Trade Blocks and the Gravity Model:

Evidence from Latin American Countries

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Abstract

We apply the gravity model to examine the effects of the Andean Community and Mercosur on both intra-regional and intra-industrial trade in the period 1980-1997. After accounting for size and distance effects, the Andean Community preferential trade agreements had a significant effect on both the differentiated and reference products, in particular capital intensive goods. In contrast, Mercosur preferential trade agreements only had a positive effect on the capital intensive subcategory of the reference products.

Keywords: gravity model, bilateral trade, trade blocks, Andean Community and Mercosur

JEL classifications: F14 and F15

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1 Introduction

In the aftermath of the debt crisis, many Latin American countries implemented stabilisation and structural adjustment programs based on tight macroeconomic policies and market deregulation. This has resulted in a larger degree of trade openness and stronger intra-regional trade. At the same time, a second wave of regional integration agreements has taken place. These agreements have left behind the old protectionism type of integration and adopted a new more open regionalism. Recent examples are the renewal of the Andean Pact or Andean Community (AC) and the Southern Cone Common Market (Mercosur).

Since 1987, the AC (formed by Bolivia, Colombia, Ecuador, Peru and Venezuela) started to design a new integration strategy that could keep up with Latin America's liberalisation process. This led to the formation of a free trade area (FTA) in 1992 that evolved into an imperfect customs union[1]. The FTA achieved a reduction of tariff and non-tariff barriers for a large proportion of products. It also included trade in services and free movement of capital and labour within its members. The old centralised policies were abolished and new instruments compatible with the World Trade Organisation's (WTO) rules were adopted to reinforce the market mechanism. On the other hand, Argentina, Brazil, Paraguay and Uruguay signed the Treaty of Asunción and formed Mercosur in 1991 with the aim of creating a duty-free common market by the end of 1994 which would allow free movement of capital and labour and convergence in macroeconomic and judicial policies. However, in 1994, the Ouro Preto protocol established a common external tariff structure ranging from 0% to 20% applied to approximately 85% of all customs items[2].

[1] The common external tariff has been adopted only in Colombia, Ecuador and Venezuela. Peru and Bolivia were exempted from it.

[2] The other 15% is determined by country members, but is subject to a schedule to bring them gradually to CET. Note that tariffs on trade between Mercosur members are forbidden with the exception of the goods included in the Adjustment Regime.

One of the main objectives of these agreements is to promote economic development through increases in intra-industrial trade. Indeed, in recent years, many scholars[3] have asked if these new integration agreements have been important for the Latin America regionalisation process and to what extent they can explain the surge of intra-industrial trade that came with it.

The present paper addresses the effects of AC and Mercosur on both intra-regional and intra-industrial trade, applying the gravity model of bilateral trade flows to a set of panel data for the period 1980-1997. We use the Rauch (1999) trade classifications between homogeneous and differentiated products to properly integrate our empirical findings with the theoretical issues involved in the gravity model. Furthermore, we subdivide our data even further using the United Nations factor intensity classification to separate trade in natural resources from manufactured goods. Note that many Latin American countries (LACs) are well endowed in natural resources, so the latter classification helps to identify more clearly in which kind of goods these regional agreements have had a positive impact.

The paper's findings suggest that regional integration agreements, AC and Mercosur, have had an impact on the dynamism of intra-regional trade and on the surge of intra-industrial trade, although relatively low compared with other important variables. Additionally, their impact has been only on some specific product classifications, not in all of them. In particular, we show that, after accounting for size and distance effects, the AC preferential trade agreements had a statistically significant effect on the aggregate differentiated and reference products category. Disaggregating the data further, we find that this is explained by its impact on the capital intensive goods category.

[3] See Thoumi (1989), Frankel (1997) and Yeats (1998) among others.

In contrast, Mercosur preferential trade agreements only had a positive effect on the capital intensive subcategory of the reference products.

To further motivate our research, section 2 shows the importance regional integration agreements have had in the regionalisation process and some stylised facts about intra-industry trade patterns. For this purpose, we focus on countries belonging to the Latin American Integration Association (LAIA) [4]. They produce more than 75% of the total GDP in LACs and accounts for 80% of its trade flows. In section 3 we briefly discuss the gravity model of trade and present the specification of the regression to be tested. Next, in section 4, we present the results of our estimation and finally, we conclude and suggest policy recommendations and lines for further research.

2 Latin America Integration Association and Intra-regional Trade Flows

2.1.The Regionalisation Process

We measure the degree of LAIA trade interdependence (or regionalisation) between 1980 and 1997 using the intensity of intra-regional trade index suggested by Anderson and Norheim (1993). That is

$$R_{ij} = \frac{(X_{ij}/X_{iw})}{(M_{wj} - X_{ij})/(M_{ww} - X_{ij})} \qquad (1)$$

where X_{ij} and X_{iw} are the exports of country i to region j and of country i to the world. M_{wj} and M_{ww} are the world imports from region j and from the world. Table 1 presents the results for total

[4] Argentina, Bolivia, Brasil, Chile, Colombia, Ecuador, México, Paraguay, Perú, Uruguay and Venezuela.

trade, exports and imports, instead of only exports[5] and assumes that regionalisation occurs when there is a high concentration of trade flows biased to a certain geographical region. A value greater than one shows that a country's (region's) trade is biased in the sense that it gives more importance to a particular region than it does the world market[6].

