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Preferential Trade Arrangements: Impacts on Agricultural Trade and Income

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Abstract

In this article, we focus on the effects of preferential trade arrangements on agricultural trade and agricultural income. Given the large number of preferential trade arrangements and complex interactions among them, we attempt to discover whether preferential trade arrangements are beneficial to agricultural trade and income, and are an effective tool to liberalize agricultural trade. The findings suggest that preferential trade arrangements with some exceptions tend to expand agricultural trade and improve agricultural income.

Keywords: agricultural trade, agricultural income, gravity model, preferential trade agreement

Highlights

The main objective of this study is to explore the effects of preferential trade arrangements on agricultural trade and agricultural income. Unlike other studies that have focused on the effects of particular trade arrangements (e.g. Zahnizer et al. 2002), this study attempts to draw a general picture of preferential trade arrangements and agricultural trade by using a large sample of countries and including most preferential trade arrangements. Given the large number of preferential trade arrangements and complex interactions among them, this study attempts to discover whether preferential trade arrangements are, on average, beneficial to agricultural trade and income. The effects of several preferential trade arrangements are given special attention (e.g. ASEAN Free Trade Agreement (AFTA), Andean Community (CAN), EU, and NAFTA).

We adopt a gravity equation approach developed in previous studies to measure the effects of preferential trade arrangements on agricultural trade. Trade creating and trade diverting dummy variables are included to estimate trade effects of preferential arrangements. To estimate income effects of preferential trade arrangements, the instrumental variable approach developed by Frankel and Romer (1999) is used. This relatively new approach relies on a geographical component of trade as an instrument to eliminate endogeneity bias that is often a problem in empirical estimations of trade-income relationships. The basis of this model is a relationship between agricultural income and international and within-country agricultural trade. Preferential trade arrangements affect agricultural income through several different channels.

Preferential trade arrangements were shown to have a positive trade creating effect on agricultural trade, with the exception of NAFTA. The trade creating effects were not statistically significant for the Andean agreement, EU, and NAFTA. However, the overall trade creating effect of preferential trade arrangements was positive and significant. Trade diverting effects were statistically significant and negative for the Andean agreement and NAFTA. Overall, the trade diverting effect was positive, indicating that agricultural trade created among member countries does not crowd out agricultural trade with non-member countries, probably because of low substitutability between traded products. Preferential trade arrangements may also create additional demand for agricultural products from non-member countries by increasing income, and possibly create an opportunity for trans-shipments.

The agricultural income regression shows that agricultural trade had a positive and statistically significant effect on agricultural income. Thus, given the fact that the overall effect of preferential trade arrangements on agricultural trade was positive, the trade effects created by preferential trade arrangements can improve agricultural income on average. Non-trade effects of preferential trade arrangements that do not influence agricultural income directly through international trade were predominantly negative (except for the effect of the Andean agreement) but were not statistically significant, except for NAFTA.

PREFERENTIAL TRADE ARRANGEMENTS: IMPACTS ON AGRICULTURAL TRADE AND INCOME

Anatoliy Skripnitchenko, Hamid Beladi, and Won W. Koo*

INTRODUCTION

There has been significant proliferation of preferential trade arrangements since the 1950s. The General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO) have been notified of 254 preferential trade arrangements since 1948. Almost half of those notifications came after 1995. Many preferential trade arrangements extend their coverage to agricultural commodities (Grethe and Tangermann 1998; Tangermann and Josling 1999). Some examples of such trade arrangements are the European Union (EU), Caribbean Community and Common Market (CARICOM), Southern Common Market (MERCOSUR), and the North American Free Trade Agreement (NAFTA).

Coverage of agricultural commodities is not usually as comprehensive as the coverage of industrial goods. Due to the traditionally protected status of agriculture, certain agricultural commodities may be excluded from the lists of products that enjoy preferential treatment. In addition, concessions on agricultural products typically offer lower preferential margins than those on industrial goods (WTO report 2002). However, this does not necessarily prevent preferential trade arrangements from being effective in promoting agricultural trade and creating more competition in the agricultural sector.

The main objective of this study is to explore the effects of preferential trade arrangements on agricultural trade and income. Unlike other studies that focused on the effects of particular trade arrangements (e.g., Zahnizer et al. 2002), this study attempts to draw a general picture of preferential trade arrangements and agricultural trade, by using a large sample of countries and including most preferential trade arrangements. Given the large number of preferential trade arrangements and the complex interactions among them, this study attempts to discover whether preferential trade arrangements are, on average, beneficial to agricultural trade and income. The effects of several preferential trade arrangements are given special attention (e.g. ASEAN Free Trade Agreement (AFTA), Andean Community (CAN), EU, and NAFTA.).

