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 find out 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.

Introduction

There has been significant proliferation of preferential trade agreements since 1950's.GATT and WTO have been notified of 254 preferential trade agreements starting from 1948. Almost a half of those notifications came after 1995. Many preferential trade agreements extend their coverage to agricultural commodities (Grethe and Tangermann, Tangermann and Josling). Examples of such trade agreements are European Community (EC), Caribbean Community and Common Market (CARICOM), Southern Common Market (MERCOSUR), North American Free Trade Agreement (NAFTA) among others.

Coverage of agricultural commodities is not usually as comprehensive as the coverage of industrial goods. Due to 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 on industrial goods (WTO). However, this does not necessarily prevent preferential trade arrangements from being effective in promoting agricultural trade and creating more competition in agricultural sector.

The main objective of this study is to explore the effects of preferential trade agreements on agricultural trade and agricultural income. Unlike other studies that focused on the effects of particular trade agreements (e.g. Zahnizer et al.), this study attempts to draw a general picture of preferential trade agreements and agricultural trade, using a large sample of countries and including most of preferential trade agreements. Given the large number of preferential trade agreements and complex interactions among them, this study attempts to find out whether preferential trade agreements are, on average, beneficial to agricultural trade and income. The effects of several preferential trade agreements are given special attention (e.g. ASEAN Free Trade Agreement (AFTA), Andean Community (CAN), EC, 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 (see for example Ghosh and Yamarik 2004), using a dummy variable approach. This study does not try to draw any implications about true welfare effects of preferential trade agreements in agriculture since evidence of trade creation may not necessarily mean welfare gains (Panagariya). We limit ourselves to finding out whether preferential trade agreements are an effective tool for stimulating agricultural trade given 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. Findings of significant trade creation in agricultural trade may be the sign of trade liberalization, albeit restricted to groups of countries who are members of a preferential trade agreement.

Having estimated trade effects of preferential trade arrangements, this study examines the effects of agricultural trade and preferential trade agreements on agricultural income. Empirical findings of the effects of preferential trade agreements on agricultural trade and income provides us with an answer whether there is a beneficial side to preferential trade agreements in agriculture trade, especially at times when complete trade liberalization is not yet achievable.

We adopt gravity equation approach developed in previous studies (Anderson, Bergstrand (1985, 1989), Anderson and van Wincoop) to measure the effects of preferential trade agreements on agriculture trade. Trade creating and trade diverting dummy variables are included to estimate trade effects of preferential agreements. To estimate income effects of preferential trade agreements, the instrumental variable approach developed by Frankel and Romer is used. This relatively new approach relies on a geographical component of trade as an instrument to eliminate endogeneity bias that often is 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. The first one is the direct effect of preferential trade arrangements on international agricultural trade. However, there exist additional channels

through which preferential trade arrangements can affect income. They can affect agricultural income through within-country agricultural trade by replacing it with trade created with foreign parties. Preferential trade arrangements can also have a direct effect on agricultural income by being related to domestic policies and altering long-run production and investment decisions of agricultural producers. Effects of preferential trade arrangements are not limited to agricultural businesses that are directly depend on trade. They 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.

The Model

Preferential Trade Agreements and Agricultural Trade

The empirical model used to estimate the relationship between preferential trade agreements 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.

The trade gravity equation is shown in equation 1, where trade, GDP, and distance are the variables that constitute the core of a gravity relationship that states that trade is proportional to countries' GDP and inversely proportional to distance between them.

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

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

The original gravity relation does not include other factors S_{ij}. However, many studies included them either because of theoretical considerations derived from other trade models (e.g. Aitken, Thursby and Thursby; Feenstra, Markusen, and Rose; Frankel and Rose, Harris and Mátyás, Ghosh and Yamarik (2002, 2004)) or because they believed that the variables can help explain bilateral trade flows. Other factors usually included are geographic factors like countries sharing common border, being landlocked or located on an island, historical factors such as colonial history and common language, monetary factors that included exchange rate volatility, 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 agreement 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 agreement and 0 otherwise. This coefficient is expected to be negative and it measures how much trade is diverted between two countries if one of them is outside of preferential trade agreement.

