NAFTA'S TRADE EFFECTS: NEW EVIDENCE WITH A GRAVITY MODEL

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Abstract

This paper estimates econometrically the impact of NAFTA on US-Mexico and US-third countries (groups of countries) trade flows. Using a traditional gravity-equation framework, we try to see to what extent the bilateral trade flows between the US and different countries differ from a gravity-type specification. By incorporating a series of dummy variables into the specification, we interpret the changes in these dummy variables over time as evidence on whether NAFTA affected the trade patterns. The main conclusion is that NAFTA did not have a significant effect on US trade patterns, neither with Mexico nor with other countries in the world (with the exception of CACM).

Resumen

Este ensayo estima econométricamente el impacto del NAFTA sobre los flujos comerciales entre Estados Unidos y México y entre Estados Unidos y terceros países (grupo países). Usando un esquema tradicional de ecuación de gravitación, intentamos ver hasta qué punto los flujos comerciales bilaterales entre los Estados Unidos y distintos países difieren de tal especificación del tipo ecuación de gravitación. Mediante la incorporación de una serie de variables dummy *en la especificación, interpretamos los cambios de las mismas en el tiempo como evidencia de si el NAFTA afectó los patrones de comercio. La conclusión principal es que el NAFTA no tuvo un efecto significativo en los patrones de comercio estadounidenses, ni con México ni con otros países en el mundo (con la excepción del mercado común centroamericano).*

JEL classification: *F10, F13, F15.*

Key words: *NAFTA, Gravity Model, Trade Diversion, Fixed Effects.*

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1. Introduction

The past 20 years have seen regionalism reemerge as a major issue in the policy agenda. For instance, in the Americas the Common Market of the South (MERCOSUR) and the North American Free Trade Agreement (NAFTA) were created in 1991 and 1992 respectively, while old regional trade agreements (RTAs), such as the ANDEAN Pact (ANDEAN) and the Central American Common Market (CACM), started a process of renewal in the late 1980s and early 1990s. [1] Crawford and Florentino (2005) find similar trends in Africa and Asia. Bhagwati and Panagariya (1999) call this the "spaghetti bowl" phenomenon, a reference to the fact that a country may belong to more than one RTA and the possible interconnections that ensue. The question this phenomenon raises is whether this "new regionalism" has had some effect on trade patterns. Moreover, the danger of RTA preferences causing a welfare-reducing shift of imports from suppliers in third countries to less efficient regional firms (i.e., trade diversion) is now a central issue in trade-related economic research.[2]

This paper explores these issues in the context of NAFTA, an RTA signed by Canada, Mexico, and the United States. NAFTA is said to have been the first modern trade agreement between the developed world and a developing nation. As such, the agreement started with significant economic asymmetries among partners, ranging from gross domestic product (GDP) per capita to factor endowments to institutional development, which increased the likelihood of a deeper impact on Mexico's economy and institutions than on those of Canada or the United States.[3] Although these asymmetries also include tariff rates, the unilateral trade liberalization undertaken by Mexico in the mid- to late 1980s reduced significantly the distances among NAFTA's partners' trade regimes.[4] When NAFTA was signed (1992), the average applied most-favored-nation (MFN) base rate for Mexico was 10 percent while the average U.S. rate was about 4 percent. At the time of implementation (January 1, 1994) tariffs for about half of all import categories were eliminated immediately while most of the remaining tariffs were set to disappear within five years. According to Estevadeordal (1999), the initial average preferential margin granted by Mexico to the United States (i.e., Mexican MFN tariffs *minus* tariffs for NAFTA members, averaged for all tariff lines) was 8 percentage points, while the average preferential margin granted by the United States to Mexico was 2.1 percentage points. The immediate question that arises is: Were these tariff preferences high enough to benefit Mexico in its trade with the United States at the cost of a diminishing participation of third countries in the U.S. markets? In particular, and due to their similar geographic location and pattern of specialization, was

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1 A review of the agreements around this time can be found in de Melo, Montenegro, and Panagariya (1993). An English version of the paper is available in de Melo, Montenegro, and Panagariya (1991).

2 See for instance Schott (2004) and Hufbauer and Goodrich (2004).

3 López-Córdoba (2001).

4 From 1985 to 1989, Mexican average tariffs dropped 11 percentage points to an average tariff level of 13.9 percent. It is important to mention that Mexico's trade liberalization started before that of some other Latin American countries, Foroutan (1998).

NAFTA benefiting Mexico's access to U.S. markets and hurting Central American and Caribbean countries' trade with the United States?

At the aggregate level, the gravity model is the most common tool used to answer these questions, as it allows one to control for the most important determinants of trade among countries (e.g., GDP, population, geography, cultural links, etc.). Estimations of a theory-based gravity model and subsequent tests applied to key parameters that track NAFTA's trade are the core of this paper. In section 2 we present the gravity model, in section 3 the data used, and in section 4 our main results, which we compare with results from other studies in section 5. Section 6 presents sensitivity analysis and section 7 presents the main conclusions.

2. The Model

In a previous work, Soloaga and Winters (2001), the authors evaluated the impact of the new wave of regionalism on bilateral trade. The conclusions were that, after controlling for the usual gravity variables (GDP, distance, common language, etc.), regionalism in the 1990s did not produce a statistically significant increase in bloc members' trade among each other. The econometric approach used bloc fixed effects for exports and imports seeking to control for the unilateral trade liberalization trend that started in the late 1980s, particularly in Latin American countries. Although those dummy variables seemed intuitively reasonable, they entered the equation entirely in an ad-hoc fashion. A recent paper by Anderson and van Wincoop (2003) developed a method that consistently and efficiently estimates a theoretical gravity equation. Their gravity equation (equation 13 in their paper) is

$$x_{ij} = \frac{y_i y_j}{y^W}\left(\frac{t_{ij}}{P_i P_j}\right)^{1-\sigma},$$

subject to (equation 12 in their paper)

$$P_j^{1-\sigma} = \sum_j P_i^{\sigma-1}\theta_i t_{ij}^{1-\sigma} \quad \forall j,$$

where x_{ij} represents exports from region i to region j, y_i and y_j are the gross domestic product in regions i and j, d_{ij} is the distance between regions i and j, t_{ij} are bilateral trade barriers, P_i and P_j are price indexes for regions i and j, and σ is the elasticity of substitution between all goods.