In particular, this study measures trade creation and trade diversion in agricultural trade in accordance with the techniques developed in previous empirical studies (for example, Ghosh and Yamarik 2004), using a dummy variable approach. This study does not attempt to draw implications about true welfare effects of preferential trade arrangements in agriculture, since evidence of trade creation may not necessarily mean welfare gains (Panagariya 2000). We limit ourselves to examining whether preferential trade arrangements are an effective tool for stimulating agricultural trade given the overall protected status of agriculture. If the level of agricultural protection is high and preferential trade arrangements do not lower it significantly, then the effects of preferential trade arrangements can be very small. Significant trade creation

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in agricultural trade may be a sign of trade liberalization, albeit restricted to groups of countries who are members of a preferential trade arrangement.

Having estimated the trade effects of preferential trade arrangements, this study examines the effects of agricultural trade and preferential trade arrangements on agricultural income. Empirical research on the effects of preferential trade arrangements on agricultural trade and income provides us with information about whether there is a beneficial side to preferential trade arrangements in agricultural trade, especially during times when complete trade liberalization is not yet achievable.

A large body of literature examines the economic effects of preferential trade arrangements from theoretical and empirical perspectives. The concepts of trade creation and trade diversion are widely applied as measures of trade liberalization and welfare improvement. Examples of earlier theoretical works on preferential trade include Viner (1950), Mead (1955), and Lipsey (1957). Panagariya (2000) offers a comprehensive survey of up-to-date literature on preferential trade arrangements.

Empirical studies often measure trade creation and trade diversion effects to evaluate preferential trade arrangements. A bilateral trade gravity equation has been used in these studies (e.g., Aitken 1973; Thursby and Thursby 1987; Feenstra, Markusen, and Rose 2001; and Frankel and Rose 2000).

Gravity estimations measure trade creation and trade diversion effects of preferential trade arrangements using dummy variables. The core of a gravity equation is a relation between bilateral trade flows, economic sizes of countries, and distance. Several trade studies derived theoretical foundations for the gravity relation (Anderson 1979; Bergstrand 1985, 1989; Anderson and van Wincoop 2003). Empirical trade studies that employed a gravity setup in their analysis typically expanded the core gravity relation by including additional explanatory variables and using preferential trade dummies (Ghosh and Yamarik 2002). Preferential trade dummy variables measure additional trade created or diverted from normal trade volume predicted by the gravity relationship.

We adopt the gravity equation approach developed in previous studies to measure the effects of preferential trade arrangements on agriculture trade. Trade creating and trade diverting dummy variables are included to estimate trade effects of preferential arrangements. To estimate the income effects of preferential trade arrangements, the instrumental variable approach developed by Frankel and Romer (1999) is used. This relatively new approach relies on a geographical component of trade as an instrument to eliminate the endogeneity bias that is often a problem in empirical estimations of trade-income relationships. The basis of this model is a relationship between agricultural income and international and within-country agricultural trade.

Preferential trade arrangements have a direct effect on international agricultural trade, which affects income. However, there exist additional channels through which preferential trade arrangements can affect income. They can affect agricultural income by replacing within-country agricultural trade with trade created with foreign parties. Preferential trade arrangements can also have a direct effect on agricultural income through interactions with domestic policies and by altering long-run production and investment decisions of agricultural producers. The

effects of preferential trade arrangements are not limited to agricultural businesses that are directly dependent on trade. Rather, the effects are likely to be sector-wide. By altering domestic price levels, for example, preferential trade arrangements can influence incomes of agricultural businesses that do not engage in international trade.

This study is organized in the following way. First we present the model used for evaluating the effects of preferential trade arrangements on agricultural trade and income. We then describe the data and econometric procedures used to estimate the model. Subsequently, we discuss the results of the gravity equation that measures the effects of preferential trade arrangements on trade. In the last section, we focus on income effects of preferential trade arrangements.

THE MODEL

Preferential Trade Arrangements and Agricultural Trade

The empirical model used to estimate the relationship between preferential trade arrangements and agricultural trade and income consists of two parts. The first part includes a standard gravity trade equation modified to include preferential trade effects, and the second part includes a regression that connects agricultural trade and income.

Equation 1 presents a standard trade gravity equation in which trade, GDP, and distance constitute the core of a gravity relationship wherein trade is proportional to countries' GDP and inversely proportional to distance between them.

$$x_{ij} = a_1 + a_2 y_i + a_3 y_j + a_4 d_{ij} + a_5 PTAc_{ij} + a_6 PTAd_{ij} + a_7 S_{ij} + e_{ij} \quad (1)$$

where x_{ij} represents a logarithm of bilateral trade flows; y_i is a logarithm of GDP; d_{ij} is a logarithm of distance between two countries; $PTAc_{ij}$ is the trade creating dummy variable that equals 1 if countries i and j participate in the same preferential trade arrangement; $PTAd_{ij}$ is the trade diverting dummy variable that equals 1 if only either country i or j is a member of a preferential trade arrangement; and S_{ij} represents other variables that have effects on trade.

