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The Long-run Decline in the share of Agricultural and Food Products in International Trade, 1951-2000: A Gravity Equation Approach of Its Causes

Raúl Serrano* and Vicente Pinilla†

ABSTRACT: The objective of this study is to determine the causes of the loss of share of agricultural products and food in international trade. The article compares, using a gravity model, the impact of various factors upon bilateral trade in agricultural products, in manufactures and in total trade, between 1963 and 2000 for a representative sample of 40 countries. The results clearly demonstrate how the low demand elasticity for agricultural products and food, the high degree of protectionism to which they were subjected and their meagre share in intra-industrial trade are the principal causes of their relatively slow growth.

RESUMEN: El objetivo de esta investigación es determinar las causas de la pérdida de participación en el comercio internacional de los productos agrarios y alimentos. Con este objetivo, el trabajo compara a través de un modelo de gravedad el impacto de varios factores en el comercio bilateral de productos agrarios y alimentos, de manufacturas y en el comercio total, entre 1963 y 2000 para una muestra representativa de 40 países. Los resultados ponen de relieve cómo la baja elasticidad renta de la demanda de los productos agrarios y alimentos, el alto grado de proteccionismo al que estuvieron sujetos y su escasa participación en el comercio intraindustrial, son las causas principales de su lento crecimiento relativo.

Keywords: Agri-food trade, International trade, gravity model, GATT, regional trade agreements, home market effect, homogenous products

JEL: F10, F14, N50, N70

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THE LONG-RUN DECLINE IN THE SHARE OF AGRICULTURAL AND FOOD PRODUCTS IN INTERNATIONAL TRADE, 1951-2000: A GRAVITY EQUATION APPROACH OF ITS CAUSES

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1. Introduction

One of the most important aspects in international trade in the second half of the XX century was the profound change in its composition, characterised by an increase in the share of manufactured products and a sharp decline in that of agricultural products and food. This is of considerable importance, since many low-income countries had serious problems in substituting the export of primary products by other more elaborate products with greater added value, or to hurriedly increase the exports of their traditional products.

We therefore believe that a comparative analysis of the determinants of trade in agriculture products and manufactures provides a deeper understanding of this important transformation of international exchanges. As is well known, the increase in trade and the integration of product markets is one of the fundamental elements of the processes of globalization. An improved understanding of the changes occurring in such trade in the second half of the twentieth century also helps us to comprehend more accurately the nature and characteristics of the second wave of globalization in this period. The literature concerned with the differential behavior of the distinct products comprising international trade at that time has tended to concentrate on two fundamental aspects: the upsurge of intra-industrial trade and the institutional obstacles to the devolpment of exchanges.

While until 1945 international trade was primarily inter-industrial, based on the exchange of primary products for manufactures, and complementary between economic regions, from then on intra-industrial trade became progressively more important, based on the exchange of manufactures between developed countries (Krugman, 1995). Given this background, the Hecksher-Ohlin-Samuelson (HOS) models, in which the exchange of homogeneous products is the result of specialisation in production and trade between countries with different endowments and factor intensities, are unable to explain the increasing

importance of intra-industrial trade. The New Trade Theory developed by Helpman and Krugman (1985) offers an alternative explanation of the new trade pattern, focused on the size of the domestic market, economies of scale, product differentiation and imperfect competition.

The literature regarding intra-industrial trade has expanded in recent decades, and concretely with regard to two types of models: product differentiation models and national product differentiation models.

On the one hand, product differentiation models assume that greater trade is the result of an increase in consumers' appetite for variety, within a framework of monopolistic competition and with increasing returns (Krugman, 1980, Helpman and Krugman, 1985). In this case, countries with large markets tend to gain more in an environment of deregulated exchanges, since demand in a large market attracts new companies and large countries export to small ones. This has been termed the "home market effect" (HME). On the basis of the studies by Feenstra, Markusen, and Rose (2001), there is ever more literature on the presence of the so-called "home market effect" like those by Feenstra, Markusen, and Rose (1998, 2001), Fidrmurc (2004) and Jensen (2006), who analyse the differences in behaviour among different product types[3].

Moreover, national product differentiation models (for homogenous products, which differ according to the place of production) are based on the idea that countries trade simply because certain products cannot be substituted (Armigton, 1969) and in this case the "reverse home market effect" occurs, as Head and Ries (2001) and Feenstra, Markusen, and Rose. (2001) show. Thus, in a more deregulated world, greater demand increases imports and small countries gain more from liberalisation.

In this context, the contribution made by Feenstra, Markusen, and Rose (2001, 2003) is extremely interesting; they propose a method to analyse the presence of the (inverse) effect of market size, using the gravity equation for both homogeneous products and differentiated products. In the first case, for a model of trade in homogenous products (national product differentiation or reciprocal dumping), exports are more sensitive to changes in the income of the importing country than in that of the exporting country. Inversely, for a model of trade in differentiated products, exports are more sensitive to changes in the income of the exporting country than in that of the importing country.

Similarly, other studies, such as those by Jensen (2006) and Schumacher and Siliverstovs (2006), based on the version *à la Bergstrand* (1989) of the gravity model include, in addition to countries'

3 See Yu (2005), Holmes and Stevens (2005), Larch (2007) and Schumacher and Siliverstovs (2007); see also other previous research e.g. Davis (1998) and Davis and Weisntein (1998)

income (which permits the HME to be studied), the factor endowment of the exporting country and the per capita income of the importing country.

Another extremely important aspect is the debate regarding the effects of GATT. Rose states that *"there is a little evidence that GATT/WTO membership has a substantial positive effect on trade"* and argues that future research must attempt to decompose trade by industry, since *"the multilateral system has been less successful at liberalizing trade in agriculture and textiles"* (Rose 2004: 111). On this basis, a significant body of literature has been developed, in an effort to analyse the influence of GATT upon the volume of trade[4].

Nevertheless, and also within the context of the liberalisation of international trade, another key factor in the second half of the XX century was the progressive regionalisation of trade through regional trade agreements; these were especially important in the case of agricultural products[5]. A good example is the extraordinary boom in the internal agricultural trade of the European Union, which at the beginning of the period accounted for 17% of the worldwide total and reached approximately 30% by the end of the XX century (Aparicio, Pinilla, and Serrano 2009).

In this context, the basic objective of the present study is to study the principal causes of the decline in the relative share of agricultural products and food in international trade in the second half of the XX century. This research is therefore a contribution to the empirical literature concerning the determinants of international trade, and contributes various ideas regarding the differences between agricultural trade and trade in other types of goods, especially manufactures, concentrating on three principal questions: changes in countries' market size, changes in per capita incomes and, lastly, the effects the various processes of liberalisation had upon international markets. This analysis by product type permites a deeper understanding of the problems and perspectives of the trade of different countries, on the basis of their specialization.

Firstly, we shall analyse, from a long-term perspective, whether the HME is present. Concretely, we shall examine the differences among differentiated goods (typical for trade in manufactures) and homogenous products (associated in principle with the majority of products which comprise agricultural trade)

4 See, among others, Rose (2005) Subramanian and Wei (2007), Tomz, Goldstein and Rivers (2007) and Felbermayr and Kohler (2006) for different samples of countries and alternative estimation methods, which have shown that GATT does have a positive effect upon trade.

5 See, as examples, Dell'Aquila, Sarker, and Meilke (1999) or Diao, Roe, and Somwaru (1999), who have demonstrated an extraordinary surge in intra-regional trade for distinct geographical areas.

We shall also employ the Bergstrand (1989) approximation, which demonstrates that the elasticity of factor endowment can be employed to distinguish between capital- or labour-intensive goods, while the elasticity of the per capita income of the importing country serves to classify goods as basic goods or luxury goods. This approximation, although little used, is of considerable importance for the purposes of our study, especially the latter classification, as it permits us to approximate one of the principal factors of the decline in agricultural trade throughout the study period, i.e. the low income demand elasticity for the majority of products which comprise it.