In this model, *relative* trade barriers determine the trade between regions. Quoting Anderson and van Wincoop (2003), "Trade between two regions depends on the bilateral barrier between them relative to average trade barriers that both regions face with all their trading partners" (pp. 176). These region-specific trade barriers are captured in the model by the price indexes P_i and P_j. They used the estimates from this general-equilibrium gravity model to conduct comparative static exercises of the effect of trade barriers on trade flows, in particular to produce a new evaluation of the border effect for trade between

the United States and Canada. Empirically, the above system of equations was estimated by a nonlinear least squares method and, more simply, also by ordinary least squares (OLS) with fixed effect for exporters and importers in place of the country-specific multilateral resistance terms.[5]

To assess NAFTA's effect on third countries in the U.S. market, here we follow Anderson and van Wincoop's (2003) approach and perform an event study. We extend the model to consider trade flows between the United States and Mexico, and between the United States and its other Latin American and Caribbean trade partners *before* and *after* the implementation of NAFTA. We used country fixed effect to control for the country-specific multilateral resistance terms. The model estimated is[6]:

(1)

$$
\begin{aligned}
ln\ Imports_{ijt} = {} & \beta_0 + \sum_{t=1}^{t=4} \beta_{1t} Ln\,(GDP_{it}\ GDP_{jt}) + \sum_{t=1}^{t=4} \beta_{2t}\ Ln\ Distance_{ijt} + \sum_{t=1}^{t=4} \beta_{3t}\ Lang_{ijt} + \\
& \sum_{t=1}^{t=4} \beta_{4t}\ Border_{ijt} + \sum_{t=1}^{t=4} \beta_{5t} LnRER_{ijt} + \sum_{t=1}^{t=4} \sum_{k=1}^{k=9} \lambda_{kt}\ DRTA_{kt} + \\
& \sum_{t=1}^{t=4} \lambda_{USA\_MEX_t} D_{USA\_MEX_t} + \sum_{t=1}^{t=4} \lambda_{USA\_CAN_t} D_{USA\_CAN_t} + \sum_{t=1}^{t=4} \lambda_{USA\_CARICOM_t} D_{USA\_CARICOM_t} + \\
& \sum_{t=1}^{t=4} \lambda_{USA\_CACM} D_{USA\_CACM_t} + \sum_{t=1}^{t=4} \lambda_{USA\_ANDEAN_t} D_{USA\_ANDEAN_t} + \sum_{t=1}^{t=4} \lambda_{USA\_MERCOSUR_t} D_{USA\_MERCOSUR_t} + \\
& \sum_{t=1}^{t=4} \lambda_{MEX\_USA_t} D_{MEX\_USA_t} + \sum_{t=1}^{t=4} \lambda_{MEX\_CAN_t} D_{MEX\_CAN_t} + \sum_{t=1}^{t=4} \lambda_{MEX\_CARICOM_t} D_{MEX\_CARICOM_t} + \\
& \sum_{t=1}^{t=4} \lambda_{MEX\_CACM_t} D_{MEX\_CACM_t} + \sum_{t=1}^{t=4} \lambda_{MEX\_ANDEAN_t} D_{MEX\_ANDEAN_t} + \sum_{t=1}^{t=4} \lambda_{MEX\_MERCOSUR_t} D_{MEX\_MERCOSUR_t} + \\
& \sum_{t=1}^{t=4} \lambda_{CAN\_MEX_t} D_{CAN\_MEX_t} + \sum_{t=1}^{t=4} \lambda_{\mathbf{CAN}\_USA_t} D_{CAN\_USA_t} + \alpha_t + \delta_{it} + \eta_{jt} + u_{ijt}
\end{aligned}
$$

where $ln\ Imports_{ij}$ is the log of non-fuel imports at 1995 prices made by country i from country j at time t, GDP_{it} is the gross domestic product of country i at time t at 1995 prices, $ln\ Distance_{ij}$ is the log of the great circle distance between countries i and j, $Lang_{ij}$ is a dummy variable with a value equals to 1 when countries i and j have a common language, $Border_{ij}$ is a dummy variable with a value equals to 1 when countries i and j have a common border. RER is the bilateral real exchange rate (see section data for details on how this variable was calculated). We considered four average periods: (i) 1988-91 (i.e., the pre-NAFTA years, in our model t=1); (ii) 1992-96 (i.e., the NAFTA-inception years, in our model t=2); (iii) 1997-2000 (i.e., the post-NAFTA-inception years, in our model t=3); and (iv) 2001-03 (to look for observable trends in the coefficients that would confirm/reject the before-after analysis, in our model t=4). To capture trade levels different than what would be expected by considering the gravity variables alone, we introduced the following set of dummy variables:

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5 The latter approach was also used by Rose and van Wincoop (2001) to assess the impact of currency unions on trade.

6 The specific derivation of this empirical estimation can be found in Anderson and van Wincoop (2003).

a) To model the RTAs, we constructed nine different dummy variables ($DRTA_{kt}$, with $k = 1$ to 9 and t=1 to 4), each of which equals one when countries i and j belong to the k^{th} regional agreement. We considered the following 9 RTAs: ANDEAN, ASEAN (Association of South East Asian Nations), CACM, CARICOM (Caribbean Community), ECOWAS (Economic Community of West African States), EFTA (European Free Trade Association), EU (European Union), MERCOSUR, and UDEAC (Customs and Economic Union of Central Africa).
b) To address the main focus of this paper we specifically modeled a set of dummy variables for imports made by the United States and by Mexico. First, there are two dummies to capture intra-NAFTA trade for the United States:
D_{USA_MEX}, which equals 1 when the United States imports from Mexico, and D_{USA_CAN}, which equals 1 when the United States imports from Canada. In addition, two dummies capture Mexican imports:
D_{MEX_USA}, which equals 1 when Mexico imports from the United States, and D_{MEX_CAN}, which equals 1 when Mexico imports from Canada. Finally, two dummies trade for Canada with its bloc partners: D_{CAN_MEX}, which equals 1 when Canada imports from Mexico, and D_{CAN_USA}, which equals 1 when Canada imports from the United States. All these dummies vary with t=1 to 4.
c. In a similar fashion, to check imports made by the United States and Mexico from their Latin American and Caribbean trade partners we created a set of four dummy variables for these two NAFTA members. For the United States, the dummy variables $D_{USA\_CARICOM}$, D_{USA_CACM}, D_{USA_ANDEAN}, and $D_{USA\_MERCOSUR}$ take the value 1 when the United States imports from countries that belong to these trade agreements. For Mexico, the dummy variables $D_{MEX\_CARICOM}$, D_{MEX_CACM}, D_{MEX_ANDEAN}, and $D_{MEX\_MERCOSUR}$ take the value 1 when Mexico imports from countries that belong to these trade agreements. All these dummies vary with t=1 to 4.

