New Measures of Trade Creation and Trade Diversion

by

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Abstract

This paper uses a panel data set to estimate the effects of regional agreements on trade flows controlling for country pair, importer-year, and exporter-year fixed effects. These fixed effects capture all of the determinants of trade flows normally included in gravity model specifications as well as controlling for yearly shocks that affects countries’ trade levels. In most cases, controlling for the fixed effects greatly reduces the estimated impact of regional agreements on trade. The estimates reveal that the average regional agreement has significant anticipatory effects on trade flows and continues to affect trade for up to 11 years after the trade deal begins. Customs unions influence trade over a longer period of time than do free trade areas. Finally, the paper shows that a trade agreement often has very different impacts on each of the countries involved and presents estimated trade effects for individual countries in year five of the agreements.

JEL Classification: F15

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1. Introduction

Since Jacob Viner (1950) described how the welfare effects of a regional trade agreement (RTA) depended on the trade creation and trade diversion generated, economists have been interested in estimating these two effects. Empirical work estimating these effects is particularly important since theoretical work suggests that regional agreements may be beneficial or harmful depending on the particular countries involved and the extent of trade creation relative to trade diversion (see Panagariya (2000) for a survey). As Burfisher, Robinson, and Thierfelder (2001, 139) put it, “whether or not a regional trade agreement benefits its members will depend on parameter values and initial economic structure – it is essentially an empirical issue that must be settled by data analysis.”

Because of data limitations, most studies do not attempt to measure the welfare effects of regional agreements, but instead take the first step down that path by estimating the impacts of the agreements on trade flows. Existing studies estimate changes in trade patterns due to regionalism in two distinct ways. Ex post studies examine trade flows after the RTA has been implemented and compare the actual levels of trade with a prediction of trade in the absence of the RTA. Ex ante studies use trade patterns and estimated elasticities or computable general equilibrium models prior to the agreement to calculate the predicted effect of eliminating trade barriers with a partner country.

Both methods as currently implemented, however, are subject to criticism. As Panagariya (2000, 325) explains, “there are sufficiently serious problems with both empirical approaches that the results based on them are unlikely to change the minds on either side of the regionalism debate.” Ex post studies must establish a counterfactual of trade that would have occurred in the absence of the agreement, but Clausing (2001, 679) comments that this exercise “has proved difficult.” One common way of predicting trade flows in the absence of the RTA is by using the gravity model to predict bilateral trade based on the distance between countries, the size of their economies, and other variables such as whether the two countries speak the same language. The effects of the agreement on trade are then measured by RTA dummy variables.
There are a number of weaknesses inherent in such an approach, however. First, Wonnacott and Lutz (1989) and Krugman (1991) have proposed a “natural trading partner” hypothesis that countries will tend to form regional agreements if they already have significant bilateral trade, and that such agreements are likely to be trade creating. Magee (2003) uses a simultaneous equations model to show empirically that higher bilateral trade flows do increase the likelihood that countries will form free trade agreements. Thus, coefficients on RTA dummy variables are capturing more than just the effects of the agreement; they also incorporate the possibility that “high levels of intra-bloc trade may be due not to the formation of preferential trading arrangements but rather to historical or political relationships between bloc members” (Haveman and Hummels, 1998, p. 62). Soloaga and Winters (2001) make a similar argument. Bayoumi and Eichengreen (1995) attempt to deal with this criticism by estimating the gravity model in first differences so that unobserved country pair characteristics that are constant over time will drop out. This method will not control for time-varying omitted variables, however, as Haveman and Hummels (1998) point out.

Gravity model estimates of RTA effects are also sensitive to the sample of countries included in the analysis. Haveman and Hummels (1998, 52) show that changing the sample of countries results in a different prediction of trade in the absence of the RTA, and thus estimates of RTA effects “vary dramatically in their conclusions.” Pomfret (1997, 254) also cites a number of “implausible results” in studies using the gravity model to measure the trade effects of RTAs and concludes that “there are clearly shortcomings” in this approach. More recently, Ghosh and Yamarik (2004) argue that the gravity-model results are very sensitive to the variables included in the regressions and to the prior beliefs of the researchers. They find a dramatic drop in the number of regional agreements that are trade creating when they incorporate the researcher’s prior beliefs into the estimation.

