$$

For future reference, we define the relationship between egg production in country j (denoted Q_j) and the total demand faced by country j by:

$$M_{ij} = \left(M_{ij}/\sum_z M_{zj}\right) Q_j \tag{5}$$

Substituting the import demand function in (4) for on the right-hand side of (5) yields:

$$M_{ij} = \lambda_j^{-1} Y_i \frac{\left(\mathbf{t}_{ij}c_j\right)^{-\eta}}{\sum_z \left(\mathbf{t}_{iz}c_z\right)^{1-\eta} N_z} V_{ij}N_j Q_j \tag{6}$$

where . $\lambda_j \equiv \sum_z Y_i \frac{\left(\mathbf{t}_{ij}c_j\right)^{-\eta} V_{ij}N_j}{\sum_z \left(\mathbf{t}_{iz}c_z\right)^{1-\eta} N_z}$.

Equation (6) combines the intensive and extensive margins of trade (See Helpman *et al.*, 2008).

4 Empirical framework

In our empirical approach we estimate a dynamic type 2 Tobit model.

4.1 Trade intensity

The log-linearization of equation (6) yields the following equation to be estimated:

$$\ln M_{ij,t} = \ln Y_i + \ln V_{ij} + \ln N_{j,t}Q_{j,t} - \eta \ln \mathbf{t}_{ij} + \Gamma_{i,t} + \Gamma_{i,t} + v_{ij,t} \tag{7}$$

where $\Gamma_j \equiv -\eta \ln (c_j) - \ln \lambda_j$ and $\Gamma_j \equiv -\ln \left(\sum_z (\mathbf{t}_{iz} c_z)^{1-\eta} N_z \right)$ are exporter and importer fixed effects respectively, and the other variables defined before. Following Egger (2002) dynamics is introduced into as static regression via an autoregressive $AR(L)$ error term: $\nu_{ij,t} = \alpha + \sum_{\ell=1}^{L} \rho_\ell \nu_{ij,t-\ell} + \varepsilon_{ij,t}$ with $|\rho| < 1$.This assumption implies that $Cov[\nu_{ij,t}, \nu_{ij,t-\ell}] \neq 0$. This model can also be written as an auto-regressive distributed-lag model of the form:

$$\ln M_{ij,t} = \sum_{\ell=1}^{L} \rho_\ell \ln M_{ij,t-\ell} + \boldsymbol{\delta} \mathbf{x}_{ij,t} + \sum_{\ell=1}^{L} \rho_\ell \boldsymbol{\delta} \mathbf{x}_{ij,t-\ell} + \varepsilon_{ij,t} \tag{8}$$

where $\boldsymbol{\delta} \mathbf{x}_{ij,t} \equiv \ln Y_i + \ln V_{ij} + \ln N_{j,t}Q_{j,t} - \eta \ln \mathbf{t}_{ij} + \Gamma_{i,t} + \Gamma_{i,t}$.Given this specification the coefficients summarized by the vector $\boldsymbol{\delta}$ represent the short term impact of the variables of the gravity equation while $\sum_{\ell=1}^{L} \rho_\ell \boldsymbol{\delta}$ represent the long term impact.

4.2 Selling in a foreign market: dynamic persistence and fixed effects

Following Melitz (2003), we consider that selling in a given foreign market implies that firms must pay some fixed costs. While all firms in country j sell output domestically, only a fraction of firms sell abroad. The ability to export is conditional on the firm-specific productivity factor. Using a zero profit condition, we define a latent variable E_{ij} as the ratio of the profit of country j's most productive firm to the fixed costs (common to all exporters) when exporting to country i..[7] A firm's self-selection into country i's export market is observed if and only if $E_{ij} > 1$. Fixed trade costs are assumed to be stochastic and i.i.d. The latent variable can be expressed as:

$$\ln E_{ij} = \lambda_0 + \chi_j + \chi_i + \lambda_1 \mathbf{t}_{ij} + \xi_{ij} \tag{9}$$

where λ_0 is a constant term, $\lambda_1 \equiv (1-\eta)$, $\chi_j \equiv (1-\eta) \ln (p_j) - \lambda_j$ is the exporter fixed effect,[8] $\chi_i \equiv -\ln \delta_i + \ln Y_i - \lambda_i$ is the importer fixed effect, trade costs are defined by $\mathbf{t}$ and ξ

[7] For details see Helpam *et al.* (2008) and the applications of Tamini *et al* (2010) and Kandilov and Zheng (2011).

[8] Feenstra (2004) argues that fixed effects are appropriate to estimate the average impact of the border barriers relative to cross-border trade. We use this insight in modelling the firms' decision to sell in a foreign market.

is a random error term.

Following Das, Robert and Tybout (2007) and Segura-Cayuela and Vilarrubia (2008) we assume that there are three costs that firms need to incur when selling to export markets. The first ones are *iceberg variable trade costs.* The second cost is a *onetime sunk cost* to access the foreign market. The third one is a *fixed per-period cost* assumed to be i.i.d. distributed. As mentioned by Segura-Cayuela and Vilarrubia (2008) one possible interpretation of the onetime sunk cost is the adaptation of firms' production structure, while the fixed cost represents the cost of distribution or of sustaining a position in a given market. Das *et al.* (2007) assert that sunk costs are start-up costs of establishing distribution channels, learning bureaucratic procedures, and adapting their products and packaging for foreign markets. These assumptions imply that firms will enter a foreign market only if they expect per-period revenues large enough to cover sunk and fixed costs. When it stops exporting, the firm saves the per-period fixed cost. The latent variable $e^*_{ij,t} \equiv \ln E^*_{ij,t}$ of equation (9) is then:

$$e^*_{ij,t} = \beta e_{ij,t-1} + \delta' \mathbf{w}_{ij,t} + \mu_{ij} + \epsilon_{ij,t} \tag{10}$$

Equation (10) is the selection equation that determines the existence of trade flow. It is a function of past selection outcome $e_{ij,t-1}$, strictly exogenous variables $\mathbf{w}_{ij,t}$ and time-invariant unobserved individual effect μ_{ij}. The scalar β captures the effect of past selection outcome, and the vector δ the effect of explanatory variables on the current process. The current selection outcome is defined as:

$$e_{ij,t} = 1\left[e^*_{ij,t} > 0\right] \tag{11}$$

Where $1\left[...\right]$ is the indicator function with value one if the expression between square brackets is true and zero otherwise. Trade is observed only if $e^*_{ij,t} > 1$:

$$m_{ij,t} = 1\left[e^*_{ij,t} > 0\right] m^*_{ij,t} \tag{12}$$

where $m^*_{ij,t}$ is a latent dependant variable.

4.3 Trade costs

The trade costs include the import tariff (denoted by $\tau_{ij} \geq 1$), the effect of distance summarized by d_{ij} with $d_{ij} = d_{ji}$, the effect of some factual factors of trade preference (trade agreement, common language and borders,...) summarized by κ_{ij} and finally s_j represents prices and distorting domestic support policies as defined above. In our database, some countries have import quotas. We take this into account by adding dummy variables representing the fact that importer and/or exporter engage in supply management in the egg sector.

Trade costs that subsume net trade costs and domestic policies are defined as:

$$\widetilde{\mathbf{t}}_{ij} = s_j^{\widetilde{\theta}_s} \tau_{ij}^{\widetilde{\theta}_\tau} d_{ij}^{\widetilde{\theta}_d} \kappa_{ij} \tag{13}$$

with

$$\kappa_{ij} = \exp \left(\begin{array}{c} \vartheta_{\kappa_1} language_{ij} + \vartheta_{\kappa_2} border_{ij} + \vartheta_{\kappa_3} GATT_i + \vartheta_{\kappa_4} GATT_j \\ + \vartheta_{\kappa_5} RTA_{ij} + \vartheta_{\kappa_6} quota_i + \vartheta_{\kappa_7} quota_j + \vartheta_{\kappa_8} legal_{ij} \end{array} \right). \tag{14}$$

We assume that factual factors of trade preference summarized by κ_{ij} have an impact on the probability to trade but do not have and impact on the intensity of trade.

Trade cost used for the gravity equation is then:

$$\widetilde{\mathbf{t}}_{ij} = s_j^{\widetilde{\theta}_s} \tau_{ij}^{\widetilde{\theta}_\tau} d_{ij}^{\widetilde{\theta}_d}. \tag{15}$$

4.4 Estimation strategy: addressing the initial condition problem

Estimations are done using a dynamic random effect Probit model. The presence of omitted individual heterogeneity, in the form of individual-specific effects in the first period, causes an "initial conditions" problem and renders the standard random-effects (RE) probit estimator inconsistent when T (time lenght) is small. We use the two-step Heckman (1979) estimators as proposed by Stewart (2007) and Arulampalam and Stewart (2009).[9] Estimations are done using Maximum simulated likelihood (Stewart, 2006).

In the second stage (trade intensity), estimations are done using double correction as proposed by Helpman et al. (2008: p 456) to deal with heterogeneity at the firm level. A polynomial decomposition of the selection variable is used to correct for the bias associated with firm heterogeneity. Finally, to control for the possibility of tariffs being endogenous, we use as instruments the lagged value of tariffs and the three-year lagged moving average mean of the value of trade and the production of the country of origin of the trade flow. The underlying intuition is that stronger import competition from a country is more like to trigger protection (see Debaere and Mostashari, 2010; Olivero and Yotov, 2012).[10]

[9] Alternative estimation methods to solve the initial conditions problem are proposed by Orme (1997, 2001), and Wooldridge (2005).

[10] The Wald tests for exogeneity confirmed concerns about endogeneity of tariffs, especially for eggs in shell and egg products.

5 Data sources

Trade volumes were obtained from the UNCOMTRADE database. Trade policies were collected from the TRAINS dataset; they account for preferential trade agreements between countries/regions.[11] The domestic support measure is taken from the WTO database, and reflects compilation of various (trade-distorting) domestic support measures, converted to ad valorem equivalent rates.[12] It avoids possible double counting, particularly when domestic policies are combined with border policies (as in the case of administered prices).