Of key interest in this equation are the parameters λ_{USA_MEX} and λ_{CAN_MEX}, as they will capture any imports made by the United States and Canada from Mexico, *in excess of what would have been expected by considering the traditional gravity variables alone*, and which could be attributed to NAFTA. In turn, the parameters $\lambda_{USA\_CARICOM}$, λ_{USA_CACM}, λ_{USA_ANDEAN}, and $\lambda_{USA\_MERCOSUR}$ measure the levels of imports made by the United States from countries in these trade blocs, again, *in excess of what would have been expected by considering the traditional gravity variables alone*. As Soloaga and Winters (2001) point out, to see the impact of NAFTA on trade flows, what matters are the *changes* in these coefficients through time *and* whether these changes are statistically significant. As our main concern is what happened with extra-bloc trade before and after the implementation of NAFTA, here we do not need to address the issue of endogeneity of the RTAs with the volume of trade (i.e., those countries that already have been trading a lot among themselves are the ones that seek RTAs).[7] Following

[7] This was not the case, for instance, in Soloaga and Winters (2001), where the main issue was the impact of regionalism on intra-bloc trade. See Baier and Bergstrand (2002) for the endogeneity of RTAs.

Anderson and van Wincoop (2003) approach, we estimated equation 1 with fixed effects for importers (*i* countries) and for exporters (*j* countries). The main purpose of introducing country fixed effects is to control for unobservable invariant characteristics of countries. In our main model, we allow these fixed effects to vary with time aiming at controlling for the (still) country specific effects but that could have varied during our sample. As a robustness check we have also run our model with country fixed effect for the whole period . As it is shown below, the main conclusions of the paper did not change. As indicated, we use four periods of data (see also below) in which we allow all the coefficients to change between periods. This method allows us to see statistically significant movements in key coefficients of our model (i.e., the bloc coefficients).

3. The Data

The GDP, exchange rates and price levels data used in this study come from the World Bank's database (World Bank (2006)). The trade data are from the UNSO COMTRADE data bank. Both nominal series were converted to 1995 U.S. dollars using the U.S. consumer price index. We used the year 1996 to ascertain membership in an RTA.[8] As indicated earlier, we considered the following RTAs: ANDEAN (Andean Pact), ASEAN (Association of South East Asian Nations), CACM (Central American Common Market), CARICOM (Caribbean Community), ECOWAS (Economic Community of West African States), EFTA (European Free Trade Association), EU (European Union), MERCOSUR, and UDEAC (Customs and Economic Union of Central Africa). NAFTA has been decomposed into Canada, Mexico, and United States country-pair trade. The distance, border, and language were taken from Montenegro and Soto (1996). The bilateral real exchange rate between countries *i* and *j* (RER_{ij}) was calculated as follows: $RER_{ij} = [NER_{i/\$} / CPI_i]/[NER_{i/\$} / CPI_i]$ were $NER_{i/\$}$ is the Nominal Exchange Rate for country *i* against the US $ and CPI_i is Consumer Price Index of country *i*. For each pair of countries the RER is specified such as its mean over our whole sample years (i.e.1988-2003) is 100.

4. Results

We applied the previously described model to a data set of 120 countries that covers more than 90 percent of the world's trade for the years 1988 to 2003. Since NAFTA entered into effect January 1, 1994, to test for the *before* and

[8] Frankel, Stein, and Wei (1997) explains the rationale for doing this: "Typically the year that an agreement is negotiated is different from the year it is ratified, which is in turn different from the year it goes into effect, which is in turn different from the year that the transition period of trade liberalization is completed." Thus, his approach is to use a uniform membership of blocs over time. "The aim is to see when their effects seem to take hold" (pp. 78). Baier and Bergstrand (2002) also use an index of RTAs "that have the value 1 for a pair of countries (i,j) with a free trade agreement in 1996, and 0 otherwise." (pp. 21). Implications of alternative ways of dealing with expanding RTA membership (in our case notably the several EU "enlargements" and to a lesser extent changes in ANDEAN pact memberships) are discussed in Carrère (Forthcoming).

after NAFTA event we considered the 1988-1991 four-year average as pre-NAFTA and the 1997-2000 four-year average as post-NAFTA. Thus, we centered the NAFTA event on 1994 and allowed two years before and two years after that year as buffers to allow for any effect to show up.[9] We also used average data for the years 2001 to 2003 to check for any observable trend in the coefficients. We ran *one single* regression by OLS with time and country effects allowing *all* the coefficients (those for the gravity variables as well as those for the country effects) to be different in the following average periods: (i) 1988-1991; (ii) 1992-1996; (iii) 1997-2000; and (iv) 2001-2003. Estimates are White-robust to heteroskedasticity,[10] and we tested for statistically significant changes in the coefficients throughout the four periods indicated above.

Table 1 shows the main gravity model results. The full set of results with time, country, and time-country effects is available from the authors upon re-

TABLE 1
MAIN GRAVITY VARIABLES

Variable	Coefficient	White's Std. Error	*t*-statistic	*P* value
Ln $(GDP_i GDP_j)_{\_88\text{-}91}$	0.928	0.295	3.141	0.000
Ln $(GDP_i GDP_j)_{\_92\text{-}96}$	0.907	0.031	28.960	0.000
Ln $(GDP_i GDP_j)_{\_97\text{-}2000}$	0.905	0.031	29.120	0.000
Ln $(GDP_i GDP_j)_{\_2001\text{-}03}$	0.913	0.031	29.260	0.000
D $Border_{ij\_88\text{-}91}$	0.479	0.133	3.610	0.000
D $Border_{ij\_92\text{-}96}$	0.626	0.126	4.970	0.000
D $Border_{ij\_97\text{-}2000}$	0.451	0.127	3.550	0.000
D $Border_{ij\_2001\text{-}03}$	0.489	0.136	3.600	0.000
Ln $Distance_{ij\_88\text{-}91}$	–1.357	0.030	-45.110	0.000
Ln $Distance_{ij\_92\text{-}96}$	–1.329	0.028	-47.610	0.000
Ln $Distance_{ij\_97\text{-}2000}$	–1.364	0.027	-51.450	0.000
Ln $Distance_{ij\_2001\text{-}03}$	–1.425	0.028	-50.650	0.000
D $Lang_{ij\_88\text{-}91}$	0.799	0.061	13.190	0.000
D $Lang_{ij\_92\text{-}96}$	0.813	0.054	14.990	0.000
D $Lang_{ij\_97\text{-}2000}$	0.850	0.053	16.030	0.000
D $Lang_{ij\_2001\text{-}03}$	0.826	0.055	15.040	0.000
Ln $RER_{ij\_88\text{-}91}$	0.969	1.020	0.950	0.342
Ln $RER_{ij\_92\text{-}96}$	2.553	0.917	2.780	0.005
Ln $RER_{ij\_97\text{-}2000}$	3.117	0.735	4.240	0.000
Ln $RER_{ij\_2001\text{-}03}$	3.787	0.720	5.260	0.000
Number of observations:	40,881			
Adjusted R-squared:	0.814			

Source: Authors' computations based on the model presented in section 2 and on data described in section 3.