Here, however, we are examining two types of products which, during the study period, were subject to very different degrees of intervention and protection; consequently, the sum of the HME and the influence of liberalisation are key factors in the analysis of trade growth in the period.

Our study, in line with the argument of Subramanian and Wei (2007), will analyse whether membership of GATT can be taken as an approximation of trade liberalisation and, if this is indeed the case, this should have a much greater effect upon products for which trade barriers have been reduced (manufactures) than upon other sectors where these remained high (agricultural products).

Finally, we believe that the "spaghetti bowl"[6] produced by the proliferation of trade agreements has been an important alternative to the multilateral liberalisation of agricultural trade. We wish to determine to what extent the various attempts at integration produced significant results and how they affected agricultural trade with respect to other products. There are numerous studies on this subject, but no consensus appears to have been reached; the debate is especially open with regard to the most appropriate calculation method[7].

To compare the two product groups (agricultural and food products vs. manufactures), the present article estimates the gravity equation for the bilateral volume of agricultural trade, of manufactures and of total trade, analysed separately and employing the same specification and the same group of countries. Concretely, using the UN-COMTRADE (2003) database we have constructed a new data panel for bilateral trade among 40 countries with a significant presence in international markets for the period 1963-2000. One limitation of the present study is the high degree of aggregation of the product types to be compared. We are conscious of the heterogeneity of these products, but our objective is precisely to

6 Defined in this way by Bhagwati and Panagariya (1999) and Baldwin, (2006)

7 As demonstrated in a recent study by Baier and Bergstrand (2007), the fundamental problem of much previous research is the cross-section technique; although this corrects the problems of estimation with instrumental variables, it does not provide stable results.

obtain conclusions from this general analysis. It is obvious that studies which analyse the determinants of trade for more homogeneous product groups or which disaggregate further those studied here are also essential (Serrano and Pinilla, 2009 a).

The empirical success of this equation in explaining trade patterns has fathered numerous subsequent articles, although very few of these have employed such a long-term perspective, concentrating instead on the agricultural products and food trade[8] and comparing it to trade in other types of goods. Both the pioneering work by Feenstra, Markusen, and Rose (2001) and subsequent studies (Fidrmuc, 2004, Jensen, 2006 and Schumacher and Siliverstovs, 2006) lack the long-term perspective of the present study.

We believe that this long-term vision can improve the understanding of the effects of growth of countries' market size. Previous research (see, for example, the analysis performed by Head and Ries (2001), which examines only 6 years) is unable to reflect companies' possible entry into or exit from an industry, which is a key indicator of the presence of the HME. Following Baldwin (1988) and Baldwin and Krugman (1989), the entry-exit decisions of companies in a market or industry are influenced by the long-term growth of market size.

The second contribution of this article is to undertake a wider analysis than that performed in previous research, by including further variables we consider to be relevant. To this end, we have combined three research lines in the gravity equation methodology: the work of Bergstrand (1989), the studies by Feenstra, Markusen, and Rose (1998 y 2001) and the latest contributions made by de Anderson and van Winncoop (2004). Furthermore, we attempt to shed somewhat more light on the debate initiated by Rose (2004), regarding the influence of GATT, and the broad spectrum of studies which aim to analyse the effects of different Regional Trade Agreements upon trade growth. In summary, we believe that the present study contributes to a greater understanding of the determinants of trade through the gravity equation.

Finally, it must be emphasised that the study shows how a correct estimation of the gravity equation must include fixed effects by country; these serve as an approximation of "multilateral resistance", following the suggestions made by Anderson and van Wincoop (2004). In addition the standard errors must be corrected using a Prais-Winstein estimation, as otherwise the models are subject to problems of specification.

8 Two exceptions, due to their importance, are Coyle, et al. (1998), who focus on the analysis of changes in the composition agricultural trade between 1985 and 1995, and Cho, Sheldon, and McCorriston. (2002), who study the effects of exchange rate volatility upon agricultural trade between 1974 and 1995.

The following conclusions can be extracted from the present study. Firstly, the extremely limited importance of the HME for agricultural exchanges, which explains that these grew less dynamically than those of manufactures and total trade. Secondly, it is important to underline the negative sign of income demand elasticity for imports in the agricultural products and food trade; this demonstrates that the latter behaved like inferior goods. Lastly, while other types of trade, such as manufactures, enjoyed greater multilateral liberalisation of their markets, strong market intervention caused it to base its growth on the proliferation and success of regional trade agreements. In order to make these arguments much more persuasive, we employed a more sophisticated econometric technique than that used in previous research. Furthermore, the sensitivity of these results for different subsamples of trade were examined.

The article is divided into six sections, followed by our conclusions. Following this introduction, the next section presents a brief synthesis of the empirical data regarding the decline in the relative share of agricultural trade in international exchanges. Section 3 establishes the theoretical framework of gravity models, while Section 4 explains the data employed and the procedure for estimating the gravity equation. The fifth section discusses the most important results and the sixth analyses their sensitivity by decomposing trade by groups of countries. The study ends with the presentation of our conclusions.

2. The decline of agricultural and food products in international markets, 1951-2000

From the mid-XIX century until the First World War the international economy witnessed a significant increase in market integration; this period is often referred to as the first wave of globalisation (O'Rourke and Williamson, 1999). Industrialisation, which took place principally in Europe, and the increase in incomes, accompanied by the reduction of transport costs, market liberalisation and a stable economic setting provided by the gold standard were the principal motors of this process. The expansion of trade was one of the key elements in this first wave of globalisation, together with the boom in capital movements and in transoceanic migrations.

Agricultural products and food played a central role in the growth of exchanges, which from 1870 onwards accounted for approximately 50% of total trade (Aparicio, Pinilla, and Serrano 2009). Trade was inter-industrial, within which exchanges of manufactures for primary products between countries with very different patterns of specialisation were predominant. After 1914, the globalisation process was interrupted as a result of the outbreak of the First World War, which was followed by a far-reaching

collapse, due to the depression of the 1930s and the Second World War (O'Rourke and Williamson, 1999).

In the second half of the XX century, the integration of the world economy accelerated once more, especially in the Western countries, with the establishment of a new economic order which encouraged a stable environment of generalised growth. Although at first this process did no more than recover past levels of integration, since approximately the 1960s the integration process accelerated at an unprecedented rhythm, often called the second wave of globalisation, in which trade once more played a key role. The pattern of international trade came to be intra-industrial, predominantly between advanced economies with similar factor endowment. Trade in agricultural products and food declined in relative terms and today represents only a small proportion of total exchanges.

This decline occurred especially in the period of the greatest expansion of international trade i.e. 1951-73. Thus, agricultural exports suffered their greatest loss of share in international trade (29 percentage points in volume and 22 in value). This fall later decelerated with regard to trade volume, since the distance separating it from the rate of growth of total trade narrowed (3.5% for agricultural trade *vs.* 4.9% for total trade); however, the value of agricultural trade continued to fall, since, as is well known, a sharp drop in its relative prices took place from 1973 until the end of the XXth century (Ocampo and Parra, 2003).

>Table 1 Growth rates of income and international trade

Among the reasons for this significanct loss of importance, and doubtless one of the most commonly cited, is the relative fall in its prices. This appears evident if we consider the difference between the drastic loss of share of agricultural trade in total trade in terms of value, compared to the more moderate (albeit important) decline in terms of volume, which demonstrates an extremely serious fall in relative prices. According to our calculations, this occurred most sharply between 1973 and 1982, and especially conditioned the incomes of countries specialised in the export of the most basic products[9].

With regard to the causes of the loss of share in terms of volume, we outline here some of the reasons most commonly given in the literature: generalised protectionism in the international markets for agricultural products; changes in consumption patterns related to rising income levels, the achievement of considerable savings in the industrial usage of raw materials and, lastly, the smaller share of intra-industrial trade for the majority of products comprising the agricultural products and food trade.