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 case of agricultural trade because policies that affect GDP or a decision to form a preferential trade arrangement are unlikely to be dependent on the volume of agricultural trade.

Income Effects of Preferential Trade Agreements

The model we use to estimate the effects of preferential trade agreements on agricultural income is based on the model from Frankel and Romer. According to their model agricultural income depends on international agricultural trade, within-country agricultural trade, and other factors. This relationship is shown in equation 2. We add a variable (PTA_i) that indicates the direct effect of preferential trade agreements on agricultural income.

(2) $y_i^A = \alpha_0 + \alpha_1 X_i + \alpha_2 WT_i + \alpha_3 PTA_i + \varepsilon_i$

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

Preferential trade agreements can affect agricultural income through different channels. The main channel is agricultural trade itself because preferential agreements are expected to increase agricultural trade volume and the effect of such changes is reflected in agricultural income trough coefficient α_1. Preferential trade arrangements can also affect within-country trade by replacing it with imports, which consequently would affect agricultural income (coefficient α_2). Adoption of preferential trade agreements can also be related to changes in domestic agricultural related policies that can influence agricultural income. A preferential trade agreement with another country can increase confidence of domestic agricultural producers in better access to foreign markets, decrease uncertainty, and therefore lead to long-run 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, and not only ones that engage in international trade. Those effects of preferential trade agreements are captured by the model through coefficient α_3.

The model includes two additional equations that describe international agricultural trade (equation 3) and within-country agricultural trade (equation 4). Following Frankel and Romer, international agricultural trade depends on geographical

and demographic characteristics of trading partners (D_i) and other factors δ_i. Variable PTA_i accounts for the effects of preferential trade agreements on international agricultural trade. The setup of the international trade equation is a gravity equation setup described in the previous section (equation 1).

(3) $X_i = \beta_0 + \beta_1 D_i + \beta_2 PTA_i + \delta_i$

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

(4) $WT_i = \gamma_0 + \gamma_1 S_i + \gamma_2 PTA_i + \rho_i$

The data on within-country agriculture trade is not available for majority of the countries. Therefore it is necessary to adjust income equation by substituting within-country trade equation into the income equation. After substituting within-country trade equation into the income equation (equation 2), we get the following model for measuring income effects of preferential trade agreements in agriculture

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

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

Estimating Income Effects

To model the relationship between agricultural income, and agricultural trade and preferential trade agreements, 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.

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

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 agreements.

Agricultural trade variable measures agricultural trade of a country with the rest of the world. Population and area are measures of a size of a country 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 agreements 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 agreements in which a country partakes. However, such a 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).

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

Frankel and Romer solved the endogeneity problem of trade in output estimations. They used geographic variables such as distance, population, dummy for landlocked countries, and dummy for common border in order to correct for endogeneity bias. Geographic characteristics tend to influence trade flows and usually are not correlated with countries' income. Frankel and Romer regressed trade on a set of geographic variables and then used fitted values 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).

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

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.

Agricultural trade equation (equation 7) is basically an empirical version of the trade equation in the theoretical specification part (equation 3), which measures geographical content of agricultural trade.

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

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

Geographical trade content variable ($\hat{X}_i$) is then used as an instrument to estimate the effects of agricultural trade and preferential trade agreements 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 income equation 6 and gravity trade equation 1, we can estimate the effects of preferential trade agreements on agricultural income. First,

preferential trade agreements will affect trade flows between countries through coefficients a_5 and a_6 in gravity equation 1 and then resulting changes in trade will affect agricultural income through coefficient c_2 in equation 6. Preferential trade agreements 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 of the countries. Their combined effect is measured by a coefficient c_5 (coefficient $\alpha_3 + \alpha_2\gamma_2$ in the income equation 5).