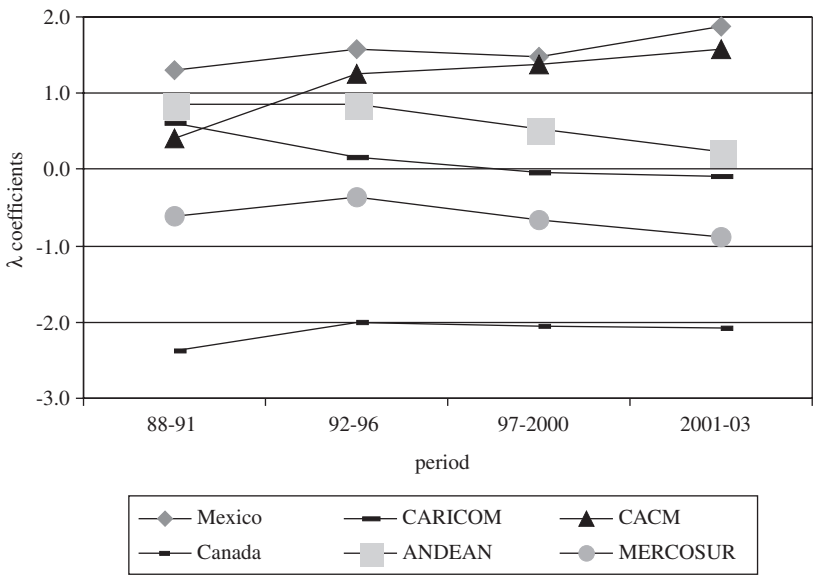
Note: The model was estimated using a single OLS regression, allowing for all coefficients, including time and country fixed effects, to be different in all periods.

[9] For sensitivity analysis, we also ran averages for different periods.

[10] See White (1980).

quest. Let us just point out here that the main coefficients are in line with previous estimates. For instance, the log of the product of the GDPs was close to 1, slightly below the theoretical prediction. Countries that share a common border trade more than those that do not, and this is also the case for those countries that speak the same language. The coefficient for the log of distance was, as expected, negative and between –1.33 and –1.43, similar to the one of the second specification presented in table 1 of Rose and van Wincoop (2001).

FIGURE 1
λ COEFFICIENTS OF U.S. IMPORTS FROM MEXICO, CANADA, CARICOM, ANDEAN, CACM, AND MERCOSUR



Source: Table 2.

Figure 1 presents the estimated values of the key dummy variables that track U.S. imports from Mexico, from Canada, and from the Latin American and Caribbean RTAs. The main results of our estimates for U.S. imports, after controlling for country fixed effects and for the usual gravity variables, following figure 1 (see also table 2) are as follows:

1. U.S. imports from Mexico seemed not to have been affected by NAFTA. The dummy variable for this country-pair trade is positive and statistically significant along the periods considered, indicating import levels above what could have been expected when considering only gravity variables. More important, the dummy variable changes in the periods considered were not statistically significant.

TABLE 2
λ COEFFICENTS FOR THE UNITED STATES, CANADA, AND MEXICO

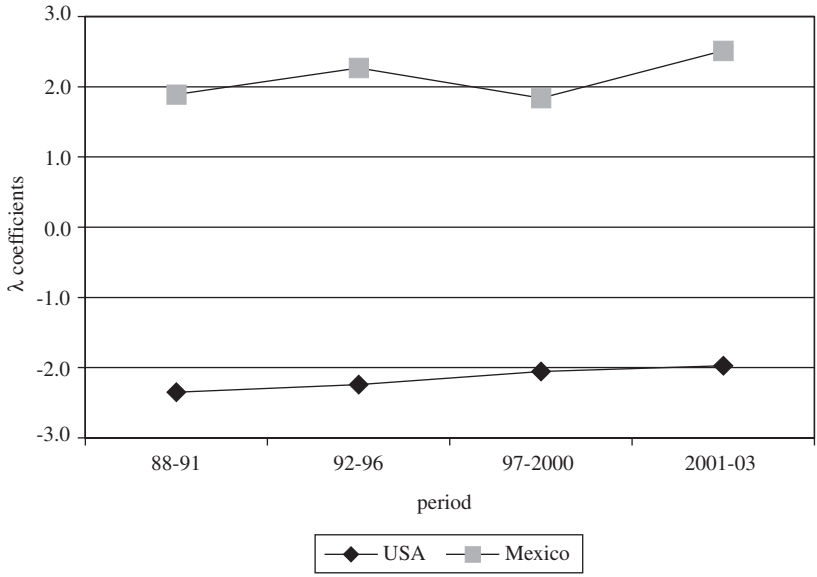
	1988-1991	1992-1996	1997-2000	2001-2003
U.S. imports from:				
MEXICO	1.304***	1.580***	1.474***	1.875***
CARICOM	0.616*	0.171	–0.033	–0.090
CACM	0.409	1.247***	1.366***	1.583***
CANADA	–2.378***	–2.017***	–2.059***	–2.085***
ANDEAN	0.868*	0.844***	0.540**	0.241
MERCOSUR	–0.604***	–0.371	–0.663***	–0.886***
Canadian imports from:				
USA	–2.353***	–2.238***	–2.043***	–1.961***
MEXICO	1.891***	2.283***	1.843***	2.513***
Mexican imports from:				
USA	0.314	0.888***	1.125***	0.891***
CARICOM	0.454	–0.082	–0.770	–1.806*
CACM	–0.821**	–1.046***	–1.173***	–0.546
CANADA	–0.045	0.595***	0.479**	0.640***
ANDEAN	0.132	0.300	–0.009	0.062
MERCOSUR	0.331	0.668**	–0.029	–0.049

Source: Authors' computations based on the model presented in section 2 and on data described in section 3.
Note: See annex table A and annex table B for the complete set of λ dummy variables. ***1%, **5%, *10%.

2. U.S. imports from Canada show a similar pattern. The dummy variable that measures the impact of these trade flows (surprisingly of negative value) was not statistically significant during the periods considered.
3. U.S. imports from CARICOM countries seemed to decrease throughout 1988-2003, but this dummy variable was significant only in the 1988-91 period (at the 10 percent level). When comparing its pre- and post-NAFTA values, its changes were not statistically significant.
4. U.S. imports from CACM countries did show a statistically significant increase when comparing the pre-NAFTA 1988-91 period with the post-NAFTA 1997-2000 years (and also with the 2001-03 period).
5. U.S. imports from ANDEAN and MERCOSUR countries did not show statistically significant changes after NAFTA.

Figure 2 presents the estimated values of the two dummy variables that track Canada's imports from the United States and Mexico. The main results of our estimates for Canada's imports from its two NAFTA partners, after controlling for country fixed effects and for gravity variables (see also table 1) are as follows:

FIGURE 2
λ COEFFICIENTS OF CANADA'S IMPORTS FROM THE UNITED STATES AND MEXICO



Source: Table 2.