Total egg production is collected from the Food and Agriculture Organisation (FAO) Statistical Yearbook. Gross Domestic Product (GDP) statistics are collected from the International Monetary Fund (IMF) World Economic Outlook Database. The dataset of distances, other trade preferences and trade resistance factors is based on a compilation by the Centre d'Études Prospectives et d'Informations Internationales (CEPII). We use the harmonic distance measure as in Head and Mayer (2002). Adjusting for missing and outlier data resulted in a dataset of 132 countries/regions,[13] listed in the appendix (Table A1). Table 1 presents descriptive statistics of the variables of interest.

6 Estimation results

6.1 Dynamic probit estimates

We estimate the total sample and split it into three distinct time periods based on WTO free trade negotiation rounds to check if market access has changed during and after the negotiations. The first period includes the Uruguay Round, which started in 1988 and ended in 1994. The second period includes the years 1995 to 2000 until the beginning of the Doha Round negotiations. The last period, from 2001 to 2010, includes 10 years of the current Doha Round negotiations. Table 2 reports the estimated results for the last period of our dynamic Probit estimation of equation (10).[14]

For eggs in shell, as expected, the estimated coefficient for distance is found to be higher than that for the other products. The likelihood of importing is higher when the two trading

[11] Data on trade and tariffs were collected using World Integrated Trade Solution (WITS) software developed by the World Bank, in collaboration and consultation with various International Organizations including the United Nations Conference on Trade and Development (UNCTAD), International Trade Center (ITC), United Nations Statistical Division (UNSD) and World Trade Organization. (See http://wits.worldbank.org/wits/)

[12] The dataset is built using WTO member notifications, and is restricted to policies classified as trade-distorting.

[13] European Union comprises 27 member nations.

[14] We present the last period results only, because of space constraints. The detailed results of all periods are available from the authors upon request.

partners are developed countries indicating that it is easier for them to overcome fixed costs. The impact of the exporter's domestic agricultural production is expected to be positive, while the importer's domestic agricultural production is expected to reduce the probability of non-zero trade flows. Our results confirm our expectations and are in line of those of Ghazalian, Larue and Gervais (2009) and Kandilov and Zheng (2011).

We assess the impact of the history of export market participation proxied by the lagged value of participation. The results are both economically and statistically significant for all products. The impact is higher for eggs in shell, as expected, followed by egg products (albumin and eggs not in shell) and finally egg preparations.[15] The estimate (not presented here) shows that for eggs in shell the value is relatively stable, from 2.24 in the first period to 2.22 in the last period, although it declines over time for the other products. The same is observed for the impact of distance on the extensive trade margin.

Marginal effect of market entry sunk cost We follow Kandilov and Zheng (2011) and compute the marginal effect of market entry sunk cost as $\Pr[e_{ij,t} = 1|e_{ij,t-1} = 1] - \Pr[e_{ij,t} = 1|e_{ij,t-1} = 0]$. The standard error is computed using the bootstrapping methods proposed by Krinsky and Robb (1986). The difference between the two values indicates how entry costs reduce the probability of exporters' participating in foreign markets. The results are summarized in Table 3.

As expected, the negative impact of sunk costs on the probability of export market participation differs substantially across commodities. The impact of sunk costs is smaller for egg products, while it is larger for Eggs in shell and Egg preparations.

Consider now the temporal pattern of the impact of entry costs on export market participation. For Eggs in shell, the effect of sunk costs increases from the first period to the second, and remains unchanged in the last period. The same result was found by Kandilov and Zheng (2011) for cereals, meat and dairy products in developing countries. For Eggs not in shell, Albumin and Egg preparations, the effect of sunk costs decreases over the three periods. This finding is in line with Kandilov and Zheng (2011), who report that in general, market access was improved by the Uruguay Round. Debaere and Mostashiri (2010) also found that reduction of tariffs had an impact statistically significant on the extensive margin of trade. Finally, the impact of sunk costs on the probability of export market participation is higher when the destination market is a developed country.

[15] Because in our specification $e^*_{ij,t}$ is a function of $e_{ij,t-1}$ and not of $e^*_{ij,t-1}$, the fact that some coefficients are greater than 1 is not an issue. Kandilov and Zheng (2011) found a coefficient greater than 1% in about 10% of their estimations for aggregate products.

6.2 Intensity of trade

As indicated in Table 4, a positive and highly significant autocorrelation coefficient clearly points out the importance of dynamics for the four products. The coefficient on distance is always negative and significant at the 5% level. As expected, there is a difference between goods with a higher impact for Eggs in shell and Egg preparations. The effect of importer GDP per capita, which serves as a proxy for foreign market demand, is positive when significant. This result confirms the intuition that greater revenue increases consumption of eggs and egg products. The future increase in the revenue of developing countries is thus expected to boost the probability of trade in the egg sector. Yet for Eggs in shell and Eggs not in shell the coefficient is not significant. As expected, total production of country of origin has a positive impact on the level of trade. Finally tariffs have an expected negative impact on the level of trade of Eggs in shell and Egg preparations, with a higher impact for the first product. For Albumin and Eggs not in shell our results show that tariffs do not affect the intensity of trade. These results confirm Figures 5-6 and 3-4, which indicate an increase in global trade despite a minor reduction in tariffs coupled with a stable value of the mean of bilateral trade flows. For these two products, the growth in trade mainly concerned the extensive trade margin.

7 Impulse response to change in trade policies

In this section we investigate the changes in intensive and extensive margins following two liberalization scenarios. The first one is an aggressive liberalization scenario, which eliminates all import tariffs and domestic support.

The second liberalisation scenario depicts a potential Doha "compromise" outcome. It involves removing export subsidies and cutting trade-distorting domestic policies according to the level of global support: 80 percent for the European Union, 70 percent for the United States and Japan and 55 percent for the other countries. The extent of tariff cuts depends on whether protection is implemented through a Tariff-Rate Quota (TRQ) or a simple tariff. In most cases, TRQs act as de facto import quotas because they set a minimum level under which imports are taxed at a very low (often zero) rate. Any imports above the minimum access are taxed at a very high (often prohibitive) rate. The moderate liberalization scenario includes tariff cuts of 20 percent when imports are restricted by a TRQ. The implicit assumption is that egg products currently protected by a TRQ are likely to be designated as sensitive, a notion introduced in the Doha Framework Agreement (WTO, 2008) and thus warrant distinct tariff cuts. For developed countries, "the moderate liberalization" scenario also includes tariff cuts of 70 percent if initial tariffs are higher than 75 percent and 50 percent in all other instances. For developing countries the tariffs is 50 percent in all instances. Note that neither scenario entails full liberalization, which would require addressing non-tariff barriers to trade.

The impact of the liberalization processes reflects adjustments on two margins: extensive and intensive margin, both within a dynamic setting. To quantify each type of response we simulate imports' reactions to a permanent change that took place in period 1, and track the evolution of the probability to export and the trade during the next 10 periods. The year 2010 was set to be period 1. For a given period when an estimated probability of exporting is strictly higher than 0.5, we consider that trade occurs. If the probability of exporting is lower than or equal to 0.5, we consider that trade does not occur during this period. Because the estimated parameters of tariffs are non-significant statistically for Albumin and Eggs not in shell, the following analyses are done for Eggs in shell and Egg preparations using the estimation results of the 2001-2010 period.

7.1 Extensive margin of trade

Trade liberalisation would induce a small increase in the probability of non-zero trade. Under the aggressive liberalization scenario, the increase in the average probability over the entire sample is less than ten percent for Egg preparations while it is higher at 80% for eggs in shell (See Figures A1 and A2). For the two scenarios, the probabilities of exporting are higher, but most of countries do not exceed the threshold of 0.5 at the end of the 10 periods examined. These results were also found by Debaere and Mostashiri (2010) for the vast majority of analyzed products. The authors also found disparity between products and between developed and developing countries. Debaere and Mostashiri (2010: 168) concluded that " At best, ... 12% of newly traded goods can be attributed to tariff reductions. ... This indicates that other factors at both the industry and country levels play a much more significant role in explaining changes in the extensive margin."

7.2 Intensive margin of trade

As indicated by Figure 7, the aggressive liberalization induces an increase in the intensive margin of trade of eggs in shell of about 200%. It is reached three years after aggressive liberalization. We thus observe a contemporaneous response and amplified effects through dynamic adjustments at the intensive margin.[16] Figure 7 illustrates that the biggest marginal response occurs in the second period. In the partial liberalization scenario the full gain is obtained after the first period, implying a very small dynamic adjustment.

Figure 8 depicts the impact of the two liberalization scenarios on international trade of Egg preparations. The dynamic effect is smalter, corresponding to a gain in trade of about

[16]There is also dynamic adjustment at the extensive margin. However, as mentioned, it applies to very few countries in the database.

150% following full liberalization, after five periods. The increase in trade following partial liberalization is modest.

Figures A3-A6 indicate the same feature when considering developed countries and Canadian imports. For developed countries' imports from developing countries and for Canadian imports the biggest marginal response occurs at the beginning of the period, indicating the trigger effect of the high level of tariffs.

8 Conclusions

Trade in processed products is growing more rapidly, and becoming more important than trade in primary goods. This trend is observed across countries and product groups, despite evidence of tariff escalation and considerable heterogeneity in domestic support policy reduction between countries. In addition, a large majority of partners do not trade with one another, suggesting that the growth of trade was predominantly due to the growth of the volume of trade among countries that trade with each other. Moreover, firms historically active in the markets would have an advantage (knowledge) over potential new entrants.

Therefore in this paper we explored potential changes in trade induced by different liberalization scenarios, taking into account the phenomenon of persistence in trading partners. Our application focuses on the egg sector, where the persistence in trading partners is acute. Over 94% of the trading partners in 2000 were still partners in 2008, whereas less than 6% of the partners of 2008 were not trading with one another in 2000. The dataset covers the period from 1988 to 2010. Table eggs, eggs for processing (Eggs not in shell and albumin) and egg products were analyzed to capture potential differences in structural parameters by the type of eggs. Our methodological approach is based on a gravity model estimated using dynamic panel econometrics. We thus take into account the persistence of trading partners while controlling for unobserved heterogeneity of bilateral trading partners. We correct for the "zeros" in trade flows using the sample selection approach suggested by Helpman et al. (2008).

