

Latin American Exports: Has Brazil displaced them?

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Abstract

This study makes use the gravity model in order to determine whether Brazil's exports growth has negatively affected the volumes exported by other countries in the region.

Estimations were made to define: a) whether the displacement effect has been uniform over the whole period; b) whether it has been the same one for all exporting countries; c) whether it can be verified that the importer is a country belonging to the LAIA and d) whether part of the effect has been compensated by redirecting exports to Brazil by the other ten Latin American countries.

The main conclusions for the 1989-2006 period is that there is no evidence of the displacement effect on the part of Brazil. However, such effect appears as relevant as from the year 2000 if two sub-periods are taken into consideration. Besides, if the Latin American countries are split into two clusters, it may be seen that there was only one displacement effect on the exports of the so-called cluster of monoexporting countries. Finally, limiting the importing countries to members of the LAIA, the results show that for the whole period, there was a displacement effect as the consequence of Brazil's exports rise. If the analysis is limited to manufactured goods, the displacement effect is higher.

I. Introduction

Over the past 20 years, Brazil has gone through a relevant economic transformation process based on different international trade liberalization measures. Along with having implemented different unilateral reforms, this country has signed a considerable number of Preferential Trade Agreements with other countries in the region, such as Argentina, Paraguay, Uruguay, Chile, Bolivia, Mexico, Cuba, Peru, Ecuador, Colombia and Venezuela, which have similar or less development level, in the framework of the Latin American Integration Association (LAIA). Some of the mentioned agreements are bilateral while others were subscribed within the MERCOSUR; all of them include different degrees of trade liberalization

Although those policy reforms, intensified as from the 1990s, have not exactly allowed Brazil a spectacular growth as in China or India, it is the only Latin American country that over the past 16 years has shown a sustained growth of its GDP at an annual average rate of 2.8%.

Brazil has strengthened its trade relations in the international markets and has doubled market share in just a few years. Also, if measured in terms of its exports and imports in relation to its GDP, the case is similar. Although they fluctuate, the Brazilian annual exports growth rates have reached a 6.4% mean in the 1989-2007 period, and has grown some 76% just over the last four years.

The gravity model is estimated in this work with the purpose of defining whether Brazil's exports growth has negatively affected the exports volumes of other countries in the region; in particular, the ten following Latin American countries: Argentina, Bolivia, Colombia, Chile, Ecuador, Mexico, Paraguay, Peru, Uruguay and Venezuela.

The gravity model applied to international trade is based on the assumption that trade between any two countries is directly related to size (usually measured by the gross product and by the per-capita product) and inversely related to transaction costs (distance, adjacency, language, others). It has been extensively used to quantify the integration trade agreements effects in terms of the advantages it shows concerning the possibility of separating such effects from other factors which are also relevant in international trade. Other works which analyse the theoretical aspects of this model have come to the conclusion that, in general, it is not possible to state that the gravity equation responds to a particular international trade model (Anderson, 1979; Bergstrand, 1985; Helpman and Krugman, 1985; Deardoff, 1995; Evenett and Keller, 1988 and Anderson and Mercoullier, 1999).

Without taking the theoretical foundations into account, the empirical success of the gravity model is based on its ability to incorporate different phenomena occurring in international trade, such as: impact of monetary unions (Rose, 2000), regional trade agreements (Soloaga and Winters, 2001; Martínez Zarzoso and Nowak-Lehman, 2003; Azevedo, 2001; Carrillo and Li, 2002; Recalde and Florensa, 2005a, 2005b, 2006), trade potential calculations (Nilsson, 2000; Egger, 2002), the Chinese exports displacement effects on Asian countries (Eichengreen et al. 2004; Greenaway et al. 2008), and others.

When the estimations were made, there was the possibility that in the specified gravity equation, the explicative variable used to corroborate the central hypothesis of the study, could be correlated to the error term. It was solved with the use of the Instrumental Variables (IV). As the errors were heteroskedastic, the instrumental variable estimator is the Generalized Method of Moment (GMM) estimator. Additionally to obtaining the parameter estimates, the tests of hypothesis are also carried out to determine whether the chosen instruments prove valid and relevant.

To complete the analysis of the results, estimations were made to define: a) whether the displacement effect has been uniform over the whole period; b) whether it has been the same one for all exporting countries; c) whether it can be verified that the importer is a country belonging to the LAIA and d) whether part of the effect has been compensated by redirecting exports to Brazil by the other ten Latin American countries.

This paper is organized as follows: after the introduction, Section 2 offers a short description of the main characteristics of Brazil's international trade over the last 20 years; the model used and the theoretical foundations are found in Section 3; Section 4 deals with the sources and the estimation methods. Section 5 discusses the econometric results, followed, finally, by the conclusions.

2. Brazil's exporting performance

Traditionally, Brazil has offered a greater variety of goods for export than most of the other Latin American countries. Although the relevance of the agricultural products for export is slightly higher than in the rest of Central and South America, they constitute almost twice as much concerning manufactured goods. It means that Brazil is not only larger in size than most of the rest of the Latin American countries but also that it has implemented its own economic policies over time.

Quite broadly and with small differences, the economic policies over the 1970s and 1980s were characterised by a significant anti-exporting bias, the result of previous imports substitution policies. Such bias lessens in the mid-1990s, with the economy's openness and the liberalisation, privatisation and deregulation policies, which appealed to direct external investment; it meant a qualitative leap in agribusiness as the result of a long modernisation, mechanisation and agricultural expansion process and of a more competitive exchange rate started in 1999. A favourable international context with greater world demand and increase in the price of commodities must also be considered over the more recent years.

