Market Access Asymmetry in Food Trade among Quad Countries

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Abstract

This paper uses a gravity-like structure derived from a monopolistic competition model to measure market access among Canada, USA, Japan and EU – Quad countries – over the 1996-2001 period. We explore the overall asymmetry and 18 food industrial-level asymmetries of bilateral trade openness. Using actual bilateral estimates of tariffs and non-tariff barriers, we investigate their role in explaining the trade reduction effect of national borders. A representative estimate of market access shows that higher asymmetries exist in USA, Canada and EU trade with Japan. Quite surprisingly, the last country is always more open than the reverse. Finally, we found that tariffs and NTBs explain a significant part of the border effects and that the NTB role is often higher than that of tariff.

Keywords: market access, food trade, asymmetry, gravity, QUAD countries
JEL Classification: F13, F14, Q17

1. Introduction

This paper uses border effect estimation from a gravity equation to asses the level of market access in the food manufacturing trade among the United States, the European Union, Canada and Japan - the so-called Quad countries. The approach is based on a gravity-like structure derived from a monopolistic competition framework *a la* Krugman (see Head and Mayer, 2000; Feenstra, 2004).

The estimation of market access through the border effect methodology - namely how much trade within countries is above international trade due to cross-border measures such as tariffs, non-tariff barriers and any other factors that might impede trade - offers different advantages with respect to *direct* protection measures, such as those based on observed tariff figures. For example, our *indirect* approach accounts for the important and often neglected fact that, for most products, most internal demand is met by domestic producers, not foreign ones. Thus an ideal protection index for foreign producers needs a benchmark based on the best possible market access situation, that is the one faced by national producers on the home market (Mayer and Zignago, 2005). This is exactly what the border effect approach tells us on comparing the relative volumes of intra versus international trade in two 'identical' countries.

Moreover, the border effect methodology captures *all* the trade impediments related to the existence of national barriers. This is a considerable advantage as most of these impediments are very hard to measure directly. For instance, consider the lack of reliable statistics on technical, sanitary and phytosanitary barriers, so pervasive in the agri-food market, and the conceptual difficulty to estimate their trade effect. By using an overall picture based on an indirect estimation approach we overcome these problems.

Finally, the estimation of an overall market access index for sectors and countries characterized by a high degree of policy related barriers – like Quad food markets – can offer new insights into the growing literature that tries to understand why national borders matter so much for international trade (see Anderson and van Wincoop, 2004 for a survey). Put differently, a contribution of the paper will be to assess how much trade policies, in the form of tariff and non-tariff barriers to trade, are responsible for the strong trade reduction effect induced by national borders. Understanding this point appears critical due to its different economic and policy implications. Indeed, if the trade reduction effect of crossing a national border is largely due to policy-unrelated border costs, such as transaction costs and/or consumer preferences for home goods, then the economic and policy implications of the border effect are quite low, at least from the perspective of trade policy reform. On the other hand, if the presence of the border effect is largely due to the existence of distortionary trade barriers, then the role of policy, and the potential welfare consequences, could, obviously, be quite different.

The paper is organized as follows. Section 2 summarizes the theoretical and empirical framework. Section 3 describes the data sources and the variables used in the empirical model. Section 4 is devoted to the presentation of our empirical results. The final section discusses the main implications and our conclusions.

2. Theoretical and empirical framework

The estimation of border effect from gravity models, initiated by McCallum (1995), recently found a solid theoretical foundation in the work of Anderson and van Wincoop (2003) and Feenstra (2004). The gravity equation suggests that trade between two regions, after controlling for size, depends on the bilateral barrier between them, in relation to the average trade barriers that both regions face with all their trading partners.

Our empirical framework consists of bilateral trade volume estimations with a gravity-like specification derived from the monopolistic competition model of trade introduced by Krugman (1980). Although monopolistic competition is not the only available model that can be used to derive gravity equation, it seems the most natural when we consider trade among the Quad countries, the most industrialized countries in the world (Fontagné et al, 2005). In this paper we use a gravity like structure introduced by Head and Mayer (2000). The model establishes a relation between the relative amounts consumers spend on foreign and domestic goods and their relative price net of transport costs.

This model combines CES utility with iceberg costs and *non strategic* price setting behavior by firms. Thus, denoting m_{ij} the value of imports of country i from j, and m_{ii} the value of imports of country i from itself, Head and Mayer (2000) show that the relative bilateral trade patterns can be expressed by the following compact characterization:

$$\frac{m_{ij}}{m_{ii}} = \left(\frac{a_{ij}}{a_{ii}}\right)^{\sigma-1}\left(\frac{p_j}{p_i}\right)^{-\sigma}\left(\frac{\tau_{ij}}{\tau_{ii}}\right)^{1-\sigma}\left(\frac{v_j}{v_i}\right) \quad (1)$$

where, v_j is the exporter's industry production value, a_{ij} represents the i consumer preferences with respect to varieties imported from j, p_j is the mill price in the exporter country and σ is the elasticity of substitution. Finally, τ_{ij} are the trade costs that determine the delivered price of the imported product (p_{ij}) as follows:

$$p_{ij} = p_j \tau_{ij} \equiv d_{ij}^{\delta}\left(1+t_{ij}\right)\left(1+ntb_{ij}\right)p_j \quad (2)$$

In this specification, trade costs are a function of distance between countries (d_{ij}, which proxies for transport costs) and "border-related costs". Such costs, related to international trade policy, depend on the level of protection of the country i vs country $j,$ and consist of an *ad valorem* tariff t_{ij} and the *ad valorem* equivalent of non-tariff barriers ntb_{ij}. These trade costs lead to rents for government and/or private beneficiaries (Anderson and van Wincoop, 2002). In the most general formulation, we assume that the structure of protection varies across all the partners' pairs, and depends on the direction of the flow for a given pair as follows:

$$\left(1+t_{ij}\right)\left(1+ntb_{ij}\right) \equiv \exp\left[\eta EU_{ij} + \varphi EUCAN_{ij} + \phi CANEU_{ij}\right]. \quad (3)$$

For simplicity purposes, equation (3) considers only trade between European countries and Canada, where EU_{ij} is a dummy variable set equal to 1 when i and j belong to EU (for $i \neq j$), $EUCAN_{ij}$ is a dummy variable set equal to 1 when i ($\neq j$) belongs to EU and j is Canada, $CANEU_{ij}$ is a dummy variable set equal to 1 when i is Canada and $j(\neq i)$ belongs to the EU.

