REGIONALISM IN WORLD AGRICULTURAL TRADE:

LESSONS FROM GRAVITY MODEL ESTIMATION

Jason H. Grant[1]

Dayton M. Lambert

Department of Agricultural Economics
Purdue University
403 W State Street
West Lafayette, IN
47907-2056
Tel: 765-494-5816
Fax: 765-494-9176
jhgrant@purdue.edu

Economic Research Service
United States Department of Agriculture
Tel: 202-694-5489
dlambert@ers.usda.gov

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[1] Jason H. Grant is a PhD student in the Department of Agricultural Economics at Purdue University and Dayton M. Lambert is an Economist at the ERS/USDA

Introduction

The effects of Regional Trade Agreements (RTAs) have been the subject of considerable debate dating back to the 1950's when Jacob Viner published his work on the "customs union issue" – an era known as "the first regionalism." More recent growth of RTAs has again sparked an interest among economic researchers. For example, over the last ten years the United States (U.S.) has signed a total of 13 free trade agreements. The European Union (EU) has successfully increased its membership from 6 members in 1986 to 25 members in December of 2002 (European Commission). Other examples include Mercosur (The Southern Common Market) that was created in March 1991, the signing of the Andean Pact in 1993 and several South African trade agreements including the South African Development Community (SADC) formed in 1992, the South African Customs Union formed in 1993 and the Community of Eastern and Southern African Countries (COMESA) formed in 1995. In 2004, the World trade Organization (WTO) notifications show that there were over 190 agreements in force with another 60 believed to be operational although not yet notified. By 2005, this number is expected to approach 300. Bhagwati (1991) has termed this latest resurgence as "the second regionalism."

The proponents of regional trade agreements argue that they promote free trade. This school of thought views RTAs as "building blocks" towards multilateral trade liberalization (Summers1991; Ethier 1998). However, there are equally as many opponents who argue that RTAs divert trade from more efficient nonmember trading countries. This school of thought views RTAs as "stumbling blocks" that are likely to lower global welfare and divert import flows from lower cost suppliers (Panagariya 2000; Krueger 1999).

Another issue raised by the formation of RTAs is their relationship with multilateral free trade. The proliferation of RTAs has been concurrent with the multilateral negotiating rounds of the General Agreement on Tariffs and Trade (GATT). These negotiations dramatically reduced tariffs and other border protection on industrial products where the current Most Favoured Nation (MFN) tariff rate is estimated at less than 5%. Yet, the same is not true for trade in agricultural products where the current MFN tariff rate is estimated at 62%. In fact, due to its sensitive nature, agriculture was virtually excluded from all eight GATT rounds until the signing of the Uruguay Round (UR) in 1994.

The special treatment of agriculture is not uncommon in regional trade agreements. For example, the North American Free Trade Agreement (NAFTA) and Mercosur liberalized trade in most agricultural products but maintain trade barriers for sensitive products such as sugar, dairy and fruit and vegetable products. Mexico and Canada required a separate bilateral agreement within NAFTA for trade in dairy, poultry, eggs and sugar. At two extremes, the Asian Free Trade Agreement (AFTA) excluded agricultural trade altogether, whereas the EU customs union and the Closer Economic Relations (CER) agreement between Australia and New Zealand permit free trade in agriculture (Jaysinghe and Sarker, 2003). Clearly, the tremendous growth in regional trade agreements during the 1990's suggests that these agreements are a force that is potentially competing with, if not surpassing multilateralism as an avenue for agricultural trade liberalisation.

Typically, debates over the effects of regional trade agreements have focused on welfare. However, to fully understand the effects of these agreements we seek to answer

a more fundamental question of what effects these agreements have had on agricultural trade. The purpose of this study is to assess the effects of regional trade agreements in agricultural trade by specifying an extended gravity model. Specifically this study addresses two important questions: (1) To what extent have RTAs created trade across individual agricultural commodities, and (2) To the extent that RTAs were trade creating, how much of this increase came at the expense of trade diversion with non-members?

This study is organized as follows. The next section develops the well known gravity equation to estimate trade creation and trade diversion effects of eight regional trade agreements. The econometric results follow and in the final section we conclude.

The Gravity Model

There are two possibilities that emerge when a group of countries form a Free Trade Agreement (FTA)[2]. In the case of trade diversion, higher cost imports from a bloc member replace lower cost foreign supplies and the RTA is said to be "trade diverting" from the most efficient supplier. In the case of trade creation, if a member is originally trading with a relatively higher cost exporter before the RTA is formed, but the formation of the RTA displaces trade with lower cost exports from a member country then the RTA is said to be "trade creating." In the case of trade diversion, world trade is reduced and at least one country is made worse off if the external tariff is greater than the cost difference between the FTA and non-member sources. In the case of trade creation, world output rises and the FTA member is better off in terms of economic welfare without a

[2] In this study, free and preferential trade agreements, customs unions and common markets are used synonymously to refer to a regional trade agreement. In a free trade area (FTA), countries enforce discriminatory trade policies by eliminating all tariff and political barriers to imports that originate wholly or in substantial measure (as determined by rules of origin) within the trading bloc. A customs union (CU), on the other hand, is a free trade area in which member countries also adopt a common set of external tariffs, quantitative restrictions, and other measures to limit imports from outside of the union. A common market involves unrestricted movements of factors across an economic union in which fiscal, monetary and other economic policies are harmonized within the union (De Rosa 1998).

corresponding welfare loss to the non-FTA member. Furthermore, lower internal consumption prices and a normal tradable good induce a positive substitution and income effect from lower import prices.

The gravity model has performed remarkably well as an empirical framework for measuring the impact of regional integration arrangements (Frankel and Wei 1995; Frankel, Stein and Wei 1995; Finger, Ng and Soloaga 1998). This literature commonly reports that trade creation has occurred within RTAs, although Finger, Ng and Soloaga and some others have found negative trade creation effects in Mercosur. However, the current gravity literature on regional integration has focused almost exclusively on trade in non-agricultural products, and in many cases, agricultural trade has been excluded from the estimation. Yet, the special treatment of agricultural trade within preferential trading blocs and in the WTO negotiations suggests that agricultural trade within RTAs may not be trade creating. Furthermore, by comparing the magnitudes of trade creation and trade diversion within a particular RTA, we can calculate a rough welfare estimate as well as the ad valorem equivalent pre-RTA border effect across several individual agricultural commodities.

Anderson (1979) provided the first theoretical foundation for the gravity model based on the properties of the constant elasticity of substitution (CES) expenditure system. Bergstrand (1985, 1989), Helpman and Krugman (1985) and Deardorff (1998) have subsequently contributed to the micro foundations of the gravity model. In the one-sector monopolistic competition models (Krugman 1980), utility is CES over varieties within a sector and σ is the elasticity of substitution between varieties.

[1] $$U = \left(\sum_j (C_j)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

Assuming monopolistic competition among firms and iceberg transportation costs leads to the following result. Each firm produces a unique variety so that it may have monopoly power over that variety expressed as a markup of price (p) over marginal cost (mc), $p = \frac{\sigma}{\sigma - 1} mc$. The number of varieties produced in each country is determined by the available labor force *(L)*, the size of the fixed costs *(a)* and the substitution elasticity *(σ)*, $n_j = L_j / a\sigma.$ Variation in pricing across export markets is determined entirely by the iceberg transport cost factor, so if p_j is the exporter's price exclusive if trade barriers and $t_{ij} \geq 1$ is the *ad valorem* trade cost, the price faced by importer *i* is $p = p_j t_{ij.}$ Consumers in country *i* import a quantity of each variety produced in exporter *j* given by

[2] $$q_{ij} = Y_i (t_{ij})^{-\sigma} \left(\frac{p_j}{P_i^{-1/\sigma}} \right)^{-\sigma},$$

where $P_i \sum_l (p_l t_{il})^{1-\sigma}$ is a price index over all varieties purchased by importer *i*. Demands are symmetric for all varieties from j, so multiplying the quantity purchased by the number of varieties and price of each variety leads to an expression for the volume of bilateral trade.

