Analyzing Trade Liberalization Effects in the Egg Sector Using a Dynamic Gravity Model

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The objective of the paper is to explore potential changes in trade induced by a liberalization scenario when taking into account persistence in trading partners. Our approach is based on the development of a gravity model that takes into account the dynamics at the extensive margin of trade as well as the persistence effect of the intensity of trade. Our empirical contribution is on the egg sector, where the persistence in trading partners is acute. Our results indicate that the use of static models underestimate imports of table eggs by more than 50% in Canada, when compared with the use of panel dynamic specification. The dynamic specification helps explain why trade liberalizations often increase trade creation between countries that had already been trading partners, while new trading partnerships remain scarce following trade liberalization. Our results also confirm the importance of sunk cost and their negative impact on the probability of export market participation for developing countries. Those results raise questions regarding the benefit of trade liberalization for developing countries, in terms of accessing new market, if they do not benefit from special treatments.

L'objectif de cette étude est d'explorer un scénario de libéralisation du commerce qui prend en considération l'effet de persistance des partenaires commerciaux. Nous développons un modèle de gravité qui prend en considération la dynamique de la marge extensive et la persistance des partenaires commerciaux. Notre contribution empirique est au niveau du secteur des œufs. Nos résultats indiquent que l'utilisation de modèle statique sous-estime l'impact de scénarios de libéralisation. Ainsi, les importations d'œufs de table au Canada suivant un tel scénario sont sous-estimées de plus de 50% par rapport au modèle dynamique. La spécification dynamique permet également d'expliquer pourquoi la libéralisation du commerce augmente souvent les échanges entre pays déjà partenaires commerciaux, alors que les gains au chapitre de la marge extensive sont modestes. Les résultats confirment également l'impact négatif des coûts fixes sur la probabilité des pays en développement de participer aux marchés de l'exportation. Ces résultats soulèvent donc des questions quant aux bénéfices de la libéralisation des échanges pour les pays en développement, en termes d'accès au marché en absence de traitements spécifiques.

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INTRODUCTION

Canada is in the midst of numerous bilateral and multilateral trade talks that can impact agricultural trade. For example, in the last months of 2013, Canada has signed a trade agreement with Europe, while one came into effect in early 2015 with South Korea. Canada is also part of the current Trans-Pacific Partnership trade talks. These new developments generate questions for various agricultural sectors and by the fact of a renewed interest in agricultural trade modeling.

The usefulness of trade models is correlated with their capacity to capture complex phenomenon. For instance, data on international trade of agricultural products suggest that a large majority of partners do not trade with one another and that trade growth, where it has occurred, generally involved growth of trade volume between existing trading partners rather than the development of new trade relationships (Villoria and Hertel 2011). This phenomenon, called trade persistence, can result in spurious estimation of the effect of trade barriers if not controlled for in trade models (Olivero and Yotov 2012). The underlying reason for the observed trade persistence in agriculture can be found in the work of Meltiz (2003), Chaney (2008), and Helpman et al (2008), who suggest that exports to a given destination incur fixed and variable costs. The fixed costs are associated with the learning curve by firms historically active in the markets, which give them an advantage over potential new entrants because of institutional ties, transport infrastructure, and underlying preferences (Villoria and Hertel 2011). De Benedictis and Vicarelli (2005, p. 9) similarly speak about "inertia in trade flows," while Kandilov and Zheng (2011), assumed that fixed costs are sunk and that they are significant and impact the trade of major agricultural commodities, even when access to export markets is improved in the years following trade agreements.

Thus, authors such as Olivero and Yotov (2012) have developed trade models, more specifically dynamic gravity trade equation, which take into account trade persistence.

Another issue when constructing trade model is market entry dynamic, which can also result in spurious estimation of the impacts of trade liberalization, if not taken into account. On this matter, Egger and Pfaffermayr (2011) extended Helpman et al's (2008) heterogeneity model of firms by specifying a structural gravity model with market entry dynamics.[1]

In order to improve upon current models, in this paper, we develop a gravity model that takes into account trade persistence and market entry dynamic (extensive margin).[2] This model is empirically applied to the egg sector. This sector is of interest from a Canadian point of view, given its high level of tariff protection in Canada, its important trade persistence, and the fact that egg trade occurs in various forms such as table eggs

[1] Tamini et al (2010) and Kandilov and Zheng (2011) are recent applications of the Helpman et al (2008) framework to agricultural products. Also, see Haq et al (2013) and Philippidis et al (2013) for gravity models applied to agri-food international trade.

[2] In the literature, the term *extensive margin* refers to the growth in exports stemming from the emergence of new destinations (e.g., Felbermayr and Kohler 2006), new exported varieties (e.g., Hummels and Klenow 2005), or the participation of new firms on export markets (Chaney 2008; Helpman et al 2008). Growth in trade at the *intensive margin* refers to an increase in the volume of trade between existing partners, in the volume of trade of existing varieties, or in the export volume of firms currently engaged in export activities.

(perishable) and egg products with long shelve life (e.g., egg powder). These various levels of perishability are likely to affect trade persistence and dynamic at the extensive margin, which is defined as the number of trading partners.

The model we develop is then used to investigate the changes in intensive and extensive margins following a partial trade liberalization scenario that depicts a potential Doha "compromise" outcome (World Trade Organization [WTO] 2008). It involves removing export subsidies and reducing tariffs according to country-specific level of global support.

This study contributes to the existing literature in three ways. First, previous gravity model studies incorporating tariff and domestic support parameters estimates restrict their analysis to cross-section data or very few years, while this study, using a long time period (1995–2010),[3] applies panel data methods to better control for country heterogeneity. Second, a gravity model that takes into account trade persistence and market entry dynamic (extensive margin) is developed, while taking into account the presence of zeros that are common in large disaggregated trade data set. Third, we provide estimates of the impacts of market entry sunk cost for various egg products.

Our results indicate that taking into account extensive and intensive margins in a panel dynamic specification model increases the value of predicted imports for table eggs by 49.57 percentage points, relative to a static model, for our trade simulations. Similarly, for egg preparation, the value of imports is increased by about 45 percentage points. The simulations show little impact on the number of trading partners (extensive margin). Results also indicate that market entry sunk costs are highest for table eggs and egg preparations (products purchased by end-users) and the lowest for intermediate products such as albumin and eggs not in shell.

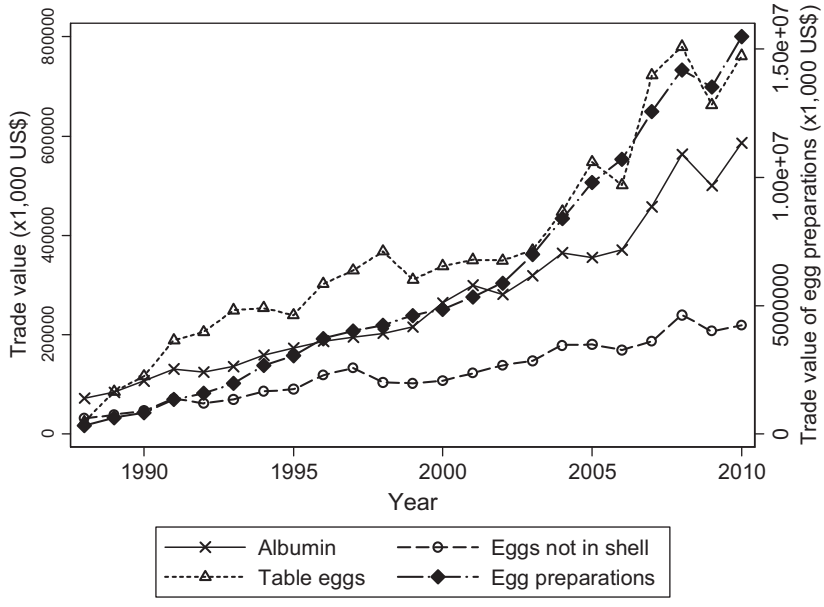
The remainder of the paper is structured as follows. The next section presents statistical evidence of persistence among trading partners for egg-related products. The third and fourth sections introduce the empirical model and the estimation results of the structural parameters of the model. The fifth section analyzes a partial liberalization scenario for eggs and its implications in the context of the current Doha Round. The last section concludes the paper.