However, most border barriers result from factors unrelated to trade policy, and so do not generate rents such as consumer preferences a_{ij}. Such barriers are due to transaction costs generated by differences in language, culture, regulations, history, institutions (see Evans, 2003) and are, in most cases, more difficult to remove. Sharing a common language (L) and a common geographical border (C) is assumed to mitigate preferences for goods produced in the home country. Thus, we have a 'home bias' in preferences (β_i), so that the consumer preferences (a_{ij}), the first term of equation (1), can be specified as follows:

$$a_{ij} \equiv \exp\left[e_{ij} - \left(\beta_i - \lambda L_{ij} - \theta C_{ij}\right)\left(EU_{ij} + EUCAN_{ij} + CANEU_{ij}\right)\right] \tag{4}$$

where e_{ij} is a random component of preferences, L_{ij} and C_{ij} are dummy variables that take a value 1 when country i and country j (for $i\neq j$) speak a common language and/or share a common border (0 otherwise). Consequently, if the two dummies switch from 0 to 1, *home bias* decreases from β_i to (β_i - λ_i - θ_i).

Replacing in (1) the trade cost specifications (2) and (3) and the consumer preferences (4) yields the following logarithmic form of the gravity equation:

$$\ln\left(\frac{m_{ij}}{m_{ii}}\right) = \ln\left(\frac{v_j}{v_i}\right) - (\sigma-1)\ln\left(\frac{d_{ij}}{d_{ii}}\right) + (\sigma-1)\lambda L_{ij} + (\sigma-1)\theta C_{ij} - \sigma\ln\left(\frac{p_j}{p_i}\right) \tag{5}$$
$$- (\sigma-1)(\beta_i+\eta)EU_{ij} - (\sigma-1)(\beta_i+\varphi)EUCAN_{ij} - (\sigma-1)(\beta_i+\phi)CANEU_{ij} + \varepsilon_{ij}$$

Taking the antilog of the estimated dummy variables' coefficients we estimate the so called *border effect*, namely how much intra-country trade is above to international trade after controlling for size, transport costs and relative prices. The *Border effect* includes both the average level of protection of the importing country and the home bias of consumers (β_i). For example, the coefficient on $EUCAN_{ij}$, $(\sigma\text{-}1)(\beta_i+\varphi)$, indicates the difficulty faced by Canadian exporters when selling its products to EU markets. Symmetrically, $CANEU_{ij}$ equal to $(\sigma\text{-}1)(\beta_i+\phi)$ indicates the difficulty European exporters have in accessing the Canadian market. Comparing the coefficient permits the identification of possible asymmetries in market access. Moreover, we can see that the level of protection of the importing country and the home bias of consumers influence the estimated *border effect* more when there is a high elasticity of substitution, σ.

3. Data and measures

Our gravity model includes 13 countries: United States, Canada, Japan and 10 European Union countries[1]. The database considers the imports of the 13 Quad countries from all the other 13 Quad countries over the period 1996-2001 (see Appendix 1). The data set used presents a total of 15,591 observations and considers the 33% of world food trade flows and the 52% of Quad country food imports from the world.

The needed data involve, primarily, bilateral trade, production and intra-trade data in a comparable industry classification. The trade data come from the United Nations Commodity Trade Data Base (COMTRADE). These trade data are detailed official data, reported as export and import by commodity and partner countries and recorded according to six internationally recognized trade and tariff classifications. Here we consider the data reported by the importer countries, using the Harmonised System (HS96 6-digit) and then aggregate these data using the conversion table from HS96 (6-digit) to the International Standard Industrial Classification ISIC Rev.3 (4-digit).

[1] The observations for Austria, Greece, Ireland, Luxembourg and the Netherlands are not considered due to a large zero value in the production dataset.

This conversion allows full comparability between trade and production data at the food industry level. Indeed, the output data come from the OECD Structural Statistics for Industry and Services database, that use ISIC Rev.3 at the 4-digit level, supplemented by other national sources in case of missing values. Our database considers the food manufacture trade and production data of 18 industries (ISIC Rev. 3-4 digit, code 1511-1600[2]).

The empirical implementation of equation (5) needs intra-country trade data. However, these figures were not available for our country sample. Thus, as is common in the literature, a country's 'imports' from itself are calculated as in Wei (1996). The value of goods shipped from a country to its own consumers m_{ii} is equal to the overall production of the country minus its total exports. Both data come from the same sources described above.

Moreover, we need measures of distance between and within countries. We use the intra-national distance estimate recently proposed by CEPII. This distance database has the considerable advantage of making internal distance constructions consistent with international distance calculations. Note that as is evident from the specification of trade costs (2), and as shown empirically by Head and Mayer (2002), any overestimate of the internal distance relative to the external one will mechanically translate into an overestimate of the border effect. In the new CEPII database, the calculation is based on bilateral distances between cities weighted by the share of the city in the overall population of the country. This procedure is used for both internal and international distances.

We take into account also whether or not two countries share a common border and a common language. Following Helliwell (1997), the two dummies take the value 1 when country *i* and country *j* (for $i \neq j$) speak a common language and/or share a common border (0 otherwise). Those data come from the same CEPII database.

Table 1. Tariff and AVE of NTB in QUAD countries.