Data and Estimation Procedures

The data used in estimation is a cross-section. We used the latest available data for 1999. Data on agricultural trade flows was obtained from World Bank Trade and Production Database. Since import data is generally more reliable than export data (Nicita and Olarreaga), we used mutual imports to calculate overall agricultural trade between each country pair. Information on current preferential trade arrangements was from the website of the World Trade Organization. We accounted for 131 preferential trade arrangements reported to WTO. Data on agricultural income (agricultural value added) population, land area, gross domestic product was obtained from World Development Indicator database maintained by the World Bank. Data on common currencies, languages, landlocked countries, border sharing was 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 OLS and IV estimators used to estimate agricultural trade and income models since error terms in cross-sectional regressions are tend to be heteroskedastic. The standard OLS and instrumental variable estimators produce unbiased estimates of regression coefficients. However, the estimates of variance-covariance matrix are inconsistent in the presence of heteroskedasticity, therefore leading to incorrect test results. To correct for heteroskedastic bias in variance-covariance matrix, we use White's estimator for OLS (see Greene) and instrumental variable regressions (see Baum, Schaffer, and Stillman).

When estimating income effects, we construct the instrument for 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 agricultural trade model. As it was shown in the theoretical section of this article, agricultural trade is a function of various economic, geographical, and demographical factors. In addition to the core variables of the gravity relationship – countries' GDPs and the distance between trading partners, we have included countries' population and land area. 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 more trade between countries in addition to 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. 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, there is a possibility 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 agreement, may not preclude expansion of agricultural trade with non-member countries. Also preferential trade arrangements typically cover a wide variety of products and services and agricultural products often constitute a small part of them.

Increased trade between members of preferential trade arrangements can positively affect overall countries' 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 transshipments. Transshipped commodities may require additional level of processing in a member country, which may not be a barrier high enough to discourage exports from non-member countries. Finally, a trade diverting dummy of a particular preferential trade agreement can be correlated with trade creating dummies that are not explicitly accounted for if member countries participate in other trade agreements with non-member countries. Inclusion of a trade creating dummy that reflects combined effect of preferential trade agreements mitigates this effect.

Preferential trade arrangements differ in terms of their size and coverage. We chose several regional trade agreements that seem to be most important in different parts of the world and for which the data was available, and estimated their effects on agricultural trade and income. In particular, we chose the North American Free Trade Agreement (NAFTA) and Andean Community (CAN) to represent Western Hemisphere. ASEAN Free Trade Area (AFTA) was chosen to represent Asia, and European Community (EC) – Europe. All of those regional trade agreements extend their coverage to agricultural commodities. To account for the effects of these preferential trade arrangements on agricultural trade, trade creating and trade diverting dummies were created to indicate countries' participation in the above regional trade agreements. The

estimation results are presented in table 1. In table 1 we include a gravity regression that includes trade creating and trade diverting dummies. Variables PTAcij and PTAdij represent combined trade creating and trade diverting effects of preferential trade agreements. The rest of trade creating and trade diverting dummies isolate the effects of AFTA, CAN, EC, and NAFTA.

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

Preferential trade agreements, on average, had positive and statistically significant effect on agricultural trade. The overall trade creation coefficient was positive and statistically significant at 1% (see table 1). The overall trade diversion effect was also positive and statistically significant at 5% significance levels. Trade creation coefficient supports the hypothesis that despite less coverage of agricultural commodities in preferential trade agreements as compared to manufacturing products, preferential trade agreements create trade opportunities for agricultural producers. Positive effect of a trade diverting dummy indicates that additional trade due to preferential trade arrangements does not necessarily divert trade with non-member countries because agricultural products traded with member and non-member countries may not be substitutes, thus not precluding agricultural trade expansion with non-member countries. Preferential trade 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 agreement.

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

AFTA had the most prominent effect on agricultural trade that was four times higher than the average effect of all preferential trade arrangements. Trade creating effect

of Andean agreement was slightly above average and the trade creating effect within EC was below average.