Our estimations strongly support the panel dynamic specification. The dynamic specification can therefore shed new light on the effect of trade agreements. It can help explain why trade liberalization often leads to relatively larger trade creation between countries that were previously trading partners. For eggs in shell the estimated coefficient for distance on the extensive margin of trade is found to be higher than that for the other products. The likelihood of importing is higher when the two trading partners are developed countries indicating that it is easier for them to overcome fixed costs. The impact of the exporter's domestic agricultural production is expected to be positive, while the importer's domestic agricultural production is expected to reduce the probability of non-zero trade flows.

Using the estimated parameters, aggressive liberalization and Doha-type compromise outcomes were simulated to assess the importance of extensive and intensive margin effects of these trade liberalization scenarios studied. Overall, simulations indicate that our trade scenarios would intensify of trade, but not increase trading partners noticeably (extensive margin). For the two liberalization scenarios, the impact (in percent of increase) is greatest for eggs in shell.

Bibliography

Abbassi, A., Bonroy, O and Gervais, J.P. 2008. Dairy Trade Liberalization Impacts in Canada. *Canadian Journal of Agricultural Economics* 56: 313-335.

Anderson, K. 2009. Distortions to Agricultural Incentives: A Global Perspective, 1955-2007 (Washington, DC: The World Bank).

Anderson, J. E. and van Wincoop, E. 2003. Gravity with Gravitas: a Solution to the Border Puzzle. *American Economic Review* 93: 170-192.

Arulampalam, W. and Stewart, M.B. 2009. Simplified Implementation of the Heckman Estimator of the Dynamic Probit Model and a Comparison with Alternatives Estimators. *Oxford Bulletin of Economics and Statistics* 71: 659-681.

Bchir, M.H., Jean, S. and Laborde, D. 2005. Binding overhang and Tariff cutting Formulas. *CEPII Working Paper* 18, Paris, France.

Bernard, A. B. and Jensen, J. B. 1999. Exceptional Exporter Performance: Cause, Effect, or both? *Journal of International Economics* 47: 1–25.

Campbell, D. L. 2010. History, Culture, and Trade: a Dynamic Gravity Approach. *MPRA working paper.*

Chaney, T. 2008. Distorted Gravity: the Intensive and Extensive Margins of International Trade. *American Economic Review* 98: 1707-1721.

Das, M., Robert, M. and Tybout, J.R. 2003. Market Entry Costs, Producer Heterogeneity and Export Dynamics. *Econometrica* 75: 837-873.

De Benedictis, L. and Vicarelli, C. 2005. Trade Potentials in Gravity Panel Models. *Topics in Economic Analysis & Policy* Volume 5, issue 1, article 20.

Debaere, P. and Mostashari, S. 2010. Do Tariffs Matter for the Extensive Margin of International Trade? An Empirical Analysis. *Journal of International Economics* 81: 163–169.

Disdier, A-C. and Head, K. 2008. The Puzzling Persistence of the Distance Effect on Bilateral Trade. *The Review of Economics and Statistics* 90: 37-48.

Egger, P. 2002. An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials. *The World Economy* 25: 297-312.

Egger, P. and Pfaffermayr, M. 2011. Structural Estimation of Gravity Models with Path-dependence Market Entry. *CEPR Discussion Papers* 8458.

Elamin, N. and Khaira, H. 2003. Tariff Escalation in Agricultural Commodity Markets. FAO Commodity Market Review, 101-120. Rome, Italy.

Feenstra, R. C. 2004. *Advanced International Trade. Theory and Evidence.* Princeton and Oxford: Princeton University Press.

Ghazalian P., Larue B. and Gervais. J-P. 2009. Exporting to New Destinations and the Effects of Tariffs: The Case of Meat Commodities. *Agricultural Economics* 40: 701-714.

Ghazalian, P.L., Tamini, L.D., Larue, B. and Gervais, J-P. (Forthcoming). A

Gravity-based Framework when there are Vertical Linkages Between Markets with an Application to the Cattle/Beef Sector. *Journal of International Trade and Economic Development.* (DOI: 10.1080/09638199.2010.505297)

Grant, J.H., Hertel, T.W. and Rutherford, T.F. 2009. Dairy Tariff-Quota Liberalization: Contrasting Bilateral and Most Favored Nation Reform Options. *American Journal of Agricultural Economics* 91: 673–684.

Heckman, J. J. 1979. Sample Selection Bias as a Specification Error. *Econometrica* 47: 153-161.

Helpman, E., Melitz, M.J. and Rubinstein, Y. 2008. Estimating Trade Flow: Trading Partners and Trading Volumes. *Quarterly Journal of Economics* 123: 444-487.

Kandilov, I.T. and Zheng X. 2011. The Impact of Entry Costs on Export Market Participation in Agriculture. *Agricultural Economics* 42: 531-546.

Kim, M., Cho, G. D., Koo, W.W. 2003. Determining Bilateral Patterns using a Dynamic Gravity Equation. Agribusiness & applied economics report 525. North Dakota University.

Koo, W.W., Kennedy, P.L. and Skripnitchenko, A. 2006. Regional Preferential Trade Agreements: Trade Creation and Diversion Effects. *Review of Agricultural Economics* 28: 408-415.

Krinsky, I and Robb, A.L. 1986. On Approximating the Statistical Properties of Elasticities. *Revew of Economics and Statistics* 68: 715-719.

Meltiz, M. J. 2003. The impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity. *Econometrica* 71: 1695-1725.

Olivero, M. P. and Yotov, Y. 2012. Dynamic Gravity: Theory and Empirical Implications. *Canadian Journal of Economics* 45: 64-92.

Orme, C.D. 1997. The Initial Conditions Problem and Two-Step Estimation in Discrete Panel Data Models. Mimeo, Department of Economic Studies, University of Manchester, UK. Unpublished paper.

Orme, C.D. 2001. Two-step Inference in Dynamic non-linear Panel Data Models. School of Economic Studies, University of Manchester, mimeo, downloadable from: http://personalpages.manchester.ac.uk/staff/chris.orme/

OECD. 2003. The Doha Development Agenda: Welfare Gain from Further Multilateral Trade Liberalization with Respect to Tariffs. Available at www.oecd.org/trade under Publications and Documents/Reports (accessed 17 October 2011).

Paiva, C. 2005. Assessing Protectionism and Subsidies in Agriculture: A Gravity Approach. *International Monetary Fund (IMF) Working Paper* No. 05/21, Washington, D.C.

Rafjalovic, J. and Cardwell, R. 2010. The Implication of WTO Negotiations on the Canadian Chicken Market: two Representations of Chicken and Stochastic World Prices. *CAPT-*

PRN working paper 2010-07

Rude, J. I. and Gervais J-P. 2006. Tariff-rate Quota Liberalization: the Case of World price Uncertainty and Supply Management. *Canadian Journal of Agricultural Economics* 54: 33-54.

Sarker, R., and Jayasinghe, S. 2007. Regional Trade Agreements and Trade in Agri-food Products: Evidence for the European Union from Gravity Modeling using Disaggregated Data. *Agricultural Economics* 37: 93-104.

Segura-Cayuela R. and Vilarrubia, J. M. 2008. Uncertainty and Entry into Export Markets. *Banco de Espana Working Papers* 0811, Banco de España

Stewart, M.B. 2007. The interrelated Dynamics of Unemployment and Low-wage Employment. *Journal of Applied Econometrics* 22: 511-531.

Stewart, M. B. 2006. Maximum Simulated Likelihood Estimation of Random-effects Dynamic Probit Models with autocorrelated Errors. *Stata Journal* 6: 256-272.

Susanto, D., Rosson, C.P. and Adcock, F.J. 2007. Trade Creation and Trade Diversion in the North American Free Trade Agreement: the Case of Agricultural Sector. *Journal of Agricultural and Applied Economics* 39: 121-134.

Tamini, L.D., Gervais, J-P. and Larue, B. 2010. Trade Liberalisation Effects on Agricultural Goods at Different Processing Stages. *European Review of Agricultural Economics* 37: 453-477.

Vijay K. V. and Shahid S. 2011. An Estimation of the Latent bilateral Trade between India and Pakistan using Panel Data Methods. *Global Economic Review* 40: 45-65.

Wooldridge, J. M. 2005. Simple Solutions to the Initial Conditions Problem in Dynamic, nonlinear Panel Data Models with unobserved Heterogeneity. *Journal of Applied Econometrics* 20: 39–54.

Wooldridge, J. M. 2002. *Econometric Analysis of Cross Section and Panel Data.* Cambridge MA: MIT Press.

World Trade Organization. 2004. Word Trade Report. Exploring the Linkage Between the Domestic Policy Environment and International Trade. Available at: www.wto.org/english /res_e/reser_e/wtr_arc_e.htm. Accessed February 3, 2012.

World Trade Organization. 2008. Committee on agriculture special session. Revised draft modalities for agriculture. www.wto.org/english/tratop_e/agric_e/agchairtxt_july08_ e.pdf. Accessed March 31, 2012.