9 A more detailed analysis of the calculations and trends of price series is given in Serrano (2007).

3. Theoretical foundation of gravity models

The first applications of the gravity equation employed in the study of the determinants of international trade, undertaken by Tinbergen (1962) and Pöyhönen (1963), lacked a theoretical basis. Subsequently, the success of this methodological approach in explaining international trade patterns led economists to formally develop its theoretical foundations. The empirical validations of the gravity equation, such as those performed by Helpman (1987), Hummels and Levinsohn (1995), Fontagné, Freudenberg and Péridy (1998) and Evenett and Kéller (2002), conclude that the equation can be derived from different theoretical models. This is an eclectic vision of trade determinants which includes, in a complementary fashion, the Hecksher-Ohlin models with specialisation (Anderson, 1979; Deardorff, 1984; Anderson and van Wincoop, 2003) and the models of the New International Trade Theory with increasing returns and monopolistic competition (Helpman and Krugman, 1985), allows the gravity equation to be better reconciled with the theoretical models.

The database and the specification of the equation employed in this article largely follow the studies by Feenstra, Markusen, and Rose (2001), Bergstrand (1985,1989) and Anderson and van Wincoop (2003) –in which a detailed explanation of their theoretical foundations can be found- and therefore we only offer a simple description of the variables and the sign and their expected result. Their functional form, applying logarithms, is:

$$\begin{aligned} ln\, X_{ij} = {} & \beta_1 + \beta_2\, ln(Y_i) + \beta_3\, ln(Y_j) + \beta_4\, ln(Ypcp_i) + \beta_5\, ln(Ypcp_j) + \\ & + \beta_6\, lnDist_{ij} + \beta_7\, lnExcvol_{ij} + \beta_8\, lnRem_{ij} + \beta_9\, Border_{ij} + \\ & + \beta_{10}\, Lang_{ij} + \beta_{11} RTA_{ij} + \beta_{12}\, GATT_{ij} + \delta_i + \delta_j + \varepsilon_t \end{aligned} \qquad (1)$$

In the initial approach of the gravity equation, $\boldsymbol{X_{ij}}$ represents the volume of trade flows between two countries, $\boldsymbol{Dist_{ij;}}$ the geographic distance between the capitals of the countries and $\boldsymbol{Y_i}$ $\boldsymbol{Y_j}$ the countries' market size, which is usually approximated by the value of their income (Gross Domestic Product-GDP) or the size of their population. The separate interpretation of the last variable is even more interesting, since it will permit us to observe that the potential of a country to offer (export) its products depends on its own average market size, as measured by GDP, while foreign demand for these products will depend on the size of the GDP of the importing country. That is to say, the potential supply and demand of its trade partners will be studied by including their respective GDPs in the model.

Following the studies by Feenstra, Markusen and Rose (1998, 2001), the use of these variables also permits us to analyse the degree of adaptation of different types of goods to intra-industrial trade[10]. This theoretical framework for the gravity equation provides a method for verifying the home market (or reverse home market) effect for different trade sectors. According to the above authors, in the case of differentiated products (manufactures) and increasing returns to scale, a country's exports respond more sensitively to changes in the income of the exporting country than to that of the importing country; this has been termed the home market effect[11]. According to Krugman (1980), when countries trade, that which has a wider market will produce a large number of differentiated products, since it will attract more companies and will become a net exporter of differentiated products. In the case of homogenous products, their trade responds more sensitively to the income of the importing country than to domestic income. On this point, several studies, such as those by Feenstra, Markusen, and Rose. (1998) and Fidrmur (2004), have provided evidence to show that agricultural trade would be framed within characteristic models of homogenous products and whose theoretical base would be easier to reconcile with national product differentiation trade models or reciprocal dumping.

Moreover, as stated above, the geographical distance between countries is usually presented as an obstacle to trade and considered as an approximation of transport costs. Various studies have centred on this argument, given that logistical infrastructure differs greatly among countries. Consequently, they propose weighting the distance between countries ($\boldsymbol{Remi_{ij)}}$ on the basis of their economic strength, income or population (Rose, 2000 or Feenstra, Markusen, and Rose 2001).

However, following Bergstrand (1989) the equation includes the GDP per capita of the countries ($Ycpc_i$, Ycpcj). Their inclusion in the model permits us to characterise trade in different types of goods. According to this author, the interpretation of the coefficient of per capita income in the exporting country may be considered as an approximation of its factor endowment, its coefficient being positive in the case of capital-intensive goods and negative for labour-intensive goods. Likewise, the coefficient of per capita income in the importing country serves to categorise the type of good, and will produce a positive sign for superior goods and a negative one for inferior goods.

10 The study by Feenstra (2004) discusses the theoretical framework of gravity models with product differentiation.

11 On this point, the assumption of monopolistic competition is not essential to obtain the gravity equation. See examples in Feenstra, Markusen, and Rose (1998 and 2001) with reciprocal dumping models and Deardorff (1998), with perfectly competitive markets in a world without trade barriers. Empirically, other studies, such as that by Evenett and Keller (2002), which argue that models of increasing returns to scale provide a better explanation of the goodness of fit of gravity equations, especially in the case of industrialised countries.

As in the vast majority of studies, we simultaneously include multiple variables, such as geographical proximity (if the countries share a border) or cultural proximity (e.g. the existence of historical or cultural ties, such as a colonial relationship or a common language). All of these are expected to produce a positive sign for its coefficient. Moreover, following other studies e.g. Cho, Sheldon, and McCorriston (2002) and Rose (2000), the model includes different measures of the volatility of the bilateral exchange rates ($\boldsymbol{Excvol_{ij}}$). The objective in the present case is to examine the impact of exchange rate uncertainty upon trade flows. Its coefficient is expected to display a negative sign i.e. the greater the instability of exchange rates, the lower will be the growth of trade between two countries.

Concerning the institutional context, the specification of the gravity equation has been refined in many studies, with the aim of taking into account those factors which may limit or stifle trade. Surprisingly, few such studies have introduced trade policies into the gravity equation. Their inclusion in the model is difficult, due to limited or non-existent data. Nevertheless, many studies have introduced dummy variables to analyse, on the one hand, the effect of regional liberalisation produced by the proliferation of regional trade agreements ($\boldsymbol{RTA_{ij}}$)[12] and, on the other, the effects of the multilateral liberalisation of international markets ($\boldsymbol{GATT_{ij}}$).

In the first case (RTAs), the objective is to examine the impact of the proliferation of Regional Trade Agremments upon trade flows. In the second case (multilateral market liberalisation), and following the proposal made by Rose (2004), various dummy variables were included to explore the effects of belonging to free trade associations. Specifically, the aim was to examine the effects of the various rounds of the General Agreement on Tariffs and Trade (GATT). Both the result and the sign of this variable are uncertain, as stated in the introduction to the present study.

Lastly, in line with the recent work by Anderson and van Wincoop (2003), the equation includes the "multilateral (price) resistance terms" proxied by the dummy variables δ_i and δ_j. This article, highly influential in recent studies, demonstrates that the omission of price indices leads to an erroneous specification of the empirical model, which may bias the results. We use country fixed effects (δ_i , δ_j) to account for the multilateral price terms (rather than a custom nonlinear least squares program), following the alternative proposed by Feenstra (2004). These variables reflect the effect of all those particularities of the exporting or importing countries which affect trade between the two countries and are not captured by

12 See, for example, Frankel (1997), Frankel and Wei (1993), Bayoumi and Eichengreen (1993) or Sapir (1997).

the remaining variables specified in the empirical model. Finally, the model includes the error term (ε_t) which is assumed to be log-normally distributed.