OBSERVATION OF THE PERSISTENCE IN TRADING PARTNERS IN EGG-RELATED PRODUCTS

Four egg-related products are considered: table eggs, eggs not in shell, albumin, and egg preparations.[4] Data for these products indicate that approximately 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 in trading partners' phenomenon is approximately 60%. In addition, more than 99% of the observed "zeros" value in trade between countries are still "zeros" in the two following years, implying a certain "incapacity" of creation of new trade flows. We also observe that a small proportion of countries trade in both directions for most egg-related products. Despite this inertia in trading relationships, Figure 1 indicates that for most egg-related products, at the end of the period, the aggregate trade value was about 32 times larger than the aggregate trade value at the beginning of the

[3] For example, Philippidis et al (2013) panel is limited to two years (2001 and 2004).

[4] HS codes are, respectively, 2002: 0407.00; 2002: 0408.11, 0408.19, 0408.91, 0408.99; 2002: 3502.11, 3502.19; and 2002: 2106.90.



Sources: UN Comtrade (http://comtrade.un.org/) and authors' calculations.

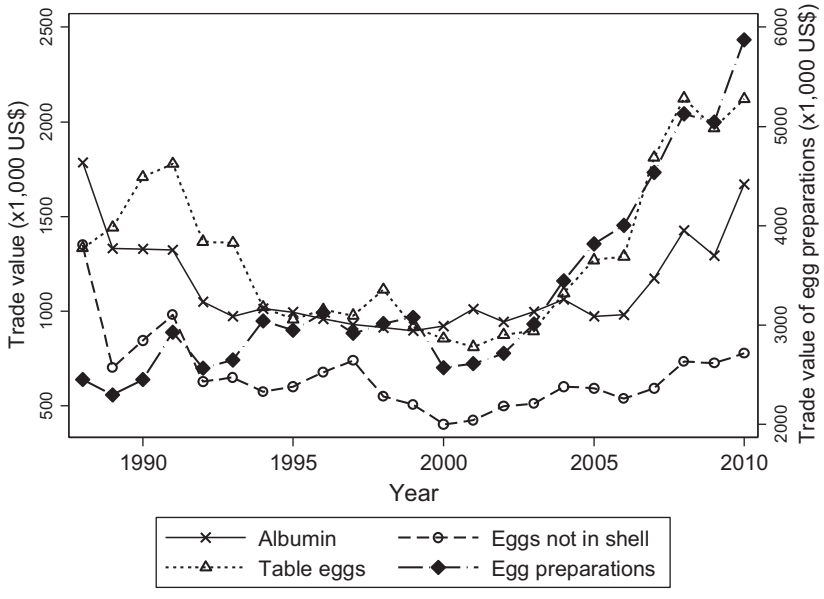
Figure 1. Aggregate volume of exports of egg products for all countries (× 1,000 US$)

period. Finally, Figure 2 indicates that the mean of nonzeros real volume of bilateral trade flows experienced a strong increase in the last 10 years especially for egg preparations. Combining Figures 1 and 2 suggests that in recent years, the growth in trade was mostly driven by the growth of trade between existing trading partners.

EMPIRICAL FRAMEWORK

Our estimation strategy is to use a panel estimation approach to control for unobserved heterogeneity of trading partners (Vijay and Shahid 2011). At the first stage, a dynamic random effect Probit model is used to analyze the decision to sell in the foreign market. In doing so, we take into account the path dependency of export market participation. At the second stage, given the persistence in trade flow, we use a panel dynamic gravity model when estimating the intensity of trade (De Benedictis and Vicarelli 2005; Raimondi et al 2012).

It is assumed that trade flows result from: (i) decision to export and (ii) the chosen level of exports. The estimation strategy follows the two decision paths. First, a binary variable determines whether exports to a particular destination are positive and this indicator depends on a latent variable with a censored distribution. Second, the estimation procedure for the volume of trade rules out negative predicted trade flows using Heckman's (1979) two-step procedure.



Sources: UN Comtrade and authors' calculations.

Figure 2. Mean of nonzeros bilateral trade flows (×1,000 US$)

Selling in a Foreign Market: Dynamic Persistence

Following Melitz (2003), selling in a given foreign market implies that firms must incur some fixed costs and firm's profits are additively separable into export-market-specific profits. As in Helpman et al (2008), Egger and Pfaffermayr (2011), Kandilov and Zheng (2011), while all firms in country *j* sell output domestically, only a fraction of firms sell abroad. The ability to export is conditional on a firm-specific productivity factor. Using a zero profit condition, one could 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*. A firm's self-selection into country *i*'s export market is observed if and only if $E_{ij} > 1$.

We assume that there are three costs that firms need to incur when selling to export markets (Das et al 2007; Segura-Cayuela and Vilarrubia 2008; Egger and Pfaffermayr 2011). The first ones are iceberg variable trade costs. The second cost is a one-time sunk cost to access the foreign market; these may be for compliance with sanitary, quality, or animal welfare standards necessary to initiate a trade relationship.[5] The third one is a per-period fixed cost assumed to be independent and identically distributed. As mentioned by Segura-Cayuela and Vilarrubia (2008), one possible interpretation of the one-time

[5] 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. Sunk export costs will amplify the trade-reducing impact of other trade barriers, and dampen the home market effect.

sunk cost is the adaptation of firms' production structure, while the per-period fixed cost represents the cost of distribution or of sustaining a position in a given market. 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. The firm saves the per-period fixed cost when it stops exporting. From this reasoning, in period t, the latent variable is a function of the realization or not of trade at time $t-1$

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

Equation (1) is the selection equation that determines the existence of a trade flow. It is a function of past selection outcome $e_{ij,t\text{-}1}$, strictly exogenous variables $\mathbf{w}_{ij,t}$, and time-invariant unobserved individual effect μ_{ij} with $\mu_{ij} \neq \mu_{ji}$. The scalar β captures the effect of past selection outcome, and the vector $\boldsymbol{\delta}'$ captures the effect of current explanatory variables on the process. Finally, the parameter $\varepsilon_{ij,t}$ is the mean-zero error term. Equation (1) implies that because of our assertion about costs, if firm in country j exports to country i in the previous time ($t-1$), then at time t, it does not have to pay a one-time sunk cost to access the market.[6] The current selection outcome is defined as

$$e_{ij,t} = 1[e^*_{ij,t} > 0] \tag{2}$$

where $1[\dots]$ is the indicator function with value 1 if the expression between square brackets is true and 0 otherwise. Trade is observed only if $e^*_{ij,t} > 0$. The predicted value of the latent variable $e^*_{ij,t}$ is used to control for the zeros when estimating the gravity equation.

Trade Intensity

Following the recent literature on gravity models (see e.g., Anderson and Yotov 2010; Fally 2015), we estimate a size-adjusted gravity model. The log-linearization form of the estimated equation is

$$\ln\left(\frac{M_{ij,t}}{Y_{i,t}\,Q_{j,t}}\right) = \ln t^{-\eta}_{ij,t} + \Gamma_i + \Gamma_j + \lambda_{ij} + \nu_{ij,t} \tag{3}$$

where M_{ij} represents the total value of import of country i from country j, Y_i is the total expenditure in value in country i, Q_j is the egg production—in value—in country j, the parameter η measures the elasticity of substitution between varieties, and $\boldsymbol{t}_{ij}$ subsumes trade costs and domestic policies. The parameters Γ_j and Γ_i are, respectively, exporter and importer fixed effects, respectively, while λ_{ij} is a time-invariant country-pair effect with $\lambda_{ij} \neq \lambda_{ji}$. Finally, the parameter $\nu_{ij,t}$ represents the error term. As indicated by Olivero and Yotov (2012), in estimating a size-adjusted gravity model, we deal, at least partially, with expenditure and production endogeneity as well as the important issue of

[6] Our study is in line of previous studies that infer the presence of sunk costs from persistence in exporting patterns (e.g., Roberts and Tybout 1997; Bernard and Jensen 2004; Campa 2004; Kandilov and Zheng 2011). Kandilov and Zheng (2011) is a recent example in agri-food sector that provides a theoretical model of market participation including lagged observed market participation.

heteroskedasticity.[7] Also, by bringing output and expenditure shares on the left-hand side in our estimations, we impose unitary estimates of the coefficients of these variables, as suggested by theory of gravity models (Anderson and van Wincoop 2003).

Similarly to Egger (2002) and more recently Drakos et al (2014), dynamics are introduced via an autoregressive AR(1) error term:[8] $\nu_{ij,t} = \rho\nu_{ij,t\text{-}1}+\varepsilon_{ij,t}$ with $|\rho|<1$. This implies that $\text{Cov}[\nu_{ij,t},\nu_{ij,t\text{-}1}] \neq 0$.