List of figures

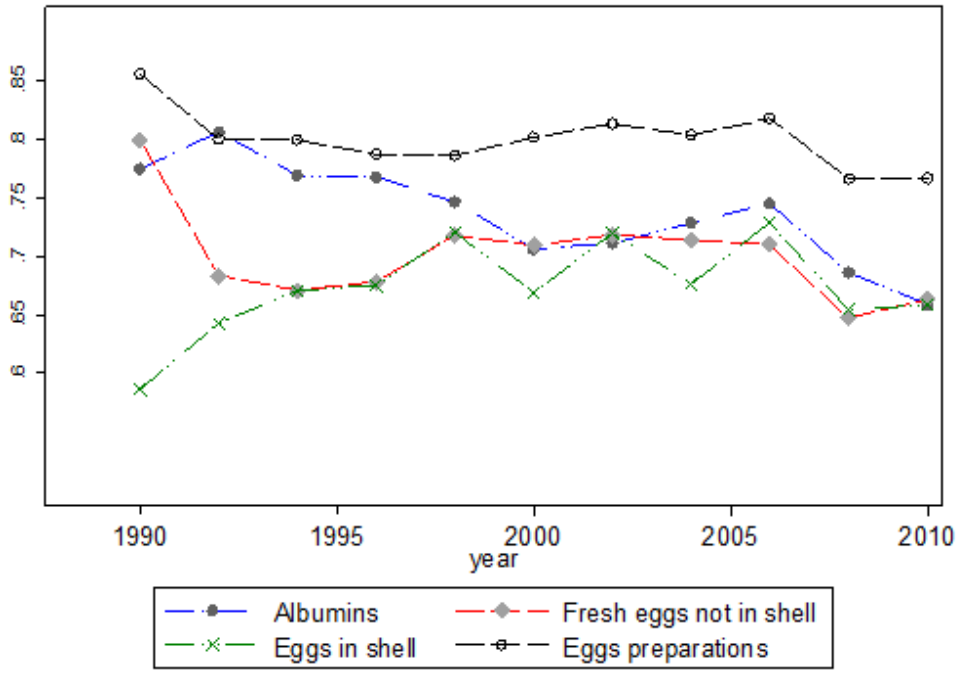

Figure 1. Fraction of positive trade flow during two successive years

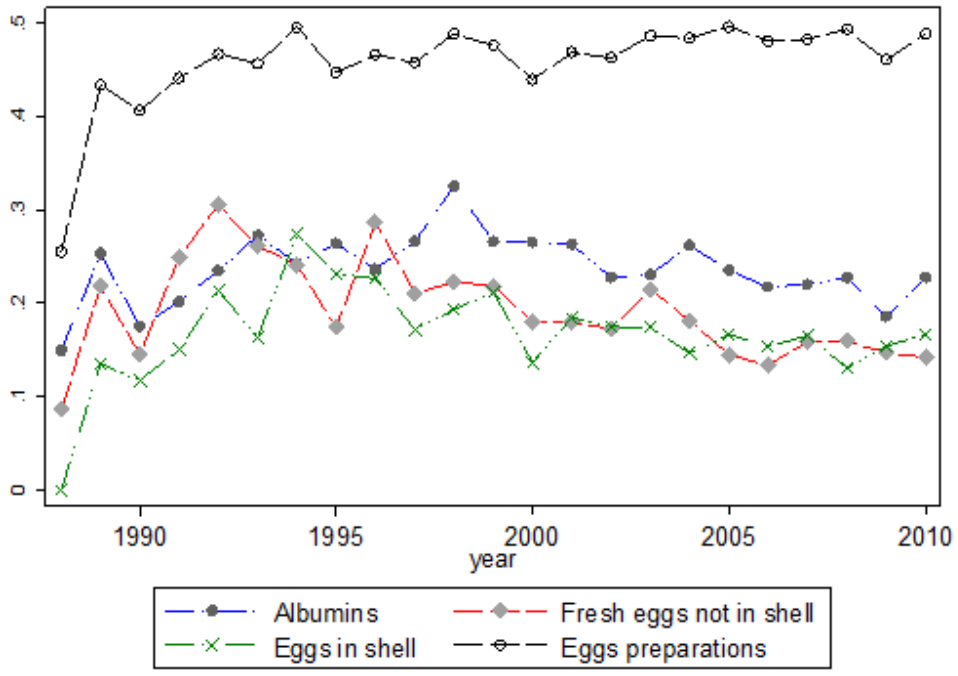

Figure 2. Fraction of countries pairs that trade in both directions

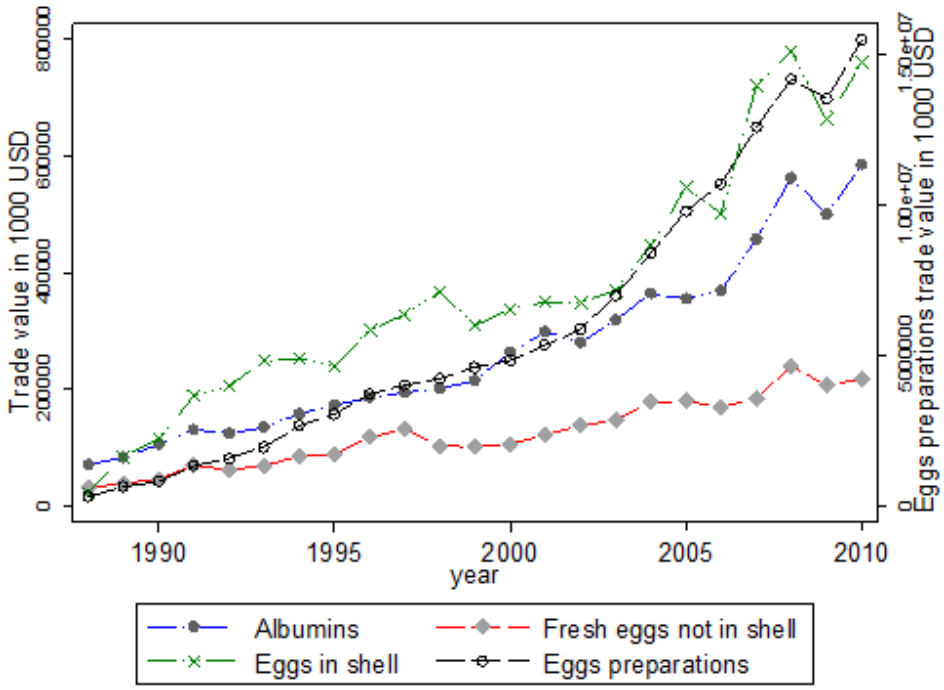

Figure 3. Aggregate volume of export of all countries (x 1 000 US$)

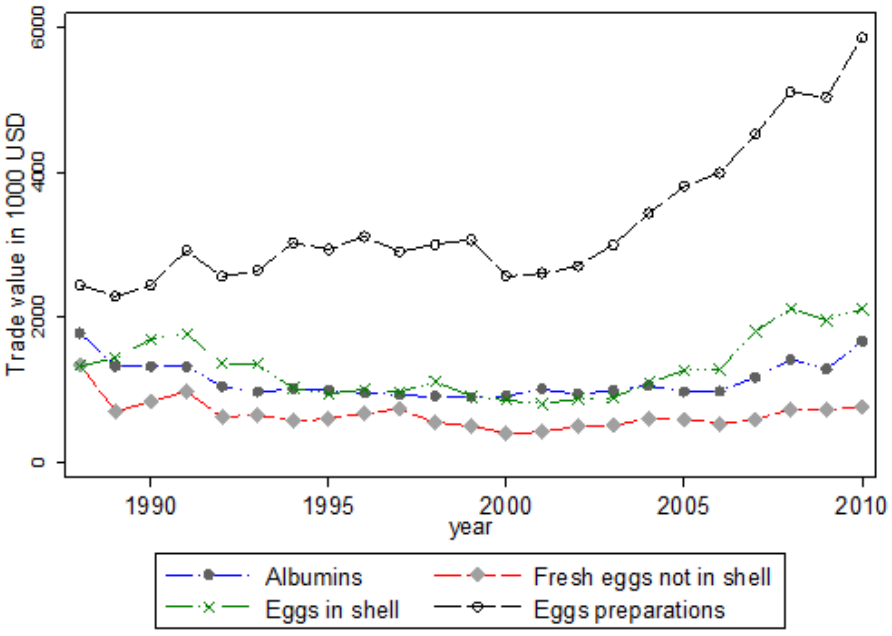

Figure 4. Mean of non zeros bilateral trade flows (x 1 000 US$)

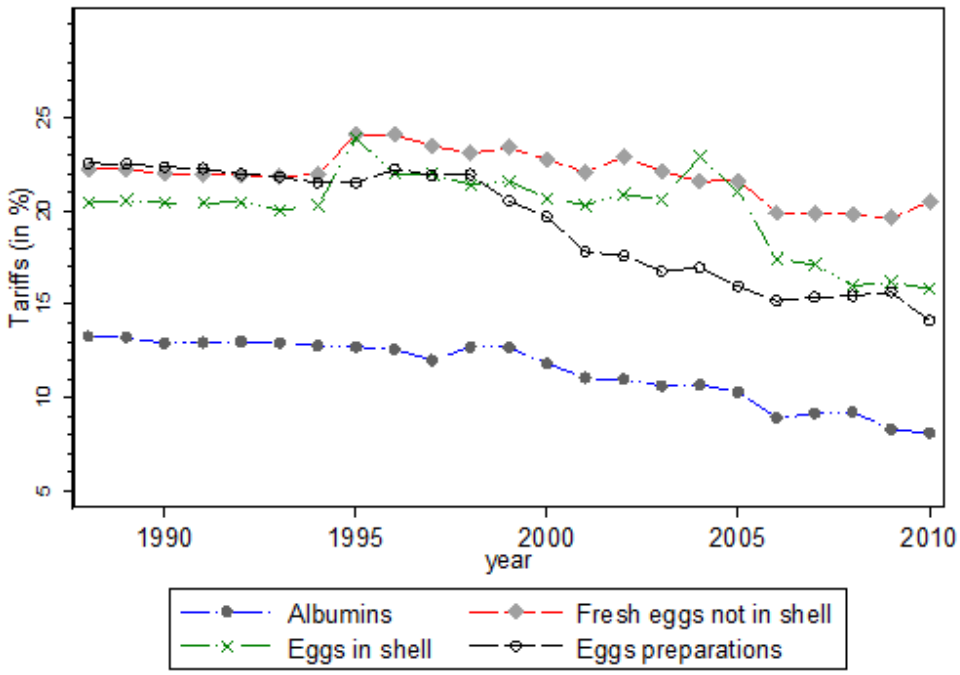

Figure 5. Evolution of tariffs in %

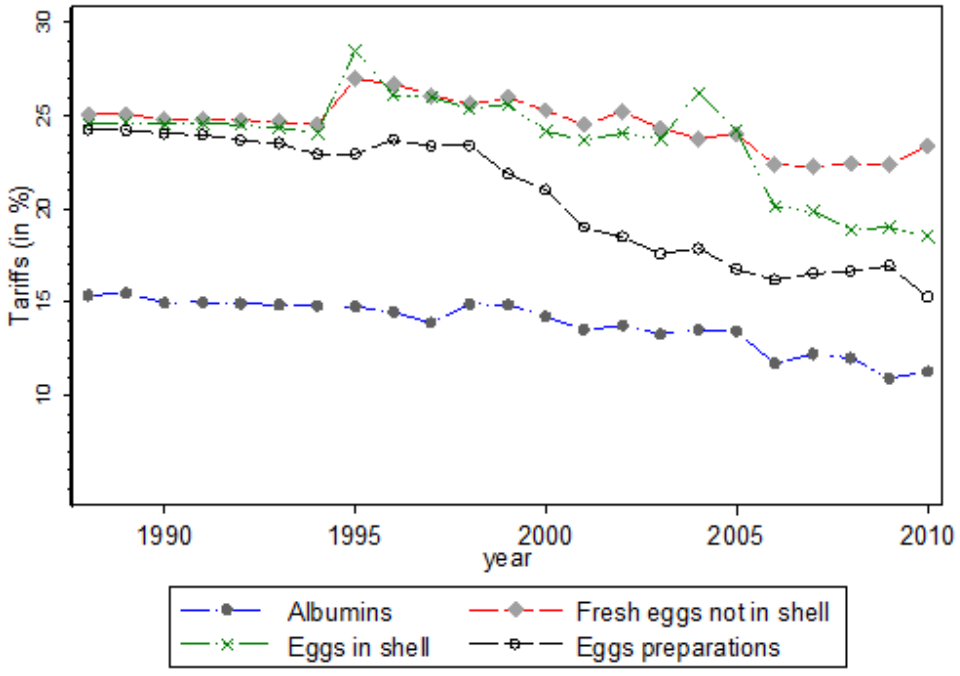

Figure 6. Evolution of tariffs in % for the sample of countries with non zero tariffs