The results suggest that the driving force in LAIA regionalisation process has come from a greater integration within its sub regions rather than between them[7]. Obviously, the main actors of this process have been the AC and Mercosur, which drastically increased their sub regional bias especially between 1985 and 1995. However, by 1997, the AC decreased its degree of regionalisation due to an increase in its share of world trade while Mercosur continued its integration process, increasing its sub regional bias[8]. Note that during the 1980s this process was explained by an import biased regionalisation, whereas in the 1990s it was explained by an export biased regionalisation. These results are consistent with the economic slowdown and increased protectionism that Latin American countries experienced during the debt crisis and with their economic resurgence under more liberal policies in the latter decade.

An important characteristic of the process is that it has decreased the propensity to trade extra-regionally for these countries. A slight variation of the intra-regional trade index allows us to obtain the intensity of extra-regional trade index.[9] Table 1 shows that during the period 1985 –1995 its

[5] For a detailed disaggregation between exports, imports and total trade flows see Carrillo and Hernandez (2000).
[6] There are many ways to measure regional bias. A simple approach is using the intra-regional trade share. Anderson and Norheim (1993) and Petri (1993) showed that this is inappropriate and instead, suggest the application of an intensity of intra-regional trade index that adjusts the intra-regional trade share by the importance in world trade of each group. A drawback of this index is that it cannot be used to compare the regionalisation process of several trading blocks or countries within a trading block.
[7] The slowdown in LAIA trade interdependence during the 90s was caused by the incorporation of Mexico to the North American Free Trade Agreement (NAFTA) in 1994.
[8] Frankel (1997) applied an analogous index to measure the AC and Mercosur regionalisation process. His findings are similar to the ones shown here, although we have extended it to 1997.
[9] For further details on this index see Carrillo and Hernandez (2000).

values for the AC and Mercosur consistently decreased. These results suggests that the higher trade interdependence achieved by LAIA countries and in particular by the AC and Mercosur, has led them to be less dependent on trade with world markets. Yeats (1998) obtained a similar result for the Mercosur countries, although his analysis only extended up to 1994. He builds upon this result, using revealed comparative advantage and exports orientation index, to argue that Mercosur's Preferential Trade Agreement has been trade diverting.

2.2.Intra-regional Trade Composition

The LAIA regionalisation process has also experienced a drastic change in terms of the composition of intra-regional trade. To show it we classify the traded goods according to Rauch (1999) and apply the Grubel and Lloyd (1975) index to analyse intra-industry trade.

The classification consists in grouping products according to whether they are: (a) traded in an organised exchange or 'homogeneous'; (b) not traded in an organised exchange, but having some quoted 'reference price', such as in industry publications; and (c) not having any quoted price or 'differentiated'[10]. Moreover, we subdivide each group into agriculture, mineral, labour and capital intensive products according to the United Nations Broad Economic Categories Classification, because Latin American countries are endowed with natural resources and we would like to distinguish between trade based in natural resources from manufactured goods.

Between the periods 1980-89 and 1990-97, the intra-regional average trade share in differentiated

[10] Homogeneous and reference price products are treated separately because "the former have specialised traders that centralise price information while the same is only potentially true for the latter" (Rauch, 1999; p.9.) In this sense, the reference price goods are an in between category that has characteristics of both homogeneous and differentiated products.

goods increased from 36% to 48%; but it decreased from 38% to 28% and from 26% to 24% for homogeneous and reference price goods respectively. The increase in the share of differentiated products has been mainly in capital intensive products. The reduction in the share of both homogeneous and reference price goods happened to be mainly in mineral intensive products. On the other hand, agriculture intensive products maintained their trade share throughout the period, while labour intensive ones increased it slightly (see tables 2 and 3).

The Grubel and Lloyd (1975) index measures two-way trade in the same 'industry' defined, as in Greenaway and Milner (1986), at a 3-digit SITC level of disaggregation. The index is

$$I_{ji} = 100\left[\frac{(X_{ji} + M_{ji}) - |X_{ji} - M_{ji}|}{X_{ji} + M_{ji}}\right] \qquad (2)$$

where X_{ji} and M_{ji} are the exports and imports of country j's industry i. The index takes the value of one when there is a perfect matching between exports and imports within the same industry and hence a strong degree of intra-industrial trade. A value of zero implies a one-way trade within that industry and no intra-industrial trade. Note that the 'new' trade theory argues that intra-industrial trade is mainly a consequence of trade in differentiated products so we expect to find higher index values in this category than in the homogeneous category[11].

Indeed, table 3 shows that the index is consistently higher in the differentiated and the reference price categories in a country by country and regional average basis, especially in the capital and labour intensive products. Moreover, we find that these categories mainly explain the increase the index had between periods. It is worth noting that in some cases the average level of the index has

increased dramatically, while the intra-regional trade share referred to it has hardly increased. In particular, this is most obvious in the labour intensive products of both differentiated and references price categories. These findings are similar to the results obtained by Havrylynshyn and Civan (1985) in their study about intra-industry trade among developing countries. They emphasised that although certain goods may have a high intra-industrial trade index it does not necessarily mean that there is a large trade share in those goods. However, our results show that capital intensive products have had an increase in both its index value and its intra-regional trade participation.

At a sub regional level, tables 2 and 4 show that the change in trade composition was even stronger and follows the same pattern found at a regional level. That is, we observe within the AC and Mercosur, higher trade shares of differentiated goods and higher levels of intra-industrial trade in capital and labour intensive products in both differentiated and reference price categories. Additionally, we also find that the intra-industry index is not correlated with the trade shares, except for capital intensive products in the differentiated product category.