Trade Costs

The trade costs include the applied *ad valorem* import tariff denoted by τ_{ij}, the effect of distance summarized by d_{ij} with $d_{ij} = d_{ji}$,[9] and distorting domestic support policies by $s_j(s_i)$. In our database, some countries have import quotas. We take this into account by adding dummy variables representing the possibility that importer and/or exporter have a tariff rate quota (*TRQ*).[10] Following the literature on the gravity model,[11] we also consider some factor variables. The variable *Language* takes the value of 1 if the trading partners share the common language and 0 otherwise, the variable *Contiguity* takes the value of 1 if the trading partners share the common border and 0 otherwise, and the variable *Legal* takes the value of 1 if the two trading partners have a common legal system and 0 otherwise. Finally, the variables *GATT* takes the value of 1 when the importer and the exporter have signed the GATT and the variable *Developed* takes the value of 1 if the importer and/or the exporter is a high-income economy as defined by the World Bank.[12] Trade costs that subsume *net* trade costs and domestic policies are defined as[13]

$$\boldsymbol{t}_{ij,t}^{-\eta} = \exp\begin{pmatrix} \vartheta_{sj}\ln(1+s_{j,t}) + \vartheta_{si}\ln(1+s_{i,t}) + \vartheta_{\tau}\ln(1+\tau_{ij,t}) \\ + \vartheta_d \ln d_{ij} + \vartheta_1 TRQ_{i,t} + \vartheta_2 TRQ_{i,t} \\ + \vartheta_3 Language_{ij} + \vartheta_4 Contiguity_{ij} + \vartheta_5 Legal_{ij} \\ + \vartheta_6 GATT_{ij,t} + \vartheta_7 Developed_{i,t} + \vartheta_8 Developed_{j,t} \end{pmatrix} \tag{4}$$

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

[7] Santos Silva and Tenreyro (2006) show that heteroskedasticity renders log-linearized version of gravity estimates inconsistent.

[8] Wald tests of serial correlation in panel data (see Wooldridge 2002; Drukker 2003) are performed and confirm our hypotheses of an AR(1) model.

[9] We use the measure of distance suggested by Head and Mayer (2002). The authors propose the following indicator: $dist_{ij} = \sum_{g\in i}(\sum_{h\in j}\varpi_h dist_{gh})\varpi_g$, where $dist_{ij}$ is the distance between the two subregions $g \in i$ and $h \in j$ and ϖ_g and ϖ_h represent the economic activity share of the corresponding subregion.

[10] Barbados, Canada, Switzerland, Costa Rica, European Union, Iceland, Korea, Malaysia, Norway, Vietnam, and South Africa. See http://www.wto.org/english/tratop_e/tariffs_e/tariff_data_e.htm. Accessed December 10, 2014.

[11] See Head and Mayer (2013).

[12] See at http://data.worldbank.org/data-catalog/world-development-indicators. Accessed December
22, 2014.

[13] See Anderson and van Wincoop (2004) for a comprehensive survey of the literature on trade costs.

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 likely to trigger protection (see Debaere and Mostashari 2010; Olivero and Yotov 2012).[14] We also control for possible endogeneity in domestic support by using as instruments the two-year lagged moving average mean of the value of domestic support.

Data Sources

Trade volumes were obtained from the UN Comtrade database and data for trade policies were collected from the TRAINS data set; they account for preferential trade agreements between countries/regions.[15] 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.[16] This avoids possible double-counting, particularly when domestic policies are combined with border policies (as in the case of administered prices).

Total egg production is provided by the Food and Agriculture Organization Statistical Yearbook. Gross domestic product statistics are collected from the International Monetary Fund World Economic Outlook Data base. The data set of distances, other trade preferences, and trade resistance factors is based on a compilation by the Centre d'Études Prospectives et d'Informations Internationales. The final data, once adjusted for missing data and outliers, consisted of a data set of 69 countries, listed in Table A1. Table 1 presents descriptive statistics of the variables of interest.

ESTIMATION RESULTS

To verify if the WTO–free trade negotiations have changed market access, the sample was split into two trade periods. The first period includes the years 1995 to 2000 after the Uruguay Round negotiations and until the beginning of the Doha Round negotiations. The second period, from 2001 to 2010, includes 10 years of the current Doha Round negotiations (*Period_2* = 1). We estimated our entire data set using as supplementary variables *Period_2* and interaction variables between *Period_2* and the variables defined by Equations (1)–(3).

Dynamic Probit Estimates

Table 2 reports the results of our dynamic Probit estimation of Equation (1). The signs of most of the estimated coefficients are consistent with the gravity models literature (Head and Mayer 2013).

The estimated coefficient for distance is found to be higher for table eggs than that for the other egg-related products, as would be expected. There are no differences between

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

[15] Data on trade and tariffs were collected using World Integrated Trade Solution (WITS) software (see http://wits.worldbank.org/wits/). The *ad valorem* applied tariff used in estimations is based on the value of the dutiable item and expressed in percentage terms.

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

Table 1. Summary statistics of the main data used in estimations

Year	Variables	Sum	Mean	Minimum	Maximum
1995	Domestic support ($\times 10^3$USD)	360,985.10	20.88	−8.24	1,731.95
	Total production (dozen of eggs)	6.12e+09	353,733.50	0.00	1.71e+07
2001	Domestic support ($\times 10^3$USD)	91,388.98	5.29	−7.05	425.36
	Total production	7.29e+09	421,799.50	0.00	2.25e+07
2010	Domestic support ($\times 10^3$USD)	187,172.60	10.82	−14.08	552.87
	Total production (dozen of eggs)	8.91e+09	515,444.00	0.00	2.80e+07
		Eggs in shell			
1995	Trade value ($\times 10^3$USD)	238,963.20	13.82	0.00	35,373.05
	Ad valorem applied tariff (%)		21.54	0.00	349.50
2001	Trade value ($\times 10^3$USD)	350,704.10	20.28	0.00	38,151.79
	Ad valorem applied tariff (%)		17.94	0.00	349.50
2010	Trade value ($\times 10^3$USD)	761,364.80	44.03	0.00	96,422.13
	Ad valorem applied tariff (%)		13.154	0.00	349.50
		Eggs not in shell			
1995	Trade value ($\times 10^3$USD)	89,784.71	5.19	0.00	34,180.97
	Ad valorem applied tariff (%)		24.11	0.00	349.50
2001	Trade value ($\times 10^3$USD)	122,121.80	7.06	0.00	28,730.37
	Ad valorem applied tariff (%)		22.11	0.00	349.50
2010	Trade value ($\times 10^3$USD)	218,683.70	12.65	0.00	37,835.69
	Ad valorem applied tariff (%)		20.48	0.00	349.50
		Albumin			
1995	Trade value ($\times 10^3$USD)	172,947.10	10.00	0.00	48,047.53
	Ad valorem applied tariff (%)		12.75	0.00	100.00
2001	Trade value ($\times 10^3$USD)	299,035.20	17.29	0.00	48,380.79
	Ad valorem applied tariff (%)		11.04	0.00	100.00
2010	Trade value ($\times 10^3$USD)	586,129.50	33.89	0.00	64,060.99
	Ad valorem applied tariff (%)		8.11	0.00	50.00
		Egg preparations			
1995	Trade value ($\times 10^3$USD)	3,048,414.00	176.29	0.00	199,027.30
	Ad valorem applied tariff (%)		21.44	0.00	150.00
2001	Trade value ($\times 10^3$USD)	5,339,703.00	308.80	0.00	310,347.80
	Ad valorem applied tariff (%)		17.89	0.00	190.00
2010	Trade value ($\times 10^3$USD)	1.55e+07	895.42	0.00	935,836.60
	Ad valorem applied tariff (%)		16.061	0.00	201.67

Sources: UN Comtrade and TRAINS (http://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures/NTMs-trains.aspx).

the two periods[17] except for egg preparations; the impact of distance on the probability to export being smaller (in absolute value) in the second period. The tariff impact is higher for eggs not in shell and egg preparations when considering the first period. For the second period, the impact is higher for table eggs (−0.178) and decreases (in absolute

[17] The value of the parameter of the variable *Log of distance* × *Period 2* is not significant even at 10%.