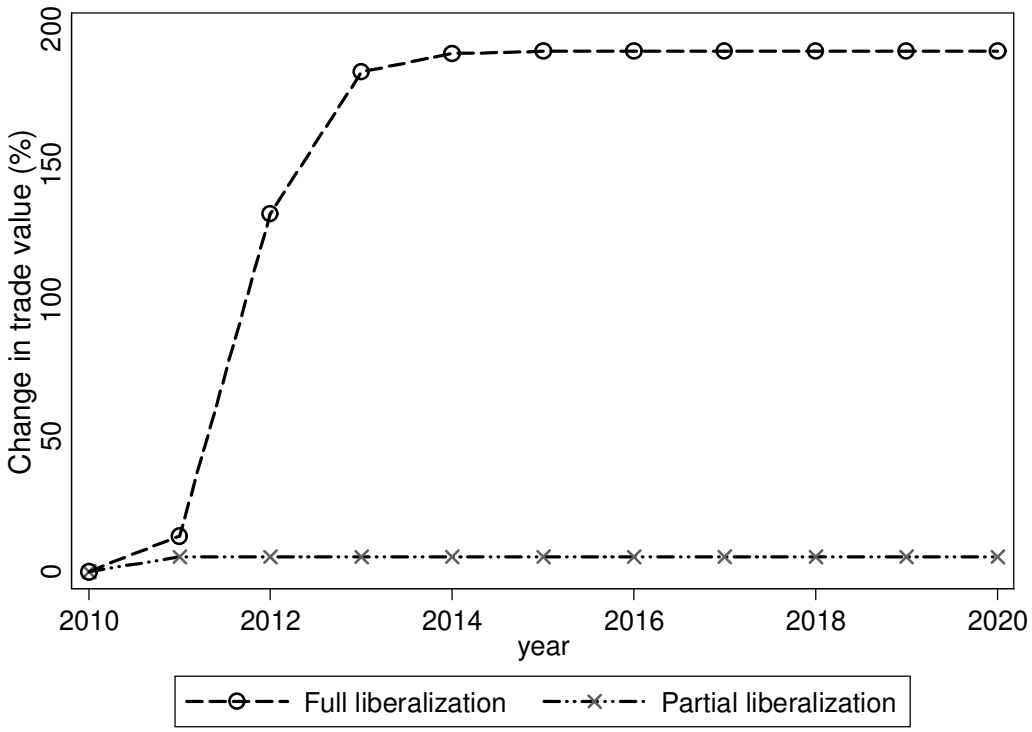

Figure 7. Cumulative impact on the value of trade of eggs in shell

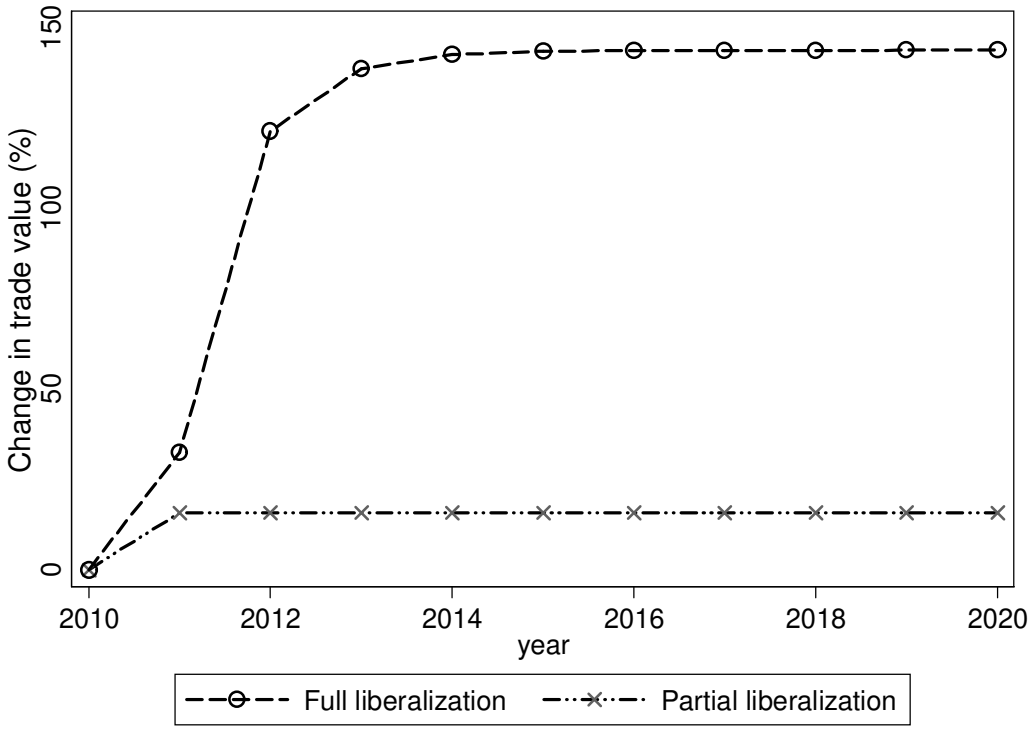

Figure 8. Cumulative impact on the value of trade of eggs preparations

List of tables

Table 1. Summary statistics of the data used in estimations

		Eggs in shell			
Year	Variables	Sum	Mean	Minimum	Maximum
1988	Trade value	24,012.71	1.38	0.00	19,519.74
	Ad valorem applied tariff		20.44	0.00	230.00
	Domestic support	417,637.80	24.15	-11.48	2,557.68
	Total production	5.09e+09	294,165.10	0.00	7,154,331.00
	Supply management		0.05	0.00	1.00
1995	Trade value	238,963.20	13.82	0.00	35,373.05
	Ad valorem applied tariff		21.54	0.00	349.50
	Domestic support	360,985.10	20.88	-8.24	1,731.95
	Total production	6.12e+09	353,733.50	0.00	1.71e+07
	Supply management		0.05	0.00	1.00
2001	Trade value	350,704.10	20.28	0.00	38,151.79
	Ad valorem applied tariff		17.94	0.00	349.50
	Domestic support	91,388.98	5.29	-7.05	425.36
	Total production	7.29e+09	421,799.50	0.00	2.25e+07
	Supply management		0.05	0.00	1.00
2010	Trade value	761,364.80	44.03	0.00	96,422.13
	Ad valorem applied tariff		15.37	0.00	349.50
	Domestic support	187,172.60	10.82	-14.08	552.87
	Total production	8.91e+09	515,444.00	0.00	2.80e+07
	Supply management		0.05	0.00	1.00

Table 1. Summary statistics of the data used in estimations(Cont'd)

		Eggs not in shell			
Year	Variables	Sum	Mean	Minimum	Maximum
1988	Trade value	31,038.64	1.805	0.00	12,796.33
	Ad valorem applied tariff		22.25	0.00	135.00
	Domestic support	417,637.80	24.15	-11.48	2,557.68
	Total production	5.09e+09	294,165.10	0.00	7,154,331.00
	Supply management		.05	0.00	1.00
1995	Trade value	89,784.71	5.19	0.00	34,180.97
	Ad valorem applied tariff		24.11	0.00	349.50
	Domestic support	360,985.10	20.88	-8.24	1,731.95
	Total production	6.12e+09	353,733.50	0.00	1.71e+07
	Supply management		.05	0.00	1.00
2001	Trade value	122,121.80	7.06	0.00	28,730.37
	Ad valorem applied tariff		22.11	0.00	349.50
	Domestic support	91,388.98	5.29	-7.05	425.36
	Total production	7.29e+09	421,799.50	0.00	2.25e+07
	Supply management		0.05	0.00	1.00
2010	Trade value	218,683.70	12.65	0.00	37,835.69
	Ad valorem applied tariff		20.48	0.00	349.5
	Domestic support	187,172.60	10.82	-14.08	552.87
	Total production	8.91e+09	515,444.00	0.00	2.80e+07
	Supply management		0.05	0.00	1.00

Table 1. Summary statistics of the data used in estimations (Cont'd)

		Albumin			
Year	Variables	Sum	Mean	Minimum	Maximum
1988	Trade value	71,376.94	4.13	0.00	27,694.64
	Ad valorem applied tariff		13.28	0.00	100.00
	Domestic support	417,637.80	24.15	-11.48	2,557.68
	Total production	5.09e+09	294,165.10	0.00	7,154,331.00
	Supply management		0.05	0.00	1.00
1995	Trade value	172,947.10	10.00	0.00	48,047.53
	Ad valorem applied tariff		12.75	0.00	100.00
	Domestic support	360,985.10	20.88	-8.24	1,731.954
	Total production	6.12e+09	353,733.50	0.00	1.71e+07
	Supply management		0.05	0.00	1.00
2001	Trade value	299,035.20	17.29	0.00	48,380.79
	Ad valorem applied tariff		11.04	0.00	100.00
	Domestic support	91,388.98	5.29	-7.05	425.36
	Total production	7.29e+09	421,799.50	0.00	2.25e+07
	Supply management		0.05	0.00	1.00
2010	Trade value	586,129.50	33.89	0.00	64,060.99
	Ad valorem applied tariff		8.11	0.00	50.00
	Domestic support	187,172.60	10.82	-14.08	552.86
	Total production	8.91e+09	515,444.00	0.00	2.80e+07
	Supply management		0.05	0.00	1.00