	Tariff				NTB ave			
	CAN	EU	USA	JPN	CAN	EU	USA	JPN
Production, processing and preserving of meat	60.5	41.1	4.3	64.6	25.1	41.7	35.6	41.3
Processing and preserving of fish	1.8	13.1	2.6	5.7	13.5	26.0	20.1	23.3
Processing and preserving of fruit	6.0	20.1	7.8	14.9	15.7	47.3	33.4	43.4
Manufacture of vegetable and animal oils	9.2	10.7	5.6	6.8	4.5	32.8	3.7	19.5
Manufacture of dairy products	122.2	86.5	35.3	194.7	52.8	79.9	67.9	73.6
Manufacture of grain mill products	14.0	45.0	12.1	116.9	23.4	34.9	6.8	30.5
Manufacture of starches and starch products	7.3	56.1	25.0	96.6	27.5	61.0	0.0	49.3
Manufacture of prepared animal feed	40.9	81.2	64.5	11.8	0.0	47.6	0.0	19.4
Manufacture of bakery products	4.3	19.3	0.8	18.0	0.0	53.8	30.0	51.8
Manufacture of sugar	4.6	80.5	38.9	151.3	0.0	59.9	0.0	45.5
Manufacture of cocoa, chocolate and sugar confectionery	28.5	26.1	17.8	38.8	0.0	68.5	4.6	39.3
Manufacture of macaroni, noodles, couscous and similar	5.2	20.4	4.6	20.6	0.0	66.6	53.4	44.0
Manufacture of other food products n.e.c.	34.8	12.6	15.7	51.7	14.1	63.7	47.0	42.7
Distilling, rectifying and blending of spirits	3.2	3.1	0.1	24.7	0.0	0.0	23.7	34.0
Manufacture of wines	11.0	8.0	8.5	39.1	0.0	0.0	9.9	9.7
Manufacture of malt liquors and malt	11.2	30.5	0.8	50.7	55.4	73.5	0.0	61.6
Manufacture of soft drinks; production of mineral water	28.4	10.2	11.0	8.2	0.0	53.4	10.4	41.7
Manufacture of tobacco products	8.3	41.8	60.8	16.5	0.0	30.5	0.0	0.0

Based on: UNCTAD's TRAINS database, Kee, Nicita and Olarreaga (2004)

For relative prices the industry-level mill price required by the theoretical model is not used because of endogeneity concerns and low data availability. Thus, following previous authors works,

[2] 1511 Production, processing and preserving of meat; 1512 Processing and preserving of fish; 1513 Processing and preserving of fruit; 1514 Manufacture of vegetable and animal oils; 1520 Manufacture of dairy products; 1531 Manufacture of grain mill products; 1532 Manufacture of starches and starch products; 1533 Manufacture of prepared animal feed; 1541 Manufacture of bakery products; 1542 Manufacture of sugar; 1543 Manufacture of cocoa, chocolate and sugar confectionery; 1544 Manufacture of macaroni, noodles, couscous and similar; 1549 Manufacture of other food products n.e.c.; 1551 Distilling, rectifying and blending of spirits; 1552 Manufacture of wines; 1553 Manufacture of malt liquors and malt; 1554 Manufacture of soft drinks; production of mineral water; 1600 Manufacture of tobacco products.

we consider the more general price level of GDP, expressed relative to the United States. The data come from the Penn World Tables v.6.1.

Finally, with the objective of understanding the role played by policy related variables in explaining the border effect, we need data on tariff and NTB for the countries and industries involved in our analysis. Then tariffs come from UNCTAD's TRAINS database. These data, available at the bilateral level at HS96-8 digit, are aggregated and converted to ISIC Rev. 3-4 digit using arithmetic means. However, the tariffs between Canada and the US come from MAcMaps (Market Access Maps)[3] dataset, as the MFN tariff is zero in the preference scheme of TRAINS data. For non-Tariff Barriers (NTB) we use NTB Ad Valorem Equivalent (AVE) estimated at the 6-digit level of the Harmonised System by Kee, Nicita and Olarreaga (2004)[4]. These data are then aggregated and converted to ISIC Rev. 3-4 digit using arithmetic means. An extract of the tariff and AVEs of NTB data is shown in table 1.

4. Results

4.1. Market access and asymmetries

Table 2 presents ordinary least squares regressions of different specifications based on the gravity equation (5), pooled over the 1996-2001 period and across 18 food industry sectors. Column (1) involves the whole sample, with a simple gravity equation where we estimate only one border, the Quad *average* border effect. The overall fit of this regression is in line with the usual findings in gravity literature. All the estimated coefficients have the expected sign and are highly significant ($p<0.01$). The coefficient on relative production, equal to 0.8, is quite near the unitary value predicted by theory. The trade elasticity of relative distance, around -1.3, is also comparable with the usual findings in gravity equations. The relative prices are significant and negative, but only in this specification. The coefficient on contiguity has a higher magnitude than usual while language is quite low and not very significant in this specification.

This basic specification gives a quite large estimated *border* effect. It implies that, on average, each country trades around 63 times more (exp(4.14)) within its national border than with another Quad country. Two countries sharing a common border have a *border effect* reduced from 63 to 17 (exp(4.14-1.28)), everything else held constant.

In column (2), we split the single *border* into 13 dummy variables, one for each of the possible combinations of the four Quad countries[5]. The border effect for intra-EU trade is quite large, with a coefficient over 4. This means that intra-country trade is, on average, 73 times larger (exp(4.28)) than crossing national border between EU countries. A comparable estimate for aggregate food trade does not exist and a recent estimation for all manufactured good (Fontagné et al., 2005) finds an intra EU border effect of only 12.8 in the late nineties. However, Head and Mayer (2000) found that intra EU border coefficients for most 'ingestible products' are higher than for non-food products, and range from 3.92 for dairy to 6.41 for sugar.

Contrary to expectations, the border effect for intra-EU trade is not the lowest one among Quad countries. Indeed, Japan's market presents the easiest access level for imports from all the other considered countries, especially from the United States. Moreover, Japanese exporters suffer from a constantly high level of border effect, evident not only in the US but also in the EU and Canadian markets. This defines big asymmetries across the country-trade combinations evident in figure 1. Those results confirm previous findings, that the Japanese market is more open to imports from the USA than the reverse. In particular, Fontagné et al (2005) consider that this 'spectacular' result might

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[3] MAcMaps is a bilateral and disaggregated measure of market access that has been constructed to integrate the major instruments of protection (*ad valorem* and specific duties, tariff rate) at the most detailed level (tariff lines), as well as all preferential regimes.