4. Data and estimation procedure for the gravity equation

We constructed export flows by volume for total trade, manufactures and agricultural and food products, following the system of the Standard International Trade Classification (SITC, Revision 2 (in 1985 $US) for the period 1963-2000, in year t ($\boldsymbol{X_{ij}}$). For total trade (all the SITC groups, 0-9.), trade in manufactures (SITC groups: 5.Chemical products: 6.Manufactured products: 7.Machinery and equipment: 8.Various manufactures) and trade in agricultural products and food (agricultural products included in the SITC groups 00-04)[13]. These data were taken from the figures for bilateral exports (FOB - free on board) supplied by the United Nations Statistics Division in the UN-COMTRADE (2003) database. The sample includes trade among 40 countries[14]. The database therefore consists of a "balanced data panel" comprising trade flows among 40 countries of origin x 39 countries of destination x 38 years = 50,388 observations[15].

> Figure 1. Evolution…..

Figure 1 shows the evolution of bilateral trade flows for international trade in agricultural products and food, manufactures and total trade, according to the data in the sample. As its examination reveals, the evolution of trade in agricultural products and food was slower than that of total trade and even more so compared to manufactures, in strong accordance with the explanation given in Section 2. Concretely,

13 SITC groups- 00: Live animals, 22: Oil-seeds and oleaginous fruits. 26: Textile fibres. 06: Sugar, 07: Coffee, tea, cocoa. 01: Meat and meat preparations. 02: Dairy products and birds' eggs. 04 Cereals. 05: Vegetables and fruit. 08: Feeding stuff for animals. 09: Miscellaneous edible products and preparations. 11: Beverages. 12: Tobacco and tobacco manufactures. 41: Animal oils and fats. 42: Fixed vegetable fats and oils. 43: Animal or vegetable fats and oils, processed.

14 Africa (Algeria, Ivory Coast, Egypt, Morocco, Nigeria, Sudan), Asia (China, India, Indonesia, Israel, Japan, Malaysia, Saudi Arabia); North America (Canada, México, United States); Latin America (Argentina, Brazil, Chile, Colombia, Ecuador, Nicaragua, Peru); Europe (Germany, Belgium-Luxembourg, Denmark, Finland, France, Greece, Italy, Ireland, the Netherlands, Norway, Portugal, Spain, United Kingdom); Oceania (Australia, New Zealand)

15 In order to obtain a balanced panel trade flows with a value of 0 are replaced by a figure for minimum trade ($100), following previous research e.g. Raballand (2003) or Schumacher and Siliverstows (2006) with a similar specification to our approach to the gravity equation. The most common alternative is to the foregoing consists of eliminating those trade flows with a value of 0. Frankel (1997) performs a comparative analysis of the two methods and finds negligible differences between the two alternatives. The present study opted for the first method, since it permits us to use more sophisticated econometric methods, which correct the recurrent problems of estimation in previous research. Nevertheless, due to the drastic lack of data, exports from China, Ivory Coast, Nigeria, Sudan, Saudi Arabia and Uruguay to the remaining countries were eliminated. Note that exports from the remaining countries to these countries remain in the sample. Thus, the sample comprises the trade flows among 40 countries of origin x 39 countries of destination x 38 years – (6 x 39 x 38 trade flows were eliminated due to a lack of data) = 50,388 observations.

using the figures from the sample, while trade in manufactures increased almost eight-fold (7.9), at the end of the period (1963), agricultural trade had only multiplied 3.3 times.

To continue with the description of the model's variables, $\boldsymbol{Y_i}$, $\boldsymbol{Y_j}$; is the real GDP of both the exporting country and the importing country, in year t, in 1985 US dollars (World Development Indicators (WDI) database CD-ROM, 2004); $\boldsymbol{Ypcp_i}$, $\boldsymbol{Ypcp_j}$: is the per capita GDP of both the exporting and importing countries, in year t, in 1985 US dollars (WDI CD-ROM, 2004); $\boldsymbol{Dist_{ij}}$: is the distance between the capitals of the countries of origin and destination (CEPPI database) ; $\boldsymbol{Excvol_{ij}}$: is an indicator of exchange rate volatility in year t[16]; $\boldsymbol{Border_{ij}}$: is a dummy variable which takes the value of 1 if the countries have a common border and 0 otherwise; $\boldsymbol{Lang_{ij}}$: is a dummy variable which takes the value of 1 if the countries share a common language and 0 otherwise ; $\boldsymbol{Rem_{ij}}$: is the relative distance weighted by income levels, following the methodology and data of Rose (2000); $\boldsymbol{RTA_{ij}}$: is a dummy variable which takes the value of 1 if the two countries belonged to the following regional trade agreements (EU, NAFTA, CER, APEC, MERCOSUR, ANDEAN, ASEAN, GSTP nd 0 otherwise[17] ; $\boldsymbol{GATT_{ij}}$ is a dummy variable aimed at capturing the impact of the various rounds of GATT. Concretely, $GATT_{63\text{-}94}$, is a dummy variable, used if the two countries belonged to that organism prior to the Uruguay Round (1994). Additionally, $GATT_{94\text{-}00}$ is a dummy variable, employed if the two countries were members of GATT following the implementation of the agreements reached in the Uruguay Round of GATT (1994). The objective of this separation is to analyse, especially, the effects of the latter which, as mentioned earlier, was the first round in which the liberalisation of trade in agricultural products and food was negotiated.

With regard to the estimation technique, our aim is to overcome the limitations of previous research which has only taken into account the variations among the units of observation (cross-section analysis).

16 Estimation of the standard deviation of the first difference of the annual natural logarithm of the nominal bilateral exchange rate, for both countries in the 10 years preceding the period t (data for exchange rates taken from WDI CD-ROM, 2004)

17 The effects of the integration of the countries in the sample were studied according to the year of their integration into the following free trade institutions:

EU: European Union, previously the European Economic Community, (Austria, Germany, Belgium-Luxembourg, Denmark, Finland, France, Greece, Italy, Ireland, the Netherlands, Portugal, Spain and the United Kingdom Unido)

EFTA: European Free Trade Association (Austria, Denmark, Finland, Norway, Portugal, United Kingdom).

NAFTA: North American Free Trade Agreement, previously CUSTA, Canada-US Free Trade Agreement (Canada, Mexico, United States).

CER: Australia-New Zealand Closer Economic Relations (Australia, New Zealand).

APEC: Asia Pacific Economic Cooperation (China, Indonesia, Japan, Malaysia, Canada, United States, Mexico, Australia, New Zealand, Chile and Peru).

MERCOSUR: Common Market of the South (Argentina, Brazil, Chile, Uruguay).

ANDEAN: Andean Pact (Chile, Columbia, Ecuador, Peru).

ASEAN: Association of Southeast Asian Nations (Indonesia and Malaysia).

GSTP: Global System of Trade Preference among developing countries (Algeria, Egypt, Morocco, Nigeria, Sudan, India, Indonesia, Malaysia, Argentina, Brazil, Columbia, Ecuador, Nicaragua)

The present study also examines the time variations within the observation units. The use of panel data increases the efficiency of the estimators and significantly reduces the potential problems caused by the omission of variables (Hiaso, 1986). From this perspective, three types of data panel estimation are proposed: the first is the estimation of ordinary least squares (OLS) with the grouped panel; the second and third take into account the time variation, by the inclusion in the model of random effects and fixed effects, respectively.

