Investigation of Factors Affecting the International Trade of Agricultural Products in Developing Countries

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Abstract: This paper investigates effective factors on agriculture in international trade on developing countries include Iran, India, Malaysia, Pakistan, Thailand, Turkey, Brazil, Indonesia, Kenya, Venezuela, Tunisia, Romania, Chile and Mexico using the Gravity Equation (GE) models and panel data for the period between 1991 and 2009. The empirical findings showed that trade in agricultural products were influenced by the growth of the market size of both the exporting and importing country. Per capita income of the importing country ($Ycpc_j$) was statistically significant and positive (0.01) for the case of agricultural products in developed countries, but negative (-0.68) and also statistically significant for the coefficient of per capita income of the exporting country trade ($Ycpc_i$).

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1. Introduction

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).

For centuries countries have relied on trade in agricultural and food commodities to supplement and complement their domestic production. The uneven distribution of land resources and the influence of climatic zones on the ability to raise plants and animals have led to trade between and within continents. Historical patterns of settlement and colonization contributed to the definition of trade patterns and to the emergence of an infrastructure to support such trade. More recently, transnational firms with global production and distribution systems have taken over from post-colonial trade structures as a paradigm for the organization of world agricultural trade. Changes in consumer taste have encouraged the emergence of global markets and added to the significance of trade. Few countries could survive the elimination of agricultural trade without a considerable drop in national income, and none could do so without

considerable reduction in consumer choice and well-being. (Fao, 2003).

Various studies have been conducted in countries investigate of effective factors on agriculture in international trade:

Raul Serrano and Vicente Pinilla (2010) investigated the causes of the loss of share of agricultural products and food in international trade. They were 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. Saadullah Khan and Hossain (2010) has developed a model of bilateral trade balance that captures the effects of all factors influencing trade balance as suggested by elasticity, absorption, and monetary approaches and the popular Gravity Model with some extensions. Using standard panel data techniques the model is empirically tested and the results show significant effects of all the relative factors on the bilateral trade balance of Bangladesh in trading with her partners.

Idsardi (2010) investigated an augmented gravity model was applied to investigate factors such as transaction cost, market size, the stage of economic development, exchange rate fluctuations and the impact of trade agreements on the export flows of the selected products. Various factors were found to have a significant impact on trade flows amongst which: economic market size, supply capacity and physical market size.

Hatab et al (2010) employed a gravity model approach to analyze the main factors influencing Egypt's agricultural exports to its major trading partners for the period 1994 to 2008. Their findings are that a one percent increase in Egypt's GDP results in roughly a 5.42 percent increase in Egypt's agricultural export flows. In contrast, the increase in Egypt's GDP per capita causes exports to decrease, which is attributed to the fact that an increase in economic growth, besides the increasing population, raises the demand per capita for all normal goods.

In this paper, the approach to analyzing gravity model was followed. The statistical technique adopted here to identify effective factors on agriculture in international trade on developing countries is panel data.

2. Material and Methods

The first applications of the gravity equation employed in the study of the determinants of international trade, undertaken by Tinbergen (1962) and Poyhonen (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:

$$LnX_{ij} = \beta_1 + \beta_2 Ln(Y_i) + \beta_3 Ln(Y_j) + \beta_4 Ln(Ypcp_i) + \beta_5 Ln(Ypcp_j) + \beta_6 LnDist_{ij} + \beta_7 LnExcvol_{ij} + \beta_{11} RTA_{ij} + \delta_i + \delta_j + \varepsilon_t$$

In the initial approach of the gravity equation, X_{ij} represents the volume of trade flows between two countries, $Dist_{ij}$ the geographic distance between the capitals of the countries and Y_i 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.

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. 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 Fidrmurc (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 ($\mathrm{Re}\,mi_{ij}$) 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 ($Ycpc_i, Ycpc_j$). 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.

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 ($Ex\,\mathrm{cov}\,l_{ij}$). 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 (RTA_{ij}).

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 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.

3. Results

We constructed export flows by volume for agricultural and food products, following the system of the Standard International Trade Classification (SITC, Revision 3 for the period 1991-2009, in year t (X_{ij}). For trade in agricultural products and food (agricultural products included in the SITC groups 00-09). 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 14 developing countries include Iran, India, Malaysia, Pakistan, Thailand, Turkey, Brazil, Indonesia, Kenya, Venezuela, Tunisia, Romania, Chile and Mexico. The database therefore consists of a "balanced data panel" comprising trade flows among 14 countries of origin x 13 countries of destination x 12 years = 20,266 observations.