[4] To obtain these figures, the estimated at HS 6-digit level, the authors first estimate the impact of NTBs on imports using Leamer's comparative advantage approach. They then transform the quantity impact into price equivalent, using import demand elastics.

[5] In agreement with previous literature (Fontagné et al., 2005; Mayer and Zignago, 2005), we dropped the regression constant so as to incorporate all the dummy variables for the estimation of each bilateral border coefficient.

be driven by an overestimate of the US-Japan distance, with respect to intra-EU distances. By contrast, Harrigan and Vanjani (2003) explain it by considering that the US has a proportionately larger demand for manufactured goods. However, another explanation could be related to differences in consumer 'home bias', with a Japanese consumer preference bias towards foreign goods instead of domestic goods. From this perspective, future work is needed to explain the Japanese puzzle.

Table 2. Border effects in the QUAD countries

Dependent variable	Ln (Imports / Intra-country trade)	
Time period	1996-01	1996-01
Regression	(1)	(2)
Ln Yj/Yi	0.78	0.83
	(0.01)	(0.01)
Ln Distance ij/Distance ii	-1.36	-1.06
	(0.03)	(0.04)
Common Language	0.12	0.97
	(0.07)	(0.08)
Contiguity	1.28	1.13
	(0.05)	(0.05)
Ln Prices	-2.00	0.10
	(0.09)	(0.10)
Border	-4.14	
	(0.06)	
Bilateral Border coefficients		
EU → EU		-4.28
		(0.07)
CAN → EU		-5.60
		(0.16)
EU → CAN		-6.58
		(0.11)
CAN → USA		-4.55
		(0.15)
USA → CAN		-6.17
		(0.15)
CAN → JPN		-2.21
		(0.25)
JPN → CAN		-8.08
		(0.24)
EU → JPN		-3.57
		(0.15)
JPN → EU		-7.87
		(0.17)
USA → EU		-5.13
		(0.14)
EU → USA		-4.97
		(0.10)
USA → JPN		-1.40
		(0.19)
JPN → USA		-5.92
		(0.22)
Adj R-square	0.405	0.502
# obs.	13,393	13,393

Notes: Robust standard errors are in parentheses.

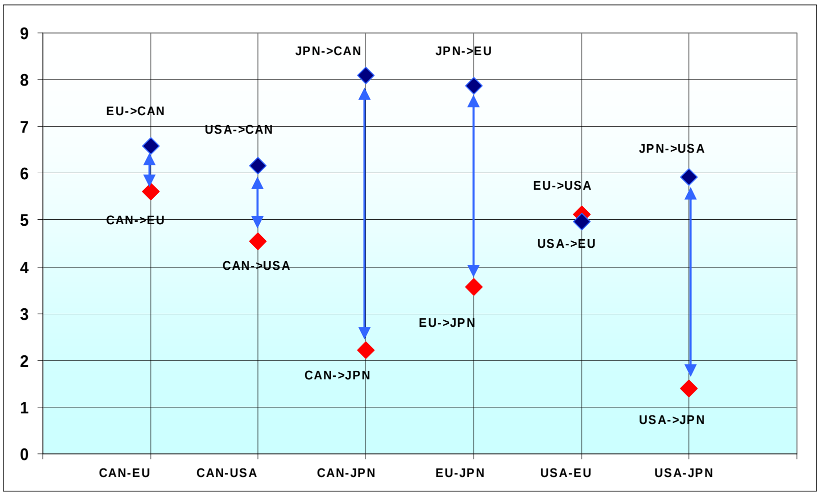

Figure 1. Market access asymmetry in QUAD country - border coefficients

Notes: The figure is based on the results of regression (2) table 2.

Flows between US and EU appear, on average, almost at the same impediment level. However, there exists a little higher 'protection' in the USA (vis-à-vis EU producers) than in the EU (vis-à-vis US producers). Although in contrast with common thinking the result is in line with previous findings, that estimate an asymmetry around one point for the food products border coefficient (Fontagné et al, 2005). Finally, between Canada and the US, and Canada and the EU countries, asymmetries are quite strong. In particular, the market access of Canadian products into European and American markets appears easier in our sample than the reverse.

4.2. Industry level market access

The estimation at the industry level allows us to evaluate the degree of symmetry in the Quad bilateral relationship for specific products. To this end, we split the 13 border coefficients estimate in regression (2) of table 2, into 234 (13 x 18) bilateral product-specific border coefficients. The regression results (not reported) present all the estimated border coefficients highly significant ($p<0.01$). The regression's R-squared is 0.655.

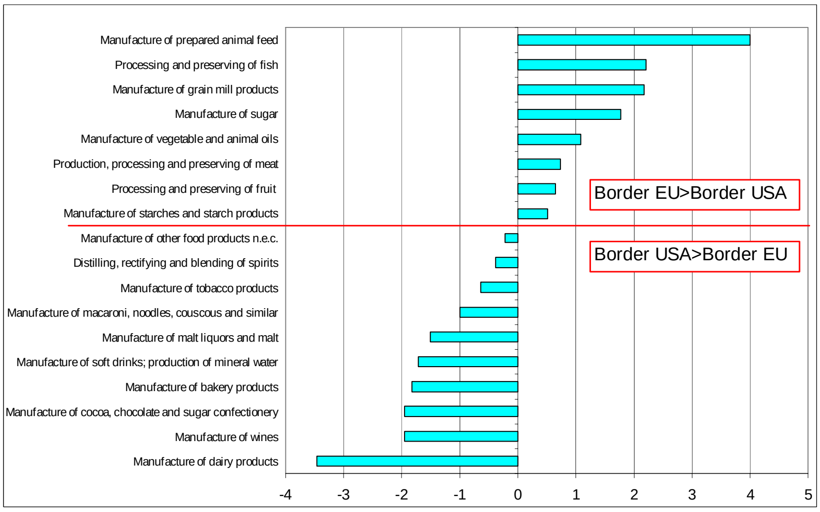

Figure 2. Market access asymmetry between EU and USA – difference in border coefficients

Notes: the figures 3 to 7 are reported in appendix 2.