Table 1. Summary statistics of the data used in estimations (Cont'd)

		Egg preparations			
Year	Variables	Sum	Mean	Minimum	Maximum
1988	Trade value	325,788.60	18.84	0.00	65,282.26
	Ad valorem applied tariff		22.58	0.00	150.00
	Domestic support	417637.80	24.15	-11.48	2,557.68
	Total production	5.09e+09	294,165.10	0.00	7154331
	Supply management		0.05	0.00	1.00
1995	Trade value	3,048,414.00	176.29	0.00	199,027.30
	Ad valorem applied tariff		21.44	0.00	150.00
	Domestic support	360,985.10	20.88	-8.24	1,731.95
	Total production	6.12e+09	353,733.50	0.00	1.71e+07
	Supply management		0.05	0.00	1.00
2001	Trade value	5,339,703.00	308.80	0.00	310,347.80
	Ad valorem applied tariff		17.89	0.00	190.00
	Domestic support	91,388.98	5.29	-7.05	425.36
	Total production	7.29e+09	421,799.50	0.00	2.25e+07
	Supply management		0.05	0.00	1.00
2010	Trade value	1.55e+07	895.42	0.00	935,836.60
	Ad valorem applied tariff		15.34	0.00	1,001.67
	Domestic support	187,172.60	10.82	-14.08	552.87
	Total production	8.91e+09	515,444.00	0.00	2.80e+07
	Supply management		0.05	0.00	1.00

Table 2. Results of the dynamic export equation in the 2001-2010 period

Variables	Eggs in shell	Eggs not in shell
Lag of participation	1.140*** (0.069)	0.966*** (0.079)
Lag of log of trade value	0.197***(0.014)	0.247*** (0.017)
Log of distance	-0.374*** (0.019)	-0.338*** (0.021)
Log of Tarif	-0.539*** (0.104)	-1.144*** (0.118)
Country of destination		
Production quota	0.216*** (0.063)	-0.021 (0.069)
Developed (=1)	0.233*** (0.047)	0.275*** (0.046)
Having signed GATT	0.095*** (0.029)	0.084* (0.035)
Log of domestic support	0.245 (0.187)	0.733*** (0.197)
Country of origin		
Production quota	0.070 (0.046)	0.171*** (0.047)
Developed (=1)	0.387*** (0.037)	0.465*** (0.041)
Having signed GATT	0.109*** (0.028)	0.148*** (0.031)
Log of domestic support	-0.353** (0.127)	-0.440** (0.139)
Log of production	0.241*** (0.008)	0.286*** (0.010)
Common legal system	0.067* (0.031)	0.056 (0.036)
Contiguity	0.214*** (0.054)	0.185** (0.062)
Common language	0.366*** (0.033)	0.271*** (0.038)
Common RTA membership	0.249*** (0.041)	0.257*** (0.049
Constant	-0.716*** (0.158)	-1.305*** (0.176)

Note: standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively.

Table 2. Results of the dynamic export equation in the 2001-2010 period (Cont'd)

Variables	Egg preparations	Albumin
Lag of participation	0.829*** (0.025)	0.990*** (0.070)
Lag of log of trade value	0.166*** (0.006)	0.260*** (0.016)
Log of distance	-0.294*** (0.012)	-0.279*** (0.022)
Log of Tarif	0.028 (0.051)	-0.449** (0.172)
Country of destination		
Production quota	0.421*** (0.033)	0.137* (0.062)
Developed (=1)	0.641*** (0.026)	0.332*** (0.049)
Having signed GATT	0.083*** (0.014)	0.128*** (0.038)
Log of domestic support	0.467*** (0.112)	0.444* (0.181)
Country of origin		
Production quota	0.305*** (0.032)	0.368*** (0.046)
Developed (=1)	0.666*** (0.025)	0.874*** (0.038)
Having signed GATT	0.066*** (0.013)	0.106*** (0.032)
Log of domestic support	-1.588*** (0.131)	-0.968*** (0.133)
Log of production	0.252*** (0.004)	0.251*** (0.009)
Common legal system	0.076*** (0.017)	0.100** (0.036)
Contiguity	0.121** (0.042)	0.353*** (0.065)
Common language	0.355*** (0.020)	0.255*** (0.039)
Common RTA membership	0.173*** (0.028)	0.164*** (0.049)
Constant	-0.452*** (0.101)	-1.857*** (0.188)

Note: standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively.

Table 3. Marginal effect of foreign market entry (percentage point reduction in the likelihood of market participation)

Commodities	Full sample	1988-1994	1995-2000	2001-2010
Eggs in shell				
All destination	0.061	0.038	0.068	0.065
Developed countries	0.094	0.065	0.106	0.100
Developing countries	0.056	0.033	0.062	0.060
Eggs not in shell				
All destination	0.043	0.019	0.031	0.038
Developed countries	0.076	0.045	0.060	0.065
Developing countries	0.037	0.014	0.025	0.034
Albumin				
All destination	0.048	0.027	0.054	0.043
Developed countries	0.118	0.075	0.134	0.112
Developing countries	0.037	0.018	0.042	0.034
Egg preparations				
All destination	0.194	0.096	0.110	0.139
Developed countries	0.284	0.172	0.188	0.213
Developing countries	0.188	0.086	0.104	0.135

Table 4. Intensity of trade in the 2001-2010 period

Variables	Eggs in shell	Eggs not in shell
Log of distance	-0.732*** (0.100)	-0.361*** (0.104)
Log of tarif	-1.013* (0.512)	-0.367 (0.941)
Importer log of GDP	-0.005 (0.007)	-0.003 (0.009)
Exporter log of production	1.260** (0.419)	1.183* (0.514)
Inverse Mills Ratio	1.182*** (0.246)	1.591*** (0.264)
Polynomial decomposition	1.258*** (0.173)	1.450*** (0.136)
Autocorrelation coefficient	0.522	0.547
Durbin-Watson statistic	1.267	1.276
Baltagi-Wu LBI statistic	1.929	1.927
	Albumin	Egg preparations
Log of distance	-0.342*** (0.100)	-1.022*** (0.039)
Log of tarif	1.127 (1.099)	-0.448*** (0.130)
Importer log of GDP	0.018* (0.008)	0.020*** (0.003)
Exporter log of production	0.675 (0.541)	0.947*** (0.138)
Inverse Mills Ratio	1.549*** (0.226)	2.089*** (0.106)
Polynomial decomposition	1.550*** (0.156)	2.082*** (0.071)
Autocorrelation coefficient	0.494	0.483
Durbin-Watson statistic	1.404	1.330
Baltagi-Wu LBI statistic	2.037	1.909

Note: standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively. Country origin and destination fixed effects are additional explanatory variables. Coefficients of fixed effects are not reported here.

Appendix

TableA1. List of countries

Algeria	Ethiopia	Morocco	Suriname
Angola	European Union	Madagascar	Swaziland
Argentina	Gabon	Mexico	Seychelles
Armenia	Georgia	Mali	Syria
Australia	Ghana	Mozambique	Chad
Azerbaijan	Guinea	Mauritania	Togo
Burundi	Gambia	Mauritius	Thailand
Burkina Faso	Guinea-Bissau	Malawi	Tajikistan
Bangladesh	Guatemala	Malaysia	Turkmenistan
Bahrain	Honduras	Namibia	Tunisia
Bahamas	Haiti	Niger	Turkey
Belarus	Indonesia	Nigeria	Taiwan
Bolivia	India	Nicaragua	Tanzania
Brazil	Iran	Norway	Uganda
Botswana	Iceland	Nepal	Ukraine
Central African Republic	Israel	New Zealand	Uruguay
Canada	Ivory Coast	Oman	United States America
Switzerland	Jamaica	Pakistan	Uzbekistan
Chile	Jordan	Panama	Venezuela
China	Japan	Peru	Vietnam
Cameroon	Kazakhstan	Philippines	Yemen
Congo	Kenya	Paraguay	South Africa
Congo	Kyrgyzstan	Qatar	Zambia
Colombia	Cambodia	Russia	Zimbabwe
Comoros	Korea	Rwanda	
Croatia	Kuwait	Saudi Arabia	
Dominica	Laos	Sudan	
Dominican Republic	Lebanon	Senegal	
Ecuador	Libya	Singapore	
Egypt	Sri Lanka	El Salvador	

Table A2a. Results of the dynamic export equation for albumin

Variable	Full sample	1988-1994	1995-2000	2001-2010
Lbin	1.191***	1.272***	1.289***	0.990***
Llvaluep	0.257***	0.287***	0.304***	0.260***
Ldistw	-0.248***	-0.203***	-0.243***	-0.279***
Ltarifp	-0.784***	-0.291	-1.000***	-0.449**
quota_d	0.168***	0.205	0.068	0.137*
quota_o	0.273***	0.125	0.123	0.368***
developed_o	0.806***	0.893***	0.801***	0.874***
developed_d	0.352***	0.511***	0.277***	0.332***
lsoutien_o	-0.617***	-0.279**	-0.662**	-0.968***
lprod_o	0.238***	0.230***	0.211***	0.251***
lsoutien_d	0.206*	0.267*	0.781**	0.444*
Legal	0.067*	0.060	-0.004	0.100**
Contig	0.337***	0.348*	0.328***	0.353***
comlang_off	0.267***	0.204**	0.370***	0.255***
gatt_o	0.207***	0.394***	0.312***	0.128***
gatt_d	0.158***	0.541***	0.136*	0.106***
Rta	0.247***	0.149	0.231**	0.164***
_cons	-2.231***	-3.474***	-2.187***	-1.857***

Note: Standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively.