The bias towards capital intensive manufactured industries is not surprising since most of the natural resources industries in the LAIA are capital intensive and tend to be vertically integrated with these manufacturing industries. In fact, the industrialisation programs aimed to strengthen capital intensive sectors rather than labour intensive ones and multinational companies tended to invest largely in these sectors, especially in countries where capital intensive sectors where competitive at least at a sub regional level[12].

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[11] See Greenaway and Milner (1986) and Harvylshyn and Civan (1985).
[12] For example, the AC Sectorial Programs of Industrial Development attempted to protect the market to help develop four key industries: metal mechanics, iron and steel, petrochemicals and automobiles. Also between 1992 and 1997, FDI in manufacturing has been has been more concentrated in Colombia and Venezuela. See Carrillo and Hernandez (2000) for more details.

So far, the evidence presented suggests that the regionalisation within the AC and Mercosur has been a consequence of more trade in differentiated products. In particular, we have shown that this has been strongest in capital intensive products. What role did the AC and Mercosur preferential trade agreements (PTA) play in this regionalisation process? We would attempt to answer this question by analysing the impact that AC and Mercosur PTAs had on intra-regional trade in the context of the Gravity Model of bilateral trade.

3 The Gravity Model of Trade

Frankel (1997) showed that regionalisation could be explained by geographical proximity and preferential trade agreements, when holding constant for the size of the trading partners and other variables that stimulate or impede bilateral trade. In a seminal paper, Krugman (1991) formalised the role played by geographical proximity in the regionalisation process. He analysed how proximity could lead to production agglomeration and hence regional bias in trade flows[13]. In this context, a pair of countries with low transportation costs between them will tend to have a higher volume of trade than countries further apart. In addition, other variables have to be taken into consideration when measuring the costs related to doing business at a distance. Linnemann (1966), Frankel (1997) identified shipping costs, time elapsed in transporting and cultural unfamiliarity. Moreover, Rauch (1999) showed that differentiated products exhibited stronger geographical proximity effects than homogeneous products.

In its simplest form, the gravity model of bilateral trade used by Tinbergen (1962) and Linneman (1966) relates trade between country i and country j to the proportion of the product of both

[13] See Krugman and Venable (1995) for an application to trade in manufactured goods.

countries GDP (Y_i an Y_j) and to the distance between them (D_{ij}) as a proxy for transaction costs. That is,

$$T_{ij} = A\frac{Y_i Y_j}{D_{ij}} \tag{3}$$

where A is a constant of proportionality. Although it has been widely recognised for its empirical success at predicting bilateral trade, initially it lacked a strong theoretical background[14]. Its recent revival has produced an extensive literature[15] and it has been shown that the gravity equation can be derived from both the traditional and the 'new' theory of international trade and not only from the latter as Helpman and Krugman (1985) and Helpman (1987) suggested. Eaton and Kortum (1997) derived it from a Ricardian framework, while Deardorff (1998) from a Heckscher-Ohlin (H-O) perspective[16]. Indeed, Deardorff (1998) argues that the gravity equation does not prove the validity of one theory or another, but it just confirms a 'fact of life'[17].

Nevertheless, it seems that the key assumption in all these models has been perfect product specialisation. Grossman (1998) argues that it is this assumption that generates the empirical success of the equation. In a world with perfect specialisation, as an exporting country increases the supply of its products, the importing country will increase its consumption proportionally, increasing the volume of trade between them. Evenett and Keller (1998) showed that there is strong evidence that the volume of trade is determined by the extent of product specialisation[18]. They also

[14] Anderson (1979) was one of the first ones that derived it from a theoretical model of trade.
[15] See Deardorff (1998), Frankel (1997), Evenett and Keller (1998) and Feenstra, Markusen and Rose (1999) for a comprehensive review.
[16] For additional ways of deriving the gravity equation see Bergstrand (1985, 1989).
[17] Note that in an early work, Hummels and Levinsohn (1995) found that the gravity equation, derived from a theoretical model based on increasing returns to scale, explained non-OECD countries bilateral trade flows.
[18] See Davis (1998) and Feenstra, Markusen and Rose (1999) for similar derivations.

argued that the perfect specialisation version of the H-O model is an unlikely candidate to explain the success of the gravity equation, while the increasing return to scale model was more likely to be a successful candidate. Furthermore, they found that models with imperfect product specialisation explained even better the variations in the volume of trade than the models with perfect product specialisation. Feenstra, Markusen and Rose (2001) extended this analysis using the Rauch (1999) trade classification. They found strong evidence that suggests that the monopolistic competition models of international trade account for the success of the equation when tested within the differentiated product category.