In order to determine which of the three estimators is most efficient, the LM Breusch-Pagan test for random effects was employed; this permitted us to choose between OLS estimation of the grouped panel and estimation with random effects. Following the application of the Breusch-Pagan tes, it was concluded that random effects are significant, and it is therefore preferable to use the estimation which includes them rather than the grouped panel estimation. Its results are given in columns 4-6 of table 2. At first sight, both for total trade and for agricultural products and food flows, and similarly for manufactures, the gravity equation presents satisfactory results[18]. The result of the adjusted R^2 shows how the proposed model is able to explain 60% of the variations in world trade. Nevertheless, it is expedient to emphasise that the equation in the case of trade in agricultural products and food has a lower explanatory capacity (52%). This question causes us to wonder whether, specifically for bilateral agricultural trade flows, some important variables have been omitted. We believe, for example, that one such variable may be the high level of protectionism to which its markets were subjected. In general, the results clearly show, as initially forecast by the gravity equation, that the bigger the market size of countries and the shorter is the distance between them, the more they trade.

> Table 2. Results….

Similarly, to demonstrate that the inclusion of fixed effects is a more appropriate method than the other two we employed initially, various tests were performed. Firstly, the F-test (Greene, 2000) of the significance of fixed effects indicates that their estimations are better than when the OLS estimation of the grouped panel is employed. Secondly, the Hausman test demonstrated that the estimators of random effects and of fixed effects differ significantly, and that the fixed effects model provides a better explanation of the sources of variation and is therefore more appropriate than the random effects model.

18 This result supports the evidence provided by studies such as those by Deardorff (1998), Evenett and Kéller (2002) and Feenstra, Markusen, and Rose (1998) in relation to the general character of the gravity equation in the explanation of trade in different product groups.

It is important to underline here that, despite having modelled temporal and spatial heterogeneity, according to a Wald test (Green, 2000) our model poses problems of heteroskedascity and, according to the Woolridge test (Wooldridge, 2001), problems of autocorrelation also exist. Lastly, the Breusch-Pagan test, used to identify problems of contemporaneous correlation in the residuals of the fixed effects model, likewise confirms the need to correct this problem. The above-mentioned problems of contemporaneous correlation, heteroskedascity and autocorrelation can be solved jointly and were resolved by the estimation of panel-corrected standard errors (PCSEs)[19]. On the positive side, once the problems of estimator specification were corrected, the models continued to function well. All the principal variables present the expected sign and are statistically significant (see columns 1-3 of table 2)

On this point, in addition to these technical reasons, there are also theoretical motives for preferring the fixed effects estimation (Feenstra 2004, 161-163). As stated earlier, Anderson and van Wincoop (2003) derived a gravity equation specification by using a model that includes the presence of "multilateral (price) resistant terms", which was approximated using fixed effects by country[20]. Furthermore, Baier and Bergstrand (2007) conclude that, for the analysis of trade agreements, the fixed effects approximation is best.

5. Results

As stated in the introduction, one of our principal objectives was to compare the differences or similarities between the pattern of trade followed by agricultural products and food exchanges and those of other types of goods. The analysis of the principal results, presented below, was aimed at achieving this objective.

The growth of GDP *(Yi Yj)*, for both total trade flows and those of manufactures and agricultural trade, display the highest coefficients with regard to the remaining variables. However, it is fitting to emphasise the differential behaviour of trade in agricultural products and food compared to other types of goods, such as manufactures. While trade in the latter, as in total trade, was driven by the growth of market size, in both the exporting and importing countries, agricultural trade flows were solely influenced by the growth in the market size of the importing country.

19 Beck and Katz (1995) demonstrate that the standard errors of PCSE are more precise than those of FGLS (estimation of Feasible Generalized Least Squares, the other alternative to solve the above-mentioned problems.

20 Following Feenstra (2004), the use of alternative methods produces similar results.

These results demonstrate that income was the key determinant of the evolution of international trade. This is no doubt closely related to the spectacular economic growth which occurred during the second half of the XX century (Serrano and Pinilla, 2009 b). Consequently, we may affirm, by comparing the model's results for the different types of goods, that agricultural trade was less capable than manufactures of taking advantage of this key factor, which helps to understand its relatively slow growth.

On this point, while for trade in manufactures rising GDP had an expansive effect associated with the increase in the market size of both the exporting and importing country, trade in agricultural products was only influenced by the growth of the market size of the importing country. Coinciding with previous research, this result implies, in the case of manufactures, the emergence of the home market effect (an effect which exceeds the growth in the market size of the exporting country compared to that of the importing country). That is to say, countries with large market sizes will attract companies, which will specialise in the production of and trade in differentiated products and will take advantage of economies of scale[21].

Moreover, as we foresaw when referring to the theoretical framework, agricultural products and food adapted better to a trade pattern based on reciprocal dumping, as suggested by Feenstra, Markusen, and Rose (2001 and 2003). In other words, price dumping is price discrimination between markets which leads to trade in the same product between countries, in both directions. This trade pattern is entirely coherent with the generalised idea that intervention in the agricultural sector was extremely pronounced in the second half of the last century. Let us take as an example the case of agriculture in Western Europe. At least until the end of the 1980s European farmers received, for many products, as much as twice their international market price. The CAP, through its guaranteed prices policy, encouraged production, which would soon become surpluses to be placed on international markets at prices below domestic prices, via subsidies to exports.

The counterpart to the destination of these exports was the increasing demand for food in countries such as China, India or numerous Latin American and African economies, which experienced demographic explosions. On this point, it must not be forgotten that such countries started from very low levels of food consumption per capita and, progressively, converged with the levels of high-income

21 These results are in consonance with those of Feenstra, Markusen, and Rose (1998), Evenett and Keller (2002), and Fidrmuc (2004); our contribution here is to broaden the results for long-term panel data, since previous research has employed cross-section analysis with more recent trade figures.

countries. Without a doubt, this helps to understand the high coefficient (2.137) displayed by the income variable for the importing country (*Yj).*

Secondly, it is notable, although unsurprising, the result in comparative terms displayed by the coefficient of per capita income of the importing country *($Ypcp_j$)*: this was statistically significant and negative (-0.974) for the case of agricultural products, but positive (1.111) and also statistically significant for trade in manufactures. As stated earlier, this is one of the most commonly reasons the literature uses to explain the loss of share of products which comprise agricultural trade in international markets. Engel established long ago that the quota of expenditure allocated to basic necessities, such as food or clothing, within the total budget falls as income rises. Thus, the low or negative elasticity of income with regard to the demand for imports of the majority of the products which comprise agricultural trade hindered more dynamic behaviour.

Furthermore, with regard to the effect upon trade of per capita income growth in the exporting country *($Ypcp_i$)*, the results are more surprising. In the case of agricultural products the sign is positive (greater than unity) and statistically significant. In other words, exports of agricultural products and food increased in line with a country's rising per capita income levels. In the case of trade flows in manufactured products the sign is the opposite i.e. as a country increased its income levels its exports of more elaborate products declined.

For our current concern, agricultural trade, the result is surprising but simpler to explain. Numerous studies have shown how, on the basis of technological innovation, significant improvements were made in agricultural productivity, and how this became, for many economies, a capital-intensive sector (Grigg, 1985 and Federico, 2005). This factor, together with strong protectionism, consolidated numerous high-income countries as net exporters of agricultural products and food.

With regard to exchange rate volatility, this displayed a negative and significant coefficient for total trade and for agricultural trade flows. Although their values are very low, it can be said that when instability surrounded multilateral payments (as happened in the crises of the 1970s and 1990s), trade was affected negatively. Our results coincide with those of other studies, such as Cho, Sheldon, and McCorriston (2002), which demonstrated that agricultural trade was more sensitive to such instability.

From an institutional perspective it is possible to talk of increasingly regionalised trade in agricultural products and food. The coefficients of the dummy variables *EU, EFTA* and *GSTP* are

positive and statistically significant. The same may be said for both total trade and trade in manufactures[22].

From a comparative perspective it is notable that the above-mentioned RTAs display a more expansive effect upon agricultural trade flows, to which must also be added the positive effects of the *APEC* and *ASEAN*. All the foregoing leads us to affirm that trade in agricultural products and food was more regionalised, as RTAs generated an increase in trade flows greater than that of other sectors[23].