The original gravity relation does not include other factors, S_{ij}. However, many studies have included them either because of theoretical considerations derived from other trade models (e.g. Aitken 1973; Thursby and Thursby 1987; Feenstra et al. 2001; Frankel and Rose 2000; Harris and Mátyás 2001; and Ghosh and Yamarik 2002, 2004) or because they believed that the variables can help explain bilateral trade flows. The other factors usually included are geographic variables like countries sharing a common border, being landlocked or located on an island; historical factors such as colonial history and common language; monetary factors that include exchange rate volatility and exchange rate regimes; trade policy factors; development factors such as GDP per capita and difference in per capita income across countries; and factors that measure relative factor endowment.

The gravity equation includes two PTA dummy variables. Trade creation is represented by a positive coefficient (a_5) on a dummy variable that equals 1 if two countries are members of a preferential trade arrangement and 0 otherwise. This dummy variable measures trade between two countries that is created in addition to normal trade flows predicted by a gravity setup. Trade diversion is measured by a coefficient (a_6) on a dummy variable that equals 1 if only one of two countries is a member of a preferential trade arrangement and 0 otherwise. This coefficient, which is expected to be negative, measures how much trade between two countries is diverted if one of them is outside of a preferential trade arrangement.

A set of variables that is usually included in a gravity equation can potentially lead to an endogeneity problem. In particular, income and PTA dummies, along with other variables, can be correlated with the error term. This occurs because, due to the specification of a gravity equation, some important variables that are correlated with trade and explanatory variables (e.g. policy variables) can be omitted. We do not expect this to be a significant problem in the case of agricultural trade because policies that affect GDP or the decision to form a preferential trade arrangement are unlikely to be dependent on the volume of agricultural trade.

Income Effects of Preferential Trade Arrangements

The model we use to estimate the effects of preferential trade arrangements on agricultural income is based on the model developed by Frankel and Romer (1999), in which agricultural income depends on international agricultural trade, within-country agricultural trade, and other factors. This relationship is shown in Equation 2. Although the levels of international agricultural trade (X_i) and within-country agricultural trade (WT_i) are influenced by preferential trade arrangements, we also add a separate variable (PTA_i) in the model to indicate the direct effect of preferential trade arrangements on agricultural income.

$$y_i^A = \alpha_0 + \alpha_1 X_i + \alpha_2 WT_i + \alpha_3 PTA_i + \varepsilon_i \tag{2}$$

where y_i^A is agricultural income; X_i is the value of agricultural international trade; WT_i is the value of agricultural trade within a country; PTA_i represents the direct effect of preferential trade arrangements; and ε_i includes all other possible factors that influence agricultural income.

Preferential trade arrangements can affect agricultural income through different channels. The main channel is agricultural trade itself, because preferential arrangements are expected to increase agricultural trade volume. The effect of increased trade is reflected in agricultural income through coefficient α_1. Preferential trade arrangements can also affect within-country trade by replacing it with imports, which consequently affects agricultural income (coefficient α_2). Adoption of preferential trade arrangements can also relate to changes in domestic agricultural policies that can influence agricultural income. A preferential trade arrangement can increase the confidence of domestic agricultural producers by ensuring better access to foreign markets, which can decrease uncertainty and lead to investment/production decisions that are not related to current trade flows. Preferential trade arrangements can also introduce more competition from abroad, changing domestic prices and affecting all agricultural businesses, not

only ones that engage in international trade but also those that are not engaged in international trade. Those effects of preferential trade arrangements are captured by the model through coefficient α_3.

To complete the model, we need two additional equations that describe international agricultural trade (Equation 3) and within-country agricultural trade (Equation 4). Following Frankel and Romer (1999), international agricultural trade depends on geographical and demographic characteristics of trading partners (D_i) and other unaccounted factors (δ_i). Variable PTA_i accounts for the effects of preferential trade arrangements on international agricultural trade.

$$X_i = \beta_0 + \beta_1 D_i + \beta_2 PTA_i + \delta_i \tag{3}$$

Within-country agricultural trade depends on the size of the country (S_i) represented by such variables as land area and population, preferential trade arrangements (PTA_i), and other factors (ρ_i).