Cautelar Pinheiro, A. and Bonelli, R. (2007) showed, by using the Hirschman-Herfindahl Index (HHI) that in the years 1975-2005 there was an uninterrupted Brazilian exports diversification process. In 2005, the ten leading sectors and their respective relative shares were: a) auto parts and vehicles: 9.0%; b) mineral extraction: 7.7%; c) steel: 7.4%; d) animal products: 6.8%; e) automobiles: 5.8%; f) machinery, equipments and tractors: 5.5%; g) agriculture and livestock: 5.5%; h) oil and petro-chemicals: 5.3%; i) vegetable oils: 3.6%; j)

oils and coal: 3.5%. The HHI shows that the re-emergence of traditional exports has also contributed importantly to the recent exporting boom. The above-mentioned study identifies two periods of rapid growth of Brazil's exports: 1975-85 and 1995-2005, both with similar annual growth rates but quite higher in some sectors. The first of the periods mentioned shows substantial diversification while the second introduces smaller changes in the sectoral distribution of exports. These conclusions have been ratified by Ríos, S. and Iglesias, R. (2005), who state that the technological innovations introduced in the exported goods in 2003 and 2004 did not play a significant role in Brazil's exports boom except for a reduced number of non-traditional markets (India, South Korea, Russia, South Africa and Thailand). In the case of the traditional market countries (USA, Japan and the EU), and also in countries like Canada, Costa Rica and Mexico in the American Continent, the innovations do not reflect a high value of the Brazilian exports to those places. Markwald and Ribeiro (2006) show that the exports structure between 1998 and 2004 did not suffer important changes, with the sole exception of the explosive rise of fuels (oil and derivatives), which more than doubled in the period. In the so-called exporting boom (2002-07), the sectors that contributed most to growth were machinery & tractors and automotives.

Brazil leads the world exports of soy, sugar, coffee, beef, chicken, orange juice and tobacco; it is second world exporter of soy oil and flour. It is the largest world producer of coffee, sugar and orange juice, and second in the world production of tobacco, soy and beef. In spite of the excellent exporting performance of agricultural products, it has not changed its relative share of manufactured goods over total exports; both the agricultural and the manufactured goods exports have introduced growing diversification in their products.

With reference to market performance, Table 1 shows that the traditional market share for Brazilian exports (USA, EU, Japan and Mercosur) has shrunk considerably in a short period, with an overall fall from 68% to 58% between the periods 1990-93 and 2002-06. The important diversification of the exported products observed in the 1970s and 1980s can now be seen in a greater diversification of consumer markets, the result of the rise of food exports to China and Hong Kong, Africa and the Arab Countries, and in the larger sales of fuels and machinery to countries in Central and South America.

On the other hand, Brazil increased its world market penetration even in a context of unfavourable international prices (2003 and 2004). It may be said that the rise of the Brazilian share was generalised, because - with the exception of the Japanese market - the country increased its share in almost all other markets (Table 2). If the kind of product is considered, it proves striking that the goods contributing most to raising market share are the

Table 1: Brazil's Exports Main Destinations (%)

Destination	1982-1985	1986-1989	1990-1993	1994-1997	1998-2001	2002-2006
Total EU	29,6	29,4	30,1	27,5	27,4	23,0
Arab Countries and Africa	8,4	4,9	4,3	3,3	3,5	4,8
USA	26,2	26,7	22,1	19,9	23,5	21,9
Mexico	1,1	0,8	2,5	1,6	2,7	3,6
Argentina	2,9	2,1	6,4	10,5	11,0	7,4
Uruguay and Paraguay	1,8	2,7	3,1	4,4	3,0	1,6
Total Mercosur	4,7	4,8	9,5	14,9	14,0	9,0
Rest of Latin America	5,6	7,8	7,4	8,2	7,9	10,6
Japan and South Korea	6,6	7,7	8,6	7,8	5,3	4,5
China and Hong Kong	2,2	2,4	2,2	3,1	3,0	6,5
Rest of the World	14,7	14,3	12,6	12,7	11,8	15,2
Total	100,0	100,0	100,0	100,0	100,0	100,0

Source: The authors' elaboration following the data of the World Integrated Trade Solution (WITS)

primary products and the semi-manufactured goods, followed in importance by the manufactured goods produced by intensive industries in economies of scale and by the capital goods industries. Consequently, it may be stated that the market geographic diversification has contributed to exports growth, especially when the demand of the South American markets fell and the international prices evolved unfavourably, affecting the traditional markets performance (EU and Japan).

Table 2: Brazil's Market Penetration (Imports from Brazil / Total Imports)

	1998	2002	2004	2006
Africa	0,84	1,32	1,93	1,96
Central America and the Caribbean	1,44	2,47	4,54	5,25
Chile	6,68	10,90	13,11	13,15
China	1,02	1,32	2,00	2,17
USA and Canada	1,06	1,32	1,42	1,43
Eastern Europe	0,76	0,93	0,77	0,87
Japan	1,12	0,85	0,86	0,95
Middle East	1,40	1,62	1,51	1,57
Mercosur	23,92	28,01	33,44	33,11
Mexico	0,85	1,57	2,27	2,24
Oceania	0,35	0,37	0,40	0,48
South East Asia	0,58	0,65	0,83	0,79
European Union	0,78	0,76	0,82	0,81
Rest of the World	0,94	0,95	1,02	1,19