At this point, we take a similar stand to Rauch (1999) and instead of further discussing its microfoundations and/or attempting to test the validity of competing trade model, we concur with Deardoff (1998) in that "all that the gravity equation says, after all, aside from its particular form, is that bilateral trade should be positively related to the two countries' incomes and negatively related to the distance between them" (p. 8). Based in equation 3, we estimate a gravity equation of the form

$$log(M_{ij}) = \beta_0 + \beta_1(Y_i) + \beta_2\, log(Y_j) + \beta_3\, log(DIF_{ij}) + \beta_4 D_{ij} + \beta_5 AD_{ij} + \beta_6 PTAC + \beta_7 PTAM + \\ + \beta_8 DUM90 + u_{ij} \qquad (4)$$

where Mij is the value of country i's imports from country j (or the value of country j's exports to country i). Income (Y_i, Y_j) proxies the size of the trading countries and distance (D_{ij}) captures transport costs. Larger countries are expected to trade more than small countries because, the former tend to innovate more, have more advanced infrastructures that facilitate trade, have more liberal trade policies, etc. Obviously, higher transport costs reduce trade so the effect is expected to be negative. In addition to these variables, we include other factors that might increase or decrease trade flows. We added the absolute difference in per capita income ($DIFY_{ij}$) to test for the Linder

hypothesis i.e. countries with similar levels of per capita income will have similar tastes, they will produce similar but differentiated products and trade more among themselves. A negative sign will lend support to this effect.[19]. We also include a dummy variable (ADJ_{ij}) to control for countries that share a common geographical frontier and our dummy variables of interest to measure the impact of the Andean Preferential Trade Agreements (PTAC) and Mercosur (PTAM). Finally, we add a dummy variable DUM90 to account for the re-opening of the international credit market and the trade reforms implemented in the area after 1990.

4 Estimating the Gravity Equation

4.1. Data and Methodology

We obtained the bilateral trade data, measured in thousands of current US dollars, from the United Nation World Trade Tables[20]. The data was available at a three-digit Standard International Trade Classification (SITC) level of disaggregation. As mentioned earlier, we classified the traded goods according to Rauch (1999) applying the methodology provided by Jon Haveman[21]. Additionally, we subdivided the data according to the United Nation Broad Economic Categories (UNBEC)[22].

In the case of the explanatory variables, the real gross domestic product data was obtained from the World Bank Development Database. To proxy the trading costs, we followed the common practice of using the great circle distance between capital cities as its proxy. This data was also obtained from the Haveman's web page and is measured in kilometres. We also included an adjacency

[19] However, this difference has also been used to test for Hecksher-Ohlin factor-endowment differences. See Hummels and Levinsohn (1995) and Frankel (1997).
[20] See the online service "trade analyser" of www.tradecompass.com.
[21] More details in www.macalester.edu/research/economics/ PAGE/HAVEMAN.
[22] This classification can be obtained from www.iedb.anu.edu.au.

dummy variable that takes the value of one when the countries have both a common border and transport infrastructure that allows them to have border trade and zero otherwise. Note that many neighbouring South American countries do not engage border trade due to harsh geographical conditions such as the Amazon jungle or the Andes mountain range. The PTAC and PTAM dummy variables take the value of one when both countries are members of the same sub regional integration agreement (AC and Mercosur respectively) and zero otherwise. Note that Peru suspended its membership in the AC from 1992 to mid 1997. Mercosur was formally formed in 1991 but it was informally operating from 1988, therefore PTAM dummy takes the value of 1 from that year onwards[23]. The variable DUM90 takes the value of 1 after 1990 and zero otherwise.

We estimate equation (4) applying random-effect Tobit left censoring estimation to account for country-pairs with zero exports between them. Similar to Yeats (1998), we express the variables in three-year period average to reduce both business-cycle fluctuations and irregular variations in trade statistics. With eleven countries, where each of them has ten country-pairs, our sample is of 110 groups and 660 observations.

4.2.Empirical Results

The results from our Tobit estimations are reported in tables 5, 6 and 7. Across the different products traded, the effects of the importer GDP and the exporter GDP are positive and statistically significant. Moreover, we find that when aggregating using Rauch classification the partner's income effect rises as we move from the homogeneous to differentiated category, while domestic income elasticity falls. This is consistent with the findings of Feenstra, Markusen and Rose (2001)

[23] We also defined it from 1991 and the results are similar and available upon request.

which show that there exists a “home market” effect for differentiated goods and monopolistic competition and homogeneous goods with “reciprocal dumping” and restricted entry of firms.[24]

When sub dividing these categories using the UNBEC classification we do not have such clear cut results. Except for both the homogeneous and differentiated agriculture intensive products, our estimations show that country i's bilateral imports are more sensitive to country j's GDP than to its own. Using Feenstra, Markusen and Rose theoretical predictions for a gravity equation derived from a differentiated goods model we can argue that the “home market” effect for capital, labour and mineral intensive products consistent with a monopolistic competition model of product differentiation persists. Additionally, there appears to be a “reverse home market” effect for agriculture intensive products consistent with an Armington model of perfect competition and national product differentiation.

The Linder effect has the expected sign and is highly significant in most of the cases of the homogeneous and references price categories. However, a surprising (but not crucial result for our purpose) is that the Linder effect is positive and highly significant in the differentiated product category. As we mentioned before, similarity in preference, in this case measured by the absolute difference in GDP per capita, should enhance bilateral trade in differentiated goods, but our results suggest that in the case of LACs heterogeneous (less similar) preferences are more likely to increase trade in differentiated goods.

The estimated coefficients of distance and adjacency have the expected sign and are highly significant. In particular, the results for the distance variable weakly support the Rauch (1999)

[24] Note that Feenstra, Markusen and Rose use bilateral exports as their dependent variable, hence they found that the domestic income coefficient rises as we move from the homogeneous to the differentiated category.

network/search view of trade in differentiated products. He argues that the search a trader must undertake to find a price that makes importing or exporting a good profitable is much higher for differentiated than for homogeneous products. The estimated (absolute) value of the distance coefficient is higher for the differentiated products than for reference price but not for homogeneous products. Further disaggregation shows that the estimated distance coefficient is larger for both differentiated agriculture and mineral intensive goods relative to their reference price and homogeneous counterparts.