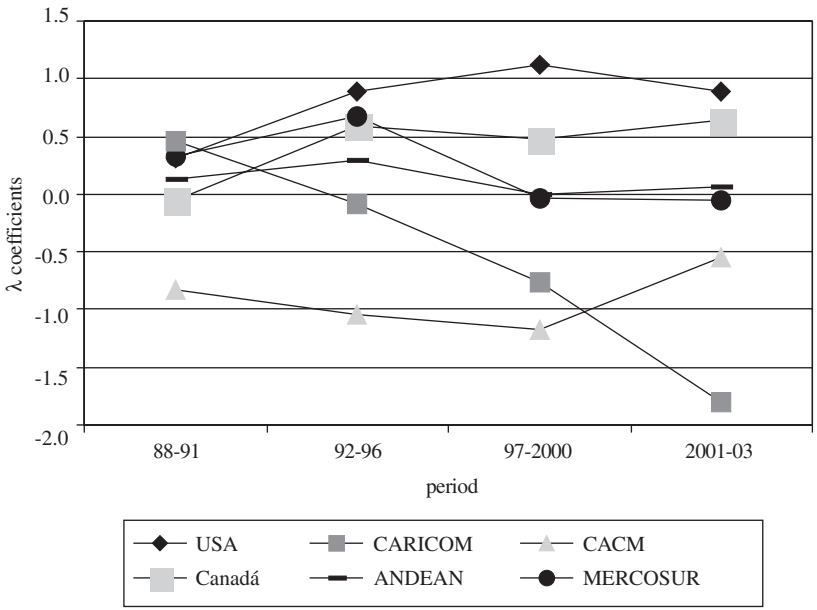
1. Canadian imports from the United States showed no changes in the post-NAFTA years.
2. Canadian imports from Mexico appeared to be statistically higher than in the pre-NAFTA years only in the 2001-2003 period, but not in the 1997-2000 period.

Figure 3 presents the estimated values of the key dummy variables that track Mexico's imports from the United States, from Canada, and from the Latin American and Caribbean RTAs. Following are the main results of our estimates for Mexico's imports, after controlling for country fixed effects and for gravity variables (see also table 2):

1. Mexican imports from the United States and from Canada were statistically higher in post-NAFTA periods.
2. Of the four dummy variables that track Mexican imports from the Latin American and the Caribbean RTAs, only the dummy variable for Mexican imports from CARICOM showed a statistically significant change (a decrease) in post-NAFTA years.

In light of what was pointed out in the introduction, the results for U.S. imports are not surprising. The United States' already low MFN tariff level before NAFTA implied only small tariff preferences for NAFTA members. Our

FIGURE 3
λ COEFFICIENTS OF MEXICO'S IMPORTS FROM THE UNITED STATES, CANADA, CARICOM, ANDEAN, CACM, AND MERCOSUR



Source: Table 2.

results show that these preferences were not sufficient (at least at the aggregate imports level) to trigger trade diversion. A similar explanation obtains for "excess" Canadian imports from the United States and (up to the 1997-2000 period) from Mexico.

For Mexico, our results show a statistically significant surge in imports from NAFTA members. It seems that the level of tariff preferences granted to Canada and to the United States in the context of NAFTA was sufficient to attract imports to Mexico from fellow members. Before NAFTA (i.e., in the 1988-91 period) imports from the United States were about the "normal" trade between countries of their size and distance predicted by the main variables in the gravity model, as indicated for the non statistically significant level of the coefficient. During NAFTA (i.e., in the 1992-96 period), "excess" imports rose to 37 percent and then to 208 percent in the post-NAFTA period (i.e., in the 1997-2000 period) [11]. Although in the subsequent period (2001-03) the "excess" imports decreased to 144 percent, the level of the λ_{MEX_USA} estimated coefficient was statistically higher than that for the pre-NAFTA periods, confirming the trend observed in the first post-NAFTA period. By the same token, before NAFTA,

[11] Due to the specification of the model the percent change is calculated as: $(\exp(\lambda_{MEX\_USA})-1)^{*}100$.

Mexican imports from Canada were about "normal" for countries of these sizes and distances. After NAFTA, Mexican imports from Canada turned out to be between 62 percent and 90 percent higher than one would expect by following gravity variables alone.

Finally, our model allowed us to check for the "stopover" effect, through which third non-NAFTA countries would increase exports to Mexico seeking indirect entry to the U.S. market. The absence of this stopover effect is congruent with the absence of a NAFTA effect on Mexican exports to the United States.

5. Other Studies

In addition to the mentioned Soloaga and Winters (2001) research, which we update and expand here, works by Frankel, Stein, and Wei (1997) and Krueger (2000) relate to the study presented in this paper. Nonetheless, following Soloaga and Winters (2001) only our statistical approach stresses the importance of *actually testing* for changes in the level of the estimates, a distinction that is not present, for instance, in Frankel, Stein, and Wei (1997) work.

Krueger (2000) recent work on NAFTA presents results that fully coincide with ours. Using data up to 1997, she concludes that "other events, especially affecting Mexican trade via the change in the real exchange rate and trade liberalization, appear to have dominated whatever effects NAFTA may have had on trade patterns to date." (pp. 770). She also adds that as a result of Mexico's unilateral trade liberalization since the late 1980s, one should expect an increasing trade/GDP ratio, which in fact happened (from less than 20 percent in the 1980s to around 70 percent in the 2000s). But also because two-thirds of Mexican trade was already with the United States, one also should expect an increasing trade with the United States. In line with Krueger's findings, we can add that the data show Mexican exports gaining market share not only in the U.S. market but also worldwide: Mexican market share in the U.S. market increased from 7 percent to 12 percent between 1992-93 and 2000-03 while Mexican exports market share in all the other countries besides the United States also almost doubled, rising from 0.16 percent to 0.27 percent in the same period. Although these higher exports levels could have been initially triggered by the 1994-95 sharp devaluation of the Mexican peso, by early 2000 in real terms the real devaluation was almost totally eroded by domestic inflation. Results from the same gravity model applied here to 1980-2003 data show a statistically significant positive increase in Mexican exports from 1988 and up to 1995 (results are not shown here due to space constraints but are available from the authors) with no additional changes after that. This reinforces the idea that trade liberalization from the late 1980s resides at the bottom of Mexican exports behavior.