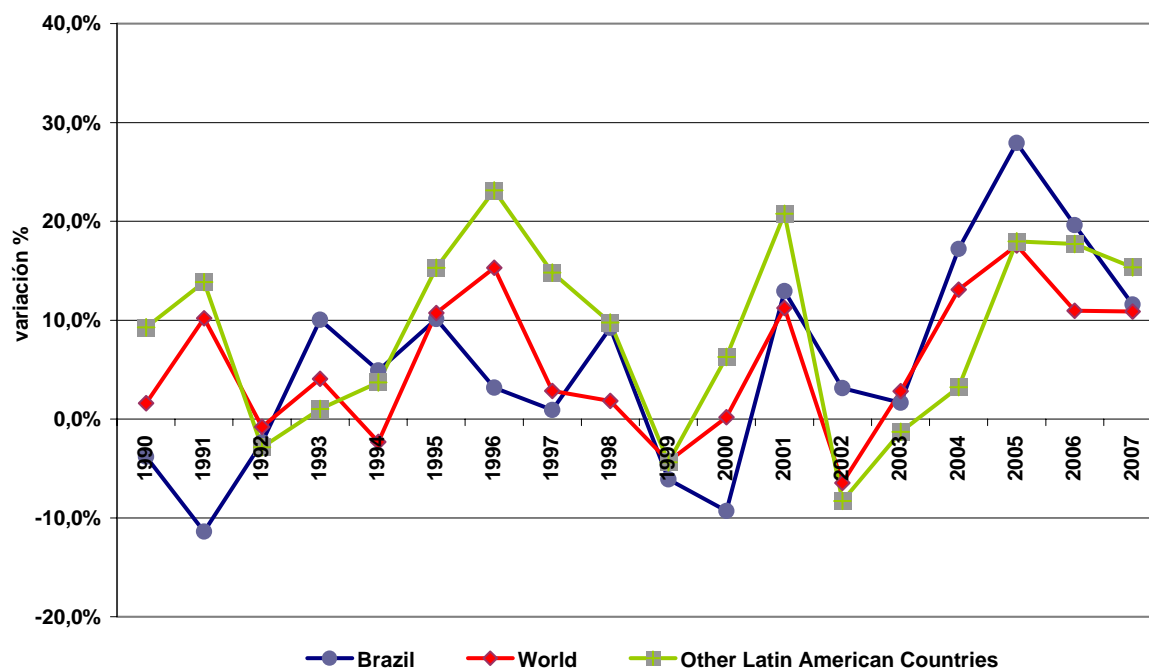
Source: The authors' elaboration following the data of the World Integrated Trade Solution (WITS)

Although Brazil has subscribed a considerable number of Preferential Trade Agreements¹, there are authors who think that since the creation of Mercosur, those agreements have not been relevant. Ríos and Iglesias (2005) have written: “Apart from the free trade agreements jointly signed by Mercosur with Chile and Bolivia in 1996 and with the countries belonging to Andean Community in 2003 after a long period of negotiations, the other negotiated agreements (Mexico, India and South Africa) are very restrictive concerning the products included and the preference levels given and received”. Accordingly, Brazil’s improved exporting performance may be found rather in the exogenous factors to the economy, such as the world economy growth and the commodities price rise, which along with the currency devaluation of January of 1999, generated greater competitiveness for agro-industrial products and a greater geographical exports diversification. Nevertheless, Markwald and Ribeiro (2006) have pointed out that Brazil’s optimum exporting performance since 2001 cannot be explained only by the world economy growth: the mere fact that Brazil is capable of growing at the same or at higher international trade rates is itself highly positive, if it is recalled that historically it showed serious difficulties to maintain a sustained exports growth above world growth.

The relevance of the international trade in the Brazilian economy is evidenced in the trade flows share increase ($X + M$) of the GDP. In the initial years of the 1990s, they represented 16% and reached 26% in 2007. Additionally, Brazil’s world trade share growth has been taking place as from the beginnings of the present decade, but has intensified over the past recent years. The so-called Brazilian exporting boom of these last five years, quite diversified in product and market composition, can be seen in the elevated annual exports growth rate (19% between 2004 and 2007), which largely outgrows the mean of the world exports and of most of the countries in the region (Fig.1). Such performance strongly contrasts with what took place between 1990 and 2000 when performance fluctuated and the average annual growth was barely 1.5%. Fig. 1 clearly shows the exports performance break of 2001.

¹ See Moncarz et al. (2009) for further information on the mentioned agreements.

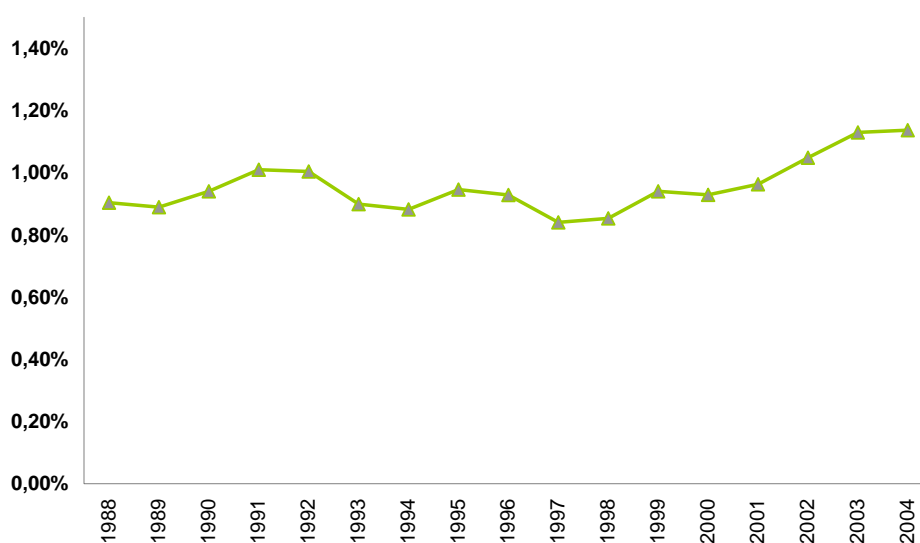
Figure 1: Exports Growth Rates (in constant 2000 US dollars)



Source: The authors' elaboration following the World Development Indicators (WDI)

As a result of this process, Brazil has increased its world exports share from 0.85% in 2001 to 1.15% seven years later (Fig.2), which means over 35% rise. This is, then, one of the best performances if compared with the rest of Latin America's countries. If only agricultural exports are taken into consideration, the world agricultural exports share percentages went from 2.7% in 2001 to 4.5% in 2005. Also, Brazil's imports grew quite similarly to exports; they represented 10% of the GDP in 2007 and show an increasing trend over the past years.