On the other hand, the coefficients for adjacency can help us to explain the sub regionalisation process LAIA went through. As expected, it tells us that countries with common frontiers (and with common transport infrastructures) that enable border trade will, in fact, have more trade. Moreover, it turns out that adjacency has a very strong effect in bilateral volume of trade. Its greatest impact was in the reference price and differentiated categories. Our estimates show that two countries having common border with transport infrastructure will trade 5.7 (exp 1.74) and 3.1 (exp 1.12) times more reference price and differentiated products respectively than countries that do not have this feature. Within these categories, the volume of trade in labour and capital intensive products was also highly sensitive to adjacency.

An important policy implication that comes out from the transport cost and adjacency variables is that investment in transport infrastructure that reduces long distance cost of doing business will have a major impact in the integration of markets. As we mentioned before, many neighbouring South American countries do not engage in border trade due to harsh geographical conditions such as the Amazon Jungle and the Andes Range. This has a major impact on intra regional trade since it imposes a natural barrier to trade between the Pacific Coastal and Atlantic Coastal countries. Limao and Venables (2001) have recently stressed the importance of investment in infrastructure as a way

to reduce these costs and promote trade. Using an upper limit Tobit they found that improving the transport infrastructure considerably reduces its CIF/FOB factor and hence has a significant impact on bilateral volumes of trade.[25]

Another important variable in our results is the dummy for the period 1990 - 1997. This variable captures the effects that macroeconomic reform and market deregulation policies (including unilateral trade liberalisation) had on bilateral trade. The estimates are positive and statistically significant reflecting the positive effects of the economic recovery in Latin American countries and the implementation of economic reforms. Our results show that these policies were a very important determinant for the increase in bilateral volumes of trade. In particular, they increased the differentiated and reference price categories' volume of trade by 3.1 (exp 1.14) and 2 (exp 0.69) times. Within these categories its major impact was on labour-intensive products and, although less, a considerable impact on the capital intensive products.

Up to this point we have shown that the gravity equation performs relatively well in explaining bilateral trade between LAIA members for the period studied. Most of our variables had the expected sign and were statistically significant. They also confirmed some of the stylised facts presented in the first section and are consistent with theoretical interpretations of the model. We now turn to the key variable of the paper: sub regional preferential trade agreements.

Our first important result is that both preferential trade agreements (PTA) did not have a significant impact on many of the trade categories studied. We found that the PTAC dummy was positive and

[25] They also found that using the great circle distance between capital underestimates the effects of transport cost in the gravity equation. We have not pursued their methodology here due to the lack of available data. However, we tried to approximate the importance of infrastructure in transport costs through the adjacency dummy variable.

significant for the aggregate differentiated product category, while the PTAM was not. A breakdown into sub groups shows that PTAC only had a significant effect on capital intensive differentiated goods. In terms of the reference products, the PTAC had a weak statistical significance in the aggregated category, while both PTAC and PTAM had a positive and significant effect on the trade of capital intensive goods. We found no significant effect of preferential trade agreements in the case of homogeneous goods.

Nonetheless, the results for the AC seem to be consistent with the view that the new integration process has achieved an increase in the volume of trade of intra-industrial goods and particularly in the capital intensive ones. The lack of a statistically significant effect on agriculture, mineral and labour intensive products in each of the categories studied suggests that the capital intensive goods sub category has been the only one in which a statistically significant amount of trade creation has taken place.

These may not seem so surprising since one would expect trade in agriculture and mineral intensive products to be driven mainly by others factors rather than integration, especially in countries with large natural resource endowments. Additionally, as mentioned in the previous section, the development of the capital intensive sector (and not the labour-intensive sector) has been one of the main objectives of the Andean integration process since its beginnings. During the 1970s and most of the 1980s, the AC's trade and industrial policies were oriented to help develop specific capital intensive industries through the Sectorial Programs for Industrial Development. These industries were metal mechanics, iron and steel, petrochemicals and automobiles. During the 1990s these industries were still playing a crucial role in the integration process. Moreover, one of the aims of the "new" integration process was to provide its members with an alternative way to gain

competitiveness in these kind of industries so they could be able to compete successfully in world markets.[26]

On the other hand, the negligible impact of Mercosur PTA on agriculture and mineral intensive products can also be attributed to the fact that volumes of trade in these industries may be driven by factors other than trade agreements. In the case of differentiated (capital and labour intensive) and in reference price (labour intensive products) categories, a possible explanation for the lack of a statistically significant impact is that during the period 1991 – 1996 Argentina, Paraguay and Uruguay were unable to complete their bilateral tariff elimination. Indeed, Olarreaga and Solonga (1998) show that these countries deviated from internal free trade in labour intensive industries such as textiles, footwear, paper and paper products by a maximum of 9 percentage points. In particular, they found that Argentina had important deviations from internal free trade in capital intensive industries such as transport equipment and iron and steel.[27]

Our second result involves the magnitude of the effects these agreements had on bilateral trade flows. When significant, the coefficient of PTAC ranged from a high of 0.59 for reference price capital intensive products to a low of 0.43 for the aggregate differentiated category, while the only significant coefficient for the PTAM was of 0.81. This means that the AC preferential trade agreement increased bilateral trade between its members by 53.7% (exp 0.43) and by 66.5% (exp 0.51) in the aggregate differentiated and reference price categories and by 73.3% (exp 0.55) and 80.4% (exp 0.59) in each of the respective capital intensive sub categories. On the other hand, Mercosur's preferential trade agreement increased the volume of trade by 125% (exp 0.81) in reference price capital intensive goods.