A recent study obtains similar results to ours using a slightly different specification and variables over the 1962-1996 period (Carrère (Forthcoming)). To track the evolution of intra-bloc trade she models RTAs-specific dummies for two year periods (i.e, NAFTA has a dummy for intra-bloc trade for the 1988-89 period, other dummy for the 1990-91 period, and so on). Of particular interest is her finding that these two-year-average intra-NAFTA trade dummies were statistically significant since 1986-87, and its coefficient increasing since 1988-89, reflecting increasing intra-bloc trade since then. In our view these

results are better seen as the impact of Mexico's unilateral liberalization than an anticipation effect of NAFTA. Since her data end in 1996 we cannot make a full comparison to our results.

Two other recent studies (Garcés-Díaz (2001) and Romalis (2004)) analyze NAFTA's impact using alternative approaches to the gravity model. Using a time-series econometric approach, Garcés-Díaz (2001) found that the behavior of Mexican exports has not been affected in any meaningful way by the NAFTA agreement. His estimated exports supply equations show that the American economic expansion is the main reason for the observed outstanding performance of Mexican exports in the 1990s. The income effect accounts for 96 percent of the expansion in Mexican exports since 1994. These results hold even after more disaggregated data were analyzed.[12]

Using a different approach, Romalis (2004) finds that NAFTA and CUSFTA (Canada-U.S. Free Trade Agreement) have had substantial impacts on North American trade. His study identifies the impact of NAFTA by exploiting the substantial variation across commodities and time in the U.S. tariff preference given to goods produced in Canada and Mexico. The author finds that the recent rapid growth in Mexico's share of U.S. trade would have been much slower without NAFTA. He shows that Mexico's share of U.S. imports has increased most rapidly in commodities for which it has been given the greatest increase in tariff preference. For those commodities with at least a 10 percentages point increase in tariff preference for Mexican goods, the simple average of Mexico's share in U.S. imports has risen by 224 percent since 1993. This is an order of magnitude higher than the more modest 23 percent rise in all the other goods (i.e., those without increment in tariff preferences for Mexican goods). According to Romalis (2004), this implies that about 25 percent to 50 percent of all the increase in Mexican exports to the United Stated since 1993 is due to Mexico's preferential treatment. If, as Garcés-Díaz (2001) showed, the American economic expansion has been driving the observed increase in Mexican exports, income elasticities are crucial. Moreover, recent work done by Soloaga and Ramirez (2004) and Soloaga and Martínez (2005) found that the income elasticity of American demand for Mexican textiles is significantly higher than that for Mexican automobiles.[13] These facts cast some doubt on whether Romalis (2004) results would stand if we allowed income elasticities to differ across goods and not assume them to be the same for all goods, as he does in his paper. A higher income elasticity for some important Mexican exports included in his list of 298 commodities with "new tariff preference greater or equal than 10%" could well explain all the increment in Mexican exports by the American expansion without implicating any NAFTA effect. His paper does not present enough information for one to assess further the importance of this for his findings.

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12 Soloaga and Ramirez (2004), using an approach similar to that of Garcés-Díaz (2001), find that even for Mexico's textile industry all the export growth in the 1990s is explained by U.S. economic expansion and by relative wages between Mexico and other main exporters to the U.S. market. Soloaga and Martínez (2005) apply the same time-series approach to Mexico's automobile industry and find similar results: the United States' economic growth explains all the variation in exports without significant changes when considering periods before and after NAFTA.

13 See also similar results in Fukao, Okubo, and Stern (2003).

6. Sensitivity Analysis

We tested for the sensitivity of our results to different gravity equation specifications and different period averages. We reran our model imposing the restriction that the coefficient for $\log(GDP_{it}\, GDP_{jt})$ be equal to the theory (i.e., equal to 1) and found no changes in the main conclusions stated above. We also reran our model with averages for each three-year period (i.e., 1986-88 and 1989-91 as pre-NAFTA, and 1998-2000 and 2001-03 as post-NAFTA). Although the basic conclusions for U.S. imports from non-NAFTA countries remained the same (i.e., no third-country effect), we found that U.S. imports from Mexico for the 2001-2003 period were statistically higher –at the 95 percent confidence level– than those for the 1986-88 period. The 1989-91 levels were not statistically different than those of 1998-2000 or 2001-03.[14] Finally, as mentioned above, we rerun our model considering country fixed effects (exporters and importers) for the whole sample –and not country-time– fixed effect by period, as we did above. The main conclusion of our paper (no impact of NAFTA on third countries' trade) did not change. It is worth to mention that, in this specification, U.S. imports from Mexico did show a statistically significant increase (at the 10% level) in post-NAFTA years and that the change in Canadian imports from Mexico due to NAFTA was higher than in our results.

7. Conclusions

For the purpose of assessing the impact of NAFTA on third-country trade with the United States and with Mexico, this paper applied a theory-based gravity model to trade data, including a set of dummy variables that track specific country-pair trade. The up-to-date data set was averaged for pre- (1988-91) and post- (1997-2000 and 2001-03) NAFTA years. It was found that after controlling for the gravity variables and for country and time fixed effects, U.S. imports from Mexico, from Canada, and from the CARICOM, ANDEAN, and MERCOSUR blocs showed no statistically significant change, while U.S. imports from CACM countries increased. From these results we can conclude that the implementation of NAFTA in 1994 did not cause, at the aggregate level, trade diversion favoring Mexico or Canada at the expense of other Latin American and the Caribbean countries. These results are not surprising considering that the U.S. tariff preference granted to Mexico in the NAFTA framework was only about 2 percent. We also found that in the post-NAFTA years, trade between Mexico and Canada increased significantly, as did Mexican imports from the United States, most probably as a reflection of the higher tariff preferences –8 percent on average– granted by Mexico to its NAFTA partners. Finally, in line with the null NAFTA effect for Mexican exports, our analysis shows no indication of any stopover effect of NAFTA: Mexico's imports from the main Latin American and the Caribbean RTAs did not increase in post-NAFTA years.

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[14] In terms of our equation, we found in this specification the following values: $\lambda_{USA\_MEX\text{-}86\text{-}88} = 1.97$, $\lambda_{USA\_MEX\text{-}89\text{-}91} = 3.95$, $\lambda_{USA\_MEX\text{-}98\text{-}00} = 3.41$, and $\lambda_{USA\_MEX\text{-}01\text{-}03} = 4.95$. All of them were statistically significant at conventional levels, but only $\lambda_{USA\_MEX\text{-}86\text{-}88}$ and $\lambda_{USA\_MEX\text{-}01\text{-}03}$ were statistically different from each other.