Figure 2: Brazil's Share in World Exports (1988-2006)



Source: The authors' elaboration following the World Development Indicators (WDI)

The above analysis clearly shows that Brazil has experienced an acceleration of its exports growth which can be seen in its world exports share increase and its access to new markets. Have Brazil's exports grown at the expense of those of the other countries in the region? Has there been displacement? It is the aim of this study to answer these questions.

3. The model used

The gravity model used to measure trade flows, was created in the 1960s by Tinbergen (1962), Poyhonen (1963) and Linnemann (1966). These authors originally determined the explicative variables of the trade flows between any two countries. Essentially, they respond to three factors: those related to the exporting country's potential supply, those linked to the importing country's potential demand and those related to the natural or artificial resistance to trade. The explicative variables generally used have been: the GDP (the expectation is that trade between two countries would grow in size and, therefore, the gross product proves a good proxy), the per-capita GDP of the importing and exporting countries (the higher the development level the greater the variety of products demanded and supplied) and the distance between each pair of countries serving as the resistance proxy. To the gravity equation, other variables are usually added which also affect trade as do cultural similarities indicators, shared geographical borders, being or not an island or colonial territory, etc. Import tariffs, quantitative restrictions, currency exchange controls and others may be considered artificial resistance measures, but, in general, they are not taken into account because these models include a lot of countries and, then, the data is hard to gather².

Because the principal aim of this work is to determine whether Brazil's exports growth has displaced other countries in the region, the gravity equation specification that follow, according to Eichengreen et al. (2004) and Greenaway et al. (2008), have been adopted:

$$\begin{aligned} \ln M_{ijt} = & \beta_0 + \beta_1 \ln X_{Bra_{it}} + \beta_2 \ln GDP_{it} + \beta_3 \ln GDP_{jt} + \beta_4 \ln GDPPC_{it} \\ & + \beta_5 \ln GDPPC_{jt} + \beta_6 \ln Dist_{ij} + \beta_7 Landl_{ij} + \beta_8 Island_{ij} \\ & + \beta_9 Border_{ij} + \beta_{10} Language_{ij} + \beta_{11} Colony_{ij} + \varepsilon_{ijt} \end{aligned} \quad (1)$$

Where:

M_{ijt} Imports of country i from Latin American country j

$X_{Bra_{it}}$ Brazil's exports to country i

² See Recalde and Florensa (2006) for detailed antecedents and uses of the gravity model in International trade.

GDP_{it} Real GDP of importing country

GDP_{jt} Real GDP of exporting country

$GDPPC_{it}$ Real GDP per capita of importing country

$GDPPC_{jt}$ Real GDP per capita of exporting country

$Dist_{ij}$ Distance between i and j

$Landl_{ij}$ Number of landlocked countries in country pair

$Island_{ij}$ Number of island nations in country pair

$Border_{ij}$ Binary dummy which is unity if i and j share a land border, zero otherwise

$Language_{ij}$ Binary dummy which is unity if i and j share common language, zero otherwise

$Colony_{ij}$ Binary dummy which is unity if i ever colonized j and vice-versa, zero otherwise

ε_{ijt} error term

The coefficients corresponding to the variables GDP_{it} , GDP_{jt} , $GDPPC_{it}$, $GDPPC_{jt}$, $Border_{ij}$, $Language_{ij}$ and $Colony_{ij}$ are expected to be positive while those for variables $Dist_{ij}$, $Landl_{ij}$ and $Island_{ij}$ are expected to be negative.

If Brazil's exports displacement of other countries in the region is indeed the case, the coefficient of the variable $XBra_{it}$ should be negative and statistically significant.

4. Data and estimation method

a- Sources

World Integrated Trade Solution (WITS) provided the quoted data concerning trade flows. Both imports and exports have been valued in American dollars, deflated according to the USA Consumer Price Index (CPI). The Real Gross Domestic Product and the Per-Capita GDP, valued at constant dollars of the year 2000 were obtained from the online World Development Indicators of the World Bank. The data related to each country's specific variables (language, common borders, exit to sea) were taken from the CEPII for gravity models (<http://www.cepii.fr>).

The panel data covers the trade flow observations of 158 importing countries and ten Latin American exporting countries. See list of countries in Annex 1. The analysed period is 1989-2006.

b- Estimation method

The proposed gravity equation specification and the characteristics of the data bear consequences on the estimation method chosen. Because the factors included in the error

term affecting the imports of country i from the Latin American country j , it is probable that they may influence the Brazilian exports to i ; the variable of interest to determine whether there has, in fact, been a displacement effect ($XBra$) may be endogenous. Thereby, the estimation by OLS is not advisable. The solution to this issue is to use the Instrumental Variables Method. Brazil's exports are instrumented by:

- i) Brazil's real GDP
- ii) The distance between Brazil and the importer country i

Two-Stage Least Squares (TSLS) represent the classical estimation method with instrumental variables; however, the estimator is efficient only when errors are homoskedastic. For this reason, the data characteristics were mentioned at the start of this section.