[3] $$M_{ij} = kY_i Y_j (t_{ij})^{-\sigma} \left(\frac{p_j}{P_i^{1-\sigma}} \right)^{-\sigma}$$

Thus, in its basic form the gravity model regresses the logarithm of the volume of trade (VT_{ij}) between countries *i* and *j* in year *t* on the logarithm of the economic size of the

importing region *i* (GDP_{it}) and exporting region *j* (GDP_{jt}) and the logarithm of the distance between them (D_{ij}):

[4] $$\ln V_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_5 \ln D_{ij} + \varepsilon_{ijt},$$

where the shipments between any two exporting *(i)* and importing *(j)* countries and their economic size *(GDP_i and GDP_j)* are measured in values (US$). The distance variable *(D_{ij})* is a proxy for the transportation costs between countries *i* and *j* and *(ε_{ijt})* is a log normal error term.

We are interested in a model that captures the trade flow effects of regional trade agreements. McCallum (1995) and Helliwell (1996) include domestic trade, along with a variable to indicate flows that take place within Canadian provinces as well as trade between Canadian provinces and U.S. states. Because the idea is to try and control for all the possible factors that explain why two nations may trade more with each other relative to the average flow of goods, the variables in equation [4] alone are not enough.

Researchers typically experiment by including proxies for trade costs such as the distance between partners, and indicators for common language and contiguity (when countries share land borders).For example, two nations that share a common border or speak a common language may trade more with each other based on relative proximity and cultural similarity. Or, countries with access to seaports may have a comparative advantage in trade relative to neighbors who are landlocked. Controlling for these factors gives us more confidence that our regional bloc dummies are picking up structural increases in trade following the signing of an RTA. The basic extension of equation [4] is as follows:

$$[5] \qquad \ln V_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln\left(\frac{GDP_{it}}{N_{it}}\right) + \beta_4 \ln\left(\frac{GDP_{jt}}{N_{jt}}\right) + \beta_5 \ln D_{ij} + \beta_6 Cont_{ij} +$$

$$\beta_7 CommLang_{ij} + \beta_8 LandLck_{ij} + \sum_{h=1}^{9} \alpha_h TradeC_{ijht} + \sum_{l=1}^{9} \gamma_l TradeD_{ijlt} + TimeDummies + FixedEffects + \varepsilon_{ijt},$$

where $Cont_{ij}$, $CommLang_{ij}$ and $LandLck_{ij}$ are dummy variables equal to one if exporter *(i)* and importer *(j)* share a common land border, speak a common language or are landlocked countries and zero otherwise[3].

The dummy variables $TradeC_{ijht}$ and $TradeD_{ijlt}$ are designed to capture trade creation or trade diversion effects respectively in agri-food trade for eight RTAs ($h, l = 1…8$). The specification of these dummies is related to the work of Frankel and Wei (1998) where the dummy variable $TradeC_{ij}$ equals one if countries *i* and *j* belong to a particular RTA and the year (*t)* is greater than or equal to the year the agreement was signed. The sign and magnitude of the coefficient indicates whether the creation of a particular RTA has stimulated or depressed intra-regional agricultural trade.[4]

The trade diversion dummy variable $(TradeD_{ijlt})$ is designed to estimate how much of the increase (if any) in trade creation came as a result of trade diversion from nonmember sources. Trade diversion is defined in terms of import costs (Viner 1950). This variable takes the value one when an RTA member imports from a nonmember and the year *(t)* is greater than or equal to the year the agreement was signed. Thus, the coefficient will

[3] Note that one or both of the importing (exporting) country may be landlocked in which case the dummy variable equals one. A landlocked country is taken from Wikopedia's online encyclopedia (http://en.wikipedia.org/wiki/Landlocked) and is defined as a country that has no coastline. There are 42 landlocked countries in the world.

[4] A special case involves trade between Australia and New Zealand, members of the CER agreement. This agreement was ratified in 1983, but our sample period is from 1985-2002. Thus, the trade creation and trade diversion dummies for the CER are defined over the entire sample period.

capture the average increase (decrease) in trade diversion from nonmember sources after the agreement came into force.[5]

Eighteen time dummies are introduced to control for other important factors influencing world agricultural trade, namely the increase in world agricultural trade over the sample period. The year 1985 is subsumed into the intercept. The unobserved heterogeneity of countries is captured using fixed effects. The fixed effects variables help proxy other country-specific factors not included in the model, such as changes in political regimes, macroeconomic shocks and other idiosyncratic factors.

The semi-logarithmic functional form of equation [5] allows us to interpret the regression coefficients that are not dummy variables as elasticities. Holding constant the other explanatory variables, $\beta_1+\beta_3$ (or $\beta_2+\beta_4$) represents the percentage change in VT_{ijt} given a one percent change in GDP_i (GDP_j) for the exporting (importing) country. We expect the signs of these coefficients to be positive and statistically significant because of the direct impact of GDP on import demand and the fact that larger exporting countries tend to trade more. β_5 is a proxy for all trade barriers that affect trade between countries *i* and *j*.[6] We expect β_5 to be negative and statistically significant as higher bilateral trade and transport costs (i.e. greater shipment distances) reduce the propensity to trade.

The variables of interest in this study are the direction and magnitude of the trade creation and trade diversion. We expect the coefficient on $TradeC_{ijht}$ in equation [5] to be

[5] Readers may criticize this method because in some instances more than one trade creation or trade diversion dummy variable is active for a particular trade flow. However, in world trade many countries are often members of several RTAs concurrently. Given that we have pooled all cross sectional trade flows for 18 years of agricultural trade data totaling over 56,000 observations and the fact the RTA agreements were signed in different years, it seems reasonable to believe that the trade creation and trade diversion coefficients are picking up variation in trade flows specific to a particular agreement. Later in the paper, we perform a robustness check to validate this specification.

[6] Trade barriers can be in the form of border restrictions predominant in agriculture, transport and distribution costs, an international border as well as information costs.

positive and significant as the elimination of significant border restrictions should encourage intra-regional bloc trade. However this is an important empirical question because like the WTO, many RTAs maintain trade restrictions for certain agricultural commodities. Tthe coefficient on $TradeD_{ijlt}$ will be negative and significant if trade creation within a particular RTA came at the expense of trade with nonmembers.