Table 2. Results of the panel dynamic selection equation in the 1995–2010 period

	Eggs in shell		Eggs not in shell	
	Coefficient	Standard error	Coefficient	Standard error
Lag of participation	1.413***	0.055	1.135***	0.156
Lag of participation × Period 2	−0.205***	0.047	0.279*	0.145
Log of distance	−0.379***	0.017	−0.280***	0.091
Log of distance × Period 2	−0.003	0.006	0.122	0.089
Log of tariffs	−0.178**	0.082	−0.639**	0.322
Log of tariffs × Period 2	−0.036	0.081	0.653**	0.322
Country of destination				
Tariff rate quota	−0.022	0.069	0.110	0.321
Tariff rate quota × Period 2	0.022	0.071	−1.227	0.853
Log of domestic support	−0.394***	0.147	−0.286	0.280
Log of domestic support × Period 2	0.242	0.152	−1.241***	0.452
Developed(= 1)	0.340***	0.047	−0.091	0.144
Developed(= 1) ×Period 2	0.014	0.041	0.106	0.151
Country of origin				
Tariff rate quota	−0.138**	0.061	0.192	0.234
Tariff rate quota × Period 2	0.043	0.061	−0.387	0.279
Log of domestic support	−0.108	0.123	0.095	0.235
Log of domestic support × Period 2	0.221*	0.125	1.733***	0.391
Developed(= 1)	0.392***	0.046	0.106	0.168
Developed(= 1) × Period 2	−0.011	0.044	0.157	0.172
Having signed the GATT	0.147***	0.041	0.109	0.133
Having signed the GATT × Period 2	−0.051	0.044	0.463*	0.269
Common legal system	0.163***	0.041	−0.055	0.146
Common legal system × Period 2	−0.036	0.038	−0.146	0.137
Contiguity	0.643***	0.073	0.740***	0.200
Contiguity × Period 2	0.097	0.060	0.120	0.193
Common official language	0.208***	0.054	0.572***	0.191
Common official language × Period 2	0.128**	0.050	−0.509***	0.171
Number of observations	109,863		8,581	
	Albumin		Egg preparations	
	Coefficient	Standard error	Coefficient	Standard error
Lag of participation	1.016***	0.055	0.945***	0.020
Lag of participation × Period 2	−0.093**	0.046	−0.079***	0.015
Log of distance	−0.157***	0.020	−0.244***	0.010
Log of distance × Period 2	0.014	0.009	0.025***	0.002
Log of tariffs	−0.306***	0.090	−0.410***	0.051
Log of tariffs × Period 2	0.257***	0.084	0.279***	0.051
Country of destination				
Tariff rate quota	0.058	0.069		
Tariff rate quota × Period 2	−0.015	0.073		
Log of domestic support	−0.116	0.153	−0.031	0.042
Log of domestic support × Period 2	0.299*	0.156	0.202***	0.049

(*Continued*)

Table 2. Continued

	Albumin		Egg preparations	
	Coefficient	Standard error	Coefficient	Standard error
Developed(= 1)	0.261***	0.055	0.390***	0.022
Developed(= 1) × Period 2	−0.025	0.049	0.007	0.017
Country of origin				
Tariff rate quota	−0.037	0.072		
Tariff rate quota × Period 2	0.181**	0.071		
Log of domestic support	0.369***	0.138	0.289***	0.036
Log of domestic support × Period 2	−0.370***	0.140	0.245***	0.045
Developed(= 1)	0.711***	0.069	0.751***	0.021
Developed(= 1) × Period 2	−0.150**	0.066	−0.118***	0.016
Having signed the GATT	0.088	0.060	0.102***	0.015
Having signed the GATT × Period 2	0.036	0.063	0.023	0.016
Common legal system	−0.000	0.052	0.059***	0.020
Common legal system × Period 2	0.008	0.048	0.001	0.015
Contiguity	0.799***	0.092	0.696***	0.056
Contiguity × Period 2	0.044	0.073	0.043	0.038
Common official language	0.399***	0.073	0.331***	0.026
Common official language × Period 2	−0.034	0.067	−0.022	0.019
Number of observations	59,785		231,941	

Notes: ***, **, * indicate significance at 1%, 5%, and 10%, respectively. Estimates of fixed effects are omitted for brevity.

value) for egg preparations (from −0.410 to −0.131 [= −0.410+0.279]) and albumin (from −0.306 to − 0.049 [= −0.306+0.257]). The likelihood of importing is higher when the two trading partners are developed countries, suggesting that it is easier for these countries to overcome the costs associated with being trading partners. As expected the impact of the exporter's domestic support is positive, while importer's domestic support and having tariff quotas in the destination country reduce the probability to import. For most of the factor variables, the impacts are the same for the two periods, the coefficients of the interaction variables being not significant. Overall, our results are in line with those of Ghazalian et al (2009) and Kandilov and Zheng (2011).

We assess the impact of the history of export market participation using the lagged value of participation as a proxy. The results are both economically and statistically significant for all products. The impact (estimated coefficient of the lagged value of participation) is higher for table eggs, albumin, and eggs not in shell than for egg preparations, implying that for these products, trading partners tend to trade more with each other.[18] The impact of the history of market participation on export declines over time for table eggs (from 1.413 to 1.208 [= 1.413−0.205]), egg preparations (from 0.945 to 0.866 [= 0.945−0.079]), and albumin (from 1.016 to 0.923 [= 1.016−0.093]). It only increases for eggs not in shell (from 1.135 to 1.414 [= 1.135+0.279]).

[18] 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 the coefficients are greater than 1 is not an issue (Kandilov and Zheng 2011).

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

Commodities	Destination	Full sample	1995–2000	2001–2010	Change from 1995–2000 period to 2001–2010 period
Egg preparations	All destinations	0.265	0.236	0.275	16.52%
	Developed countries	0.300	0.274	0.309	12.76%
	Developing countries	0.248	0.216	0.258	19.42%
Eggs in shell	All destinations	0.241	0.238	0.242	1.68%
	Developed countries	0.291	0.287	0.292	1.84%
	Developing countries	0.212	0.207	0.213	2.92%
Eggs not in shell	All destinations	0.237	0.235	0.237	0.75%
	Developed countries	0.233	0.233	0.233	0.18%
	Developing countries	0.249	0.251	0.248	−1.15%
Albumin	All destinations	0.231	0.213	0.234	9.94%
	Developed countries	0.261	0.238	0.265	11.11%
	Developing countries	0.211	0.191	0.215	12.60%

Marginal effect of market entry sunk cost

Marginal effect of market entry sunk cost is simply the difference between two transition probabilities. The probability (Pr) of exporting in the next period conditional on not exporting in this period and the probability of exporting in the next period conditional on exporting in this period (Kandilov and Zheng 2011)[19]

$$\Pr[\, e_{ij,t} = 1 |\, e_{ij,t-1} = 1] - \Pr[\, e_{ij,t} = 1 |\, e_{ij,t-1} = 0] \tag{5}$$

The difference between the two values indicates how sunk entry costs reduce the probability of exporters participating in foreign markets. The results are summarized in Table 3. According to Ghazalian (2012, p. 269) "... primary agricultural products generally exhibit little differentiation. ... Conversely processed food products are characterised by higher levels of differentiation (e.g., intrinsic product attributes, country of production labelling). The unfamiliar attributes of foreign processed food products are expected to have higher impacts for uncertainty-avoiding consumers." Thus, we should expect the negative impact of sunk costs on the probability of participation to the export market to differ across the egg-related products studied by their level of differentiation. One could also expect that the impact of sunk costs for table eggs would be high because of its end-user status. Table 3 indicates that the impact of sunk costs is larger

[19] As mentioned by Kandilov and Zheng (2011, p. 536), "... panel data set can provide a researcher with a unique opportunity to assess this kind of transition probabilities, as it contains sequential observations over time for the same pair of trading partners."

for table eggs and egg preparations, while it is smaller for eggs not in shell and albumin. This result is as expected given that these two products are less differentiated. When considering the full sample, the value of 0.265 (first row and third column of Table 3) for egg preparations indicates that sunk costs reduce the likelihood of exporting by 26.5%, while the corresponding effect is 24.1% for table eggs and 23.7% for eggs not in shell. More interesting, when considering developed countries, the impact of sunk cost is 30% for egg preparations and 29.1% for table eggs, while it is 23.3% for eggs not in shell and 26.1% for albumin. Difference between products is less important when considering developing countries. As with those of Kandilov and Zheng (2011), our results indicate that the negative impact of sunk costs on the probability of export market participation is higher when the destination market is a developed country. This result confirms our expectation that nations with higher incomes adopt stricter regulation (Li et al 2014).