In our opinion, the greater influence of RTAs upon agricultural trade flows is also a reflection of the different degree of protectionism to which different trade sectors were subjected in the second half of the XX century. In other words, given the high degree of protectionism in agricultural markets, the effect of their liberalisation among countries in the same region must, obviously, be greater than in other sectors with lower barriers to trade, as in the case of manufactures.

Likewise, as Rose (2004) proposed, we attempted to verify the importance of membership of GATT upon countries for trade in various sectors. The results for total trade are in consonance with those obtained by Rose (2004) i.e. the effects are not significant for total trade. However, a positive and significant sign was found for trade in manufactures. The dummy variable $GATT_{62\text{-}94}$ and $GATT_{94\text{-}00}$ displays a positive and significant sign for the manufacturing sector. This effect was not evident for the agricultural sector, which confirms that agricultural trade was highly protected, at least until the Uruguay Round (1986-1994).

Somo authors have talked of a certain reduction of multilateral protectionism in agricultural markets, via the agreements established in the Uruguay Round (1986-94). Despite this, the coefficient of the

22 Studies such as those by Frankel and Rose (1998), Rose (2000) and Feenstra, Markusen, and Rose (2001), together with the more recent work of Baier and Bergstrand (2007), are also in accordance with the results of our study i.e. that regional trade agreements are, in general, creators of trade.
Our results coincide with those of early studies, such as those by Aitken (1973), Bergstrand (1985) and Thursby and Thursby (1987), which had already demonstrated that European commercial blocs increased their trade during the 1960s and 1970s, and subsequent research e.g. Endoh (2005), for the group of developing countries that formed part of the GSTP from 1989 onwards. However, in the long term the present study finds no evidence of trade creation for *APEC, NAFTA, CER, ANDEAN or ASEAN* and even shows trade diversion effects in the case of *MERCOSUR*. This is in contrast to the results of, for example, Frankel and Wei (1993, 1995) and Frankel (1997), regarding trade creation in the Asian and North American blocs for the period 1970-1992, and those of Soloaga and Winters (2001) for trade in Latin America in the 1990s.

23 It was impossible to compare this result with those of previous studies of agricultural trade flows, as they either analyse this aspect for other time periods or because they only take into account the specific case of one region. Nevertheless, our long-term vision produces results which differ from those of Koo, Kennedy, and Skripnitchenko (2006) for a cross-section in 1999 or those of Jayasinghe and Sarker (2008) for NAFTA in the period 1985-2000. However, our results agree with Fidrmuc (2004), for a cross-section in 1989, and Sarker and Jayasinghe (2007), for the period 1985-2000, with reference to the greater influence of, for example, the EU, upon agricultural trade flows.

dummy variable $GATT_{94\text{-}00}$, is not significant statistically and does not exceed the values which, for example, were found for the RTA coefficients.

6. Sensitivity analysis of the countries sampled

As described earlier, the process of the integration of agricultural markets during the second half of the XX century was especially important among high-income countries. We would therefore like to extend here the analysis of the determinants of agricultural trade, in comparison to other sectors, employing a more disaggregated approach to trade flows for different subsamples of trade flows. According to Feenstra, Markusen, and Rose (2001) and Hummels and Levinsohn (1995), it is possible that the results already given do not depend upon product type but instead on individual country characteristics. We therefore performed the same exercise for different subsamples of countries.

>Figure 2. Evolution……

This section is dedicated to analysing the differences between agricultural and manufacturing trade in four categories of trade flows, the first of which is among high-income countries (N-N). As figure 2 shows, their bilateral trade flows achieved higher growth in agricultural exchanges. The second is trade flows which originate in high-income countries and are destined to low-income countries (N-S). The third is trade flows whose origin is in underdeveloping countries and are exported to the developed world (S-N), on which trade in primary products was based in previous stages, and which grew very slowly in the study period . The final category is trade flows between low-income economies (S-S), whose growth of exchanges accelerated, especially in the final fifteen years of the last century.

Table 3 shows the estimation of the equation with PCSE and fixed effects[24] for the four subsamples of trade flows. Briefly, its results lead to the following conclusions, which help to understand the previous results more clearly. Firstly, the emergence of intra-industrial trade (explained by the home market effect*)*, found in the aggregated trade flows of manufactures, is principally based on exports from high-income countries to less developed countries.

24 Following the same process employed in aggregate trade flows, we established that this type of estimation is the most appropriate.

Secondly, it is notable that the previous effect is also to be found in some categories of trade flows of agricultural products and food. Concretely, the home market effect (an elastic supply of exports with regard to domestic income) is apparent in the export flows from advanced economies to underdeveloping countries. This result confirms the commercial specialisation of the developed economies, since they exported more highly elaborated agricultural products with greater added value.

>Table 3. Result……..

Thirdly, the negative sign of income elasticity of the demand for imports of products which comprise agricultural trade and food (see the variable $lnYpcp_j$) is a result largely determined by exports from low-income countries to more developed countries; thus, the former are exporting basic products which, as we know, have lower elasticity in the more advanced economies.

Fourthly, a comparison of the coefficients of the dummy variables which represent the effects of RTAs demonstrates their more expansive effect upon agricultural flows among high-income economies than in the remaining cases. Concretely, the variables *EU, EFTA,* and *NAFTA* display stronger effects than those organisations in which relatively underdeveloped countries were integrated.

Lastly, it is striking that the effect of market liberalisation, following the Uruguay Round of GATT ($Gatt_{94\text{-}00}$) was extraordinarily important for exports from low-income countries, which implies that previously they had to deal with highly protected markets (see table 3, columns 11 and 12).

7. Conclusions

The present study employs the gravity model to compare trade patterns for agricultural products and food, manufactures and total trade, for a large part of the second half of the XX century, using panel data. Furthermore, the analysis constitutes an advance with respect to previous research, which was principally based on cross-section studies. The vision presented here is longer-term and resolves some of the recurrent problems in estimation using panel data.

The study demonstrates that, on the basis of the results of the Hausman test, the correct econometric specification is that of fixed effects. The results are robust with regard to various specifications and models. Five of the results achieved are of special interest and should be emphasised.

Firstly, trade in both agricultural products and food (and, by extension, trade in homogenous products) and manufactures, are satisfactorily explained by the gravity equation.

Secondly, the evolution of income levels was the key factor to the understanding of the expansion of trade in not only agricultural products and food but also manufactures. Nevertheless, and with regard to other studies, it is especially notable that for trade in manufactures the home market effect (an elastic supply of exports in relation to domestic income) was very important; this is typical of intra-industrial trade. The consequences of this result provide an initial clue for the understanding of the loss of share of agricultural products in international markets i.e. their relatively low level of intra-industrial trade.

Thirdly, the negative sign of the income elasticity of demand for imports of products comprising agricultural trade and food is notable; this shows that these may be categorised as inferior goods. Consequently, this is another very important factor for the understanding of its relative decline, since in the case of manufactures the sign is positive and the coefficient much higher.

Fourthly, the proliferation of Regional Trade Agreements, especially in the European Union, had a much greater effect upon agricultural products and food than on other types of products. We believe that the foregoing reflects the different degrees of protectionism to which different trade sectors were subjected in the second half of the XX century.

Lastly, in our opinion there exist various factors which demonstrate that the relatively low growth of trade in agricultural products and food is also due to their facing stronger barriers to trade for a considerable part of the second half of the XX century. Especially notable are the above-mentioned increased growth of trade in zones with regional agreements, where obstacles to trade were lower, and in addition the belated and insufficient effect of the GATT agreements upon the liberalization of agricultural trade. Finally, it must not be forgotten the lower explanatory potential of models which analyse agricultural trade flows compared to others, such as trade in manufactures that were indeed protected; this apparently demonstrates the existence of other barriers to trade, which our model has been unable to capture.