As far as trade diverting effects of selected preferential trade agreements are concerned, CAN and NAFTA had expected negative and statistically significant trade diverting effects. AFTA and EC had positive trade diverting effects although trade diverting effect of EC was not statistically significantly different from zero. This result can be explained in the same way as it was for an average trade diverting dummy PTAdij if those regional trade arrangements 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 case of particular preferential trade arrangements can simply proxy other preferential trade agreements with non-member countries that were not explicitly included in the regression. EC can be an example of the latter argument since EC member countries have preferential trade agreements with countries in Eastern Europe and North Africa.

The net effects of preferential trade agreements on agricultural trade, obtained by comparing trade creating and trade diverting effects, were positive overall. However, Andean agreement and NAFTA were trade diverting since their trade diverting coefficients were negative and statistically significant and trade creating coefficients corresponding to those agreements were not statistically different from zero.

Finally, in table 1 we tested the overall statistical significance of trade creating and trade diverting effects. The hypothesis that trade creation and trade diversion effects were zero were rejected at conventional statistical levels.

Preferential Trade Agreements and Their Effects on Agricultural Income

The results of trade regressions showed that participation in preferential trade arrangements have 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. Agricultural income equation is set as a linear function of agricultural trade, land area, population, and variables that capture effects of preferential trade agreements that do not pass directly through international agricultural trade. The results of the agricultural income regression are presented in table 2.

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

The agricultural income regression separates effects of regional trade arrangements on agricultural income into the ones that pass through agricultural trade and the ones that influence within-country agricultural trade and production decisions (non-trade effects). Since previous gravity estimations showed that participation in preferential trade agreements increase agricultural trade, a positive coefficients on trade variable in income regressions (table 2) would suggest positive trade effects of preferential trade

agreements on agricultural income. Non-trade effects are measured by coefficients on the variables indicating participation in preferential trade agreements. Preferential trade variables in agricultural income regression are constructed as sums of member countries' GDPs weighed by distance.

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

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

Average non-trade effect of preferential trade agreements on agricultural income PTA_i was negative but statistically insignificant. Negative sign suggests that by displacing within-country agricultural trade and altering agricultural production and business environment they 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 of non-trade effect of preferential trade agreements shows that those effects are unlikely to diminish the positive and statistically significant effects of preferential trade arrangements passing through international trade.

Although there is no expected sign on the non-trade income effects of preferential trade agreements. The coefficients on specific regional trade agreements tended to be negative except for Andean agreement (CAN) but statistically insignificant (NAFTA and EC). Only AFTA had negative and statistically significant non-trade impact on agricultural income.

Due to insignificance of non-trade income effects of preferential trade arrangements, we also estimated income regression without them. This did not introduce significant changes to the coefficient estimates for trade, population, and land size effects. Agricultural trade and population remained to have positive and statistically significant impact on agricultural income.

These empirical results show that agricultural trade expansion due to participation in preferential trade agreements may be beneficial as far as agricultural income is concerned. Preferential trade arrangements have positive effect on agricultural trade as it was shown from the gravity regression and agricultural trade, in turn, has positive effect on agricultural income. There is a possibility that non-trade effects of preferential trade agreements 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 passing through international trade and within-country trade and non-trade effects. The income equation in the second part of the model was estimated using instrumental variable technique because of a concern that there were common factors affecting agricultural income and agricultural trade, making the latter correlated with the residuals. The instrument was constructed based on geographical content of agricultural trade.

Preferential trade arrangements were shown to have positive trade creating effect on agricultural trade except for NAFTA. The trade creating effects were not statistically significant for Andean agreement, EC, and NAFTA. However, overall trade creating effect of preferential trade agreements was positive and significant. Trade diverting effects were statistically significant and negative for Andean agreement and NAFTA. Overall trade diverting effect was positive, indicating that agricultural trade created with member countries does not crowd out agricultural trade with non-member countries,

probably because of low substitutability between traded products. Preferential trade arrangements also may create additional demand for agricultural products from non-member countries by increasing income, and possibly create an opportunity for transshipments.

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

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Table 1. 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%

Table 2. 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%