$$WT_i = \gamma_0 + \gamma_1 S_i + \gamma_2 PTA_i + \rho_i \tag{4}$$

The data on within-country agriculture trade is not available for a majority of the countries. Therefore, it is necessary to adjust the income equation by inserting the within-country trade equation, which yields the following model for measuring income effects of preferential trade arrangements in agriculture

$$y_i^A = (\alpha_0 + \alpha_2\gamma_0) + \alpha_1 X_i + \alpha_2\gamma_1 S_i + (\alpha_3 + \alpha_2\gamma_2) PTA_i + (\varepsilon_i + \alpha_2\rho_i) \tag{5}$$

The income effects of preferential trade arrangements that are passed through international agricultural trade in Equation 5 are measured by coefficient α_1, as in the original income equation (Equation 2). Direct income effects of preferential trade arrangements are measured by coefficient α_3 as in Equation 2. The coefficient on the preferential trade variable in Equation 5 ($\alpha_2\gamma_2$) measures the combined effects of preferential trade arrangements that change within-country trade on agricultural income.

ESTIMATING INCOME EFFECTS

To model the relationship between agricultural income, and agricultural trade and preferential trade arrangements, we use a simple linear regression structure derived in the previous section. We adapt the theoretical specification of the income equation (Equation 5) to empirical estimations.

$$y_i^A = c_1 + c_2 X_i + c_3 n_i + c_4 p_i + c_5 \sum_j \frac{PTA_{ij} GDP_j}{d_{ij}} + e_i \tag{6}$$

where y_i^A is agricultural value-added, X_i is agricultural trade, n_i is population, p_i is land area, and $\sum_j \frac{PTA_{ij} GDP_j}{d_{ij}}$ is a variable that measures significance of preferential trade arrangements.

The agricultural trade variable measures agricultural trade of a country with the rest of the world. Population and area are measures of country size and are predictors of countries' internal agricultural trade. They were denoted by S_i in the theoretical specification of within-country trade (Equation 4). To model the effect of preferential trade arrangements in the income equation, apart from the effect through trade, there are several choices. The simplest one is to use the number of preferential trade arrangements in which a country participates. However, this variable may not be a good choice as it ignores size effects of partner countries. A more realistic measure of a country's involvement in preferential trade would be a sum of partner countries' sizes weighed by the distance (following Frankel and Rose's study of currency unions (2000)).

Empirical models that deal with effects of trade on income are prone to endogeneity problems. In income regression, endogeneity is very likely because agricultural income is used instead of GDP. Various governmental policies have simultaneous effects on agricultural trade and output. For example, farm subsidies affect both agricultural output and agricultural trade. Sometimes, it is difficult to account for such endogenous policy linkages in empirical models because of their complexity and/or poor data availability. In such cases, the trade variable is correlated with the error term that includes unaccounted policy effects.

Frankel and Romer (1999) solved the endogeneity problem of trade in output estimations. They used geographic variables such as distance, population, a dummy for landlocked countries, and a dummy for common border in order to correct for endogeneity bias. Geographic characteristics tend to influence trade flows and are usually not correlated with countries' income. Frankel and Romer regressed international trade on a set of geographic variables and then used aggregated fitted value $\hat{X}_i$ (geographical content of trade) as an instrumental variable in the output regression. We adopted their technique to our particular case, using agricultural trade as a dependent variable (Equation 7).

$$X_{ij} = b_0 + b_1 d_{ij} + b_2 n_i + b_3 p_i + b_4 n_j + b_5 p_j + b_6 (l_i + l_j) + b_7 cb_{ij} + e_{ij} \qquad (7)$$

where X_{ij} is agricultural trade, n is population, p is area, l is a dummy variable for landlocked countries, and cb_{ij} is a dummy variable for common border.

Having estimated Equation 7, we construct an instrumental variable that is calculated as a sum of fitted values across trading partners:

$$\hat{X}_i = \sum_{i \neq j} \left(\hat{b}_0 + \hat{b}_1 d_{ij} + \hat{b}_2 n_i + \hat{b}_3 p_i + \hat{b}_4 n_j + \hat{b}_5 p_j + \hat{b}_6 (l_i + l_j) + \hat{b}_7 cb_{ij} \right) \quad . \qquad (8)$$

The geographical trade content variable ($\hat{X}_i$) is then used as an instrument to estimate the effects of agricultural trade and preferential trade arrangements on agricultural income in Equation 6. Since this instrument is correlated only with geographic characteristics, it should be orthogonal to the error term that includes unexplained policy variations.

Finally, having estimated the income equation and gravity trade equation, we can estimate the effects of preferential trade arrangements on agricultural income. First, preferential trade arrangements will affect trade flows between countries through coefficients a_5 and a_6 in gravity equation (1), and then the resulting changes in trade will affect agricultural income through coefficient c_2 in Equation 6. Preferential trade arrangements will also affect agricultural income through within-country trade and direct production impacts. However, we cannot distinguish between them because data on within-country agricultural trade is unavailable for most countries. Their combined effect is measured by coefficient c_5 (coefficient $\alpha_3 + \alpha_2\gamma_2$ in Equation 5).