Figure 1 shows Value of exports and imports of agricultural products in the developing countries during the period 1961-2009. According to the figure, the value of export and import of commercial products in

this sector to developing countries, in the long term, have an upward trend.

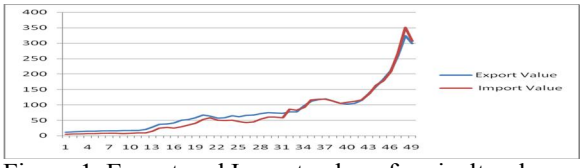

Figure 1. Export and Import value of agricultural products in the developing countries during the period 1961-2009. (Billion dollar)

Figure 2, shows the share of agricultural products of total merchandise exports in the developing countries during the period 1961-2009. We can see in the figures that the agricultural sector's share of total merchandise exports and imports has been declining consistently over the long term. Minimum and maximum share of agricultural exports of total exports between 2007 and 1962, respectively, which are about 6 and 48 percent and Minimum and maximum share of agricultural imports of total imports for 2006 and 1962, respectively 7 and 21 percent.

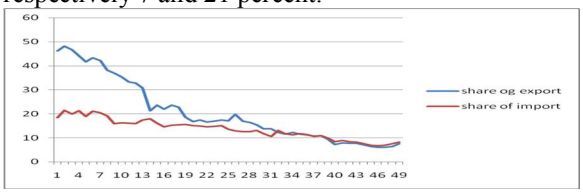

Figure 3. The share of agricultural products of total merchandise exports and import in developing countries during the period 1961-2009.

To continue with the description of the model's variables, Y_i, 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, 2009); $Ycpc_i, Ycpc_j$: is the per capita GDP of both the exporting and importing countries, in year t, in 1985 US dollars (WDI CD-ROM, 2009); $Dist_{ij}$: is the distance between the capitals of the countries of origin and destination (CEPPI database); $Ex\,\mathrm{cov}\,l_{ij}$: is an indicator of exchange rate volatility in year t; $Border_{ij}$: is a dummy variable which takes the value of 1 if the countries have a common border and 0 otherwise; $\mathrm{Re}\,m_{ij}$: is the relative distance weighted by income levels, following the methodology and data of Rose (2000); RTA_{ij} : is a dummy variable which takes the value of 1 if the two countries belonged to the following regional trade agreements (APEC, ASEAN, GSTP and MERCOSUR) 0 otherwise.

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).

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 1. At first sight, the gravity equation presents satisfactory results. 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 1. Gravity Equation Results for International Trade in Agriculture

Variables	Fixed effects
LnY_i	1.01*** (0.52)
LnY_j	0.89*** (0.03)
$LnYcpc_i$	-0.68**** (0.59)
$LnYcpc_j$	0.01*** (0.05)
$LnEx\,\mathrm{cov}\,l_{ij}$	0.11*** (0.01)
$LnDist_{ij}$	-1.92*** (0.06)
APEC	1.37*** (0.16)
ASEAN	0.91*** (0.25)
GSTP	0.68*** (0.17)
MECOSOUR	1.94*** (0.23)
Constant	-12.26** (1.27)

All variables are in logarithms, except for binary variables (APEC, ASEAN, GSTP and MERCOSUR). Standard errors are given in parentheses. *** And **denote statistical significance at the 1% and 5% level.

On this point, for trade in agricultural products rising GDP had an expansive effect associated with the increase in the market size of both the exporting and importing country. Coinciding with previous research, this result implies, in the case of agricultural products,

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. 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.

Secondly, it is notable, the result in comparative terms displayed by the coefficient of per capita income of the importing country ($Ycpc_j$): this was statistically significant and positive (0.01) for the case of agricultural products in developing countries.

Furthermore, with regard to the effect upon trade of per capita income growth in the exporting country ($Ycpc_i$), the results are more surprising. In the case of agricultural products the sign is negative (-0.68) and statistically significant i.e. as a country increased its income levels its exports of more elaborate products declined.

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 agricultural trade flows. Although this value is 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 APEC, ASEAN, GSTP and MERCOSUR are positive and statistically significant. 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. 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.

4. Discussions

The present study employs the gravity model to investigate trade patterns for agricultural products, for 14 countries and 20 years, 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.

The empirical findings showed that trade in agricultural products were increase in the market size of both the exporting and importing country. Per capita income of the importing country ($Ycpc_j$) was statistically significant and positive (0.01) for the case of agricultural products in developed countries, but negative (-0.68) and also statistically significant for the coefficient of per capita income of the exporting country trade ($Ycpc_i$).