Although it was not a central objective of this article, we believe that our results shed further light upon the controversial debate regarding the effects of Regional Trade Agreements. It is possible to talk of a progressively regionalised trade in agricultural products and food, due especially to the signing, implementation and widening of the *EU* and the *EFTA.* More recently, in the last decade of the last century, we also found a positive effect for two preferential trade agreements, the *APEC, ASEAN* and the *GSTP*.

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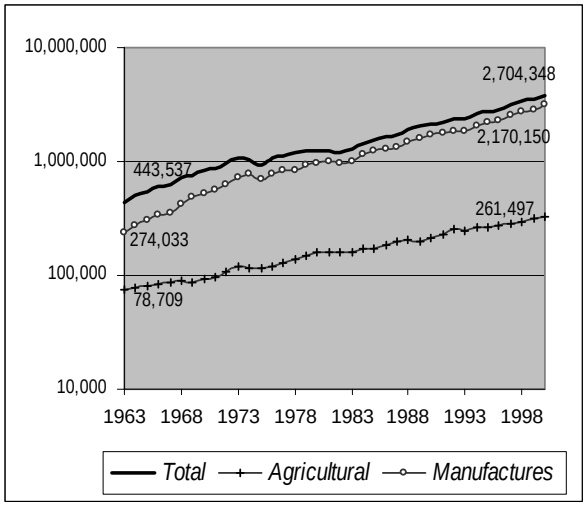
TABLES AND FIGURES

Table 1. Long-term Trends in Income and International Trade (rates of average annual growth), 1951-2000

	1951-2000	**1951-1973**	**1973-2000**
Worldwide GDP (1990 $US)	3.9	4.9	3.1
Total trade (value)	9.7	10.0	9.4
Agricultural trade (value)	5.6	5.6	5.5
Share of agricultural trade (value)	43.0 (1951)	17.6 (1973)	6.7 (2000)
Total trade (volume)	6.7	8.9	4.9
Agricultural trade (volume)	4.1	4.9	3.5
Share of agricultural trade (volume)	29.6 (1951)	12.3 (1973)	8.5 (2000)

Source: Worldwide GDP data from Maddison (2001). Trade data: authors' calculations based on FAO (1947-2000), FAOSTAT (2004), UN COMTRADE (2003) and WTO (2003).
Note that trade shares were calculated for 1951, 1973 and 2000.

Figure 1. Evolution of Bilateral Flows of International Trade in Agricultural Products, Manufactures and Total Trade. (Logarithmic scale, millions of 1985 $US)



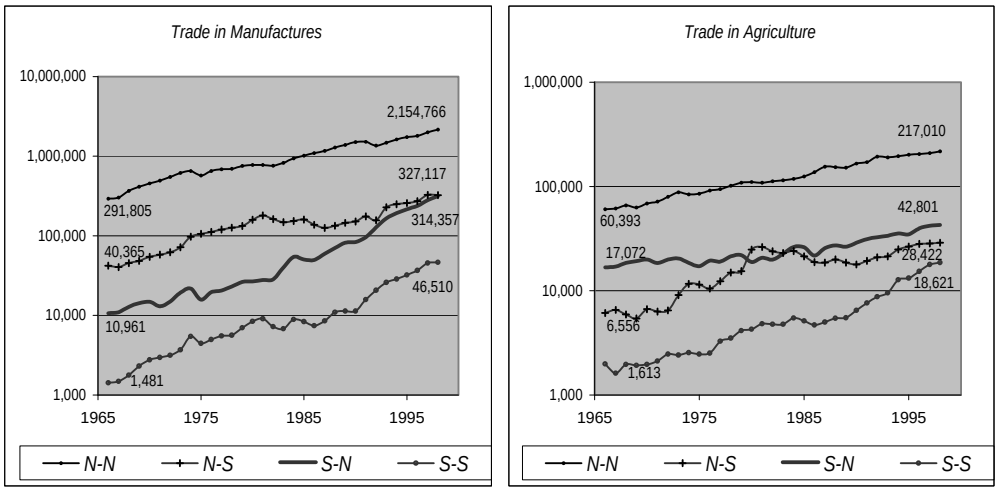
Source: Authors's compilation using UN-COMTRADE (2003). Series given in Appendices.

Table 2. Gravity Equation Results for International Trade in Agriculture, Manufactures and Total Trade