We push this framework a step further and calculate the percentage increase or decrease in trade creation and trade diversion due to the signing of an RTA using a simple nonlinear transformation. Consider a simplified semi-logarithmic regression equation of the form

[6] $$\ln V = \alpha + \sum_i \beta_i \ln X_i + \sum_j \gamma_i D_i + \varepsilon_{ij}$$

where X_i represent continuous explanatory variables and D_i is a set of dummy variables. The coefficient of a continuous variable is

[7] $$\beta_i = \frac{\partial \ln V}{\partial \ln X_i} = \frac{\partial V}{\partial X_i}\frac{X_i}{V}.$$

Thus the coefficient of a continuous variable is the elasticity of V for a small change in the explanatory variable X_i. However, a dummy variable is a discontinuous variable and the derivative of V with respect to a small change in D_i does not exist. Instead, we can calculate the percentage change in V going from V_0 to V_1 for a discrete change in D_i from 0 to 1 as,[7]

[7]We use the multivariate Delta method to derive the asymptotic variances of the trade creation and trade diversion estimates Previous studies have used equation [8] to calculate percent changes in the coefficients involving a dummy variable without regard to the properties of the variance-covariance estimates when using a nonlinear transformation. Note that equation [8] is a continuous and differentiable function. Let $g = (\exp(\gamma) - 1) * 100$ and let $\text{var}(\hat{\gamma})$ be the OLS variance from equation [5]. Then using the multivariate Delta method, the asymptotic variance of a nonlinear transformation such as [8] is:

$$\text{var}(g) = \frac{\partial g}{\partial \gamma} Var(\hat{\gamma}) \frac{\partial g}{\partial \gamma}' .$$

$$[8] \qquad \left[\frac{V_0 - V_1}{V_1}\right]*100 = \left[\frac{\exp(\alpha + \sum_i \beta_i \ln X_i + \gamma \cdot 1 + \varepsilon_i) - \exp(\alpha + \sum_i \beta_i \ln X_i + \gamma \cdot 0 + \varepsilon_i)}{\exp(\alpha + \sum_i \beta_i \ln X_i + \gamma \cdot 0 + \varepsilon_i)}\right]*100$$

$$= (\exp(\gamma) - 1)*100$$

Implicit in the RTA dummy variables is the implied *ad valorem* equivalent of the pre-RTA border cost. Let the *ad valorem* trade cost increase in distance according to $t(Dist) = (Dist_{ij})^{\delta_1}$, and denote the *ad-valorem* trade cost savings from the formation of the RTA *($TradeC_{ijt}$)* as (δ_h).[8] Assuming that this proxy for the pre-RTA border cost enters multiplicatively the trade barrier function is $t_{ij} = (DIST)^{\delta_0} \exp(\delta_h)$, for $h = 0…8$ (i.e. one distance parameter and 8 RTA parameters). The trade barrier coefficient for distance is interpreted as $\beta_5 = -\delta_{h=0}(\sigma)$ and for the pre-RTA border $\alpha_h = \delta_h(\sigma)$ for h = 1…8.

Data

Time series bilateral trade data (V_{ijt}) in millions of U.S. dollars for 9 agricultural commodities are taken from the Comtrade database and aggregated to the GTAP regional level which includes 87 countries and regions. All GDP and population data are taken from the World Bank Development Indicators which reports GDP data in U.S. dollars. Distance measures and contiguity and common language indicators are taken from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Distances are calculated following the great circle formula, which uses latitudes and longitudes of the most important cities/agglomerations in terms of population.

A pooled, cross sectional, time series regression of equation [5] is estimated for 18 years of trade data (1985-2002) and for 11 regression scenarios. Nine of these

[8] Note that contiguity, common language, and access to a sea port (landlocked) also involve trade cost savings. We have not included these coefficients in the trade cost function because we are really interested in the ad valorem tariff equivalent of the pre-RTA border cost.

regressions are for individual agricultural commodities and the remaining two scenarios are for all agricultural and non agricultural commodities. Table 2 lists the HS 2 industry used to classify the nine individual agricultural commodities along with a description of the products included in these industries. In total, there are 86 countries that potentially export to 85 other countries for 18 years. Thus there are 131,580 possible bilateral trade observations (86*85*18) for a single commodity. Tables 3 through 5 displays the number of observations after eliminating all non-trading countries (zero trade values).

Results

The econometric results from the 11 regression scenarios are displayed in tables 3 through 5. The regression scenarios are labeled 1 through 11 accordingly. The standard gravity estimates are displayed in table 3. Table 4 presents the trade creation and trade diversion coefficient estimates where trade diversion estimates are shown in parentheses. Finally, for convenience tables 6 and 7 display the percentage change in trade creation and trade diversion using equation [5] with the upper and lower 90 percent confidence levels in parentheses.

In terms of the standard gravity estimates, table 3 shows that the implied income elasticities (GDP + per capita GDP) are positive and significant in nearly all cases. However, the magnitudes of these estimates are lower than the estimates found in the literature which typically range from 0.70 to 1.20 (see for example Frankel and Wei 1997, Anderson and van Wincoop 2003). Regression 11 for non agricultural goods supports this where the implied income elasticity is 0.90 and 0.70 for the exporting and importing country respectively. The smaller income elasticities for agriculture is to be expected for two reasons. One, usually agriculture makes up a much smaller percentage

of national GDP than manufacturing or industrial goods. Two we typically view raw agricultural commodities as necessities so that when national income rises, countries may choose to trade higher valued non-agricultural goods especially from the perspective of an importing country. The GDP coefficients also suggest that larger countries trade more than do smaller countries but a one percent increase in the economic size of a nation (proxied by GDP) brings a much smaller increase in the value of agricultural trade than in non agricultural trade (compare the GDP coefficients in regressions 10 and 11).

Distance is negative and significant in 5 of the 9 individual agricultural commodities (regressions 1 through 9) and for all agriculture and non agriculture regressions (regressions 10 and 11). In this case, the coefficient on distance for trade in agricultural goods is roughly half the distance coefficient in non agricultural trade. This may reflect the fact that many agricultural products are shipped by ground transportation. The contiguity, common language and landlocked coefficients all have the expected sign and are significant at the one percent level.

Trade Creation and Trade Diversion

This section discusses the empirical results of trade creation and trade diversion in eight RTAs listed in Table 2. Tables 5 shows the percentage increase/decrease in trade creation and table 6 shows how much of this increase/decrease came at the expense of trade diversion with nonmembers.

Trade Creation

NAFTA and the expansion of the European Union to 15 members (EU-15) show positive and significant trade creation effects for 8 out of 9 and 6 out of 9 individual agricultural commodities, respectively (table 4). In NAFTA, the results are largest in the

case of bovine cattle, vegetables and fruit and oilseeds. For these commodities, the magnitude of the coefficients suggest that two NAFTA members traded an additional 361 percent in the case of bovine cattle, 511 percent in the case of vegetables and fruits and an additional 264 percent in the case of oilseeds. Using an elasticity of substitution of 5, the implied tariff equivalent of the pre-RTA border cost for all agricultural commodities (regression 10) is 127 percent (100*exp(1.22/5)). With an elasticity of substitution of 10 the pre-RTA border is 112 percent.

A similar pattern emerges for trade in Mercosur, Africa and the Andean Pact and for 8 agricultural commodities in the CER and APEC, the exception being Cattle. For trade in all agricultural commodities (regression 10) for these RTAs, the ad valorem tariff equivalent of the pre-RTA border ranges from a low of 115 (Africa) to a high of 206 (CER) using an elasticity of substitution of 5. This suggests that bound tariff costs alone which average 62 percent in world agricultural trade (Gibson et al 2001) account for roughly one-third of total trade costs.[9] On this criterion, regional trade agreements would have to be considered a major success.

AFTA shows that trade decreased after the formation of the agreement in 5 out of 9 commodities. However, this is not surprising given that AFTA is composed of five Southeast Asian nations who do not necessarily have a strong comparative advantage in agricultural production.