There are strong evidence of heteroskedasticity in trade data; for this reason, the model was initially estimated by TSLS to be able to later determine the presence of heteroskedasticity. The Breusch-Pagan/Godfrey and White/Koenker statistics, which are standard heteroskedasticity tests in OLS, are valid in the context of instrumental variables only if the structural equations belonging to endogenous regressors are homoskedastic. Then, the Pagan and Hall heteroskedasticity test is used, which reduces the demands previously mentioned. Under the null hypothesis of homoskedasticity, the Pagan-Hall statistic is distributed as chi-square with degrees of freedom equal to the number of regressors in the main equation.

When estimating the model with TSLS, the value of the Pagan-Hall statistic throws 1195.47, significant at 1%. In the presence of heteroskedasticity, the gravity equation parameters should be estimated with the Generalized Method of Moment (GMM) because this estimator is more efficient than the one obtained with the TSLS. The only problem with the GMM estimator is that it does not possess good statistical properties in small samples; but, because in the present model there are over 7000 observations per each regression that was carried out, it should, then, not mean a problem at all. After estimating the gravity equation with the GMM, tests were made to determine whether the $XBra$ is endogenous and whether the instruments chosen are valid in the sense that they should be orthogonal to the error term.

With the first issue, the test of endogeneity was used; under the null of exogeneity, the statistic is distributed as a chi-square with degrees of freedom equal to the number of variables suspected of being endogenous. The validity of the instruments is proved with the

use of the Hansen J test because the equation is over-identified. Following the null hypothesis in which the instruments are orthogonal to the error term, the statistical J shows a chi-squared distribution with degrees of freedom equal to the number of over-identification restrictions.

Finally, it must be mentioned that it was not possible to analyse the issue of the weak instruments because the tests available are based on independent equally-distributed errors.

5. Econometric Results

a) General results

The results corresponding to the estimation of the gravity equation for the 1989-2006 period are shown in the second column of Table 3. The R^2 is 0.84; then, it may be stated that the proposed specification is well adjusted to the data. Also, the values of the statistics associated with the endogeneity and orthogonality tests of the instruments help to state that Brazil's exports variable is endogenous and that the instruments chosen are valid. As a matter of fact, the p value of the endogeneity test is 0; then, the null hypothesis of the exogeneity of the variable $XBra$ is rejected, while the p value corresponding to the Hansen J test is 0,045; then, the instruments orthogonality hypothesis at 1% is not rejected.

The GDP of the importer/exporter country has a positive effect on the imports level, the same as the development level of the importer/exporter country, proxied by the corresponding per-capita GDP. As is to be expected, distance has a negative effect on trade, the same as the landlocked and island countries. Instead, the countries sharing common frontiers or speaking the same language on average show they trade more than those that do not meet this requirement. Finally, for the years 1989-2006, Brazil's exports bear a negative effect on the exports of the Latin American countries selected, but it is not significant. Then, it may be deduced that there is no evidence that Brazil's exporting performance has indeed hurt the performance of the other Latin American countries over the 1989-2006 period.

b) Changing displacement effect

Because the Brazilian exporting boom has been developing only over the present decade, it seems appropriate to split the analysed period into two sub-periods to be able to determine whether the significance of the coefficient associated with Brazil's exports change depending on which sub-period - 1989-1999 or 2000-2006 - is taken.

Table 3
Efficient GMM Estimates

Dependent: Ln imports	Period			Exporting Countries	
	1989-2006	1989-1999	2000-2006	Cluster 1	Cluster 2
Ln XBra	-0.042 (0.032)	-0.038 (0.044)	-0.109** (0.049)	-0.069 (0.037)	-0.391** (0.061)
Ln GDPi	1.179** (0.033)	1.177** (0.046)	1.239** (0.051)	1.225** (0.040)	1.589** (0.063)
Ln GDPIj	0.738** (0.015)	0.801** (0.020)	0.666** (0.023)	0.719** (0.017)	1.207** (0.072)
Ln GDPPCi	0.152** (0.014)	0.131** (0.019)	0.165** (0.020)	0.214** (0.017)	0.006 (0.023)
Ln GDPPCj	0.434** (0.032)	0.329** (0.042)	0.550** (0.049)	0.685** (0.048)	-1.132 (1.124)
Ln Distance	-1.468** (0.034)	-1.406** (0.041)	-1.583** (0.059)	-1.521** (0.051)	-1.997** (0.055)
Islandij	-0.202** (0.041)	-0.181** (0.055)	-0.279** (0.063)	0.031 (0.051)	-0.465** (0.066)
Landlockedij	-0.556** (0.037)	-0.434** (0.05)	-0.682** (0.057)	0.016 (0.056)	-0.740** (0.065)
Border	0.661** (0.077)	0.729** (0.097)	0.559** (0.129)	-0.004 (0.103)	1.065** (0.115)
Language	0.938** (0.052)	0.819** (0.070)	1.136** (0.077)	1.016** (0.066)	0.770** (0.090)
Trend	-0.102** (0.003)	-0.038** (0.006)	0.076** (0.076)	-0.009** (0.003)	-0.009 (0.005)
Constant	-34.48** (0.594)	-35.413** (0.83)	-34.953** (0.927)	-37.080** (0.777)	-35.513** (1.404)
<i>Endogeneity [p-value]</i>	185.031 [0.000]	103.571 [0.000]	94.492 [0.000]	195.831 [0.000]	149.784 [0.000]
<i>J-Statistic [p-value]</i>	4.004 [0.045]	2.275 [0.132]	0.052 [0.819]	2.592 [0.107]	1.656 [0.198]
R^2	0.843	0.852	0.833	0.893	0.755
N	16807	9094	7713	7678	9129

Significance level: * 5% , ** 1%

significant; but, the opposite occurs for the 2000-2006 sub-period. In fact, a 1% increase of the Brazilian exports causes a 0.10% average reduction in the neighbouring countries' exports to third countries. This shows that the displacement effect is a recent phenomenon.