Table 3 also shows that the impact of entry sunk costs on export market participation between our two selected trading periods remains the same or has increased. Our results contradict those of Kandilov and Zheng (2011) who found a reduction for most of their studied products. The reason could be greater product standards over time due to consumer preferences regarding agri-food products, especially in developed countries. Looi Kee et al (2009) as well as Li et al (2014) offer another potential explanation, which is that policy makers adopt more stringent regulation as tariffs are reduced by various trade agreements.

Intensive Margin of Trade

In Table 4, a positive and highly significant autocorrelation coefficient indicates the importance of dynamics for the four products studied. The coefficient on distance is always negative and significant at the 5% level except for eggs not in shell. There is also a difference between products, table eggs, and egg preparations being the most affected. Also, from period 1 to period 2, our estimations show an increase in the impact of distance for albumin (from –0.292 to –0.712[20]) and egg preparations (from –1.264 to –1.341[21]). Tariffs have a negative impact on the level of trade of table eggs and egg preparations, with, as expected, 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. The others policy variables (domestic support and TRQ) are not significant except for egg preparations. For shell eggs, albumin and eggs not in shell, domestic support, and TRQs impact the probability of having a trade relationship (Table 2) but not the intensity of trade.

Robustness check

We reestimated a gravity equation using three alternatives of type II Tobit models. First, we estimate a nonadjusted trade equation.[22] Column [1] of Tables A2–A5 indicates that for the two specifications (size-adjusted trade and nonadjusted trade equations), the results of the main structural parameters are close. For example, for shell eggs, the coefficient of distance is –0.813 in the first period (Table 4) when using trade-adjusted equation,

[20] $-0.292-0.420 = -0.712$.

[21] $-1.264-0.077 = -1.341$

[22] The estimated gravity equation is $\text{In}(M_{ij,t}) = \ln t_{ij,t}^{-\eta} + \Gamma_i + \Gamma_j + \lambda_{ij} + \nu_{ij,t}$.

Table 4. Results of the dynamic trade equation in the 1995–2010 period

	Eggs in shell		Eggs not in shell	
	Coefficient	Standard error	Coefficient	Standard error
Log of distance	−0.813***	0.111	0.068	0.573
Log of distance × Period 2	−0.159	0.099	−0.617	0.621
Log of tariffs	0.703	0.576	−0.014	1.204
Log of tariffs × Period 2	−1.092*	0.607	0.339	1.617
Country of destination				
Tariff rate quota	0.947	2.114	−0.791	1.667
Tariff rate quota × Period 2	−0.916	2.172	3.535	2.954
Log of domestic support	0.339	0.482	0.723	1.123
Log of domestic support × Period 2	−0.012	0.121	−1.124	2.211
Country of origin				
Tariff rate quota	1.456	2.054		
Tariff rate quota × Period 2	−1.454	2.115		
Log of domestic support	0.196	0.318		
Log of domestic support × Period 2	0.173	0.213		
Having signed the GATT	−0.081	0.246	−0.256	0.714
Having signed the GATT × Period 2	0.022	0.314		0
Common legal system	0.335**	0.168	1.285	0.791
Common legal system × Period 2	−0.209	0.153	−0.748	0.805
Contiguity	0.626***	0.227	0.841	0.656
Contiguity × Period 2	−0.014	0.197	0.345	0.675
Common official language	0.116	0.248	0.307	1.001
Common official language × Period 2	0.044	0.229	0.572	1.105
Inverse Mills Ratio	−0.516***	0.045	−0.666***	0.125
Autocorrelation coefficient	0.524		0.607	
Durbin–Watson statistic	1.171		1.047	
Baltagi–Wu LBI statistic	1.719		1.628	
Number of observations	8,751		1,228	

	Albumin		Egg preparations	
	Coefficient	Standard error	Coefficient	Standard error
Log of distance	−0.292**	0.114	−1.264***	0.038
Log of distance × Period 2	−0.420***	0.104	−0.077***	0.026
Log of tariffs	1.321	0.896	0.119	0.127
Log of tariffs × Period 2	−1.085	0.924	−0.353***	0.124
Country of destination				
Tariff rate quota	−2.556	2.454		
Tariff rate quota × Period 2	2.366	2.497		
Log of domestic support	1.197	0.753	−0.766***	0.137
Log of domestic support × Period 2	0.121	0.307	0.597***	0.153
Country of origin				
Tariff rate quota	−1.831	2.209		
Tariff rate quota × Period 2	3.399	2.256		
Log of domestic support	−0.004	0.361	−0.057	0.136
Log of domestic support × Period 2	0.011	0.041	−0.119	0.097

(*Continued*)

Table 4. Continued

	Albumin		Egg preparations	
	Coefficient	Standard error	Coefficient	Standard error
Having signed the GATT	0.168	0.408	0.248***	0.055
Having signed the GATT × Period 2	−0.237	0.466	0.101***	0.034
Common legal system	0.272	0.190	0.605***	0.063
Common legal system × Period 2	0.065	0.175	0.007	0.048
Contiguity	0.606**	0.297	0.291**	0.133
Contiguity × Period 2	−0.437*	0.263	−0.035	0.097
Common official language	−0.047	0.272	0.114	0.085
Common official language × Period 2	−0.096	0.250	0.053	0.061
Inverse Mills Ratio	−0.753***	0.065	−0.754***	0.029
Autocorrelation coefficient	0.524		0.569	
Durbin–Watson statistic	1.159		1.037	
Baltagi–Wu LBI statistic	1.675		1.523	
Number of observations	9,290		60,038	

Notes: LBI, locally best invariant.
***, **, * indicate significance at 1%, 5%, and 10%, respectively. Estimates of fixed effects are omitted for brevity.

while it is –0.774 for the nonadjusted trade (Table A2, column [1]), confirming the robustness of the estimations using an adjusted trade gravity equation. We also estimated the model without fixed effects, and overall, our results show that this specification underestimates the effect of trade costs as indicated by column [2] of Tables A2–A5.[23] For instance, for shell eggs, the coefficient of distance is –0.193 in the first period (Table A2, column [2]), while it is –0.813 in our main estimation approach; while for egg preparations, we obtain –0.199 for an estimation without fixed effects versus –1.264. Finally, under type II Tobit specification, we estimate a static model. The results of column [3] of Tables A2–A5 indicated that without taking into account path dependency and persistence, the impacts of trade costs on the intensity of trade are overestimated which is in line with the prediction of Das et al (2007), indicating that sunk export costs amplify the trade-reducing impact of trade barriers and dampen the home market effect.

Santos Silva and Tenreyro (2006) suggest the use of the Poisson pseudo-maximum likelihood (PPML) procedure to estimate the multiplicative form of the gravity equation. These authors advocate that the log-linearized version of the gravity equation introduces problems of heteroskedasticity in the multiplicative error term that turns into a serious endogeneity problem. They showed that the PPML procedure yields consistent estimates. We then estimate a multiplicative form of the gravity equation using the PPML estimator. As indicated by column [4] of Tables A2–A5, the dynamic Poisson estimations yield coefficients regarding distance that are modified for shell eggs, albumin, and egg preparations, even if they remain qualitatively similar. Our results are similar to those of Raimondi and

[23] See recent discussions of Fally (2015) on fixed effects in the gravity literature.

Olper (2011)[24] and they show that the PPML estimator inflates the magnitude of the coefficients. The coefficient of tariffs has the wrong sign for shell eggs, while the sign remains negative for egg preparations. Also, the results of column [4] of Tables A2–A5 indicate that the estimated coefficients of policy variables (TRQ and domestic support) have the wrong sign for most of the products.[25] The pattern is similar for static Poisson estimation results (column [5] of Tables A2–A5). Detailed results of our robustness check are presented in Tables A2–A5.

IMPULSE RESPONSE TO CHANGE IN TRADE POLICIES

In this section, we use the previously estimated coefficients to simulate trade responses to changes in trade policies. The impact of a liberalization process reflects adjustments on two margins: extensive (estimated coefficient of Equation [1] presented in Table 2) and intensive margin (estimated coefficient of Equation [3] presented in Table 4), both within a dynamic setting. To quantify each type of response, we simulate imports' reactions to a permanent change in trade policies that take place in 2010, and track the evolution of the probability to export and the trade to 2020. 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.[26] When predicting the value of trade, we use the estimated coefficients specification of the trade equation given by Equation (3). The keys structural parameters of our simulations are tariffs coefficients, country of origin and destination, domestic support coefficient, and finally the coefficient of serial correlation of the error term.[27] Using these coefficients, we compute the change in percentage of the value of trade.[28] Because the estimated parameters of tariffs are not statistically significant for albumin and eggs not in shell, the following analysis concentrates on table eggs and egg preparations.