[26] Maldonado (1999).

An important consequence of these results is that their magnitudes suggest that the AC and Mercosur PTA did not have a strong trade creation effect within its members in differentiated and reference price categories. Hence, they may not be the main reason why intra regional and intra industrial trade have surged during the 1990s. An alternative answer maybe found by comparing these results with the ones obtained for the ADJ and DUM90 variables. That is, the fact that member countries are natural trading partners and have transport infrastructures that facilitates trade between them and the effect of the liberalisation process they undertook during the 1990s may explain an important proportion of the increase in intra regional volume of trade.

5 Conclusions and Policy Implications

This paper aims to analyse the importance of preferential trade agreements in enhancing intra-industrial trade in Latin American countries. Preliminary inspection of the data showed that the trade regionalisation process in these countries during the late 1980s and 1990s was a consequence of an increase in intra-industrial trade within the Andean Community and Mercosur.

In this context, we tested for the effectiveness of the Andean Community and Mercosur preferential trade agreements in increasing trade in differentiated, homogeneous and reference price products. Applying the gravity model of bilateral trade flows, we found that these trade agreements have had an impact on the dynamism of intra-regional trade and on the surge of intra-industrial trade, although relatively low compared with other important variables. In particular, their impact has been only on some specific product classifications, not on all of them. Indeed, we show that,

[27] These authors also suggest, contrary to Yeats (1998) hypothesis, that the increase in bilateral volumes of trade within Mercosur members during the 90's can be attributed to distance and adjacency effects and not so much to trade diverting forces.

after accounting for size and distance effects, the AC preferential trade agreements had a statistically significant effect on the aggregate differentiated and reference products category. Disaggregating the data further, we find that this happens because of its impact on the capital intensive goods category. In contrast, Mercosur preferential trade agreements only had a positive effect in the capital intensive sub category of the reference products.

Nevertheless, variables such as distance, adjacency and the proxy for macro economic reforms have the expected signs and are statistically significant across all categories and sub-categories of products. Therefore, the effects of both AC and Mercosur have not been as strong as has been publicised so policymakers should revise and perhaps re-design these agreements.

Some other policy recommendations can be drawn from our analysis. In recent years, the AC and Mercosur have started negotiations for building a South American free trade area. In this scenario, as our empirical results corroborate, size and distance will be one of the main determinants of trade. Hence, countries should make efforts to reduce transaction costs between both sub regions to achieve a deeper economic integration.

Finally, note that we have not addressed the welfare impacts of regional trade agreements, the effects of lobbying and the progression of the agreements. We leave these important topics for future research.

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Table 1
LAIA: Intensity of Intra-Regional and Extra-Regional Trade Index
(1980 - 1997)

	1980	1985	1990	1995	1997
Intra - regional trade index					
AC	2.75	3.65	5.40	5.66	4.62
MERCOSUR	4.50	4.69	7.06	7.24	7.00
MEXICO	0.99	1.03	1.27	0.66	0.57
CHILE	5.89	5.94	6.62	5.35	4.71
LAIA	***3.54***	***3.78***	***5.26***	***4.75***	***4.12***
Intra - sub regional trade index					
AC	3.45	4.07	9.50	17.16	13.81
MERCOSUR	6.82	7.05	12.96	16.30	18.28
Extra - sub regional trade index					
AC	0.97	0.97	0.95	0.89	0.90
MERCOSUR	0.91	0.94	0.90	0.82	0.78

Source: Directions of Trade, IMF

Table 2
Intra - Regional and Intra - Sub Regional Average Trade Share (%)

	1980 - 1989	1990 - 1997
LAIA		
Homogenous	38.1	27.8
Reference price	25.8	24.3
Differentiated	36.2	47.8
AC		
Homogenous	21.9	22.7
Reference price	36.1	29.4
Differentiated	42.0	47.9
MERCOSUR		
Homogenous	32.5	26.5
Reference price	24.5	21.9
Differentiated	43.0	51.4

Source: United Nations Trade Statistics

Table 3
LAIA Regional Gruber - Lloyd Index of Intraindustrial Trade (%)
1980 - 1997