With respect to the tests, the endogeneity of the variable XBra can be corroborated; the value of the Hansen J statistic is 2.275 for the regression between 1989 and 1999, and 0.052 between 2000 and 2006. It may be deduced, then, that the instruments prove valid in both regressions.

c) Variation of the displacement effect according to the exporting country's characteristics

It has also been the purpose of this work to determine whether the displacement effect varies depending on the Latin American exporting country's structure. To this end, the exporting countries have been grouped into two separate clusters: 1) Argentina, Colombia, Mexico and Uruguay; 2) Bolivia, Chile, Ecuador, Paraguay, Peru and Venezuela. This division was made taking into account the degree of concentration of the different exported goods in each country. In the countries in group 2, over 50% of their exports have concentrated mainly in two items which correspond to the two-digit classification of the CUCI system³.

The last two columns of Table 3 show that while Brazil's exports do not throw a negative effect on the first cluster of exporters, the opposite occurs in the other one. A 1% rise of Brazil's exports to a country *i* causes an almost 0.4% reduction of the second cluster's exports to this same market.

As the countries in the second group are virtually mono-exporters, to interpret the above-mentioned result, it is necessary to analyse the evolution of Brazil's exports concerning the items where those countries concentrated their exports. The data in Annex 2 show the evolution of Brazil's exports value in agricultural products, oil and gas and metallic mineral extraction in the 1989-2007 period. Over the last 8 years, the value of the agricultural, oil and metallic mineral extraction exports have multiplied by 3, 55 and 4 respectively. This would explain the displacement effect.

With respect to the remaining explicative variables, those which prove statistically significant keep the same sign, according to what was stated in a) of point 5. The conclusions do not differ either in the cases of the tests of endogeneity and orthogonality.

d- Intra-LAIA displacement effect

To end the analysis of the displacement effect, the gravity equation has been estimated, limiting the importing countries to the LAIA members, because all the Preferential Trade Agreements signed by Brazil involve members of the quoted association.

The second column estimates in Table 4 show that there is a displacement effect over the whole period as a consequence of Brazil's exports increase. An almost 0.3% reduction can

³ In the years 1989-2006, 50% of Bolivia's exports were concentrated in gas and non-processed minerals; 45% of Ecuador's and 70% of Venezuela's were concentrated in oil and their derivatives, 53% of Chile's and 54% of Peru's were concentrated in metal ore mining and basic metal industries; finally 55% of Paraguay's were agricultural products.

be seen in the exports to the LAIA members per each 1% rise in Brazilian exports. If the analysis is limited to manufactured goods, column 3 shows that the displacement effect rose by some 63%. When, again, considering the two sub-periods, the displacement effect has been relevant only in the second sub-period, and this result would explain the displacement effect for the 1989-2006 period. For the years 2000-2006, a 1% increase in the Brazilian exports reduces exports to members of the LAIA by around 1.2%.

Table 4
Efficient GMM Estimates – Intra-ALADI *

Dependent: Ln Imports	1989-2006	Manufactures		
		1989-2006	1989-1999	2000-2006
Ln XBra	-0.291** (0.089)	-0.475** (0.080)	-0.080 (0.077)	-1.207** (0.169)
Ln GDPi	0.927** (0.044)	1.089** (0.041)	0.900** (0.046)	1.599** (0.091)
Ln GDPj	0.642** (0.031)	0.787** (0.028)	0.791** (0.033)	0.778** (0.049)
Ln GDPPCi	0.387** (0.104)	0.518** (0.097)	0.637** (0.113)	0.502** (0.153)
Ln GDPPCj	0.330** (0.063)	0.346** (0.058)	0.297** (0.066)	0.418** (0.100)
Ln Distance	-0.774** (0.066)	-1.055** (0.062)	-0.992** (0.074)	-1.161** (0.103)
Landlockedij	-0.601** (0.097)	-0.262** (0.086)	-0.481** (0.098)	-0.073 (0.157)
Border	1.139** (0.087)	0.651** (0.086)	0.755** (0.103)	0.430** (0.136)
Trend	0.059** (0.006)	0.067** (0.006)	0.088** (0.010)	0.213** (0.031)
Constant	-23.783** (1.218)	-27.044** (1.098)	-25.036** (1.175)	-34.985** (2.432)
<i>Endogeneity [p-value]</i>	17.770 [0.000]	53.141 [0.000]	9.587 [0.002]	29.942 [0.000]
<i>J-Statistic [p-value]</i>	0.890 [0.345]	0.912 [0.339]	0.126 [0.722]	14.152 [0.000]
R^2	0.972	0.971	0.974	0.972
<i>N</i>	1620	1615	985	630

* Except Brazil and Cuba. The variables island and language were omitted because they are collinear.
Significance level: * 5% , ** 1%

These results may be interpreted as evidence that can be added to that found in Moncarz et al. (2009), in the sense that Brazil has used the Preferential Trade Agreements to reach its industrialisation objectives at the expense of the Latin American partners.

e) Offsetting effects

Whether the displacement effect may be offset by the exports increase of Latin American countries to Brazil is the point in this section. A gravity model is estimated in which Brazil's imports from the ten Latin American countries depend on the Gross Domestic Product and the Per-Capita Domestic Product of the importing and exporting country and distance.