We investigate the changes in intensive and extensive margins following a partial liberalization scenario that depicts a potential Doha "compromise" outcome (WTO 2008). It involves removing export subsidies and cutting tariffs. The extent of tariff cuts depends on whether protection is implemented through a TRQ or a simple tariff. In most cases,

[24] Raimondi and Olper (2011) also used data disaggregated at HS6 digit level.

[25] Using data at more aggregated level, Philippidis et al (2013) found that the number of counterintuitive sign of coefficients is higher when using the two-stage approach.

[26] In doing so, we use an approach similar to goodness-of-fit measure used in binary outcome models (see Wooldridge 2002, p. 465).

[27] Indeed, a model of the form $y_t = \beta x_t + \xi_t$ with $\xi_t = \alpha x i_{t-1} + \zeta_t$ can also be written as $y_t = \beta x_t + \xi_t = \beta x_t + \alpha(y_{t-1} + \beta x_{t-1}) + \zeta_t = \alpha y_{t-1} + \beta x_t - \alpha\beta x_{t-1} + \zeta_t$. This specification is used when simulating changes in domestic and trade policies.

[28] Yen and Rosinski (2008) demonstrate the existence of a downward bias from using approximations instead of the correct formulas for expected conditional and unconditional means and marginal effects (i.e., $\exp(E[\log(y)])$ is a fraction of the true mean $E[y] = E[\exp(\log(y))]$). Given that we report percentage changes in trade, the fraction or multiplicative bias can be factored out of the numerator and denominator of the percentage change, and hence should not matter even if we use approximations. Also, note that we compute the changes given that the other variables (gross domestic product, other trade costs captured by the fixed effects, etc.) being constant.

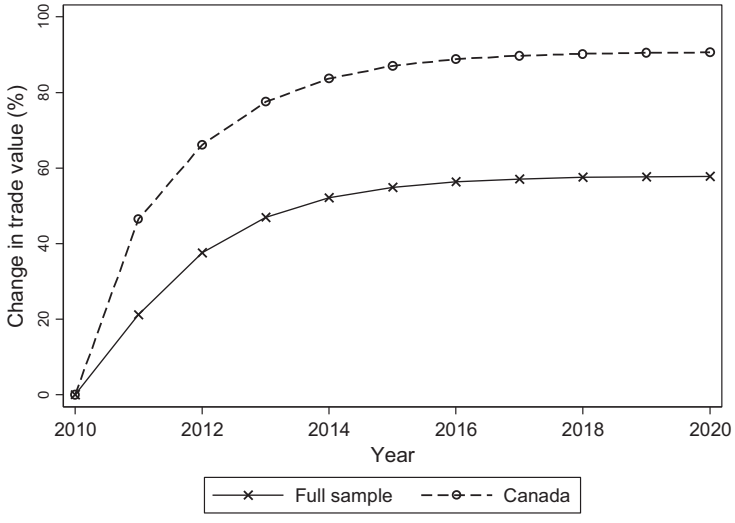


Figure 3. Cumulative impact (2010–2020) on the change in trade value of table eggs following partial liberalization

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 high rate. The liberalization scenario includes tariff cuts of 20% 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 warrants distinct tariff cuts. For developed countries, the scenario also includes tariff cuts of 70% if initial tariffs are higher than 75% and 50% in all other instances. For developing countries, the tariff cut is 50% in all instances. Given this scenario, the mean of tariffs goes from 13.154% to 6.61% for shell eggs and from 16.061% to 8.58% for egg preparations. Note that in this scenario, we do not address nontariff barriers to trade.

Simulation Impact on Extensive Margin of Trade

Trade liberalization would induce a small increase in the probability of nonzero trade. The probabilities of exporting are higher, but the vast majority of countries do not exceed the threshold of 0.5 at the end of the 10 periods examined. Similar results were also found by Debaere and Mostashari (2010) for the vast majority of their analyzed products. The authors also found disparity between products and between developed and developing countries. Debaere and Mostashari (2010, p. 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."

Simulation Impact on Intensive Margin of Trade

As indicated by Figures 3 and 4, the partial liberalization scenario induces modest increases of the intensity of trade for both table eggs and egg preparations when considering

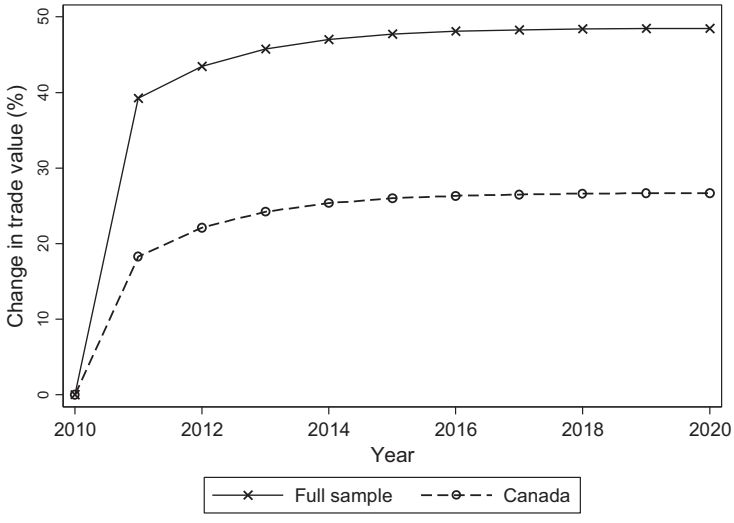


Figure 4. Cumulative impact (2010–2020) on the change in trade value of egg preparations following partial liberalization

the full sample.[29] Most of the gain is obtained during the first two periods. By 2020, our liberalization scenario induces an increase of 57.84% of the value traded for table eggs versus an 8.27% increase under the static model.[30] For Canada, the change in the value of importations of table eggs following partial liberalization is about 17% when simulations are done using the results of the static model, while, as indicated in Figure 3, it is of 90.62% under a dynamic model. According to results on the simulation impact on the extensive margin, this increase in Canadian imports would be mostly captured by the United States, our main current partner.[31]

As indicated in Figure 4, when considering the full sample, the increase in the value of trade for egg preparations is 48.49% under a dynamic model, relative to 3.31% in the static one. For Canada, the increase in the value of importations of egg preparations following partial liberalization is smaller than for the full sample at 26.70% (see Figure 4) when considering the dynamic model and 1.01% for the static one. The lower impact when considering Canadian's imports of egg preparations is likely resulting from the relatively small mean of *ad valorem* applied tariffs.

Overall, the results of simulations show that dynamic adjustments are important when considering the impact of changes in tariff level and domestic policies. We observe a contemporaneous response and amplified effects through dynamic adjustments at the intensive margin. Because of persistence in trading partners and trade intensity, analyz-

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

[30] To compute the different results of the static model, we use the estimated coefficients of the static models that are included in the robustness check table (see Tables A2 and A5, column [3]).

[31] Using a static gravity model, Ghazalian et al (2012) found that under the partial liberalization scenario, Canada cattle imports would decrease by 21%. For beef, the imports would increase, respectively, by 14.7%. Also, see Philippidis et al (2013).

ing "final" impact of potential change in trade and domestic support policies is better estimated within a dynamic process. Without taking it into account, the static model underestimates the "final" impact of trade liberalization.

CONCLUSIONS

We observe over the period 1995–2010 for the egg-related products studied that 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 already trade with each other. Trade persistence effect may lead to an overestimation of the real effect of trade barriers if not controlled for (Olivero and Yotov 2012). With this in mind, we developed a gravity model that takes into account the dynamics at the extensive margin of trade as well as the persistence effect of the intensity of trade. This model was applied to the egg sector, where the observed persistence in trading partners is quite important. For instance, 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.

Our estimations indicate a strong difference when using a panel dynamic specification relative to a static one. 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 greater trade activities between countries that were previously trading partners, while new trading partnerships remain scarce. For Canada, the dynamic specification of our model generates significant differences for our trade scenarios. For instance, the increase in the value of table egg imports is 17% in the static model, while it is of 90.62% under the dynamic one. Similarly, for egg preparation, the value of imports is increased by 26.70% in the dynamic model relative to a 1.01% increase in the static one, a difference of 25.69 percentage points.