In summary, the results suggest that RTAs may be an important avenue for trade liberalization in agriculture. In fact, if we compare the trade creation effects for all agriculture versus non agricultural trade (regressions 10 and 11) we see that in 5 out of 9

[9] However, countries often apply tariff rates below their bound levels suggesting that applied rates make up a much smaller fraction of the total trade cost.

cases, the magnitude of trade creation in agricultural trade exceeds that of non agricultural trade. The explanation for this relates to the fact that the GATT/WTO has been successful in creating an integrated world economy for trade in non agricultural goods, whereas trade in agricultural goods has only recently been brought under its governance. While significant trade restrictions existed in agriculture before the formation of an RTA the reduction or elimination of these barriers likely lead to a much larger percentage increase in post-RTA trade relative to pre-RTA trade.

Trade Diversion

For convenience, table 4 presents the results for trade diversion in square brackets under those of trade creation. Table 6 shows the magnitude of trade diversion and the 90 percent confidence interval constructed using the multivariate Delta method.

The signing of NAFTA appears to have come at little expense of trade diversion with nonmembers (Table 4). In terms of all agricultural commodities (regression 10), NAFTA imports from a nonmembers averaged 11 percent less after 1994 (with 90 percent confidence that this number lies between -4 and -19 percent in repeated samples, table 6). To put this in context, a 240 percent trade creation effect for all agriculture (table 4) suggests that the signing of NAFTA may have increased welfare for its members. Interestingly, vegetables and fruit (regression 5) and other food products (regression 9) are the only statistically significant and negative trade diversion effects across individual commodities at -18 and -9 percent respectively (table 6). However, trade creation far outweighs trade diversion for these commodities.

A different story emerges in the EU-15 where positive trade creation effects are almost offset by negative trade diversion effects for vegetables and fruit, wheat and

durum, other crops and other food. In the case of wheat and durum and other crops (regressions 6 and 8), negative trade diversion effects exceed trade creation (tables 5 and 6) suggesting that the expansion of the European Union to 15 members may have reduced welfare in a few agricultural commodities. To get a rough idea of the magnitude of the decrease in welfare, note that in terms of value the average bilateral trade flow for wheat and durum and other crops is 40 million and 30 million U.S. dollars (USD) respectively. With no statistically significant trade creation effects in these two commodities, the welfare loss from trade diversion is roughly 12.5 million and 9.6 million USD times the cost difference on imports between members and nonmembers.[10]

Trade is diverted from nonmember sources in Mercosur for three products, bovine cattle, wheat and durum and oils seeds (table 6). However, trade diversion is more than offset by the magnitude of trade creation in these same products (table 5). Furthermore, the trade creation effect in Mercosur for all agriculture is among the highest at 384 percent. Because trade creation is unambiguously welfare improving, it is likely that the signing of Mercosur was welfare improving for its members despite some trade diversion in certain commodities.

Trade diversion was most prominent among APEC members where 7 out of 9 commodities showed negative and significant trade diversion effects (table 4). In fact, trade diversion exceeded trade creation in 4 out of 9 commodities (bovine cattle, sugar, vegetables and fruit and other crops, tables 5 and 6). This result suggests that the formation of APEC may be welfare decreasing even though no formal agreement exists

[10] Alternatively, the EU-15 members traded an average of 40 million dollars in wheat with nonmembers before the expansion to 15 members but only traded an average of 40*(1-0.31) = 27.6 million dollars in wheat after the expansion. The difference in trade for other crops is calculated analogously.

among its members.[11] At the other extreme, the CER agreement boosted trade among its members in every commodity except Bovine Cattle and increased trade with nonmembers after the agreement was signed. Dairy products and other food commodities stand out. The results suggest that two CER members traded an additional 582 (766) percent more dairy (other food) commodities after the RTA was signed and traded an additional 499 (577) percent with nonmembers.

Regional trade agreements involving South African countries diverted trade from nonmember sources in 7 out of 9 commodities. However only 4 out of these 9 commodities are statistically significant and in no case does trade diversion outweigh the trade creating effects of this agreement. The formation of AFTA boosted trade with nonmembers in 4 out of nine commodities (Bovine Cattle, Other Livestock, Dairy Products, Other Crops and Other Food). The remaining trade diversion coefficients are insignificant. Again, this result is to be expected. Table 5 shows that two AFTA members actually traded less with each other after the formation of the agreement because AFTA members do not specialize in production or exports of agricultural commodities. Thus we expect to see a positive trade diversion coefficient implying that AFTA members rely more on imports from larger countries that specialize in production and exports. Finally, in terms of the relative magnitude of trade creation and trade diversion, the Andean Pact increased intra-regional trade among its members in 6 agricultural commodities with dairy products and oil seeds showing the highest trade creation effects.

[11] In this study APEC is treated as an RTA although no formal agreement has been signed by its members.

An Alternative Specification

While we can never be sure we have the true model underlying the data, we can check to see if an alternative specification will authenticate our results. Instead of using the full model as in equation [5] which includes all RTAs simultaneously, we can restrict our attention to the set of bilateral trade observation that only involves at least one or both RTA members (i.e. importer, exporter or both). For example, in the case of Nafta, the set of bilateral trade observations is reduced to those observations where at least one or both members of Nafta are involved. We repeat this exercise for the eight RTA's (table 3) running separate regressions for each agreement. The trade creation and trade diversion dummies are defined as in equation [5] but only for the RTA being evaluated.

Figure 4 presents the trade creation and trade diversion results of eight separate regressions (called the bloc model in figure 4) for the case of all agriculture (regression 10) and compares them to the full model results using equation [5]. The results reveal the magnitude of trade creation is greater in the full model than in the bloc model in all RTAs except AFTA. This is to be expected because the dummy variables are relative to the average trade flow in the model. For example, in terms of value, average trade between two Nafta members is the highest among all RTAs for trade in agricultural commodities. In the full model where the average flow includes all countries, the percentage increase in Nafta trade creation will be higher than in the bloc model which only includes intra and extra-regional Nafta trade. This is because Nafta trade is large and the increase in Nafta trade after 1994 is greater if the base comparison is the average world trade flow versus if the base comparison is relative to pre-Nafta trade flows. We would be more concerned if a coefficient switched signs when estimating the bloc model.

This does not happen in any case. Thus, in the case of trade creation, the bloc model results reinforce our findings that significant trade creation has occurred in agriculture for all RTAs.[12]

In terms of trade diversion, again the bloc model reinforces our full model results. In one half of the cases, the magnitude of trade diversion is greater in the bloc model (Nafta, EU-15, APEC and AFTA). Mercosur diverted trade from nonmemebers under the bloc model, but increased trade with nonmembers under the full model. Again this results can be explained in terms of the average flow. In the full model, two Mercosur members traded more with nonmembers on average relative to the average world trade fllow after the agreement was signed, but traded less with nonmembers in the bloc model relative to the average Mercosur trade flow.

In summary, our alternative specification supports the claim that RTAs have generally increased agricultural trade between members but the magnitude of this increase depends on the average flow it is being compared to. In only three cases did the trade creation effect come at the expense of trade diversion with nonmembers (Nafta, EU-15 and APEC). However, the magnitude of trade creation exceeds trade diversion in every case except for the EU-15.