DATA AND ESTIMATION PROCEDURES

We used a cross-section of the latest available data for 1999. Data on agricultural trade flows were obtained from the World Bank Trade and Production Database. Since import data are generally more reliable than export data (Nicita and Olarreaga 2001), we used mutual imports to calculate overall agricultural trade between each country pair. Information on current preferential trade arrangements was obtained from the website of the World Trade Organization. There were 131 preferential trade arrangements reported to the WTO. Data on agricultural income (agricultural value added), population, land area, and gross domestic product were obtained from World Development Indicator database maintained by the World Bank. Data on common currencies, languages, landlocked countries, and border-sharing were obtained from Central Intelligence Agency World Factbook. Distances between countries, measured as distances between their capitals, were calculated using a computer program (the program was developed by John A. Byers) that contained data on latitudes and longitudes of major cities in the world.

The use of cross-sectional data requires us to make adjustments to usual Ordinary Least Squares (OLS) and Instrumental Variable (IV) estimators used to estimate agricultural trade and income models, since error terms in cross-sectional regressions tend to be heteroskedastic. The standard OLS and instrumental variable estimators produce unbiased estimates of regression coefficients. However, the estimates of the variance-covariance matrix are inconsistent in the presence of heteroskedasticity, leading to incorrect test results. To correct for heteroskedastic bias in the variance-covariance matrix, we use White's estimator for OLS and instrumental variable regressions (Greene 1997). An attractive feature of White's estimator is that it can be applied to regressions with an unknown type of heteroskedasticity. For OLS, White's estimator of the variance-covariance matrix is $\hat{\Sigma}_{OLS} = (X'X)^{-1}(X'ee'X)(X'X)^{-1}$, where X is the matrix of dependent variables and ee' is a matrix of the products of residuals with all off-diagonal elements being equal to zero. This estimator was also used for tests of trade creation and trade

diversion effects (White 1980). For the instrumental variable estimator, the robust variance-covariance estimator is

$$\hat{\Sigma}_{IV} = (X'Z(Z'Z)^{-1}Z'X)^{-1}(X'Z(Z'Z)^{-1}(Z'ii'Z)(Z'Z)^{-1}Z'X)(X'Z(Z'Z)^{-1}Z'X)^{-1} \quad (9)$$

where Z is a matrix of instruments and ii' is a matrix of the products of IV residuals with all off-diagonal elements being set to zero (see Baum et al. 2002).

When estimating income effects, we construct the instrument for the endogenous trade flow variable, using variables and coefficient estimates from the gravity regression. The presence of coefficients from another regression, which are stochastic variables, requires an adjustment of the variance-covariance matrix. The following adjustment term is added to the IV variance estimate: $\hat{\Sigma}_A = \left(\frac{\partial a}{\partial b}\right)\hat{\Sigma}_{OLS}\left(\frac{\partial a}{\partial b}\right)'$, where a is a vector of IV regression coefficients and b is a vector of OLS coefficient estimates.

ESTIMATION OF GRAVITY RELATION FOR AGRICULTURAL TRADE

In this section, we present and discuss the results of estimation of the agricultural trade model. As it was shown in the theoretical section, agricultural trade is a function of various economic, geographic, and demographic factors. In addition to the core variables of the gravity relationship—countries' GDPs and the distance between trading partners—we have included countries' populations and land areas. We also accounted for several demographic and geographic factors that countries can have in common and which can facilitate trade between countries: common borders, languages, currencies, and colonial history. We expect that those factors will have positive effect on agricultural trade.

The effects of preferential trade arrangements are introduced in the model using a dummy variable. We use a trade creation dummy to see if common membership in one or several regional trade agreements generates trade between countries in excess of the trade predicted by a gravity relationship. Using a preferential trade dummy, we measure the trade effects of preferential trade arrangements on agricultural income. If preferential trade arrangements generate positive trade, this, in turn, can improve agricultural income, provided agricultural trade and agricultural income are positively related.