	HOMOGENOUS GOODS				REFERENCE PRICE GOODS								DIFFERENTIATED GOODS							
	Agriculture Intensive		Mineral Intensive		Agriculture Intensive		Mineral Intensive		Labour Intensive		Capital Intensive		Agriculture Intensive		Mineral Intensive		Labour Intensive		Capital Intensive	
	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97
ARGENTINA	4.8	7.4	12.7	9.2	14.1	17.5	4.5	9.3	34.8	60.2	25.1	39.1	3.2	14.8	7.9	18.4	17.8	41.8	30.8	49.3
BOLIVIA	2.0	2.5	5.5	3.9	7.0	10.1	0.1	1.9	10.6	19.2	0.6	2.0	0.8	5.1	0.0	1.4	0.8	5.1	0.6	3.4
BRASIL	6.2	8.5	3.7	6.5	11.5	13.0	8.6	9.4	30.8	59.8	21.9	32.0	6.2	16.6	2.7	11.7	10.6	30.0	15.7	34.4
CHILE	2.1	6.9	0.4	1.9	3.4	9.4	1.3	8.5	20.2	34.4	23.8	23.4	7.7	15.7	3.5	10.6	3.4	22.7	8.4	14.2
COLOMBIA	1.7	7.1	3.4	9.4	0.7	16.9	2.2	10.4	18.9	55.5	12.1	25.5	1.4	15.2	5.8	28.0	6.0	25.5	12.9	24.1
ECUADOR	1.4	6.6	1.9	5.6	0.1	6.9	1.7	12.1	0.6	49.0	3.2	10.4	1.9	17.8	2.7	16.7	6.1	21.1	4.9	13.4
MEXICO	1.4	1.9	5.3	9.2	6.0	6.3	6.4	9.7	19.7	22.2	14.6	17.8	4.7	9.5	0.8	17.1	17.7	25.1	27.7	21.6
PARAGUAY	3.6	3.2	0.0	2.2	10.5	2.4	2.5	4.3	1.1	38.9	1.5	3.6	1.7	5.7	0.2	1.8	0.8	8.7	0.9	2.4
PERU	0.9	1.1	2.6	2.7	1.4	9.1	3.2	10.1	14.5	34.8	8.0	9.0	5.4	9.2	5.2	14.0	7.1	18.0	5.6	9.5
URUGUAY	4.2	6.2	3.2	12.4	6.6	9.0	6.7	21.8	38.1	51.0	36.3	41.2	7.3	21.3	19.4	33.0	26.9	38.3	21.2	33.4
VENEZUELA	1.3	7.8	1.0	1.3	0.6	13.4	7.6	24.3	13.4	56.3	13.5	28.0	0.8	15.4	3.0	29.3	2.6	26.9	8.4	21.1
AVERAGE	**2.7**	**5.4**	**3.6**	**5.8**	**5.6**	**10.4**	**4.1**	**11.1**	**18.4**	**43.8**	**14.6**	**21.1**	**3.7**	**13.3**	**4.7**	**16.5**	**9.1**	**23.9**	**12.5**	**20.6**
Trade Share (%)	14.6	14.0	23.5	13.8	5.8	6.6	7.7	3.8	0.5	1.1	11.8	12.8	3.6	3.7	0.6	0.7	4.5	6.6	27.5	36.8

Source: United Nations Trade Statistics

Table 4

LAIA Sub Regional Gruber - Lloyd Index of Intraindustrial Trade (%)

1980 - 1997

ANDEAN COMMUNITY

	HOMOGENOUS GOODS				REFERENCE PRICE GOODS								DIFFERENTIATED GOODS							
	Agriculture Intensive		Mineral Intensive		Agriculture Intensive		Mineral Intensive		Labour Intensive		Capital Intensive		Agriculture Intensive		Mineral Intensive		Labour Intensive		Capital Intensive	
	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97
BOLIVIA	1.7	0.3	0.0	5.6	0.4	5.0	0.0	0.8	0.0	8.5	0.1	2.8	0.5	8.4	0.0	15.0	6.1	15.1	2.4	8.1
COLOMBIA	2.6	10.1	4.6	3.4	1.2	22.9	3.2	16.4	10.6	67.4	16.4	32.6	2.9	21.3	8.5	41.8	5.1	28.2	20.2	30.6
ECUADOR	1.1	5.0	3.7	2.6	0.1	11.2	0.6	22.0	1.4	61.8	7.9	15.3	1.7	22.1	6.9	27.4	7.0	26.2	13.9	21.4
PERU	0.9	1.8	0.9	0.9	1.0	16.9	0.2	3.1	3.9	30.1	6.3	8.4	2.5	11.3	22.1	31.9	11.8	15.0	13.1	17.4
VENEZUELA	3.3	17.9	2.1	2.0	1.8	25.0	3.7	17.1	25.6	61.5	17.8	35.8	2.1	20.1	4.1	40.9	2.8	28.5	20.3	30.4
AVERAGE	**1.9**	**7.0**	**2.3**	**2.9**	**0.9**	**16.2**	**1.6**	**11.9**	**8.3**	**45.8**	**9.7**	**19.0**	**2.0**	**16.6**	**8.3**	**31.4**	**6.6**	**22.6**	**14.0**	**21.6**
Trade Share (%)	10.3	14.2	11.6	8.5	11.0	7.5	4.6	2.6	0.6	1.5	19.9	17.8	2.9	3.4	0.9	0.5	12.7	11.9	25.5	32.1

MERCOSUR

	HOMOGENOUS GOODS				REFERENCE PRICE GOODS								DIFFERENTIATED GOODS							
	Agriculture Intensive		Mineral Intensive		Agriculture Intensive		Mineral Intensive		Labour Intensive		Capital Intensive		Agriculture Intensive		Mineral Intensive		Labour Intensive		Capital Intensive	
	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97	80 - 89	90 - 97
ARGENTINA	8.6	10.2	18.1	10.9	20.4	19.1	29.4	22.5	36.9	68.2	28.3	43.0	4.3	16.4	10.1	23.4	24.0	45.4	39.0	55.7
BRASIL	7.8	8.9	19.1	12.6	14.9	15.5	24.2	24.4	37.3	65.2	25.8	41.8	5.3	17.1	4.6	15.3	13.7	37.0	27.4	49.0
PARAGUAY	4.5	3.6	0.0	2.3	11.4	2.6	2.5	4.4	1.1	39.5	1.7	3.8	1.8	6.1	0.2	1.8	0.8	9.1	0.9	2.3
URUGUAY	4.5	7.2	10.3	17.2	7.5	10.2	6.9	23.0	41.3	62.5	39.2	44.3	8.2	23.6	20.7	36.7	30.3	42.4	21.9	35.7
AVERAGE	**6.4**	**7.5**	**11.9**	**10.7**	**13.5**	**11.9**	**15.8**	**18.6**	**29.1**	**58.8**	**23.8**	**33.3**	**4.9**	**15.8**	**8.9**	**19.3**	**17.2**	**33.5**	**22.3**	**35.6**
Trade Share (%)	23.1	18.5	9.4	8.0	6.9	7.9	2.6	1.4	0.8	1.2	14.2	11.4	6.5	4.5	0.9	0.7	5.2	6.6	30.4	39.6