Conclusion

Agricultural trade has only recently been brought under the auspices of the WTO under a separate agreement. However, relative to trade in non-agricultural goods, progress in achieving agricultural trade liberalization under the WTO has been slow. The implementation of Article XXIV of the GATT, 1947 permits a group of countries to form

[12]In the case of the CER agreement between Australia and New Zealand, the magnitude of trade creation in the full model is far greater than in the bloc model (3687% versus 260%). More work is needed to determine the cause of this discrepancy.

a trade union whereby duties and other trade barriers are reduced or removed on all sectors of trade in the group and nonmembers should not find trade with the group any more restrictive than before the group was established.

Within regional trade agreements however, agricultural trade often receives special treatment in the form of maintaining higher duties over longer periods of time, and in some cases by completely exempting agricultural barriers from the reduction commitments within the agreement.

Very little is known about the extent of trade creation and trade diversion across individual agricultural commodities. This study addressed the fundamental question of what effect RTAs have had on trade. To answer this question we developed an extended gravity model to estimate the magnitude of trade creation and trade diversion across 9 individual agricultural commodities and for 8 RTAs .

The results indicate that agricultural trade in NAFTA and the CER has been very responsive to a decrease in trade restrictions. In 8 out of 9 commodities (the exception being dairy products), trade creation in NAFTA exceeded 75 percent and was over 200 percent in 3 commodities (cattle, vegetables and fruit and oil seeds). Furthermore, almost all of NAFTA and CER trade creation came at the expense of little or no trade diversion with nonmembers suggesting that these both agreements increased the welfare of its members.

The EU-15 and African agreements also show positive trade creation effects but the magnitudes are roughly half of those in NAFTA and the CER. However, both the EU-15 and African agreements show negative and significant trade diversion effects in 7 out of 9 and 5 out of 9 commodities. In 5 out of 9 cases in the EU-15 and in only 1 out of

9 cases in Africa, trade diversion exceeded trade creation. Although the welfare effects are ambiguous when trade creation and trade diversion effects are similar, it is possible that welfare in agriculture may have decreased with the expansion of the European Union to 15 members.

Two AFTA members actually reduced intra-regional trade across agricultural commodities after the agreement was ratified but much of this loss was offset by increased imports from nonmembers. In this situation the welfare results depend on the cost of importing from nonmembers and the size of the external RTA tariff. On the other hand, APEC members created trade across all commodities but much of this came at the expense of reduced imports from nonmembers. For trade in cattle and vegetables, trade diversion was greater than trade creation.

Finally, both Mercosur and the Andean Pact created trade with the exception of cattle in the Andean Pact. However, significant trade diversion in cattle, wheat and durum, and oilseeds occurred in Mercosur and in other livestock in the Andean Pact.

Are regional trade agreements building blocks or stumbling blocks in the reform of agricultural trade? Our extended gravity model results suggest that a majority of regional trade agreements are an effective avenue to promote multilateral free trade. Furthermore with only a few commodity specific exceptions, regional trade agreements have increased trade with nonmembers even as the members have increased trade among themselves to a greater extent. Thus, regional trade agreements are an attractive alternative for countries wishing to speed up the move towards multilateral free trade in agriculture.

References

Anderson, J. E. 1979. "A Theoretical Foundation for the Gravity Equation. *American Economic Review* 69(1): 106-116.

Anderson, J., and E.V. Wincoop. 2003. "Gravity with Gravitas: A Solution to the Border Puzzle." *American Economic Review* 106: 170-92.

Bergstrand, J. H. 1989. "The Generalized Gravity Equation, Monopolistic Competition, and the Factor Proportions Theory in International Trade." *Review of Economic and Statistics* 71: 143-53.

Bhagwati, J. (1991). "The World Trading System at Risk." Princeton, NJ: Princeton University Press.

Clausing, K.A. 2001. "Trade Creation and Trade Diversion in the Canada-United States Free Trade Agreement." *Canadian Journal of Economics* 34: 677-96.

dell'Aquila, C., R. Sarker, and K.D. Meilke. 1999. "Regionalism and Trade in Agrifood Products." Working Paper 99-5, International Agricultural Trade Research Consortium, St. Paul, MN.

Ethier, W. 1998. "The New Regionalism." *The Economic Journal* 108: 1149-161.

Feenstra, R.C. 2002. "Border Effects and the Gravity Equation: Consistent Methods for Estimation." *Scottish Journal of Political Economy* 49: 491-506.

Frankel, J., and S.J. Wei. 1998. "Regionalization of World Trade and Currencies: Economics and Politics." In *The Regionalization of the World Economy*. Edited by J. Frankel. National Bureau of Economic Research. Chicago: University of Chicago Press.

Gibson, P., J. Waino, D. Whitley and M. Bohmen (2001). *Profiles of Tariffs in Global Agricultural Markets.* Agricultural Economic Report number 796, Economic Research Service, USDA, January 2001, Washington, D.C.

Helpman, E., and P. Krugman. 1985. *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy*. Cambridge, MA: MIT Press.

Hummels, D. 1999. "Toward a Geography of Trade Costs," University of Chicago, January 1999.

Jayasinghe, S. and R. Sarker. 2004. "Effects of Regional trade Agreements on trade in Agrifood Products: Evidence from gravity Modeling using Disaggregated Data," Working Paper 04-WP 374, Iowa State University, Sept. 2004.

Krueger, A.O. 1999. “Are Preferential Trading Arrangements Trade Liberalizing or Protectionist?” *Journal of Economic Perspective* 13: 105-24.

Krueger, A.O. 2000. “Trade Creation and Trade Diversion under NAFTA.” NBER Working Paper No. W7429. National Bureau of Economic Research, Cambridge, MA.

Panagariya, A. 2000. “Preferential Trade Liberalization: Traditional Theory and New Developments.” *Journal of Economic Literature* 38: 287-331.

Summers, L. 1991. “Regionalism and the World Trading System.” In Policy Implications of Trade and Currency Zones: A summary of the Bank’s 1991 Symposium. Kansas City, MO: Federal Reserve Bank of Kansas City. November/December.

Viner, J. (1950). “The Customs Union Issue.” Carnegie Endowment for International Peace, New York.

Table 1. Regional Trade Agreement members and year of signing

No.	*Regional Trade Agreement*	*Members*	Year Signed
1	North Amercian Free Trade Agreement (NAFTA)	• United States, Canada, Mexico	1994
2	Mercosur (Southern Common Market)	• Argentina, Brazil, Paraguay, Uruguay	1995
3	European Union expansion to 15 members (EU-15)	• Belgium, Germany, Spain, France, United Kingdom, Greece. Ireland, Italy, Luxembourg, Netherlands, Portugal, Denmark, Austria, Finland, Sweden	1995
4	Closer Economic Relations (CER)*	• Australia, New Zealand	1983
5	AFRICA	• Members from the South African Customs Union (SACU), the South African Development Community (SADC) and the Common Market for East and South Africa (COMESA)	1996
6	Association of South East Asian Nations (ASEAN) Free Trade Agreement (AFTA)	• Indonesia, Malaysia, Philippines, Singapore, Thailand	1992
7	Asian-Pacific Economic Cooperation (APEC)*	• Australia, Canada, Chile, China, Hong Kong, Indonesia, Japan, Korea, Mexico, Malaysia, New Zealand, Peru, Philippines, Russia, Singapore, Thailand, Taiwan, United States, Vietnam	1989
8	Andean Pact	• Venezuela, Columbia, Peru, Bolivia, Ecuador	1993

* According to the WTO notifications, APEC is not a regional trade agreement because it lacks a formal agreement among its members.