We also measure the effects of countries not participating in a preferential trade arrangement using a trade diversion dummy. The trade diversion dummy is expected to have a negative sign, since trade is likely to be diverted from the countries outside of a preferential trade arrangement. However, it is possible for it to have positive effect. There can be several explanations. In this study, agricultural trade is highly aggregated. Therefore, if agricultural products traded with member and non-member countries are not substitutes, increased trade with member countries as the result of a preferential trade arrangement may not preclude expansion of agricultural trade with non-member countries. Also, preferential trade arrangements typically cover a wide variety of products and services, of which agricultural products often constitute a small part. Increased

trade between members of preferential trade arrangements can positively affect countries' overall income, generating more demand for imports that may not necessarily originate in member countries. Another explanation can be that countries who are members of a preferential trade arrangement may not maintain the same level of protection against exports from non-member countries, thus allowing trans-shipments. Trans-shipped commodities may require an additional level of processing in a member country, which may not be a high enough barrier to discourage exports from non-member countries. Finally, a trade diverting dummy for a particular preferential trade arrangement can be correlated with trade creating dummies that are not explicitly accounted for if member countries participate in other trade arrangements with non-member countries. Inclusion of a trade creating dummy that reflects the combined effect of preferential trade arrangements mitigates this effect.

Preferential trade arrangements differ in terms of their size and coverage. We chose several regional trade agreements that seem to be the most important in different parts of the world and for which the data were available, and estimated their effects on agricultural trade and income. In specific, we chose NAFTA and CAN to represent the Western Hemisphere. AFTA and the EU were chosen to represent Asia and Europe, respectively. All of these regional trade agreements extend their coverage to agricultural commodities. General information on AFTA, CAN, the EU, and NAFTA is summarized in Table 1. To account for the effects of these preferential trade arrangements on agricultural trade, trade creating and trade diverting dummies were developed to indicate countries' participation in the regional trade agreements. The estimation results are presented in Table 2, which includes trade creating and trade diverting effects of PTAs. Variables $PTAc_{ij}$ and $PTAd_{ij}$ represent the combined trade creating and trade diverting effects of preferential trade arrangements. The rest of the trade creating and trade diverting dummies isolate the effects of AFTA, CAN, EU, and NAFTA.

Table 1. Agricultural Provisions for Selected Regional Trade Agreements

RTA	RTA Countries Coverage	Description
AFTA (1992) ASEAN Free Trade Area	Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam	Reduced tariffs on trade in processed agricultural products. Gradual reduction of tariffs on unprocessed agricultural products by 2003.
CAN (1988) Andean Community	Bolivia, Colombia, Ecuador, Peru, and Venezuela	Trade between all member countries with the exception of Peru is fully deregulated and duty free.
EC-15 (1958) European Communities (now EU)	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom	Common Agricultural Policy. Free movement of agricultural goods between the communities.
NAFTA (1994) North American Free Trade Agreement	Canada, Mexico, and United States	Agricultural tariffs between the US and Canada were removed by 1998 with few exceptions covered by TRQ's. Most agricultural tariffs and all non-tariff barriers between the US and Mexico were eliminated, and some tariffs are being phased out over 5 to 15 year period. Agricultural tariffs between Canada and Mexico followed the same pattern; however tariffs on dairy, poultry, eggs, and sugar remained (FAS).

Table 2. Agricultural Trade Estimation Results

Variable	Coefficient	Standard Deviation
Constant	-26.763	***1.324
$\ln(GDP_i)$	0.951	***0.046
$\ln(GDP_j)$	0.938	***0.043
$\ln(Distance_{ij})$	-0.872	***0.068
$\ln(Population_i)$	-0.306	***0.049
$\ln(Population_j)$	-0.312	***0.063
$\ln(Land_i)$	0.191	***0.039
$\ln(Land_j)$	0.185	***0.041
$Landlocked_{ij}$	-0.796	***0.141
$Borders_{ij}$	0.865	***0.267
$Currency_{ij}$	0.6	***0.218
$Language_{ij}$	1.116	***0.155
$History_{ij}$	0.639	***0.212
$PTAc_{ij}$	0.673	***0.244
$AFTAc_{ij}$	2.369	***0.31
$CANc_{ij}$	0.814	0.694
ECc_{ij}	0.24	0.278
$NAFTAc_{ij}$	-1.224	0.843
$PTAd_{ij}$	0.42	**0.167
$AFTAd_{ij}$	0.817	***0.171
$CANd_{ij}$	-0.834	***0.164
ECd_{ij}	0.209	0.126
$NAFTAd_{ij}$	-0.584	***0.149

R^2 = 0.646

Trade Creation & Diversion = 0; $\chi^2(10) = 155.7$

Trade Creation = 0; $\chi^2(5) = 102.5$

Trade Diversion = 0; $\chi^2(5) = 76$

Number of Observations = 1,356

*** – significant at 1%

**– significant at 5%

The regression results show that most of the traditional gravity variables have a statistically significant impact on agricultural trade. GDP has a positive and statistically significant impact on agricultural trade. The effect of the distance between countries was negative and statistically significant, suggesting that countries that are located close to each other will trade more. Population had a negative and statistically significant effect on agricultural trade. These results may suggest that larger countries have more agricultural trade opportunities domestically, and therefore would be less involved in international trade, replacing it with within-country trade.