The gravity model proposed is:

$$\ln M_{ijt} = \alpha_0 + \alpha_1 \ln GDP_{it} + \alpha_2 \ln GDP_{jt} + \alpha_3 \ln GDPPC_{it} + \alpha_4 \ln GDPPC_{jt} + \alpha_5 \ln Dist_{ij} + \varepsilon_{ijt} \quad (2)$$

Where:

M_{ijt} Imports of Brazil from Latin American country j

GDP_{it} Real GDP of Brazil

GDP_{jt} Real GDP of exporting Latin American country

$GDPPC_{it}$ Real GDP per capita of Brazil

$GDPPC_{jt}$ Real GDP of exporting Latin American country

$Dist_{ij}$ Distance between Brazil and exporting Latin American country

ε_{ijt} error term

The model to be estimated is simpler than in equation (1) because most dummy variables prove invariant both temporally and by cross section.

First, the impact that Brazil's growth may have on its imports level is examined. Table 5 shows the estimates. By estimating the model with OLS - the results are seen in the second column -, most coefficients are statistically non significant, with the exception of the exporter country's GDP and per-capita GDP and of distance. This, together with the high R-squared (0.81), introduces the possibility that there may be multicollinearity. To determine whether there is a high correlation between the variables, the Variance Inflation Factor (VIF) is calculated. The VIF shows in which way the variance of the coefficient estimates are magnified by multicollinearity. Practice tells us that if the VIF associated to a variable is high, said variable should be put aside in the regression. The VIF associated to Brazil's per-capita GDP is 1479.13; then, the variable is excluded from the specification of the gravity equation.

Table 5
OLS Estimates - Impact of Brazil's growth on its imports, 1989-2006

Dependent Variable: Ln Brazil's Imports	Full Model	Restricted Model
Ln Brazil's GDP	54.092 (29.034)	4.151* (2.043)
Ln GDPj	0.736** (0.081)	0.737** (0.081)
Ln Brazil's GDPPC	-48.156 (27.929)	
Ln PBIPCj	1.125** (0.118)	1.126** (0.119)
Ln Distance	-2.771** (0.191)	-2.775** (0.192)
Trend	-0.848 (0.443)	-0.088 (0.051)
Constant	-1061.695 (555.454)	-108.589** (14.975)
R^2	0.81	0.81
N	180	180

Significance level: * 5% , ** 1%

When estimating the model once more, this time a restricted one, the VIF of the variables prove smaller than 10, and multicollinearity is no longer a problem to be solved. For the restricted model, the coefficient of Brazil's GDP is equal to 4.15 and significant at 5%. Then, a 1% rise in Brazil's GDP produces a 4.15% increase in the level of imports. The remaining explicative variables, except for the trend, are significant and exhibit the expected sign.

For the restricted model and for each one of the 10 Latin American countries analysed, the GDP elasticity of Brazil's imports is determined. The second column of Table 6 (pag. 17) shows the results. The elasticity estimates can be found between 3 and 4, being all of them statistically significant at 5%.

For the regressions in Tables 3 and 4, the negative effect of Brazil's exports to its neighbours was found to be significant for the 2000-2006 period; then, the value of the elasticities was calculated by again splitting the period analysed into the 1989-1999 and 2000-2006 sub-periods. When calculating the estimates for the second sub-period, all the coefficients prove non significant. For this regression there were only 70 observations so that equation (2) was estimated by redefining the second sub-period and taking the temporal interval 2000-2008 because a lack of significance was suspected as the consequence of not having enough observations.

The results in Table 6 show that Brazil's elasticities estimates grow significantly between the 1989-1999 and 2000-2008 periods, from a range of 3 – 7 to around 8; then, part of the displacement effect found would be offset by redirecting the exports to Brazil.

Table 6
OLS Estimates - Impact of Brazil's Imports

Dependent Variable: Ln Brazil's Imports	1989-2008	1989-1999	2000-2008
Ln GDP Brazil * Argentina	3.422* (1.512)	4.174** (1.208)	8.081* (3.753)
Ln GDP Brazil * Bolivia	3.834* (1.513)	3.188* (1.259)	8.084* (3.702)
Ln GDP Brazil * Chile	3.574* (1.501)	4.815** (1.171)	8.201* (3.687)
Ln GDP Brazil * Colombia	3.313* (1.513)	5.465** (1.192)	8.201* (3.696)
Ln GDP Brazil * Ecuador	3.567* (1.507)	5.351** (1.200)	8.228* (3.646)
Ln GDP Brazil * Mexico	3.029* (1.622)	7.431** (1.441)	8.413* (3.850)
Ln GDP Brazil * Peru	3.479* (1.501)	4.947** (1.171)	8.182* (3.679)
Ln GDP Brazil * Paraguay	3.973* (1.551)	3.493** (1.376)	7.970* (3.774)
Ln GDP Brazil * Uruguay	3.902* (1.502)	3.863** (1.203)	8.135* (3.676)
Ln GDP Brazil * Venezuela	3.421* (1.512)	5.384** (1.187)	8.207* (3.697)
Ln GDPj	5.951** (1.326)	4.777* (2.470)	1.643** (0.415)
Ln GDPPCj	3.435** (1.271)	1.643** (0.222)	2.680** (1.001)
Ln Distance	-3.519* (1.744)	-2.868** (0.868)	-2.252** (0.837)
Trend	-0.165** (0.043)	0.004 (0.058)	-0.193 (0.170)
Constant	-23.384 (14.708)	-37.092 (22.961)	-5.772 (5.400)
R^2	0.85	0.95	0.85
N	200	110	90

6. Conclusions

By using the gravity equation, this work means to find out whether Brazil's exports growth has negatively affected the volumes exported by other countries in the region; in particular,

the group of the following ten Latin American countries: Argentina, Bolivia, Colombia, Chile, Ecuador, Mexico, Paraguay, Peru, Uruguay and Venezuela. When calculating the estimates, there was the possibility that in the specified gravity equation, the explicative variable used to corroborate the central hypothesis may be correlated with the error term. The solution was found by using the Instrumental Variables. As the errors are heteroskedastic, the IV estimator is obtained by estimating the gravity equation with the Generalized Method of Moment (GMM). To determine whether the instruments chosen are valid and relevant, different tests of hypothesis were carried out. Similarly, different estimations were made to amplify the results and to determine: a) whether the displacement effect has been uniform over the whole period; b) whether it has been the same one for all the exporting countries, especially, when the importer is a member of the LAIA and c) whether part of the effect has been offset by redirecting the exports of the ten Latin American countries to Brazil.