Table 2. Commodity Descriptions

No.	**Commodity**[a]	**2-Digit HS Industry**[a]	*Description*[a]
1	Bovine Cattle	01	• Bovine cattle, sheep, goats and horses
2	Other Livestock	01-05, 15, 41	• Pigs, Poultry and other edible meats, chilled and un-chilled
3	Dairy Products	04, 21	• Unconcetrated milk, cream, buttermilk, cheese, whey, butter, yogurt and ice cream
4	Sugar Products	17	• Sugars, sugar cane, sugar beet, fructose and molasses
5	Vegetables and Fruit	07, 08	• Edible vegetables and roots, potatoes fresh and chilled, tomatoes fresh and chilled, onions, shallots, garlic, leeks, etc. fresh or chilled, cabbage, cauliflower, kohlrabi & kale, fresh, chilled, lettuce and chicory, fresh or chilled, carrots, turnips, beetroot, etc. fresh or chilled, cucumbers and gherkins, fresh or chilled, leguminous vegetables, fresh or chilled • Bananas, including plantains, fresh or dried, citrus fruit, fresh or dried, grapes, fresh or dried, melons, watermelons and papaws (papayas), fresh, apples, pears and quinces, fresh, • Coconuts, Brazil nuts and cashew nuts, fresh or dried
6	Wheat and Durum	10	• Wheat, meslin and durum not for seed.
7	Oil Seeds	12	• Soybeans, ground nuts not roasted, copra, linseed, rape seed (canola), sunflower and other oil seed crops
	Other Crops	06, 09, 12, 23, 24	• Coffee, tea, mate and spices, live trees, crop seed for sowing, cereal straw, forage products, animal fodder, vegetable residues, tobacco not manufactured and locust beans
9	Other Food	03-04, 07-09, 11, 13, 16-23, 35	• Fish, fresh, frozen or chilled, whole and smoked, fillets, fish meat, mince, cereal flour, starches and gluten, cocoa and other food preparations

[a] Commodity classifications and descriptions are taken from the Comtrade Database available at: http://unstats.un.org/unsd/comtrade/mr/rfCommoditiesList.aspx

Table 3. Gravity Variables

	Regressions[a]										
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Variable	**Bovine Cattle**[b]	**Other Livestock**[b]	**Dairy Products**[b]	**Sugar Products**[b]	**Veg. & Fruits**[b]	**Wheat Durum**[b]	**Oil Seeds**[b]	**Other Crops**[b]	**Other Food**[b]	**All Agr.**[b]	**Non Agr.**[b]
Intercept	**-5.16***** (0.85)	**-3.83***** (0.53)	**-4.46***** (0.60)	**1.70**** (0.80)	**-1.75***** (0.53)	**-3.04***** (1.07)	**-6.56***** (0.94)	**-4.48***** (1.02)	**-3.96***** (0.38)	**-3.51***** (0.37)	**-7.03***** (0.31)
GDPi	**0.16***** (0.01)	**0.30***** (0.01)	**0.08***** (0.01)	**0.03***** (0.01)	**0.20***** (0.01)	**0.34***** (0.01)	**0.30***** (0.01)	**0.34***** (0.01)	**0.37***** (0.00)	**0.40***** (0.00)	**0.72***** (0.00)
GDPj	**-0.09** (0.19)	**-0.44***** (0.12)	**-0.27**** (0.14)	**-0.13** (0.18)	**-0.11** (0.11)	**0.63***** (0.24)	**0.25*** (0.20)	**0.00** (0.22)	**-0.49***** (0.09)	**-0.39***** (0.09)	**-0.76***** (0.07)
Per Capita GDPi	**0.07***** (0.01)	**0.06***** (0.01)	**0.30***** (0.01)	**-0.03***** (0.01)	**-0.01**** (0.01)	**-0.02** (0.02)	**0.01** (0.01)	**-0.05***** (0.02)	**0.02***** (0.00)	**-0.01***** (0.00)	**0.19***** (0.00)
Per Capita GDPj	**0.53**** (0.27)	**0.87***** (0.17)	**0.59***** (0.20)	**-0.01** (0.25)	**0.32**** (0.17)	**-0.76***** (0.31)	**-0.09** (0.29)	**0.30** (0.30)	**1.03***** (0.12)	**0.84***** (0.12)	**1.45***** (0.10)
Distance	**0.00** (0.01)	**-0.31***** (0.01)	**-0.19***** (0.02)	**-0.01** (0.02)	**-0.22***** (0.01)	**0.02** (0.02)	**0.13***** (0.02)	**-0.13***** (0.02)	**-0.46***** (0.01)	**-0.36***** (0.01)	**-0.78***** (0.01)
Contiguity	**0.86***** (0.05)	**0.85***** (0.03)	**1.10***** (0.04)	**0.68***** (0.05)	**0.68***** (0.04)	**0.60***** (0.07)	**0.66***** (0.05)	**0.68***** (0.06)	**0.81***** (0.03)	**1.04***** (0.03)	**0.63***** (0.03)
Landlocked	**-0.22***** (0.04)	**-0.25***** (0.03)	**-0.52***** (0.03)	**-0.49***** (0.04)	**-1.03***** (0.03)	**0.07*** (0.06)	**0.17***** (0.04)	**0.24***** (0.04)	**-0.58***** (0.02)	**-0.33***** (0.02)	**-0.22***** (0.01)
Common Language	**0.49***** (0.04)	**0.10***** (0.02)	**0.20***** (0.03)	**0.10***** (0.04)	**0.31***** (0.03)	**0.36***** (0.06)	**0.15***** (0.04)	**0.00** (0.05)	**0.55***** (0.02)	**0.70***** (0.02)	**0.54***** (0.02)
Adj. R-square	**0.35**	**0.41**	**0.38**	**0.19**	**0.31**	**0.37**	**0.29**	**0.31**	**0.51**	**0.53**	**0.70**
F-Statistic	**53*****	**128*****	**81*****	**23*****	**87*****	**33*****	**33*****	**30*****	**357*****	**535*****	**1427*****
Number of Obs.	**12,766**	**23,654**	**16,918**	**12,388**	**24,486**	**7,221**	**10,182**	**8,691**	**43,977**	**59,989**	**76,699**

*, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

[a] Dependent variable is the value of bilateral trade (V_{ij}) in millions of US$.

[b] Robust standard errors are in parentheses.