Land area had a statistically significant and positive effect on agricultural trade in most of the cases. One would expect a positive coefficient on a land area variable because, accounting for countries' populations and GDPs, large distances within a country may encourage additional international trade with the countries located nearby.

If countries did not have direct access to a sea or an ocean, their ability to engage in agricultural trade was diminished. The coefficient on the landlocked variable was negative and statistically significant. If countries shared a common border, agricultural trade between them tended to be higher. Common currency, common language, and common colonial history also had statistically significant, positive effects on agricultural trade, as expected.

Preferential trade arrangements, on average, had a positive and statistically significant effect on agricultural trade. The overall trade creation coefficient was positive and statistically significant at 1% (Table 2). The overall trade diversion effect was also positive and statistically significant at 5%. The trade creation coefficient supports the hypothesis that preferential trade arrangements create trade opportunities for agricultural producers despite less coverage of agricultural commodities as compared to manufacturing products. The positive effect of the trade diverting dummy indicates that additional trade due to preferential trade arrangements does not necessarily divert trade from non-member countries. Agricultural products traded with member and non-member countries may not be substitutes; thus, preferential arrangements do not preclude agricultural trade expansion with non-member countries. Instead, the arrangements may stimulate demand for agricultural products from countries outside a preferential trade arrangement by increasing countries' overall income. There is also a possibility of transshipments due to non-uniform trade protection levels in countries who are members of a preferential trade arrangement.

The trade creation effects of selected regional trade agreements were positive, except for NAFTA, but most of them were not statistically significant. Only AFTA had a statistically significant impact on agricultural trade.

AFTA had the most prominent effect on agricultural trade. It was four times higher than the average effect of all preferential trade arrangements. The trade creating effect of the Andean agreement was slightly above average, and the trade creating effect within the EU was below average.

In regard to trade diverting effects of the selected preferential trade arrangements, CAN and NAFTA had the expected negative sign and were statistically significant. AFTA and the EU had positive trade diverting effects, although the trade diverting effect of EU was not significantly different from zero. This can be explained in the same way as it was for an average trade diverting dummy $PTAd_{ij}$: regional trade arrangements may result in additional demand for imports from non-member countries or traded agricultural products exhibit low degree of substitutability. However, positive trade diversion effects in the case of particular preferential trade arrangements can simply be a proxy for other preferential trade arrangements with non-member countries that were not explicitly included in the regression. This may be the case with the EU, whose member countries have preferential trade arrangements with countries in Eastern Europe and North Africa.

The net effects of preferential trade arrangements on agricultural trade, obtained by comparing trade creating and trade diverting effects, were positive overall. The exceptions are the Andean agreement and NAFTA, which are considered trade diverting since their trade diverting coefficients were negative and statistically significant and trade creating coefficients were not statistically different from zero. Finally, in Table 2 we tested the overall statistical significance of trade creating and trade diverting effects. The hypothesis that trade creation and trade diversion effects were zero was rejected at conventional statistical levels.

PREFERENTIAL TRADE ARRANGEMENTS AND THEIR EFFECTS ON AGRICULTURAL INCOME

The results of trade regressions show that participation in preferential trade arrangements has an overall positive impact on agricultural trade. To show that trade effects of preferential trade arrangements influence agricultural income, we need to estimate a statistical relationship between agricultural income and agricultural trade. An agricultural income equation is set as a linear function of agricultural trade, land area, population, and variables that capture the effects of preferential trade arrangements that are not a direct result of international agricultural trade. The results of the agricultural income regression are presented in Table 3.

Table 3. Agricultural Income Estimation Results

Variable	Coefficient	Standard Deviation	Coefficient	Standard Deviation
Constant	-307.242	***132.778	170.17	136.047
$Trade_i$	2.593	***0.253	2.79	***0.296
$Land_i$	-8.584	11.030	-8.212	10.308
$Population_i$	1.136	***0.093	1.071	***0.085
PTA_i			-1.984	1.671
$AFTA_i$			-14.859	***4.543
CAN_i			4.578	17.838
EC_i			-1.212	1.827
$NAFTA_i$			-0.277	1.645
	R^2=0.909		R^2 = 0.955	
Number of Observations = 53				
*** – significant at 1%				

An instrument was required to estimate the relationship between agricultural income and preferential trade arrangements because the agricultural trade variable is endogenous. The instrument was constructed by regressing agricultural bilateral trade on countries' geographic characteristics and then obtaining a variable containing predicted agricultural trade. Distance, countries' land areas, populations, landlocked status, and the presence of common borders were chosen as explanatory geographic variables.