ANNEX TABLES

ANNEX TABLE A
λ COEFFICIENTS

Variable	Coefficient	White's Std. Error	*t*-statistic	*P* value
$\lambda_{USA\_MEX\_88\text{-}91}$	1.304	0.287	4.540	0
$\lambda_{USA\_MEX\_92\text{-}96}$	1.580	0.262	6.030	0
$\lambda_{USA\_MEX\_97\text{-}2000}$	1.474	0.266	5.550	0
$\lambda_{USA\_MEX\_2001\text{-}03}$	1.875	0.275	6.810	0
$\lambda_{USA\_CAN\_88\text{-}91}$	–2.378	0.221	–10.780	0
$\lambda_{USA\_CAN\_92\text{-}96}$	–2.017	0.228	–8.860	0
$\lambda_{USA\_CAN\_97\text{-}2000}$	–2.059	0.210	–9.820	0
$\lambda_{USA\_CAN\_2001\text{-}03}$	–2.085	0.225	–9.250	0
$\lambda_{USA\_CACM\_88\text{-}91}$	0.409	0.435	0.940	0.347
$\lambda_{USA\_CACM\_92\text{-}96}$	1.247	0.260	4.800	0
$\lambda_{USA\_CACM\_97\text{-}2000}$	1.366	0.319	4.280	0
$\lambda_{USA\_CACM\_2001\text{-}03}$	1.583	0.342	4.630	0
$\lambda_{USA\_CARICOM\_88\text{-}91}$	0.616	0.307	2.000	0.045
$\lambda_{USA\_CARICOM\_92\text{-}96}$	0.171	0.359	0.480	0.635
$\lambda_{USA\_CARICOM\_97\text{-}2000}$	–0.033	0.385	–0.090	0.931
$\lambda_{USA\_CARICOM\_2001\text{-}03}$	–0.090	0.428	–0.210	0.833
$\lambda_{USA\_ANDEAN\_88\text{-}91}$	0.868	0.459	1.890	0.059
$\lambda_{USA\_ANDEAN\_92\text{-}96}$	0.844	0.326	2.590	0.01
$\lambda_{USA\_ANDEAN\_97\text{-}2000}$	0.540	0.254	2.130	0.034
$\lambda_{USA\_ANDEAN\_2001\text{-}03}$	0.241	0.233	1.030	0.301
$\lambda_{USA\_MERCOSUR\_88\text{-}91}$	–0.604	0.227	–2.660	0.008
$\lambda_{USA\_MERCOSUR\_92\text{-}96}$	–0.371	0.239	–1.550	0.121
$\lambda_{USA\_MERCOSUR\_97\text{-}2000}$	–0.663	0.205	–3.240	0.001
$\lambda_{USA\_MERCOSUR\_2001\text{-}03}$	–0.886	0.228	–3.890	0
$\lambda_{MEX\_USA\_88\text{-}91}$	0.314	0.247	1.270	0.203
$\lambda_{MEX\_USA\_92\text{-}96}$	0.888	0.220	4.040	0
$\lambda_{MEX\_USA\_97\text{-}2000}$	1.125	0.245	4.590	0
$\lambda_{MEX\_USA\_2001\text{-}03}$	0.891	0.261	3.420	0.001
$\lambda_{MEX\_CAN\_88\text{-}91}$	–0.045	0.203	–0.220	0.823
$\lambda_{MEX\_CAN\_92\text{-}96}$	0.595	0.171	3.480	0
$\lambda_{MEX\_CAN\_97\text{-}2000}$	0.479	0.201	2.390	0.017
$\lambda_{MEX\_CAN\_2001\text{-}03}$	0.640	0.207	3.100	0.002
$\lambda_{MEX\_CACM\_88\text{-}91}$	–0.821	0.402	–2.040	0.041
$\lambda_{MEX\_CACM\_92\text{-}96}$	–1.046	0.404	–2.590	0.01
$\lambda_{MEX\_CACM\_97\text{-}2000}$	–1.173	0.402	–2.920	0.004
$\lambda_{MEX\_CACM\_2001\text{-}03}$	–0.546	0.439	–1.240	0.214
$\lambda_{MEX\_CARICOM\_88\text{-}91}$	0.454	0.373	1.220	0.223
$\lambda_{MEX\_CARICOM\_92\text{-}96}$	–0.082	0.481	–0.170	0.865
$\lambda_{MEX\_CARICOM\_97\text{-}2000}$	–0.770	0.563	–1.370	0.171
$\lambda_{MEX\_CARICOM\_2001\text{-}03}$	–1.806	0.969	–1.860	0.062
$\lambda_{MEX\_ANDEAN\_88\text{-}91}$	0.132	0.617	0.210	0.831
$\lambda_{MEX\_ANDEAN\_92\text{-}96}$	0.300	0.536	0.560	0.576