In figures 2 to 7 we present bilateral asymmetry in market access for the six different combinations of our sample. Following Fontagné et al. (2005), we plot those results using the difference in border coefficients for each industry in each country pair. For example, figure 2 identifies animal feed, fish, and grain mill products as more ‘protected’ productions in the EU (vis-à-vis US producers) than in the USA (vis-à-vis EU producers). Reciprocally, dairy products and wine are more ‘protected’ in the USA.

Finally, all 18 industry productions considered present large asymmetries in the market access of Canada, the EU and the USA with Japan. In particular, sugar, meat products, dairy products and distilled spirits are the four sectors with easier access to Japan, than the reverse (figs. 5-7). No analogous estimate for food industry sectors exists, however, Fontagnè et al. (2005), using 3-digit sectors, find similar asymmetries for the overall food products. Moreover, previous research on the perennially contentious US-Japan bilateral relationship find Japan more open to manufactured imports from the EU countries (Harrigan, 1996), as well as from the USA (Harrigan and Vanjani, 2003), than the reverse.

4.3. The role of tariff and NTB in explaining border effect

In previous regressions we estimated bilateral borders that derive from both policy and non-policy related barriers. Now, let us try to answer to two more questions: how much of the border effect is due to policy related barriers? And, which kind of policy barriers are more protectionist, tariff or NTBs?

Column (1) of Table 3 shows the results of basic regression estimated on 2000 data, without any tariff or NTB variable. Thus, it represents our benchmark to compare the effect of policy related barriers on estimated border effect.

In regression (2) we introduce tariffs. The first result is that bilateral tariffs explain a not negligible part of the border effect. Indeed, except among EU countries that have nil bilateral tariffs, border coefficients decrease in all country combinations, with an average *border effect* reduction of 27%[6]. This result confirms previous findings, though the *border effect* is much larger. Indeed, Fontagné et al. (2005) find an average *border effect* reduction of 16% for manufactured trade goods and observe that the presence of tariffs increases the ratio of internal to cross-border trade volumes. Moreover, the results of regression (2) show that tariffs explain 33% of the border coefficient for European imports coming from the USA and Canada, and 41% when imports come from Japan.

Tariff coefficient is often used to estimate price elasticity (σ). From regression (2) the elasticity of substitution becomes equal to 2.48[7]. This value is low but quite consistent with previous findings. For example, Fontagné et al. (2005) estimated an elasticity of substitution for manufactured goods that ranges from 1.96 to 3.79, depending on the specification. Lopez and Pagoulatos (2002) find 1.59 as the mean value of elasticity of substitution for food manufacturing industries in the US market.

Column (3) introduces the *ad valorem* equivalent of NTB as a protection variable. Once again there is a general decrease in border coefficient, except for intra-EU trade. The average border effect reduction of NTB is 30%, thus slightly higher than tariffs. On comparing the results with those of regression (2), it can be seen that the NTBs explain border effect more than tariffs do, for some country pairs. This result confirms the Kee et al. (2004) conclusions, that find aveNTBs often higher than tariffs imposed on the same product. In particular, NTBs represent 44% of the EU limits on market access (vis-à-vis US, Canada and Japan producers). By contrast, the estimated border effects of Canadian imports from Quad countries decrease more on introducing tariff, rather than NTB variables.

Finally, in column (4) both the tariffs and the NTB are included, so we can estimate how much of the border effect is due to policy related barriers. It was found that, on average, 39% of the border is related to policy, but the higher level of the border policy component concerns access to the Japanese markets (over 50%). Policy related barriers represent 50% of the difficulty in accessing EU markets, while they represent less than 30% of the EU and Japanese exporters’ difficulty when selling products to the Canadian and USA markets. These results have important implications. Indeed, we found that for Canada and the USA the transaction cost differences between foreign and domestic products generates 70% of the border effects. This high border component can be caused partially by home-

[6] To calculate the average *border effect* reduction we first estimate border effect variation for each country-pair. For example, without any policy variables *border effect* of EU imports (vis-à-vis US producers) is equal to *exp(5.40).* Introducing the tariff variable, the border effect reduces to *exp(4.99).* Thus, the variation of the European border is calculated as (exp(5.00)-exp(5.40))/exp(5.40) and is equal to -33%.

[7] In regression (2) $(\sigma\text{-}1)= 1.48$

bias, in preference, and partially by not-observed policy barriers such as safety regulations, border costs that are, in most cases, quite difficult to remove.

Table 3. The role of tariff and NTB in explaining border effect in the QUAD countries