The agricultural income regression separates the effects of regional trade arrangements on agricultural income into two categories: the ones that pass through agricultural trade and those that influence within-country agricultural trade and production decisions (non-trade effects). Since previous gravity estimations showed that participation in preferential trade arrangements increases agricultural trade, a positive coefficient on the trade variable in income regressions (Table 3) would suggest positive trade effects of preferential trade arrangements on agricultural income. Non-trade effects are measured by coefficients on the variables indicating participation in preferential trade arrangements. Preferential trade variables in the agricultural income regression are constructed as sums of member countries' GDPs weighed by distance.

The IV estimation of agricultural income equations shows that agricultural trade has a positive and statistically significant effect on agricultural income. Given that preferential trade arrangements were shown to be trade creating on average, trade effects of preferential trade arrangements would have positive effects agricultural income.

Land areas of trading partners had a negative but statistically insignificant effect on agricultural income. Since land area is an explanatory variable in the within-country agricultural trade equation, its effect on agricultural income is expected to be negative because within-country trade occurs over larger distances. Population had a positive and statistically significant impact on agricultural income. This effect is also as expected because one would anticipate more within-country trade if a country has large population. Within-country trade, in turn, is expected to expand agricultural income.

The average non-trade effect of preferential trade arrangements on agricultural income (PTA_i) was negative but statistically insignificant. The negative sign suggests that by displacing within-country agricultural trade and altering agricultural production and the business environment, the arrangements can harm agricultural producers. Preferential trade arrangements can bring more competition to local markets, lowering domestic prices and affecting agricultural businesses that may or may not be involved in international agricultural trade. Preferential trade arrangements can alter vertical and horizontal linkages between agricultural businesses that may, on average, result in an income decline. However, statistical insignificance shows that the non-trade effects of preferential trade arrangements are unlikely to diminish the positive and statistically significant effects of preferential trade arrangements resulting from international trade.

Although there is no expected sign on the non-trade income effects of preferential trade arrangements, the coefficients on specific regional trade agreements tended to be negative (with the exception of CAN) but statistically insignificant (NAFTA and the EU). Only AFTA had a negative and statistically significant non-trade impact on agricultural income.

Due to the insignificance of non-trade income effects, we also estimated an income regression without them. This did not significantly change the coefficient estimates for trade, population, and land size effects. Both agricultural trade and population continued to have a positive and statistically significant impact on agricultural income.

These empirical results show that agricultural trade expansion due to participation in preferential trade arrangements may be beneficial as far as agricultural income is concerned. Preferential trade arrangements have a positive effect on agricultural trade, as was shown from the gravity

regression. Agricultural trade, in turn, has a positive effect on agricultural income. There is a possibility that non-trade effects of preferential trade arrangements can negatively influence agricultural income; however, the empirical analysis showed that, on average, those effects are not significant.

CONCLUSIONS

In this article we analyzed the effect of preferential trade arrangements on agricultural income. We presented an empirical model that separated income effects of preferential trade arrangements into trade related and non-trade related effects. The model was then estimated, using 1999 cross-sectional data on bilateral agricultural trade and agricultural income.

The model consisted of two parts. In the first part, we isolated the trade effects of preferential trade arrangements, using a gravity equation. The second part included both types of effects of preferential trade arrangements – the effects resulting from international trade and the within-country trade and non-trade effects. The income equation in the second part of the model was estimated using the instrumental variable technique because of a concern for common factors affecting agricultural income and agricultural trade, correlating the latter with the residuals. The instrument was constructed based on the geographical content of agricultural trade.

Preferential trade arrangements were shown to have positive trade creating effects on agricultural trade, with the exception of NAFTA. The trade creating effects were not statistically significant for the Andean agreement, the EU, and NAFTA. However, the overall trade creating effect of preferential trade arrangements was positive and significant. Trade diverting effects were statistically significant and negative for the Andean agreement and NAFTA. The overall trade diverting effect was positive, indicating that agricultural trade created between member countries does not crowd out agricultural trade with non-member countries, probably because of low substitutability between traded products. Preferential trade arrangements may also create additional demand for agricultural products from non-member countries by increasing income, and they could possibly create an opportunity for transshipments.

The agricultural income regression showed that agricultural trade had a positive and statistically significant effect on agricultural income. Thus, given the fact that the overall effect of preferential trade arrangements on agricultural trade was positive, an increase in trade volume through preferential trade arrangements can improve agricultural income on average. However, non-trade effects of preferential trade arrangements that do not influence agricultural income directly through international trade were predominantly negative (except for the effect of CAN) but not statistically significant except for AFTA.

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