Results from our model also confirm the importance of taking sunk costs into account, especially for developing countries for which they have an important negative impact on the access to foreign markets. In light of our results, future research should take a closer look at the benefit of trade liberalization for developing countries, in terms of accessing new markets, especially in the absence of special treatments.

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APPENDIX

Table A1. List of countries

Albania	Czech Republic	Japan	Panama	Turkey
Argentina	Denmark	Jordan	Peru	Uganda
Australia	Estonia	Kenya	Poland	Ukraine
Belgium	Finland	Korea	Portugal	United Kingdom
Botswana	France	Kuwait	Romania	United States of America
Brazil	Germany	Latvia	Russia	Vietnam
Bulgaria	Greece	Lebanon	Saudi Arabia	Yemen
Cameroon	Guatemala	Luxembourg	Slovakia	Zambia
Canada	Hungary	Malaysia	Slovenia	Zimbabwe
Chile	Honduras	Malta	South Africa	
China	India	Mexico	Spain	
Costa Rica	Iran	Morocco	Sweden	
Croatia	Ireland	Netherlands	Switzerland	
Colombia	Israel	New Zealand	Syria	
Cyprus	Italy	Norway	Thailand	

Table A2. Results of alternative estimation methods of the equation of intensity of trade of eggs in shell (1995–2010)

	Type II Tobit estimation					
	[1] Nonadjusted trade		[2] Dynamic Heckman without fixed effects		[3] Static Heckman	
	Coefficient	s.e.	Coefficient	s.e.	Coefficient	s.e.
Log of distance	−0.774***	0.111	−0.193**	0.083	−2.147***	0.275
Log of distance × Period 2	−0.148	0.100	−0.133**	0.066	−0.105*	0.055
Log of tariffs	0.790	0.580	−0.197	0.288	−0.306	0.269
Log of tariffs × Period 2	−1.119*	0.611	−0.225	0.282	−0.317	0.250
Country of destination						
Tariff rate quota	−0.764	2.131	−0.296	0.463	0.463	0.604
Tariff rate quota × Period 2	1.926	2.190	0.547	0.474	2.300***	0.478
Log of domestic support	0.290	0.488	0.397*	0.217	0.942***	0.252
Log of domestic support × Period 2	0.001	0.003	−0.111	0.220	−0.460**	0.200
Country of origin						
Tariff rate quota	2.993	2.070	1.262**	0.501	−0.910	0.675
Tariff rate quota × Period 2	−3.332	2.132	−0.184	0.506	0.580	0.475
Log of domestic support	0.372	0.322	−0.180	0.215	0.042	0.202
Log of domestic support × Period 2	0.007	0.021	0.138	0.225	0.233	0.206
Having signed the GATT	−0.100	0.247	0.143	0.134	0.480***	0.145
Having signed the GATT × Period 2	0.276	0.316	−0.174	0.150	−0.335**	0.149
Common legal system	0.351**	0.168	0.175	0.151	0.680***	0.182
Common legal system × Period 2	−0.272*	0.155	−0.016	0.120	−0.144	0.100
Contiguity	0.594***	0.227	0.496**	0.222	2.809***	0.543
Contiguity × Period 2	−0.067	0.199	0.058	0.166	−0.103	0.138
Common official language	0.014	0.249	−0.331*	0.195	0.792***	0.249
Common official language × Period 2	0.151	0.231	0.175	0.158	0.462***	0.149
Inverse Mills Ratio	−0.572***	0.046	−0.673***	0.045	3.334***	0.777

(*Continued*)

Table A2. Continued

	Poisson estimation			
	[4] Dynamic specification		[5] Static specification	
	Coefficient	s.e.	Coefficient	s.e.
Log of distance	−1.831***	0.002	−4.778***	0.136
Log of distance × Period 2	0.030***	0.002	0.105***	0.001
Log of tariffs	0.250***	0.006	0.052***	0.006
Log of tariffs × Period 2	−0.093***	0.007	0.226***	0.006
Country of destination				
Tariff rate quota	−0.044**	0.017	0.345***	0.013
Tariff rate quota × Period 2	1.097***	0.011	1.073***	0.009
Log of domestic support	0.126***	0.005	−0.109***	0.004
Log of domestic support × Period 2	−0.255***	0.005	−0.029***	0.004
Country of origin				
Tariff rate quota	−0.872***	0.019	−1.770***	0.016
Tariff rate quota × Period 2	0.332***	0.014	0.850***	0.013
Log of domestic support	0.181***	0.007	0.372***	0.006
Log of domestic support × Period 2	−0.149***	0.006	−0.205***	0.006
Having signed the GATT	0.051***	0.005	0.340***	0.004
Having signed the GATT × Period 2	1.065***	0.011	−0.334***	0.004
Common legal system	0.434***	0.003	1.070***	0.159
Common legal system × Period 2	−0.138***	0.002	−0.029***	0.002
Contiguity	0.749***	0.003	1.749***	0.388
Contiguity × Period 2	0.104***	0.002	0.043***	0.002
Common official language	0.152***	0.005	1.389***	0.239
Common official language × Period 2	0.266***	0.004	0.180***	0.003
Inverse Mills Ratio				

Notes: s.e., standard error.
***, **, * indicate significance at 1%, 5%, and 10%, respectively. Estimates of fixed effects are omitted for brevity.

Table A3. Results of alternative estimation methods of the equation of intensity of trade of eggs not in shell (1995–2010)

	Type II Tobit estimation					
	[1] Nonadjusted trade		[2] Dynamic Heckman without fixed effects		[3] Static Heckman	
	Coefficient	s.e.	Coefficient	s.e.	Coefficient	s.e.
Log of distance	0.290	0.573	0.141	0.302	−1.452**	0.703
Log of distance × Period 2	−0.814	0.619	−0.183	0.289	0.111	0.297
Log of tariffs	−0.136	1.193	0.510	0.905	−2.214	1.448
Log of tariffs × Period 2	0.573	1.606	−0.845	0.912	0.891	1.375
Country of destination						
Tariff rate quota	−1.278	1.654	−1.294	0.966	2.243	1.612
Tariff rate quota × Period 2	4.433	2.933	1.920	1.577	11.557***	3.417
Log of domestic support	0.243	0.908	0.895	0.716	0.928	0.880
Log of domestic support × Period 2	0.437	0.701	−1.338	0.906	−2.408***	0.906
Country of origin						
Tariff rate quota						
Tariff rate quota × Period 2						
Log of domestic support						
Log of domestic support × Period 2						
Having signed the GATT	−0.684	0.707	0.056	0.429	−0.388	0.455
Having signed the GATT × Period 2	0.003	0.017	−0.200	1.228	3.203	2.067
Common legal system	1.446*	0.791	−0.369	0.471	0.848	0.652
Common legal system × Period 2	−0.745	0.801	−0.015	0.426	−1.184***	0.416
Contiguity	0.648	0.656	1.468**	0.603	6.115***	2.137
Contiguity × Period 2	0.422	0.671	−0.006	0.540	−0.319	0.429
Common official language	0.336	1.002	−0.965	0.871	3.814**	1.842
Common official language × Period 2	0.388	1.099	0.931	0.819	−1.217	1.213
Inverse Mills Ratio	−0.664***	0.124	−0.668***	0.118	6.030**	2.599

(*Continued*)

Table A3. Continued

	Poisson estimation			
	[4] Dynamic specification		[5] Static specification	
	Coefficient	s.e.	Coefficient	s.e.
Log of distance	−0.795***	0.013	−4.621***	0.694
Log of distance × Period 2	0.094***	0.013	1.297***	0.020
Log of tariffs	−0.483***	0.032	−0.098***	0.035
Log of tariffs × Period 2	0.134***	0.032	−1.572***	0.039
Country of destination				
Tariff rate quota	1.346***	0.042	0.734***	0.049
Tariff rate quota × Period 2	3.282***	0.063	4.645***	0.060
Log of domestic support	−0.317***	0.039	1.603***	0.127
Log of domestic support × Period 2	−0.802***	0.044	1.926***	0.058
Country of origin				
Tariff rate quota				
Tariff rate quota × Period 2				
Log of domestic support				
Log of domestic support × Period 2	−0.485***	0.154	−0.332	0.408
Having signed the GATT	0.235***	0.021	0.361***	0.029
Having signed the GATT × Period 2	2.371***	0.109	−0.324	0.204
Common legal system	0.281***	0.016	1.178	0.810
Common legal system × Period 2	−0.191***	0.016	−0.236***	0.016
Contiguity	1.058***	0.021	1.306	1.248
Contiguity × Period 2	−0.010	0.021	1.014***	0.016
Common official language	−0.271***	0.042	3.314**	1.314
Common official language × Period 2	0.242***	0.041	−0.219***	0.038
Inverse Mills Ratio				

Notes: s.e., standard error.
***,**, * indicate significance at 1%, 5%, and 10%, respectively. Estimates of fixed effects are omitted for brevity.