Dependent variable	Ln (Imports / Intra-country trade)			
Regression	(1)	(2)	(3)	(4)
Ln Yj/Yi	0.86	0.86	0.86	0.86
	(0.03)	(0.03)	(0.03)	(0.03)
Ln Distance ij/Distance ii	-1.07	-1.07	-1.06	-1.06
	(0.09)	(0.09)	(0.09)	(0.09)
Common Language	1.00	0.99	0.99	0.98
	(0.19)	(0.19)	(0.19)	(0.19)
Contiguity	1.11	1.12	1.13	1.13
	(0.12)	(0.12)	(0.12)	(0.12)
Ln Prices	-0.07	-0.06	-0.07	-0.06
	(0.25)	(0.25)	(0.25)	(0.25)
Ln (1+Tariff)		-1.48		-1.23
		0.38		(0.40)
Ln (1+NTBave)			-1.62	-1.09
			(0.49)	(0.51)
Bilateral Border coefficients				
EU → EU	-4.19	-4.19	-4.21	-4.21
	(0.16)	(0.17)	(0.17)	(0.17)
CAN → EU	-5.67	-5.26	-5.08	-4.94
	(0.37)	(0.39)	(0.42)	(0.42)
EU → CAN	-6.43	-6.14	-6.25	-6.07
	(0.26)	(0.27)	(0.27)	(0.27)
CAN → USA	-4.37	-4.33	-4.11	-4.16
	(0.36)	(0.35)	(0.37)	(0.36)
USA → CAN	-6.15	-6.05	-5.97	-5.95
	(0.38)	(0.37)	(0.37)	(0.37)
CAN → JPN	-1.94	-1.39	-1.45	-1.16
	(0.51)	(0.54)	(0.53)	(0.55)
JPN → CAN	-8.05	-7.79	-7.89	-7.73
	(0.61)	(0.61)	(0.62)	(0.61)
EU → JPN	-3.56	-3.04	-3.09	-2.81
	(0.36)	(0.38)	(0.39)	(0.40)
JPN → EU	-7.84	-7.48	-7.27	-7.16
	(0.43)	(0.44)	(0.47)	(0.47)
USA → EU	-5.40	-4.99	-4.82	-4.68
	(0.36)	(0.37)	(0.40)	(0.40)
EU → USA	-4.63	-4.43	-4.37	-4.29
	(0.23)	(0.24)	(0.25)	(0.25)
USA → JPN	-1.45	-0.91	-0.99	-0.70
	(0.46)	(0.46)	(0.46)	(0.46)
JPN → USA	-5.73	-5.52	-5.49	-5.39
	(0.52)	(0.52)	(0.53)	(0.52)
Adj R-square	0.520	0.524	0.523	0.526
# obs.	2,300	2,300	2,300	2,300

Notes: Robust standard errors are in parentheses

5. Concluding remarks

The present paper applies the estimation of border effect from gravity models, initiated by McCallum (1995) and recently surveyed by Feenstra (2004) and Anderson and van Wincoop (2004).

The empirical analysis utilizes a gravity-like bilateral trade equation based on a comparison of international trade flows with intra-national trade flows. With this method we investigated the differences in market access difficulty among four industrialized country 'blocs': Canada, USA, EU and Japan. The analysis strongly confirms the existence of important asymmetry in food manufactured market access.

The results on bilateral openness show that only the USA and the EU are more or less equally open to each other, while Japan seems to be more open to food manufactured imports from Quad countries than those countries are open to imports from Japan. This last result appears puzzling due to the long term recognition of high marked food protection in Japan. However, even though previous papers reached similar conclusions with respect to Japanese openness in manufacturing, the underlying (true) reason still calls for an explanation.

Earlier results are also given in detail across industry. This has allowed the identification of food production where each country-pair presents higher asymmetry in relative market access.

Finally, by introducing two policy variables (tariff and NTBs) into the model we found how much trade policies, in the form of tariff and non-tariff barriers to trade, are responsible for the strong trade reduction effect induced by national borders. The results show that policy related barriers represent half, or more, of the export difficulties when selling food products to the EU or Japan, while they represent only 1/3 of the Canadian and USA border barriers. Moreover, the elasticity of substitutions estimated by the model ($\sigma = 2.48$) tell us that imports and domestic food products are imperfect substitutes. Those results lead to different economic and policy implications. Indeed, for Canadian and USA imports, the trade reduction effect of crossing a national border appears to be more due to policy-unrelated border costs, such as transaction costs, consumer preferences for home goods and/or not-observed policy barriers. On the other hand, for the EU and Japanese imports, the presence of border effect seems more due to the existence of policy trade barriers.

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Appendix 1

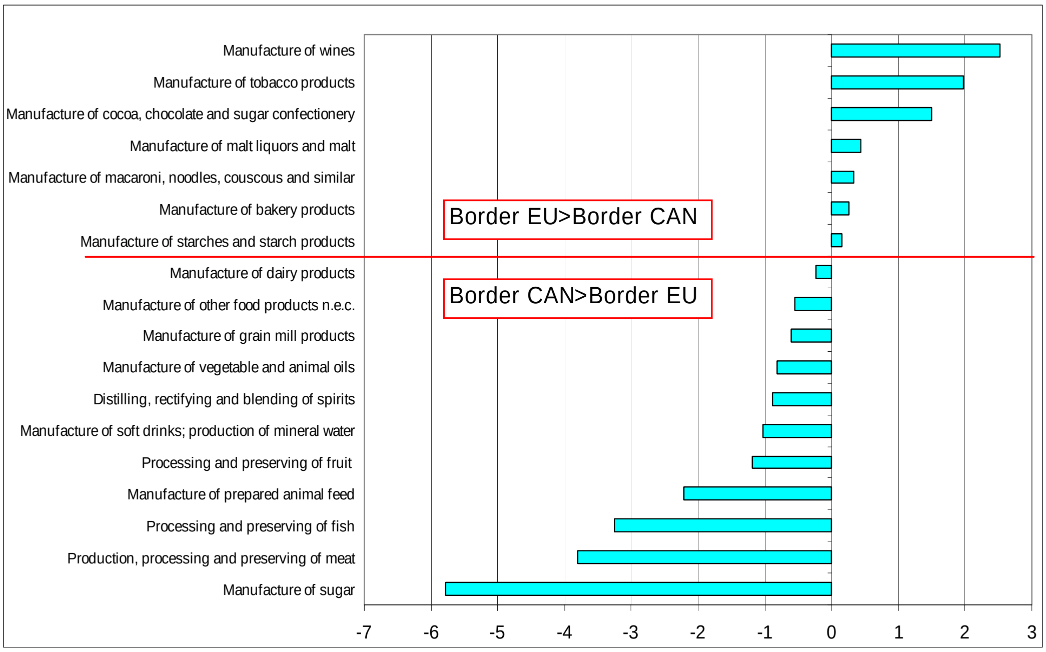
Bilateral trade among QUAD countries (million US$)