$\lambda_{MEX\_ANDEAN\_97\text{-}2000}$	–0.009	0.509	–0.020	0.986
$\lambda_{MEX\_ANDEAN\_2001\text{-}03}$	0.062	0.640	0.100	0.923
$\lambda_{MEX\_MERCOSUR\_88\text{-}91}$	0.331	0.359	0.920	0.357
$\lambda_{MEX\_MERCOSUR\_92\text{-}96}$	0.668	0.288	2.320	0.02
$\lambda_{MEX\_MERCOSUR\_97\text{-}2000}$	–0.029	0.340	–0.090	0.932
$\lambda_{MEX\_MERCOSUR\_2001\text{-}03}$	–0.049	0.485	–0.100	0.919
$\lambda_{CAN\_USA\_88\text{-}91}$	–2.353	0.230	–10.230	0
$\lambda_{CAN\_USA\_92\text{-}96}$	–2.238	0.213	–10.500	0
$\lambda_{CAN\_USA\_97\text{-}2000}$	–2.043	0.204	–9.990	0
$\lambda_{CAN\_USA\_2001\text{-}03}$	–1.961	0.216	–9.080	0
$\lambda_{CAN\_MEX\_88\text{-}91}$	1.891	0.260	7.280	0
$\lambda_{CAN\_MEX\_92\text{-}96}$	2.283	0.209	10.950	0
$\lambda_{CAN\_MEX\_97\text{-}2000}$	1.843	0.220	8.390	0
$\lambda_{CAN\_MEX\_2001\text{-}03}$	2.513	0.216	11.650	0
$\lambda_{CACM\_MEX\_88\text{-}91}$	1.056	0.331	3.190	0.001
$\lambda_{CACM\_MEX\_92\text{-}96}$	0.914	0.226	4.040	0
$\lambda_{CACM\_MEX\_97\text{-}2000}$	0.826	0.244	3.380	0.001
$\lambda_{CACM\_MEX\_2001\text{-}03}$	1.323	0.317	4.170	0
$\lambda_{ANDEAN\_MEX\_88\text{-}91}$	1.462	0.276	5.290	0
$\lambda_{ANDEAN\_MEX\_92\text{-}96}$	1.516	0.222	6.830	0
$\lambda_{ANDEAN\_MEX\_97\text{-}2000}$	1.093	0.301	3.630	0
$\lambda_{ANDEAN\_MEX\_2001\text{-}03}$	1.652	0.315	5.250	0
$\lambda_{ANDEAN\_USA\_88\text{-}91}$	0.704	0.203	3.460	0.001
$\lambda_{ANDEAN\_USA\_92\text{-}96}$	0.700	0.166	4.230	0
$\lambda_{ANDEAN\_USA\_97\text{-}2000}$	0.705	0.169	4.180	0
$\lambda_{ANDEAN\_USA\_2001\text{-}03}$	0.626	0.212	2.950	0.003
$\lambda_{CACM\_USA\_88\text{-}91}$	0.468	0.360	1.300	0.194
$\lambda_{CACM\_USA\_92\text{-}96}$	0.594	0.155	3.840	0
$\lambda_{CACM\_USA\_97\text{-}2000}$	0.938	0.181	5.200	0
$\lambda_{CACM\_USA\_2001\text{-}03}$	0.935	0.250	3.750	0
$\lambda_{CARICOM\_MEX\_88\text{-}91}$	0.478	0.397	1.200	0.229
$\lambda_{CARICOM\_MEX\_92\text{-}96}$	0.639	0.280	2.280	0.022
$\lambda_{CARICOM\_MEX\_97\text{-}2000}$	1.014	0.249	4.070	0
$\lambda_{CARICOM\_MEX\_2001\text{-}03}$	1.285	0.225	5.700	0
$\lambda_{CARICOM\_USA\_88\text{-}91}$	–0.019	0.241	–0.080	0.936
$\lambda_{CARICOM\_USA\_92\text{-}96}$	0.133	0.212	0.630	0.531
$\lambda_{CARICOM\_USA\_97\text{-}2000}$	0.372	0.194	1.920	0.055
$\lambda_{CARICOM\_USA\_2001\text{-}03}$	0.242	0.183	1.320	0.186
$\lambda_{MERCOSUR\_MEX\_88\text{-}91}$	2.099	0.258	8.120	0
$\lambda_{MERCOSUR\_MEX\_92\text{-}96}$	1.971	0.219	9.020	0
$\lambda_{MERCOSUR\_MEX\_97\text{-}2000}$	1.470	0.313	4.690	0
$\lambda_{MERCOSUR\_MEX\_2001\text{-}03}$	1.816	0.288	6.310	0
$\lambda_{MERCOSUR\_USA\_88\text{-}91}$	0.531	0.234	2.270	0.023
$\lambda_{MERCOSUR\_USA\_92\text{-}96}$	0.735	0.226	3.260	0.001
$\lambda_{MERCOSUR\_USA\_97\text{-}2000}$	0.931	0.244	3.810	0
$\lambda_{MERCOSUR\_USA\_2001\text{-}03}$	0.929	0.229	4.070	0

Source: Authors' computations based on the model presented in section 2 and on data described in section 3.

Note: The model was estimated as a single OLS regression, allowing for all coefficients, including time and country fixed effects, to be different in all periods.

ANNEX TABLE B
λ ESTIMATES: INTRA-BLOC TRADE

Variable	Coefficient	White's Std. Error	*t*-statistic	*P* value
$\lambda_{ANDEANij\_88\text{-}91}$	0.708	0.317	2.230	0.026
$\lambda_{ANDEANij\_92\text{-}96}$	1.269	0.278	4.570	0
$\lambda_{ANDEANij\_97\text{-}2000}$	1.904	0.334	5.710	0
$\lambda_{ANDEANij\_2001\text{-}03}$	2.179	0.380	5.740	0
$\lambda_{ASEANij\_88\text{-}91}$	–0.548	0.237	–2.310	0.021
$\lambda_{ASEANij\_92\text{-}96}$	–0.957	0.258	–3.700	0
$\lambda_{ASEANij\_97\text{-}2000}$	–0.752	0.291	–2.580	0.01
$\lambda_{ASEANij\_2001\text{-}03}$	–0.793	0.291	–2.720	0.007
$\lambda_{CACNij\_88\text{-}91}$	1.341	0.306	4.380	0
$\lambda_{CACNij\_92\text{-}96}$	1.443	0.257	5.620	0
$\lambda_{CACNij\_97\text{-}2000}$	1.722	0.233	7.400	0
$\lambda_{CACNij\_2001\text{-}03}$	2.102	0.251	8.390	0
$\lambda_{CARICOMij\_88\text{-}91}$	2.530	0.293	8.650	0
$\lambda_{CARICOMij\_92\text{-}96}$	2.580	0.239	10.770	0
$\lambda_{CARICOMij\_97\text{-}2000}$	2.589	0.215	12.030	0
$\lambda_{CARICOMij\_2001\text{-}03}$	2.675	0.214	12.510	0
$\lambda_{ECOWASij\_88\text{-}91}$	1.213	0.293	4.140	0
$\lambda_{ECOWASij\_92\text{-}96}$	1.120	0.257	4.350	0
$\lambda_{ECOWASij\_97\text{-}2000}$	1.222	0.243	5.030	0
$\lambda_{ECOWASij\_2001\text{-}03}$	1.601	0.254	6.310	0
$\lambda_{EFTAij\_88\text{-}91}$	–0.169	0.259	–0.650	0.515
$\lambda_{EFTAij\_92\text{-}96}$	0.011	0.229	0.050	0.962
$\lambda_{EFTAij\_97\text{-}2000}$	0.144	0.228	0.630	0.528
$\lambda_{EFTAij\_2001\text{-}03}$	0.089	0.215	0.410	0.678
$\lambda_{EUij\_88\text{-}91}$	–1.398	0.112	–12.440	0
$\lambda_{EUij\_92\text{-}96}$	–1.194	0.108	–11.060	0
$\lambda_{EUij\_97\text{-}2000}$	–0.999	0.108	–9.240	0
$\lambda_{EUij\_2001\text{-}03}$	–1.009	0.108	–9.320	0
$\lambda_{MERCOSURij\_88\text{-}91}$	0.428	0.431	0.990	0.321
$\lambda_{MERCOSURij\_92\text{-}96}$	0.779	0.409	1.900	0.057
$\lambda_{MERCOSURij\_97\text{-}2000}$	1.150	0.450	2.560	0.011
$\lambda_{MERCOSURij\_2001\text{-}03}$	0.990	0.482	2.060	0.04
$\lambda_{UDEACij\_88\text{-}91}$	3.044	0.736	4.130	0
$\lambda_{UDEACij\_92\text{-}96}$	2.492	0.708	3.520	0
$\lambda_{UDEACij\_97\text{-}2000}$	2.761	0.613	4.500	0
$\lambda_{UDEACij\_2001\text{-}03}$	2.552	0.649	3.930	0

Source: Authors' computations based on the model presented in section 2 and on data described in section 3.

Note: The model was estimated as a single OLS regression, allowing for all coefficients, including time and country fixed effects, to be different in all periods.

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