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References

1. Anderson JE, 1979. A theoretical foundation for the gravity equation. American Economic Review 69: 106-116.
2. Anderson JE and Wincoop E van , 2004. Trade Costs. Journal of Economic Literature 42: 691-751.
3. Aparicio, G. and V. Pinilla, and R. Serrano, 2009. Europe and the international trade in agricultural and food products, 1870-2000. In: Lains P and Pinilla V(eds), Agriculture and Economic Development in Europe since 1870. Routledge, London, 52-75.

4. Bergstrand JH, 1985. the gravity equation in international trade: some microeconomic foundations and empirical evidence. The Review of Economics and Statistics 67: 474-481.
5. Bergstrand JH, 1989. The generalised gravity equation, monopolistic, and the factor-proportions theory in international trade. The Review of Economics and Statistics 71: 143-153.
6. Cho G, Sheldon I and McCorriston S, 2002. Exchange rate uncertainty and agricultural trade. American Journal of Agricultural Economics 84 (4): 931-942.
7. Deardorff A, 1984. Testing trade theories and predicting trade Flows. In: Jones R and Kenen P (eds), Handbook of International Economics. North Holland, Amsterdam.
8. Evenett SJ and Keller W, 2002. on theories explaining the success of the gravity equation. Journal of political economy 110(2): 281-316.
9. Feenstra RC, 2004. Increasing returns and the gravity equation. In R Feenstra (ed.). Advanced International Trade: Theory and Evidence. Princeton University Press, Princeton.
10. Feenstra RC, Markusen JA and Rose AK, 2001. Understanding the home market effect and the gravity equation: the role of differentiating goods. Working paper, 6804, NBER, Cambridge.
11. Feenstra RC, Markusen JA and Rose AK, 2003. Using the Gravity Equation to Differentiate among Alternatives. Theories of Trade. Canadian Journal of Economics 34 (4): 430-447.
12. Fidrmuc J, 2004. The core and periphery of the world economy. The Journal of International Trade & Economic Development 13 (1): 89-106.
13. Fontagne L, Freudenberg M and Peridy N, 1998. Intraindustry trade and the single market: Quality matters. Working paper Nº 1959. London, Centre Economic Policy Research.
14. Hatab, A.A. and E. Romstad and X. Huo, 2010. Determinants of egyptian agricultural exports: a gravity model approach, Modern Economy, 1:134-143
15. Helpman E (1987) Imperfect Competition and International Trade: Evidence from fourteen industrial countries. Journal of the Japanese and International Economies 1(1): 62-81.
16. Helpman E and Krugman P, 1985. Market Structure and Foreign Trade; Increasing Returns, Imperfect competition, and the International Economy. MIT press, Cambridge, Mass.
17. Helpman E and Krugman P, 1985. Market Structure and Foreign Trade; Increasing Returns, Imperfect competition, and the International Economy. MIT press, Cambridge, Mass.
18. Hiaso C, 1986. Analysis of Panel Data. Econometric Society Monographs. Cambridge University Press: Cambridge.
19. Hummels D and Levinsohn J , 1995. Monopolistic competition and international trade: Reconsidering the evidence. Quarterly Journal of Economics 110: 799-836.
20. Krugman P, 1989. Exchange Rate Instability. The MIT Press, Cambridge, MA.
21. Poyhonen A, 1963. A tentative model for the volume of trade between countries. Weltwirtschaftliches Archiv 90: 93-100.
22. O'Rourke, K.H. and J.G. Williamson, 1999. Globalization and history. The evolution of a nineteenth-century atlantic economy. The MIT Press, Cambridge, MA.
23. Ocampo, J.A. and M.A. Parra, 2003. The terms of trade for commodities in the twentieth century. CEPAL Review, 79: 7-35.
24. Rose AK, 2004. Do we Really Know That the WTO Increases Trade? The American Economic Review 94(1): 98-114.
25. Saadullah Khan, M.Z. and M. Ismail Hossain, 2010. A model of bilateral trade balance: extensions and empirical tests, Economic Analysis and Policy, 40(3).
26. Seck, A. and L. Cissokho and K. Makpayo and J. Haughton, 2010. How important are non-tariff barriers to agricultural trade within ECOWAS? Jonathan Haughton 8 Ashburton Place, Boston, MA 02108 Research Working Paper No. 2010-3.
27. Serrano, R. and V. Pinilla, 2009. The long-run decline in the share of agricultural and food products in international trade, 1951-2000: a gravity equation approach of its causes, Sociedad Española de Historia Agraria - Documentos de Trabajo. DT-SEHA n. 10-02. www.seha.info
28. World Agriculture: Towards 2015/2030. An FAO perspective.
ftp://ftp.fao.org/docrep/fao/005/y4252E

1/21/2013