	PCSE-FE			Fixed effects			Random effects			OLS grouped panel		
Ln X_{ij}	TOT	MANF	AGR	TOT	MANF	AGR	TOT	MANF	AGR	TOT	MANF	AGR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
lnY_i	0.692**	2.277***	-0.572*	0.717***	2.235***	-0.795***	0.988***	1.624***	0.548***	1.184***	1.597***	1.036***
	(0.275)	(0.279)	(0.333)	(0.066)	(0.069)	(0.085)	(0.032)	(0.034)	(0.042)	(0.008)	(0.008)	(0.011)
lnY_j	1.390***	0.455***	2.137***	1.241***	0.227***	1.972***	0.993***	0.779***	1.151***	1.039***	0.955***	1.083***
	(0.171)	(0.170)	(0.220)	(0.054)	(0.056)	(0.069)	(0.027)	(0.028)	(0.035)	(0.007)	(0.008)	(0.011)
$lnYpcp_i$	0.023	-1.160***	1.566***	0.286***	-0.708***	1.987***	0.304***	0.226***	0.690***	0.395***	0.558***	0.323***
	(0.371)	(0.339)	(0.419)	(0.079)	(0.083)	(0.102)	(0.039)	(0.042)	(0.052)	(0.011)	(0.124)	(0.016)
$lnYpcp_j$	-0.056	1.111***	-0.974***	-0.046	1.181***	-0.869***	0.110***	0.357***	-0.010	0.109***	0.022**	0.195***
	(0.167)	(0.183)	(0.223)	(0.062)	(0.064)	(0.079)	(0.029)	(0.032)	(0.039)	(0.008)	(0.009)	(0.017)
$lnExcvol_{ij}$	-0.055***	-0.012	-0.030*	-0.091***	-0.042***	-0.049***	-0.099***	-0.005***	-0.063***	-0.129***	-0.114***	-0.087***
	(0.012)	(0.012)	(0.016)	(0.006)	(0.006)	(0.008)	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)	(0.010)
$lnDist_{ij}$	. . .	. . .	. . .	. . .	. . .	. . .	-0.984***	-1.217***	-0.956***	-1.022***	-1.231***	-1.012***
							(0.060)	(0.065)	(0.079)	(0.014)	(0.015)	(0.019)
$lnRem_i$	-0.000	0.000	-0.001	0.019*	0.017	0.011	0.037***	0.008	0.059***	0.103***	-0.136***	0.317***
	(0.005)	(0.006)	(0.006)	(0.010)	(0.010)	(0.013)	(0.010)	(0.010)	(0.013)	(0.012)	(0.014)	(0.030)
$Border_{ij}$	. . .	. . .	. . .	. . .	. . .	. . .	-0.228	-0.316	0.297	-0.411***	-0.399***	-0.231***
							(0.281)	(0.303)	(0.371)	(0.164)	(0.067)	(0.072)
$Lang_{ij}$	. . .	. . .	. . .	. . .	. . .	. . .	0.965***	1.378***	1.411***	1.043***	1.439***	1.458***
							(0.165)	(0.178)	(0.218)	(0.033)	(0.036)	(0.043)
EU	0.234***	0.183***	0.319***	0.359***	0.221***	0.396***	0.288***	0.193***	0.394***	-0.677***	-0.827***	0.140***
	(0.041)	(0.042)	(0.062)	(0.053)	(0.055)	(0.068)	(0.052)	(0.054)	(0.066)	(0.133)	(0.036)	(0.043)
EFTA	0.177***	0.276***	0.459***	0.337***	0.571***	0.782***	0.358***	0.570***	0.742***	0.052	0.451***	-0.282***
	(0.055)	(0.078)	(0.097)	(0.120)	(0.125)	(0.153)	(0.119)	(0.124)	(0.153)	(0.829)	(0.064)	(0.096)
APEC	0.083	0.209	0.313**	0.108	0.342***	0.465***	0.110	0.403***	0.420***	0.829***	0.966***	1.243***
	(0.121)	(0.150)	(0.153)	(0.071)	(0.074)	(0.091)	(0.071)	(0.074)	(0.091)	(0.058)	(0.078)	(0.090)
NAFTA	0.108	-0.051	-0.099	0.293	-0.119	-0.162	0.279	-0.180	-0.187	-0.911***	-1.418***	-1.464***
	(0.112)	(0.124)	(0.132)	(0.258)	(0.269)	(0.331)	(0.258)	(0.271)	(0.332)	(0.203)	(0.296)	(0.241)
CER	-0.093	-0.121	-0.152	0.115	-0.088	-0.067	0.533	0.419	0.302	1.009***	1.314***	0.857***
	(0.090)	(0.118)	(0.122)	(0.811)	(0.745)	(1.038)	(0.698)	(0.736)	(0.904)	(0.066)	(0.087)	(0.185)
MERCOSUR	-0.303**	-0.346**	-0.221	-0.787***	-0.825***	-0.726**	-0.724***	-0.714***	-0.641**	1.438***	1.409***	2.686***
	(0.136)	(0.139)	(0.233)	(0.220)	(0.230)	(0.281)	(0.220)	(0.230)	(0.283)	(0.127)	(0.157)	(0.164)
ANDEAN	0.208	0.293**	0.027	0.336*	0.462**	0.046	0.390**	0.547***	0.072	2.563***	3.023***	2.910***
	(0.127)	(0.132)	(0.204)	(0.180)	(0.187)	(0.230)	(0.177)	(0.185)	(0.228)	(0.095)	(0.098)	(0.120)
ASEAN	0.769*	0.177	1.166**	0.753	-0.320	1.148	0.893	0.115	1.296*	2.415***	2.450***	2.965***
	(0.448)	(0.444)	(0.474)	(0.590)	(0.616)	(0.756)	(0.548)	(0.576)	(0.707)	(0.134)	(0.137)	(0.124)
GSTP	0.761***	0.585***	0.805***	1.143***	0.933***	1.289***	1.068***	0.903***	1.075***	-0.054	-0.096*	-0.622***
	(0.154)	(0.136)	(0.169)	(0.043)	(0.045)	(0.055)	(0.040)	(0.042)	(0.052)	(0.066)	(0.174)	(0.088)
$Gatt_{62\text{-}94}$	0.045	0.184**	0.059	-0.094***	0.127***	-0.011	-0.069**	0.206***	-0.020	0.460***	1.204***	0.694***
	(0.069)	(0.077)	(0.093)	(0.033)	(0.035)	(0.043)	(0.032)	(0.034)	(0.042)	(0.032)	(0.034)	(0.043)
$Gatt_{94\text{-}00}$	0.092	0.223**	0.177	-0.028	0.184***	0.206***	-0.057	0.233***	0.129**	0.450***	1.215***	0.887***
	(0.089)	(0.098)	(0.109)	(0.039)	(0.041)	(0.050)	(0.038)	(0.040)	(0.049)	(0.037)	(0.004)	(0.054)
Constant	-37.81***	-56.24**	-30.62***	-34.65***	-50.84***	-25.26***	-28.21***	-40.11***	-26.15***	-34.49***	-45.16***	-32.66***
	(4.452)	(4.139)	(4.663)	(1.069)	(1.114)	(1.369)	(0.817)	(0.872)	(1.070)	(0.344)	(0.354)	(0.498)
No of observations	50.388	50.388	50.388	50.388	50.388	50.388	50.388	50.388	50.388	50.388	50.388	50.388
Adjusted R^2	0.600	0.625	0.517	0.260	0.352	0.187	0.644	0.687	0.492	0.659	0.716	0.530

Note: TOT: total trade, MANF: trade in manufactures, AGR: trade in agricultural products and food.
Columns 10-12: Estimation of grouped panel with ordinary least squares. Columns 7-9 with random effects model, 4-6 with fixed effects model. Columns 1-3: Prais-Winstein estimation with PCSE and fixed effects. All variables are in logarithms, except for binary variables (common border, language, RTAs and GATT). Standard errors are given in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Figure 2. Evolution of trade flows for agricultural products and manufactures: Groups of flows by economic region (Logarithmic scale. Millions of 1985 $US)



Source: Authors' compilation using UN-COMTRADE (2003).

Table 3. Results of gravity equation for international trade in agricultural products and food, manufactures and total trade: Groups of flows by economic region.

	Agriculture PCSE-FE				Manufactures PCSE-FE				Total trade PCSE-FE			
	N-N	**N-S**	**S-N**	**S-S**	**N-N**	**N-S**	**S-N**	**S-S**	**N-N**	**N-S**	**S-N**	**S-S**
lnY_i	-1.333***	1.339*	-1.322	-5.207***	1.087***	3.460***	0.650	-3.536***	-0.355**	2.899***	0.568	-4.020***
lnY_j	1.657***	1.280***	3.478***	3.198***	0.273	0.843***	0.376	3.451***	0.188	0.964***	2.412***	4.070***
$lnYpcp_i$	1.802***	-0.801	2.482**	7.474***	-0.115	-3.512***	0.806	5.657***	1.567***	-3.056***	0.646	5.406***
$lnYpcp_j$	-0.356	0.481	-2.687***	-1.621***	1.355***	0.967***	2.016***	-1.395**	0.884***	0.642**	-1.244*	-1.984***
$lnExcvol_{ij}$	-0.021**	0.023	0.019	0.016	0.006	-0.010	0.029	-0.015	-0.016**	-0.023	-0.019	-0.093**
$lnRem_i$	-0.005	-0.000	0.002	-2.068***	-0.005	0.011	-0.429	-1.094*	-0.007**	0.010	0.591	-1.149*
EU	0.465***				0.231***				0.218***			
EFTA	0.270***				0.190***				0.157***			
APEC	0.105	-0.513**	0.0.58	1.076**	-0.082	-0.153	0.150	0.821*	-0.024	-0.278*	0.031	0.313
NAFTA	0.186*	0.472**	-0.207		-0.018	-0.149	0.631**		0.137**	0.049	0.538**	
CER	0.036				0.019				0.037			
MERCOSUR				-0.920***				-0.642***				-0.682***
ANDEAN				-0.055				0.315**				0.173
ASEAN				-0.108				-0.553				0.034
GSTP				0.504***				0.639***				0.670***
$Gatt_{62\text{-}94}$	0.094	0.177	-0.004	-0.327*	0.148	0.198**	0.207	0.043	0.061	0.150*	-0.030	-0.173
$Gatt_{94\text{-}00}$	0.094	0.257	0.359**	0.624***	0.171	0.240*	0.272	0.473**	0.110	0.198*	0.073	0.244
Constant	2.530	-64.80***	-37.64***	21.40	-29.47***	drop	-42.39***	-3.521	drop	-76.16***	-49.23***	12.77
No.observ.	14.440	15.200	10.640	10.108	14.440	15.200	10.640	10.108	14.440	15.200	10.640	10.108
Adjusted R^2.	0.864	0.451	0.517	0.463	0.924	0.647	0.578	0.494	0.966	0.674	0.616	0.455

Note: Prais-Winsten estimation with PCSE and fixed effects.
N-N: North-North trade, between high-income countries.
N-S: North-South trade, exports from high-income countries to low-income countries.
S-N: North-South trade, exports from low-income countries high-income countries.
S-S: South-South trade, between low-income countries.
All variables are in logarithms, except binary variables (such as common border, language and different RTAs).
***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.