	Year					
	1996-1997		1998-1999		2000-2001	
CAN-EU	1,535	1.6%	1,671	1.7%	1,706	1.8%
EU to CAN	*980*	*64%*	*1,105*	*66%*	*1,148*	*67%*
CAN to EU	*554*	*36%*	*566*	*34%*	*558*	*33%*
CAN-JPN	1,359	1.4%	1,255	1.3%	1,448	1.5%
CAN to JPN	*1,329*	*98%*	*1,224*	*98%*	*1,417*	*98%*
JPN to CAN	*30*	*2%*	*31*	*2%*	*32*	*2%*
CAN-USA	9,575	10.0%	11,388	11.7%	12,265	12.8%
CAN to USA	*5,459*	*57%*	*6,771*	*59%*	*7,500*	*61%*
USA to CAN	*4,116*	*43%*	*4,617*	*41%*	*4,765*	*39%*
EU-JPN	3,837	4.0%	3,851	4.0%	4,004	4.2%
EU to JPN	*3,760*	*98%*	*3,779*	*98%*	*3,933*	*98%*
JPN to EU	*77*	*2%*	*72*	*2%*	*72*	*2%*
EU-USA	8,964	9.3%	9,882	10.2%	9,897	10.4%
EU to USA	*6,154*	*69%*	*6,951*	*70%*	*7,367*	*74%*
USA to EU	*2,810*	*31%*	*2,931*	*30%*	*2,530*	*26%*
USA-JPN	9,856	10.2%	8,997	9.3%	9,702	10.2%
USA to JPN	*9,479*	*96%*	*8,566*	*95%*	*9,248*	*95%*
JPN to USA	*377*	*4%*	*431*	*5%*	*454*	*5%*
EU-EU	61,052	63.5%	60,169	61.9%	56,491	59.1%
Total Trade	96,177	100.0%	97,212	100.0%	95,514	100.0%

Notes: EU countries are: Belgium-Luxembourg, Germany, Denmark, Spain, Finland, France, United Kingdom, Italy, Portugal, Sweden

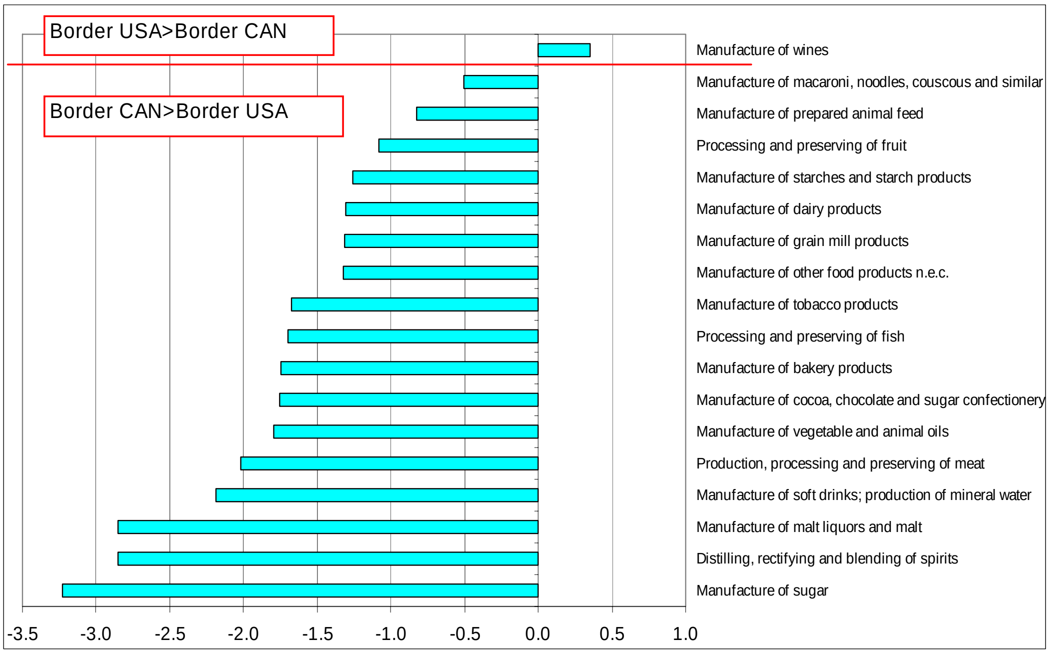
Appendix 2

Figure 3. Market access asymmetry between EU and Canada – difference in border coefficients



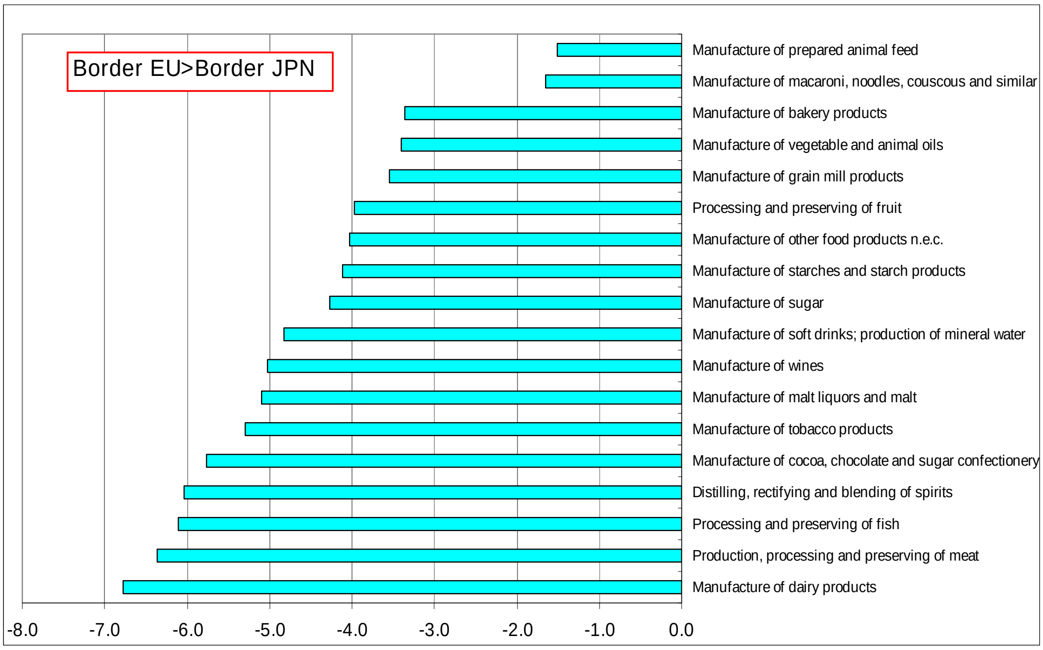
Note: all the estimated border coefficients are highly significant ($p<0.01$)