Table A2b. Results of the dynamic export equation for eggs in shell

Variable	Full sample	1988-1994	1995-2000	2001-2010
Lbin	1.189***	1.178***	1.229***	1.140***
Llvaluep	0.201***	0.226***	0.252***	0.197***
Ldistw	-0.368***	-0.345***	-0.379***	-0.374***
Ltarifp	-0.345***	-0.055	-0.296*	-0.539***
quota_d	0.247***	0.284**	0.259**	0.216***
quota_o	0.134***	0.274***	0.150*	0.070
developed_o	0.375***	0.432***	0.393***	0.387***
developed_d	0.284***	0.511***	0.265***	0.233***
lsoutien_o	-0.293***	-0.268**	-0.052	-0.353**
lprod_o	0.242***	0.241***	0.228***	0.241***
lsoutien_d	0.277***	0.333**	0.347	0.245
Legal	0.089**	0.164**	0.135***	0.067*
Contig	0.257***	0.323***	0.312***	0.214***
comlang_off	0.326***	0.233***	0.255***	0.366***
gatt_o	0.113***	0.122*	0.045	0.095***
gatt_d	0.126***	0.119*	0.103*	0.109***
Rta	0.290***	0.352***	0.179**	0.249***
_cons	-0.900***	-1.434***	-0.651**	-0.716***

Note: Standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively.

Table A2c. Results of the dynamic exports equation for egg preparations

Variable	Full sample	1988-1994	1995-2000	2001-2010
Lbin	1.227***	1.202***	0.902***	0.829***
Llvaluep	0.160***	0.225***	0.231***	0.166***
Ldistw	-0.253***	-0.207***	-0.257***	-0.294***
Ltarif	-0.309***	0.094	-0.020	0.028
quota_d	0.371***	0.444***	0.317***	0.421***
quota_o	0.286***	0.369***	0.307***	0.305***
developed_o	0.527***	0.597***	0.634***	0.666***
developed_d	0.577***	0.709***	0.601***	0.641***
lsoutien_o	-1.059***	-0.867***	-1.316***	-1.588***
lprod_o	0.232***	0.210***	0.222***	0.252***
lsoutien_d	0.011	0.255***	0.380***	0.467***
Legal	0.071***	0.206***	0.045*	0.076***
Contig	0.066*	0.243***	0.123*	0.121**
comlang_off	0.306***	0.214***	0.341***	0.355***
gatt_o	0.154***	0.264***	0.234***	0.083***
gatt_d	0.133***	0.334***	0.121***	0.066***
Rta	0.312***	0.399***	0.342***	0.173***
_cons	-1.000***	-2.208***	-1.111***	-0.452***

Note: Standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively

Table A2d. Results of the dynamic exports equation for eggs not in shell

Variable	Full sample	1988-1994	1995-2000	2001-2010
Lbin	1.163***	1.079***	1.030***	0.966***
Llvaluep	0.242***	0.318***	0.308***	0.247***
Ldistw	-0.308***	-0.208***	-0.283***	-0.338***
Ltarifp	-0.778***	-0.368*	-0.475***	-1.144***
quota_d	0.132*	0.231*	0.242**	-0.021
quota_o	0.174***	0.252**	0.107	0.171***
developed_o	0.485***	0.706***	0.564***	0.465***
developed_d	0.346***	0.487***	0.464***	0.275***
lsoutien_o	-0.454***	-0.368**	-0.321	-0.440**
lprod_o	0.275***	0.251***	0.258***	0.286***
lsoutien_d	0.276**	0.330**	0.150	0.733***
Legal	0.061	0.124	0.071	0.056
Contig	0.246***	0.471***	0.389***	0.185**
comlang_off	0.262***	0.093	0.289***	0.271***
gatt_o	0.163***	0.193*	0.264***	0.084*
gatt_d	0.190***	0.576***	0.152**	0.148***
Rta	0.296***	0.361**	0.298***	0.257***
_cons	-1.770***	-3.318***	-2.114***	-1.305***

Note: Standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively.

Table A3. Trade intensity equation

	Eggs in shell			
Variable	Full sample	1988-1994	1995-2000	2001-2010
ldistw	-1.010***	-1.349***	-1.039***	-0.732***
ltarifp	0.099	1.401	0.911	-1.013*
lgdp_d	0.003	0.890*	0.766*	-0.005
lprod_o	0.488**	-0.167	-0.551	1.260**
imr	0.147	0.584*	0.852***	1.182***
imr2	0.316**	0.653***	0.835***	1.258***
rho_ar	0.591	0.279	0.337	0.522
D-W	1.205	1.554	1.439	1.267
B. W	1.753	2.271	2.146	1.929
	Eggs not in shell			
Variable	Full sample	1988-1994	1995-2000	2001-2010
ldistw	-0.466***	-0.359*	-0.347**	-0.361***
ltarifp	0.449	0.179	0.667	-0.367
lgdp_d	0.000	0.263	1.226***	-0.003
lprod_o	0.288	0.144	-1.839*	1.183*
imr	0.766***	1.103***	0.760***	1.591***
imr2				
rho_ar	0.605	0.460	0.437	0.547
D-W	1.248	1.305	1.353	1.276
B. W	1.815	2.024	2.130	1.927

Note: standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively. Country origin and destination fixed effects are additional explanatory variables. Coefficients of fixed effects are not reported here.

Table A3. Trade intensity equation (Cont'd)

	Egg preparations			
Variable	Full sample	1988-1994	1995-2000	2001-2010
ldistw	-1.272***	-1.354***	-0.922***	-1.022***
ltarifp	-0.196*	-1.239	-0.140	-0.448***
lgdp_d	0.024***	1.047***	0.763***	0.020***
lprod_o	0.692***	0.370	-0.723***	0.947***
imr	0.886***	0.500***	1.690***	2.089***
imr2	0.887***	0.513***	1.523***	2.082***
rho_ar	0.610	0.410	0.357	0.483
D-W	1.149	1.290	1.446	1.330
B.W	1.653	1.930	2.167	1.909
	Albumin			
Variable	Full sample	1988-1994	1995-2000	2001-2010
ldistw	-0.446***	-0.278*	-0.072	-0.342***
ltarifp	-0.426	-1.869	-0.972	1.127
lgdp_d	0.024***	0.630	0.482	0.018*
lprod_o	-0.184	-0.232	-0.850	0.675
imr	0.778***	1.442***	1.664***	1.549***
imr2	0.802***	1.194***	1.499***	1.550***
rho_ar	0.594	0.356	0.393	0.494
D-W	1.291	1.470	1.446	1.404
B.W	1.823	2.073	2.170	2.037

Note: standard deviations in parentheses. ***, **, * indicate significance at 1%, 5% and 10% respectively. Country origin and destination fixed effects are additional explanatory variables. Coefficients of fixed effects are not reported here.

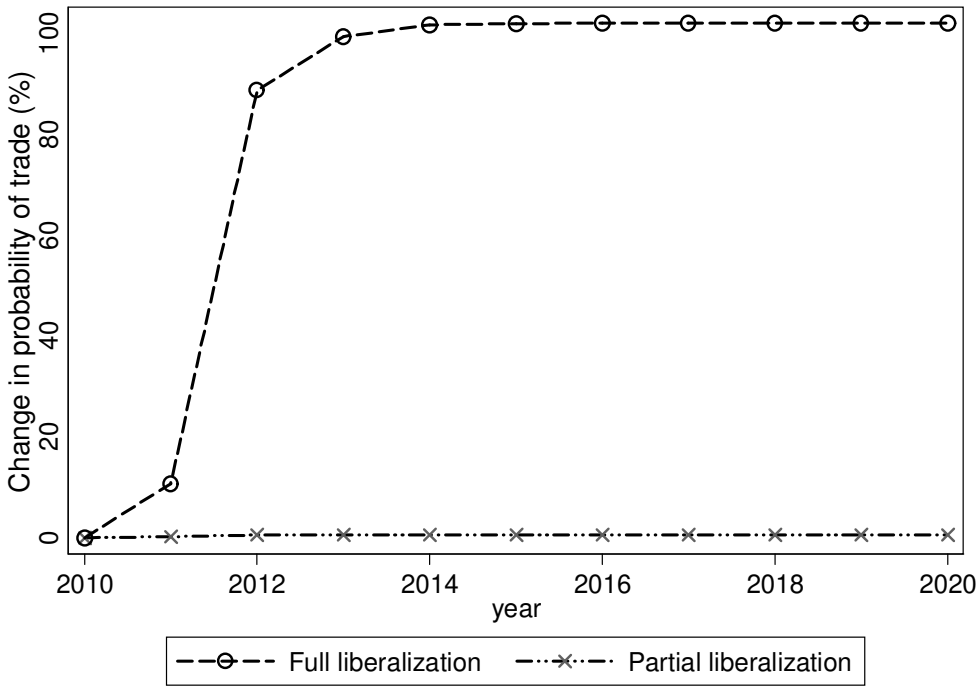

Figure A1. Cumulative impact on the probability of trade for eggs in shell

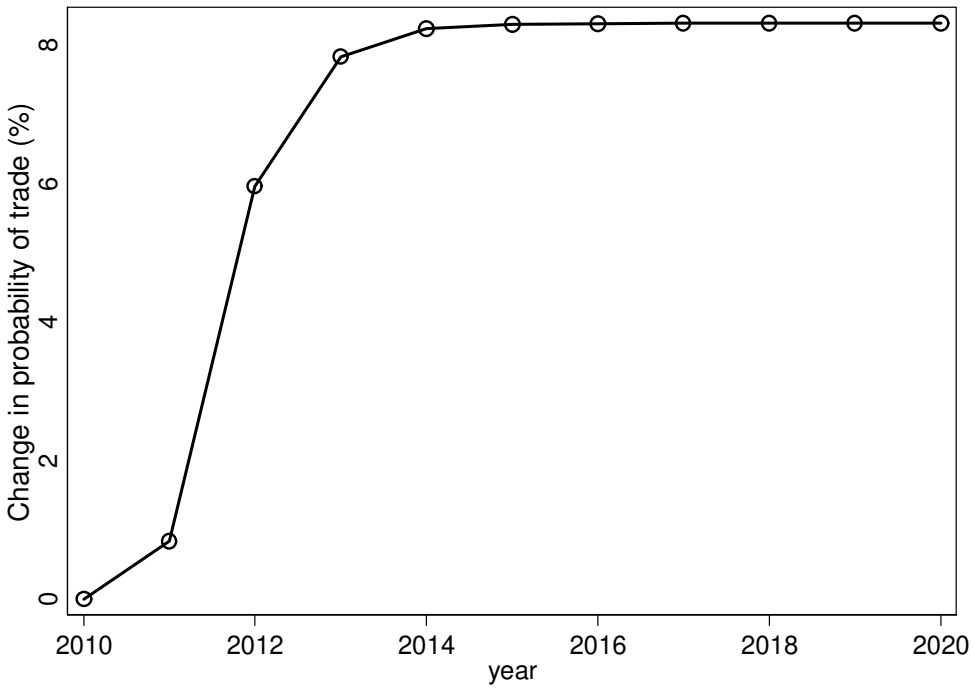

Figure A2. Cumulative impact on the probability of trade for eggs praparations following aggressive leberalization