Table 4. Trade Creation [Trade Diversion] estimates in 11 regression scenarios

	Regressions[a]										
Trade Creation [Trade Diversion][b]	***1*** **Bovine Cattle**	***2*** **Other Livestock**	***3*** **Dairy Products**	***4*** **Sugar Products**	***5*** **Veg. & Fruits**	***6*** **Wheat Durum**	***7*** **Oil Seeds**	***8*** **Other Crops**	***9*** **Other Food**	***10*** **All Agr.**	***11*** **Non Agr**
NAFTA	**1.53*** **	**1.01*** **	**-0.04**	**0.55*** **	**1.81*** **	**0.93*** **	**1.29*** **	**0.80*** **	**0.62*** **	**1.22*** **	**0.59*** **
	[0.10]	*[-0.08]*	*[0.06]*	*[-0.09]*	*[-0.19**]*	*[1.71***]*	*[-0.10]*	*[0.30*]*	*[-0.10**]*	*[-0.12***]*	*[0.24***]*
MERCOSUR	**0.81*** **	**-0.03**	**0.55*** **	**0.21***	**-0.11**	**0.20**	**1.07*** **	**0.68*** **	**1.20*** **	**1.58*** **	**0.65*** **
	*[-0.52***]*	*[0.20***]*	*[0.00]*	*[-0.01]*	*[-0.01]*	*[-0.44*]*	*[-0.32*]*	*[0.25*]*	*[0.16***]*	*[0.09*]*	*[0.22***]*
CER	**-0.78***	**1.29*** **	**1.92*** **	**0.77***	**1.19*** **	**----**	**-0.26**	**0.00**	**2.12*** **	**3.63*** **	**4.83*** **
	[0.46]	*[0.77***]*	*[1.79***]*	*[1.07***]*	*[1.62***]*	*[0.50]*	*[1.53***]*	*[0.51]*	*[1.91***]*	*[2.55***]*	*[4.21***]*
EU-15	**0.51*** **	**0.53*** **	**0.70*** **	**0.64*** **	**0.24*** **	**0.03**	**-0.40*** **	**-0.05**	**0.28*** **	**0.43*** **	**-0.06****
	*[-0.48***]*	*[-0.51***]*	*[-0.72***]*	*[-0.02]*	*[-0.26***]*	*[-0.37***]*	*[0.02]*	*[-0.38***]*	*[-0.39***]*	*[-0.33***]*	*[-0.10***]*
APEC	**0.34*** **	**0.38*** **	**0.46*** **	**0.04**	**0.28*** **	**0.80*** **	**0.08**	**0.17***	**0.86*** **	**0.91*** **	**1.19*** **
	*[-0.57***]*	*[-0.35***]*	*[-0.15**]*	*[-0.19**]*	*[-0.40***]*	*[-0.37***]*	*[0.06]*	*[-0.22*]*	*[0.05*]*	*[-0.16***]*	*[-0.18***]*
AFRICA	**0.48*** **	**0.41*** **	**0.67*** **	**0.52*** **	**0.56*** **	**0.69*** **	**0.48***	**0.42****	**0.41*** **	**0.70*** **	**0.90*** **
	[-0.19]	*[0.07]*	*[-0.21**]*	*[0.39**]*	*[-0.31**]*	*[-0.21**]*	*[-0.38]*	*[-0.17]*	*[-0.30***]*	*[-0.09*]*	*[-0.38***]*
AFTA	**-1.30*** **	**0.21****	**-1.02*** **	**0.28***	**-0.09**	**-2.31*** **	**-1.04*** **	**-1.00*** **	**0.11***	**0.30*** **	**0.53*** **
	*[0.28***]*	*[0.23***]*	*[0.13**]*	*[-0.16]*	*[0.07]*	*[-0.03]*	*[-0.16*]*	*[0.33**]*	*[0.14**]*	*[0.23***]*	*[-0.03]*
ANDEAN PACT	**-0.82*** **	**0.52*** **	**-0.03**	**1.10*** **	**0.39****	**----**	**0.87*** **	**0.45***	**1.52*** **	**1.33*** **	**1.49*** **
	[-0.11]	*[-0.37***]*	*[0.03]*	*[-0.20]*	*[0.12]*	*[0.26*]*	*[-0.17]*	*[0.55***]*	*[0.36***]*	*[0.39***]*	*[0.18***]*
Adj. R-square	**0.35**	**0.41**	**0.38**	**0.19**	**0.31**	**0.37**	**0.29**	**0.31**	**0.51**	**0.53**	**0.70**
F-Statistic	**53*** **	**128*** **	**81*** **	**23*** **	**87*** **	**33*** **	**33*** **	**30*** **	**357*** **	**535*** **	**1427*** **
Number of Obs.	**12,766**	**23,654**	**16,918**	**12,388**	**24,486**	**7,221**	**10,182**	**8,691**	**43,977**	**59,989**	**76,699**

*, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

[a] Dependent variable is the value of bilateral trade (VT_{ij}) in millions of US$.

[b] Trade diversion coefficient estimates are shown in square brackets directly below trade creation estimates.

Table 5. Percent increase/decrease in trade creation at the 90% confidence level*

	Regressions										
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Trade Creation	**Bovine Cattle**	**Other Livestock**	**Dairy Products**	**Sugar Products**	**Veg. & Fruits**	**Wheat & Durum**	**Oils Seeds**	**Other Crops**	**Other Food**	**All Agr**	**Non Agr**
NAFTA	**361%**	**174%**	**-4%**	**73%**	**511%**	**152%**	**264%**	**122%**	**86%**	**240%**	**81%**
	(558,163)	(265,84)	(27,-35)	(132,14)	(710,312)	(241,63)	(401,127)	(239,5)	(130,42)	(314,167)	(109,52)
MERCOSUR	**125%**	**-3%**	**74%**	**23%**	**-10%**	**22%**	**190%**	**97%**	**233%**	**384%**	**91%**
	(190,60)	(22,-28)	(129,19)	(55,-9)	(18,-38)	(83,-39)	(315,65)	(157,37)	(293,172)	(476,293)	(120,62)
CER	**-54%**	**264%**	**582%**	**116%**	**230%**	----	**-23%**	**0%**	**736%**	**3689%**	**12412%**
	(-18,-90)	(453,74)	(1013,151)	(289,-58)	(410,50)	----	(42,-88)	(109,-110)	(1159,313)	(5122,2255)	(16618,8206)
EU-15	**67%**	**70%**	**101%**	**89%**	**27%**	**3%**	**-33%**	**-5%**	**33%**	**54%**	**-6%**
	(86,49)	(83,56)	(119,82)	(111,68)	(39,14)	(17,-11)	(-25,-41)	(7,-16)	(41,24)	(64,45)	(-1,-11)
APEC	**40%**	**47%**	**59%**	**4%**	**32%**	**123%**	**8%**	**18%**	**136%**	**149%**	**228%**
	(64,17)	(63,31)	(79,39)	(23,-15)	(46,17)	(171,75)	(28,-13)	(44,-7)	(153,119)	(166,131)	(250,207)
AFRICA	**62%**	**51%**	**96%**	**68%**	**75%**	**99%**	**61%**	**52%**	**50%**	**100%**	**147%**
	(115,8)	(89,12)	(142,50)	(125,11)	(128,22)	(174,25)	(148,-25)	(104,1)	(77,23)	(132,69)	(180,115)
AFTA	**-73%**	**23%**	**-64%**	**33%**	**-9%**	**-90%**	**-65%**	**-63%**	**11%**	**35%**	**69%**
	(-66,-79)	(42,4)	(-57,-71)	(76,-10)	(5,-22)	(-86,-95)	(-57,-73)	(-53,-73)	(24,-2)	(52,17)	(87,52)
ANDEAN PACT	**-56%**	**68%**	**-3%**	**202%**	**48%**	----	**138%**	**56%**	**358%**	**279%**	**343%**
	(-33,-79)	(119,16)	(27,-33)	(323,81)	(91,4)	----	(243,32)	(135,-23)	(491,226)	(389,170)	(449,236)

* Values show the percent change in the value of bilateral trade between members of an RTA calculated as $\left(\exp(\hat{\beta})-1\right)*100$ (equation 8).

* Values in parentheses show the upper and lower 90% confidence intervals calculated using the Delta Method (see footnote 6)

* Significance at the 10% level occurs when the upper and lower values of the confidence interval do not switch signs.