Figure 4. Market access asymmetry between USA and Canada – difference in border coefficients



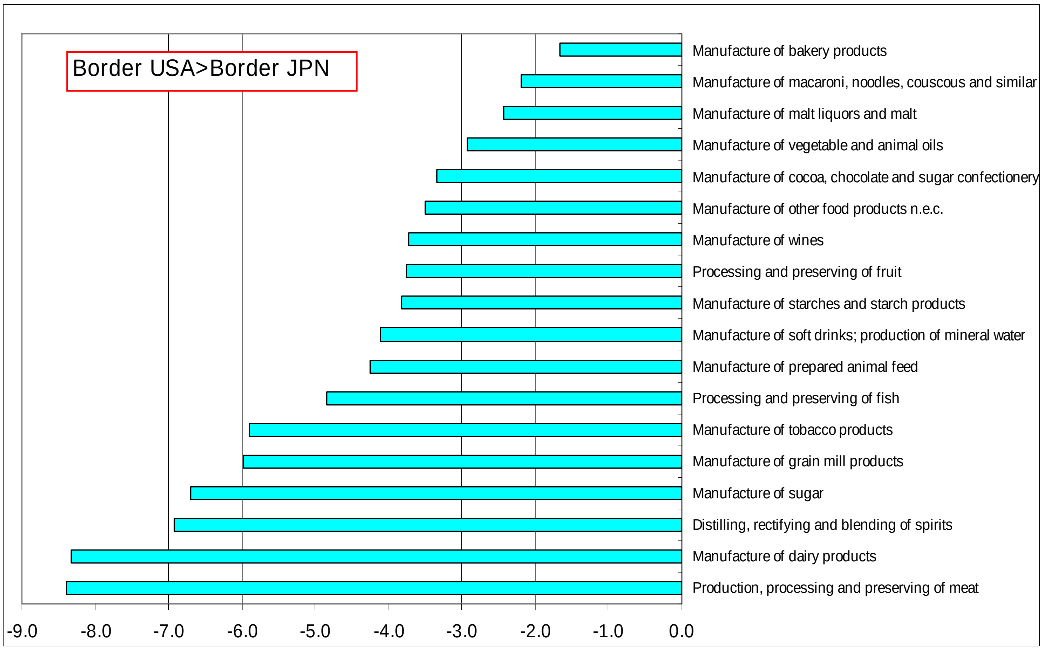
Note: all the estimated border coefficients are highly significant (p<0.01)

Figure 5. Market access asymmetry between EU and Japan – difference in border coefficients



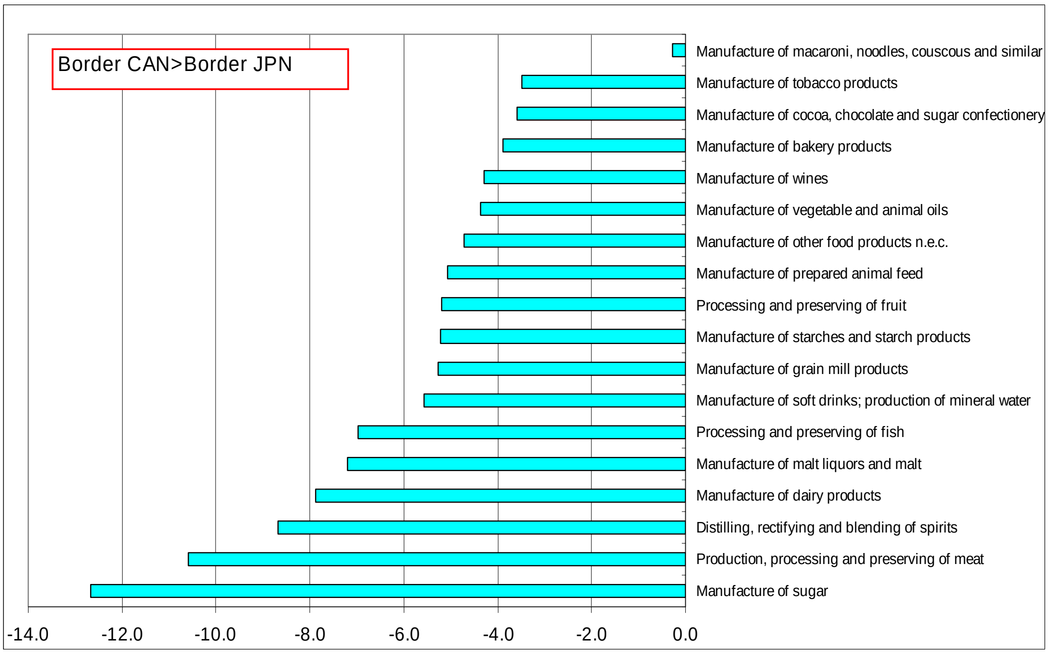
Note: all the estimated border coefficients are highly significant (p<0.01)

Figure 6. Market access asymmetry between USA and Japan – difference in border coefficients



Note: all the estimated border coefficients are highly significant (p<0.01)

Figure 7. Market access asymmetry between USA and Japan – difference in border coefficients



Note: all the estimated border coefficients are highly significant (p<0.01), except Japan's imports from Canada's production, processing and preserving of meat (*p=0.015*).