Table A4. Results of alternative estimation methods of the equation of intensity of trade of albumin (1995–2010)

	Type II Tobit estimation					
	[1] Nonadjusted trade		[2] Dynamic Heckman without fixed effects		[3] Static Heckman	
	Coefficient	s.e.	Coefficient	s.e.	Coefficient	s.e.
Log of distance	−0.223*	0.115	0.325***	0.100	−1.281***	0.171
Log of distance × Period 2	−0.434***	0.104	−0.090	0.079	0.011	0.066
Log of tariffs	0.297	0.896	−0.073	0.314	−0.385	0.327
Log of tariffs × Period 2	−0.061	0.924	−0.171	0.295	0.332	0.284
Country of destination						
Tariff rate quota	−1.245	2.456	−0.553	0.553	0.443	0.786
Tariff rate quota × Period 2	1.826	2.498	0.998*	0.597	0.360	0.632
Log of domestic support	−1.631**	0.753	0.136	0.258	0.278	0.242
Log of domestic support × Period 2	0.111	0.569	−0.267	0.284	−0.280	0.291
Country of origin						
Tariff rate quota	−0.026	2.210	1.713***	0.560	−0.663	0.662
Tariff rate quota × Period 2	0.177	2.258	−0.122	0.581	1.575***	0.559
Log of domestic support	0.022	0.361	−0.209	0.227	−0.162	0.204
Log of domestic support × Period 2	0.311	0.409	0.373	0.249	−0.076	0.228
Having signed the GATT	−0.347	0.408	0.142	0.176	0.990***	0.214
Having signed the GATT × Period 2	0.851*	0.466	−0.166	0.191	−0.135	0.176
Common legal system	0.260	0.190	0.119	0.192	0.577***	0.167
Common legal system × Period 2	0.042	0.175	−0.142	0.151	−0.177	0.122
Contiguity	0.616**	0.298	0.905***	0.308	3.063***	0.657
Contiguity × Period 2	−0.530**	0.263	−0.328	0.226	−0.237	0.180
Common official language	−0.067	0.272	−0.706***	0.247	0.965***	0.366
Common official language × Period 2	0.015	0.250	0.264	0.194	0.095	0.162
Inverse Mills Ratio	−0.833***	0.065	−1.004***	0.062	3.559***	0.923

(*Continued*)

Table A4. Continued

	Poisson estimation			
	[4] Dynamic specification		[5] Static specification	
	Coefficient	s.e.	Coefficient	s.e.
Log of distance	−0.125***	0.002	−1.638***	0.119
Log of distance × Period 2	0.054***	0.001	−0.142***	0.002
Log of tariffs	−0.077***	0.004	−0.081***	0.012
Log of tariffs × Period 2	−0.013***	0.003	−0.153***	0.011
Country of destination				
Tariff rate quota	1.012***	0.006	0.687***	0.019
Tariff rate quota × Period 2	−0.355***	0.006	−0.310***	0.015
Log of domestic support	−0.400***	0.003	−0.553***	0.016
Log of domestic support × Period 2	0.136***	0.003	0.011*	0.007
Country of origin				
Tariff rate quota	0.109***	0.007	2.251***	0.029
Tariff rate quota × Period 2	0.044***	0.007	−1.144***	0.027
Log of domestic support	−0.494***	0.003	−0.629***	0.011
Log of domestic support × Period 2	0.334***	0.003	0.899***	0.012
Having signed the GATT	0.103***	0.002	1.541***	0.010
Having signed the GATT × Period 2	0.612***	0.004	0.035	0.071
Common legal system	−0.275***	0.003	0.341	0.216
Common legal system × Period 2	−0.056***	0.002	−0.196***	0.004
Contiguity	1.396***	0.005	1.336***	0.413
Contiguity × Period 2	0.021***	0.003	−0.206***	0.005
Common official language	0.668***	0.004	0.895***	0.330
Common official language × Period 2	0.139***	0.002	0.122***	0.005
Inverse Mills Ratio				

Notes: s.e., standard error.
***, **, * indicate significance at 1%, 5%, and 10%, respectively. Estimates of fixed effects are omitted for brevity.

Table A5. Results of alternative estimation methods of the equation of intensity of trade of egg preparations (1995–2010)

	Type II Tobit estimation					
	[1] Nonadjusted trade		[2] Dynamic Heckman without fixed effects		[3] Static Heckman	
	Coefficient	s.e.	Coefficient	s.e.	Coefficient	s.e.
Log of distance	−1.188***	0.038	−0.199***	0.040	−1.401***	0.054
Log of distance × Period 2	−0.134***	0.026	−0.137***	0.026	−0.097***	0.019
Log of tariffs	0.048	0.126	0.095	0.127	−0.453***	0.111
Log of tariffs × Period 2	−0.290**	0.124	−0.254**	0.127	0.081	0.104
Country of destination						
Tariff rate quota						
Tariff rate quota × Period 2						
Log of domestic support	−0.091	0.136	0.202***	0.067	−0.086	0.055
Log of domestic support × Period 2	0.511***	0.091	0.160**	0.075	0.055	0.059
Country of origin						
Tariff rate quota						
Tariff rate quota × Period 2						
Log of domestic support	−0.378***	0.135	0.060	0.070	−0.151**	0.059
Log of domestic support × Period 2	−0.052	0.096	0.051	0.079	−0.006	0.060
Having signed the GATT	0.104*	0.055	0.161***	0.052	0.420***	0.047
Having signed the GATT × Period 2	−0.034	0.054	0.011	0.054	−0.175***	0.041
Common legal system	0.509***	0.062	0.135*	0.073	0.473***	0.058
Common legal system × Period 2	0.097**	0.048	0.080	0.049	0.183***	0.034
Contiguity	0.137	0.132	0.831***	0.163	0.407***	0.153
Contiguity × Period 2	0.074	0.097	0.136	0.099	0.144**	0.066
Common official language	0.257***	0.084	−0.072	0.094	0.595***	0.093
Common official language × Period 2	−0.133**	0.061	−0.088	0.063	−0.271***	0.043
Inverse Mills Ratio	−0.830***	0.029	−1.170***	0.028	0.108	0.194

(*Continued*)

Table A5. Continued

	Poisson estimation			
	[4] Dynamic specification		[5] Static specification	
	Coefficient	s.e.	Coefficient	s.e.
Log of distance	−1.208***	0.000	−2.482***	0.046
Log of distance × Period 2	−0.001*	0.000	0.043***	0.000
Log of tariffs	−0.440***	0.001	−1.166***	0.002
Log of tariffs × Period 2	0.161***	0.002	0.621***	0.002
Country of destination				
Tariff rate quota				
Tariff rate quota × Period 2				
Log of domestic support	−0.055***	0.001	−0.222***	0.001
Log of domestic support × Period 2	0.167***	0.001	0.318***	0.001
Country of origin				
Tariff rate quota				
Tariff rate quota × Period 2				
Log of domestic support	−0.032***	0.001	−0.108***	0.001
Log of domestic support × Period 2	−0.018***	0.001	0.002**	0.001
Having signed the GATT	0.268***	0.001	0.525***	0.001
Having signed the GATT × Period 2	0.018***	0.003	−0.350***	0.001
Common legal system	0.451***	0.001	0.843***	0.062
Common legal system × Period 2	−0.025***	0.001	−0.009***	0.000
Contiguity	0.117***	0.001	1.094***	0.194
Contiguity × Period 2	−0.043***	0.001	−0.006***	0.001
Common official language	0.157***	0.001	1.194***	0.090
Common official language × Period 2	−0.004***	0.001	−0.157***	0.001
Inverse Mills Ratio				

Notes: s.e., standard error.
***, **, * indicate significance at 1%, 5%, and 10%, respectively. Estimates of fixed effects are omitted for brevity.