Source: United Nations Trade Statistics

Table 5
Differentiated Goods: Gravity Model Tobit-Panel Data Estimation Results

	Total	Agriculture Intensive	Mineral Intensive	Labour Intensive	Capital Intensive
Importer GDP	0.69	1.23	0.40	0.82	0.58
	(9.71)	(17.56)	(3.13)	(7.03)	(7.62)
Exporter GDP	1.33	1.07	2.13	1.42	1.76
	(15.35)	(14.31)	(17.15)	(15.54)	(16.26)
Linder Effect	0.21	0.50	0.15	0.28	0.03
	(2.79)	(5.91)	(0.86)	(2.96)	(16.26)
Distance	-1.13	-1.25	-1.68	-1.61	-1.14
	(4.95)	(7.62)	(5.74)	(5.20)	(2.81)
Adjacency	1.12	1.99	2.45	1.11	1.11
	(4.47)	(8.65)	(5.16)	(2.79)	(2.89)
PTAC	0.43	-0.39	0.21	0.38	0.55
	(1.99)	(1.47)	(0.52)	(0.38)	(2.45)
PTAM	-0.18	-0.44	-0.06	0.34	0.09
	(0.84)	(1.47)	(0.16)	(1.04)	(0.36)
DUM90	1.14	1.28	1.34	1.94	1.18
	(13.53)	(10.47)	(7.77)	(15.02)	(11.96)
Constant	-18.73	-27.84	-29.49	-22.08	-23.66
	(11.34)	(13.82)	(8.94)	(7.82)	(11.54)
Observations	660	660	660	660	660
Uncensored	653	584	412	601	640
Censored	7	76	248	59	20
LR Test					
Chi-squared value	274.77	374.39	260.46	257.09	264.37

Absolute value of t-statistics in parentheses

Table 6
Reference Price Goods: Gravity Model Tobit-Panel Data Estimation Results

	Total	Agriculture Intensive	Mineral Intensive	Labour Intensive	Capital Intensive
Importer GDP	1.08	0.72	1.42	0.88	0.76
	(14.69)	(6.53)	(16.46)	(5.24)	(10.09)
Exporter GDP	1.14	0.93	1.49	1.72	2.39
	(13.65)	(8.17)	(15.41)	(9.36)	(32.19)
Linder Effect	0.17	0.02	0.39	0.32	0.07
	(1.92)	(0.18)	(3.79)	(2.06)	(1.00)
Distance	-0.92	-1.00	-2.46	-1.40	-1.75
	(5.12)	(3.58)	(11.95)	(3.08)	(11.25)
Adjacency	1.74	1.87	0.88	2.02	0.76
	(5.71)	(3.74)	(2.81)	(2.53)	(3.41)
PTAC	0.51	0.54	-0.55	0.37	0.59
	(1.85)	(1.33)	(1.89)	(0.77)	(3.37)
PTAM	0.18	-0.22	0.32	-0.37	0.81
	(0.68)	(0.59)	(0.87)	(0.76)	(2.91)
DUM90	0.69	-0.22	0.48	2.33	0.73
	(6.88)	(0.59)	(2.93)	(12.26)	(6.46)
Constant	-24.27	1.37	-28.83	-33.39	-34.32
	(13.33)	(9.65)	(12.50)	(6.45)	(19.15)
Observations	660	660	660	660	660
Uncensored	633	606	489	453	561
Censored	27	54	171	207	99
LR Test					
Chi-squared value	465.59	330.15	473.51	301.11	587.78

Absolute value of t-statistics in parentheses

Table 7
Homogenous Goods: Gravity Model Tobit-Panel Data Estimation Results

	Total	Agriculture Intensive	Mineral Intensive
Importer GDP	1.28	1.01	0.87
	(3.34)	(5.11)	(5.58)
Exporter GDP	0.98	0.53	2.20
	(12.58)	(2.21)	(9.61)
Linder Effect	0.32	0.17	0.13
	(3.34)	(0.69)	(0.70)
Distance	-1.45	-1.16	-1.01
	(5.84)	(4.96)	(2.36)
Adjacency	1.01	2.55	1.84
	(3.47)	(7.76)	(2.27)
PTAC	-0.16	0.07	0.43
	(0.65)	(0.19)	(0.97)
PTAM	-0.37	-0.49	0.72
	(1.12)	(1.34)	(1.24)
DUM90	0.86	1.17	1.33
	(6.30)	(8.66)	(6.00)
Constant	-21.74	-13.22	-40.79
	(10.03)	(6.15)	(10.37)
Observations	660	660	660
Uncensored	618	584	506
Censored	42	76	154
LR Test			
Chi-squared value	385.35	555.45	331.42

Absolute value of t-statistics in parentheses