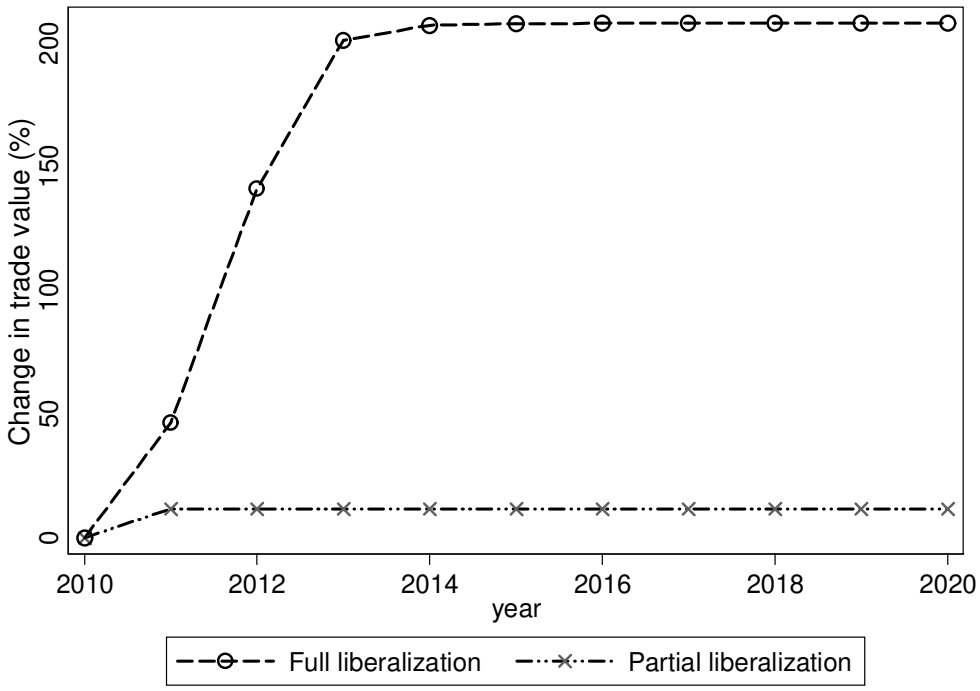

Figure A3. Cumulative impact on Canadian'imports of eggs in shell

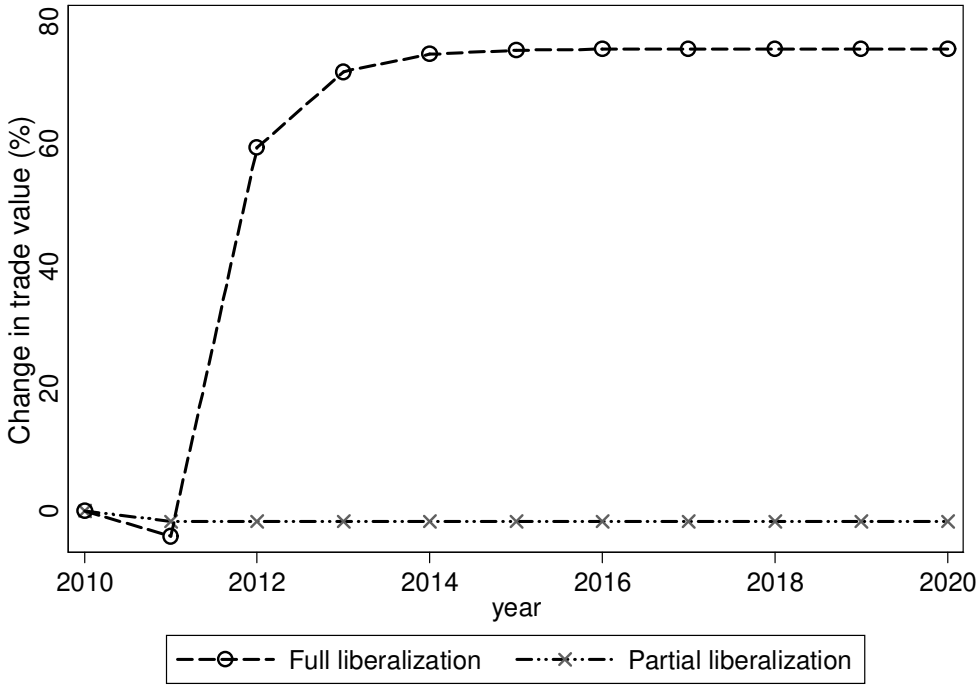

Figure A4. Cumulative impact on Canadian'imports of egg preparationsl

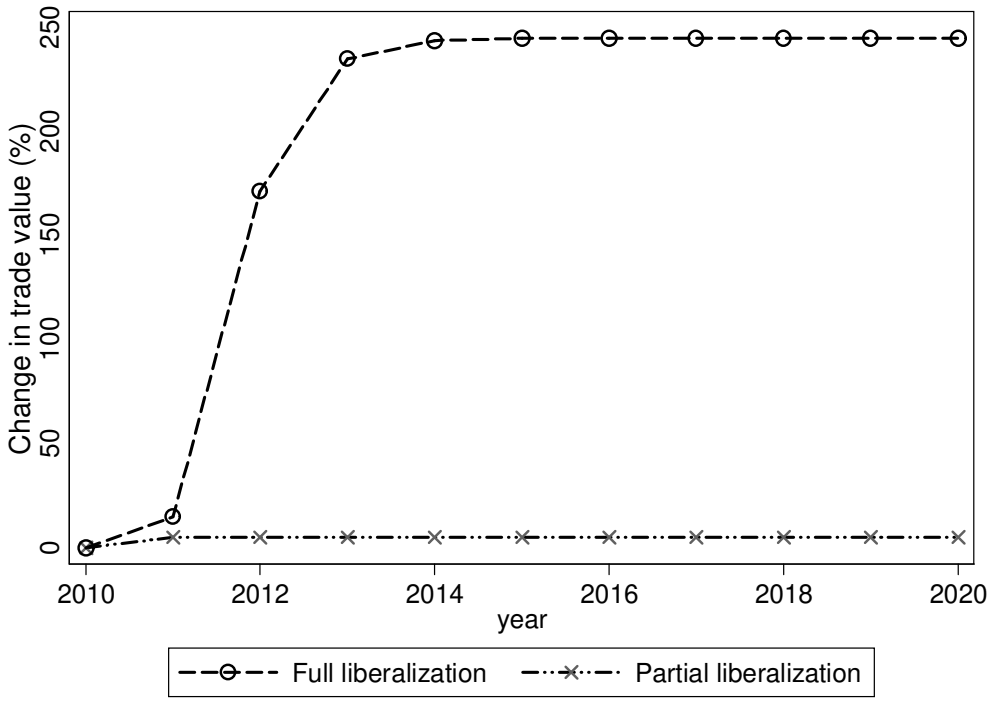

Figure A5. Cumulative impact on the value of developed countries' imports of eggs in shell from developing countries

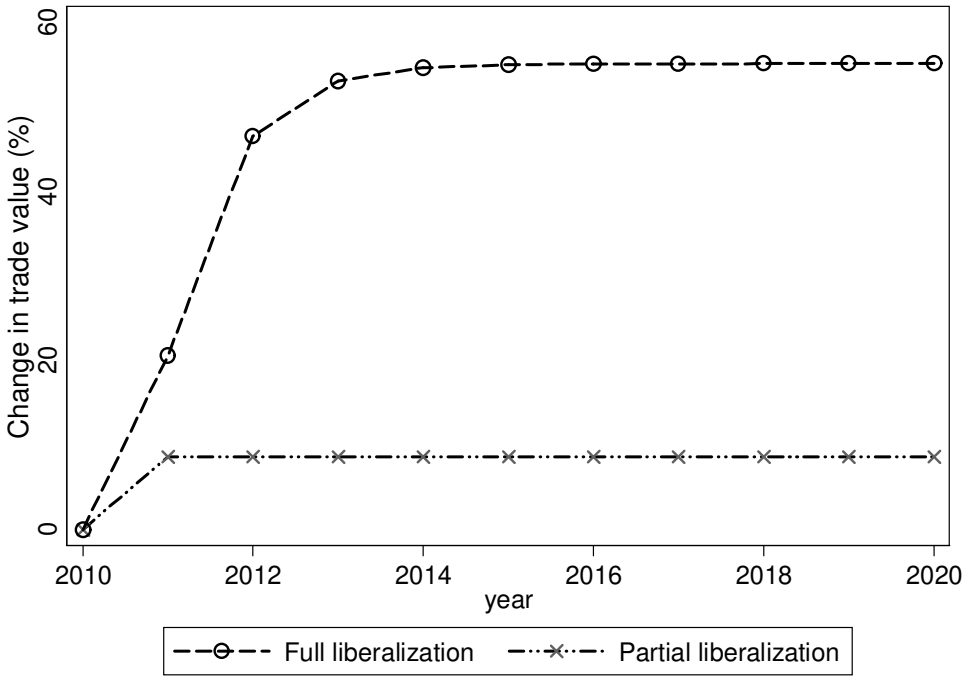

Figure A6. Cumulative impact on the value of developed countries' imports of egg preparations from developing countries