Table 6. Percent increase/decrease in trade diversion at the 90% confidence level*

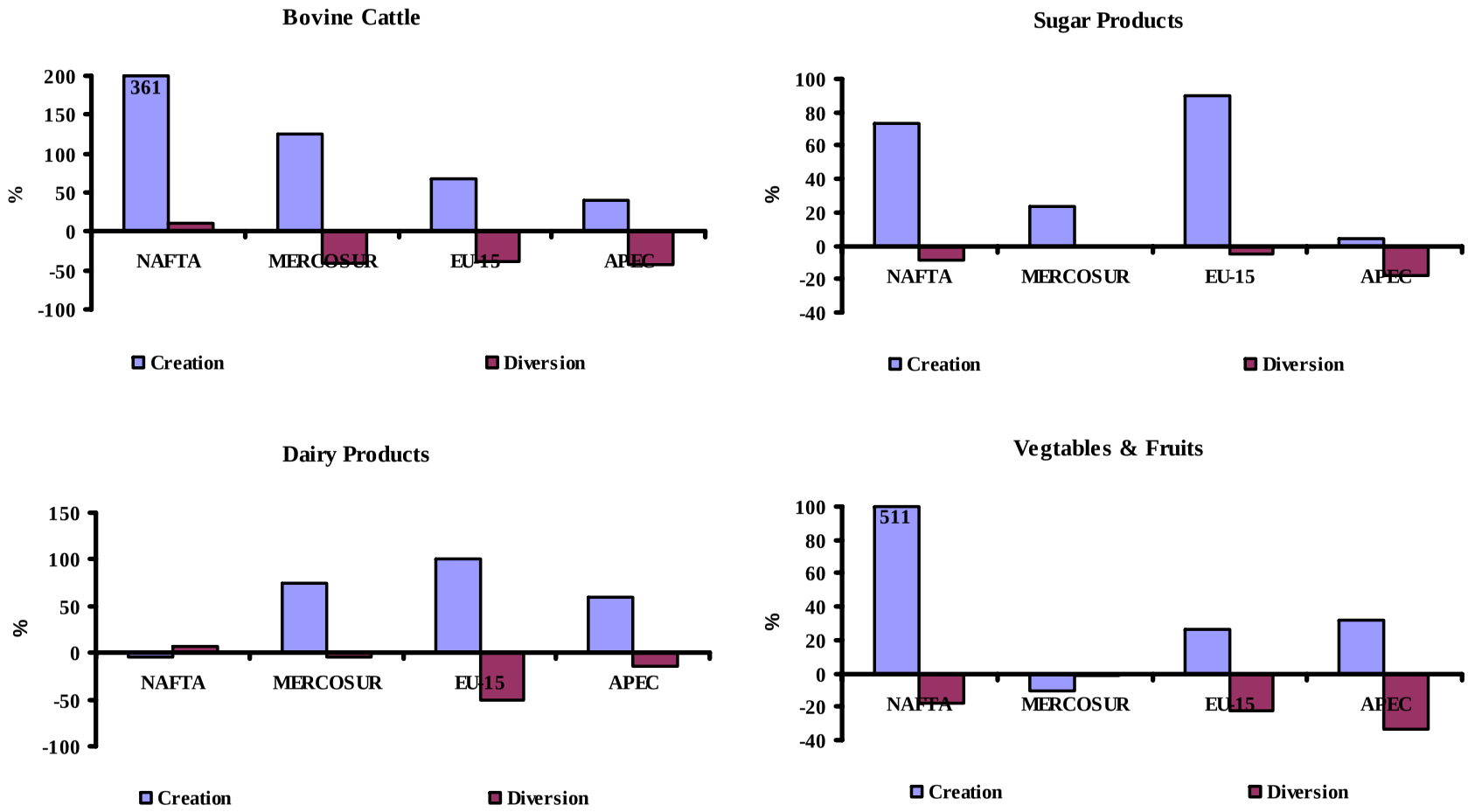
	Regressions										
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Trade Diversion	**Bovine Cattle**	**Other Livestock**	**Dairy Products**	**Sugar Products**	**Veg. & Fruits**	**Wheat & Durum**	**Oils Seeds**	**Other Crops**	**Other Food**	**All Agr**	**Non Agr**
NAFTA	**11%**	**-7%**	**6%**	**-8%**	**-18%**	**453%**	**-10%**	**35%**	**-9%**	**-11%**	**28%**
	(39,-17)	(4,-19)	(22,-9)	(10,-27)	(-5,-30)	(1071,-165)	(8,-27)	(81,-12)	(-1,-17)	(-4,-19)	(38,18)
MERCOSUR	**-41%**	**22%**	**0%**	**-1%**	**-1%**	**-36%**	**-27%**	**28%**	**17%**	**9%**	**25%**
	(-27,-55)	(38,6)	(15,-16)	(19,-20)	(13,-16)	(-5,-66)	(0,-55)	(60,-4)	(28,7)	(18,-1)	(34,16)
CER	**59%**	**115%**	**499%**	**192%**	**406%**	**64%**	**362%**	**66%**	**577%**	**1187%**	**6642%**
	(181,-63)	(219,12)	(830,168)	(412,-28)	(659,153)	(236,-108)	(732,-8)	(222,-90)	(814,339)	(1638,736)	(8630,4653)
EU-15	**-38%**	**-40%**	**-51%**	**-2%**	**-23%**	**-31%**	**2%**	**-32%**	**-32%**	**-28%**	**-9%**
	(-32,-44)	(-36,-44)	(-47,-56)	(7,-11)	(-17,-28)	(-21,-41)	(12,-9)	(-23,-40)	(-29,-35)	(-25,-31)	(-6,-13)
APEC	**-43%**	**-30%**	**-14%**	**-18%**	**-33%**	**-31%**	**6%**	**-20%**	**5%**	**-15%**	**-17%**
	(-34,-52)	(-23,-37)	(-4,-23)	(-2,-33)	(-26,-41)	(-15,-47)	(25,-14)	(-2,-38)	(12,-2)	(-10,-21)	(-12,-22)
AFRICA	**-17%**	**8%**	**-19%**	**47%**	**-27%**	**-19%**	**-31%**	**-16%**	**-26%**	**-8%**	**-32%**
	(4,-39)	(31,-16)	(-7,-31)	(92,3)	(-5,-48)	(-2,-36)	(12,-75)	(11,-43)	(-15,-36)	(2,-18)	(-26,-37)
AFTA	**32%**	**25%**	**14%**	**-15%**	**7%**	**-3%**	**-15%**	**39%**	**15%**	**26%**	**-3%**
	(57,7)	(39,12)	(29,0)	(7,-36)	(20,-5)	(20,-27)	(2,-33)	(73,4)	(24,5)	(36,16)	(5,-10)
ANDEAN PACT	**-11%**	**-31%**	**3%**	**-18%**	**13%**	**29%**	**-16%**	**74%**	**43%**	**48%**	**20%**
	(18,-39)	(-18,-44)	(19,-13)	(7,-44)	(36,-11)	(70,-12)	(14,-46)	(117,31)	(58,27)	(63,33)	(30,10)

* Values show the percent change in the value of bilateral trade between members of an RTA calculated as $\left(\exp(\hat{\beta})-1\right)*100$ (see footnote …)

* Values in parentheses show the upper and lower 90% confidence intervals calculated using the Delta Method (see footnote ….)

* Significance at the 10% level occurs when the upper and lower values of the confidence interval do not switch signs.

Figure 3. Trade Creation and Trade Diversion in four agricultural commodities and four RTAs



* In some cases Nafta trade creation is reduced for clarity. The actual trade creation value is shown where necessary for Nafta.

Figure 4. A comparison of the full model and individual regressions for each RTA for all agriculture (regression 10)