The main conclusions are:

a) No evidence has been found that Brazil's exporting performance has hurt the other Latin American countries' exports when the years 1989-2006 are taken globally.

b) When the sub-periods are taken, the results show that a 1% rise of the Brazilian exports cause an average 0.10% reduction in the neighbouring countries' exports to third markets through the years 2000-2006. This shows that the displacement effect proves a recent phenomenon.

c) If the Latin American countries are split into two clusters according to the degree of concentration of their main exported goods, it may be seen that there was only one displacement effect on the exports of the so-called cluster of monoexporting countries.

d) When the gravity equation is estimated, limiting the importing countries to members of the LAIA, the results show that for the whole period, there was a displacement effect as the consequence of Brazil's exports rise. If the analysis is limited to manufactured goods, the displacement effect is higher. When again considering the two sub-periods, it is observed that the displacement effect has been relevant only in the second sub-period.

e) With respect to the offsetting effects, there is an increase in the sensibility of the Brazilian imports from the Latin American countries in the sample, which could be defined as some sort of reciprocity. However, according to the results found in Moncarz et al (2009), the goods that Brazil may be displacing would be more sophisticated than the goods that Brazil imports from its trade partners.

7. Annexes

Annex 1

Import Countries

Algeria	Dominica	Macedonia, FYR	Slovak Republic
Angola	Estonia	Madagascar	Slovenia
Antigua and Barbuda	Ethiopia(includes Eritrea)	Malawi	Solomon Islands
Argentina	Fiji	Malaysia	South Africa
Armenia	Finland	Mali	Spain
Australia	France	Malta	Sri Lanka
Austria	Gabon	Mauritania	St. Kitts and Nevis
Azerbaijan	Gambia	Mauritius	St. Lucia
Bahamas	Georgia	Mexico	St. Vincent and the Grenadines
Bahrain	Germany	Moldova	Sudan
Bangladesh	Ghana	Mongolia	Suriname
Barbados	Greece	Morocco	Sweden
Belarus	Grenada	Mozambique	Switzerland
Belgium	Guatemala	Nepal	Syrian Arab Republic
Belize	Guinea	Netherlands	Tajikistan
Benin	Guinea-Bissau	New Zealand	Tanzania
Bermuda	Guyana	Nicaragua	Thailand
Bolivia	Haiti	Níger	Togo
Bulgaria	Honduras	Nigeria	Tonga
Burkina Faso	Hungary	Norway	Trinidad and Tobago
Burundi	Iceland	Oman	Tunisia
Cambodia	India	Pakistan	Turkey
Cameroon	Indonesia	Panama	Turkmenistán
Canada	Iran, Islamic Rep.	Papua New Guinea	Uganda
Cape Verde	Ireland	Paraguay	Ukraine
Central African Rep.	Israel	Peru	United Arab Emirates
Chad	Italy	Philippines	United Kingdom
Chile	Jamaica	Poland	United States
China	Japan	Portugal	Uruguay
Colombia	Jordan	Romania	Venezuela
Comoros	Kazakhstan	Russian Federation	Vietnam
Congo, Dem. Rep.	Kenya	Rwanda	Yemen
Congo, Rep.	Kiribati	Samoa	Zambia
Costa Rica	Korea, Rep.	Sao Tome and Principe	Zimbabwe
Cote d'Ivoire	Kuwait	Saudi Arabia	Vietnam
Croatia	Kyrgyz Rep.	Senegal	Yemen
Cyprus	Latvia	Serbia	Zambia
Czech Rep.	Lebanon	Seychelles	Zimbabwe
Denmark	Liberia	Sierra Leone	
Djibouti	Lithuania	Singapore	

Exporter Countries

Argentina	Ecuador	Uruguay
Bolivia	Mexico	Venezuela
Chile	Peru	
Colombia	Paraguay	

Annex 2

Brazil's Exports – Primary Production Main Items (U\$ millions)

Year	Agriculture	Oil and Gas	Metallic Mineral Extraction
1989	3450.1	4.3	2441.3
1990	2747.8	1.1	2652.8
1991	2570.7	0.2	2859.4
1992	2481.8	0.8	2533.1
1993	2716.6	1.1	2464.1
1994	4227.0	0.5	2480.6
1995	3494.5	54.6	2744.1
1996	3525.3	16.7	2893.0
1997	5909.3	6.5	3029.4
1998	5124.5	10.0	3439.4
1999	4496.5	2.4	2905.0
2000	4436.5	160.7	3222.2
2001	5277.3	721.5	3103.8
2002	5327.7	1711.1	3190.7
2003	7093.9	2148.4	3628.3
2004	9434.6	2543.6	5236.8
2005	9638.3	4220.2	8010.2
2006	10823.0	6909.1	9755.3
2007	14470.6	8929.6	12010.2

Source: Authors' elaboration following the data of the World Integrated Trade Solution (WITS)

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