Ex ante studies of trade creation and diversion fall into two camps. Some studies, such as Karemera and Ojah (1998) estimate import demand elasticities within industries prior to the formation of a trade agreement. These elasticities are then used to project the effects of eliminating tariffs with a trading partner. Wylie (1995) criticizes this approach, however, as missing important general equilibrium
impacts of trade agreements. As he argues (p. 81), “the tariff changes, substitution elasticities, and resulting macroeconomic stimulative effects themselves are probably of less potential importance in stimulating trade and growth than the reduced uncertainty” of the policy environment. 1 An alternative is to estimate computable general equilibrium models of trade, as Brown, Deardorff, and Stern (1992) have done. Clausing (2001) and Wylie (1995) both point out that CGE estimates are very sensitive to the assumptions and parameters built into the model, however. The net result is that “the empirical work has failed to reach firm conclusions on even the most basic issue regarding preferential trading agreements: whether trade creation outweighs trade diversion.” (Clausing, 2001, 678)

This paper estimates the effect of regional agreements on trade flows after controlling for country pair, importer-year, and exporter-year fixed effects. This estimation technique is similar in principle to the ex post studies described above in that the method is to compare existing levels of trade under an RTA to a hypothesized counterfactual level of trade in the absence of the RTA. The predicted counterfactual used in this paper, however, eliminates many of the criticisms of gravity model studies. First, the estimation includes an importer-exporter fixed effect that controls for unobserved reasons why two countries may have historically had high levels of bilateral trade. Thus, the method adopted in this paper solves the problem that countries forming RTAs may have higher trade volumes even in the absence of the agreement. Year fixed effects for each importing and exporting country are also included to capture the effects of importer and exporter changes in output, income per capita, population, and other variables included in gravity model specifications. The fixed effects are more flexible, however, in that they also capture any aggregate shocks to the countries’ trade flows in a given year. Controlling for aggregate shocks is particularly important since Krueger (1999) concludes that NAFTA did not have a large effect on trade in the first three years of its existence relative to the impacts of shocks such as the “tequila crisis”

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1 This argument is consistent with testimony at 1997 ITC hearings on NAFTA by executives who indicated that NAFTA’s tariff reductions were less important than its investment guarantees and other provisions (U.S. International Trade Commission, 1997, page 2-29).
and cuts in Mexican nontariff barriers prior to NAFTA. Finally, the use of fixed effects eliminates the
need to choose which variables to include as controls in the regression, and thus it alleviates the criticism
of Ghosh and Yamarik (2004) that the researcher’s prior beliefs are influencing the results presented. The
models estimated in the paper also allow regional agreements to have different impacts on trade flows
over time so that the dynamic effects of trade deals can be measured.

The new estimates in this paper reveal several interesting results. First, regional agreements have
a clear anticipatory effect on trade flows – there is a significant increase in trade during the four years
leading up to the beginning of the average RTA. The change in bilateral trade also continues to be
influenced by the formation of a regional agreement for many years after its start – the estimates here find
significant positive effects of RTAs on bilateral trade flows up to 11 years after the agreement begins.
This dynamic analysis of regionalism is an advance over most previous measures of RTA trade effects,
which have been primarily static cross-section estimates that do not consider the maturity of the trade
deal. The paper also shows that the type of agreement signed changes both the overall trade effect and the
time path of trade effects. On average, a customs union (CU) has long-lasting impacts on intra-bloc trade
while a free trade agreement (FTA) has shorter and, in the long-run, smaller impacts on trade within the
region. Preferential trading arrangements have the smallest effects on trade flows, and these effects do
not begin until several years after the trading bloc forms. For countries joining a new regional agreement,
intra-bloc trade effects amount to less than 3 percent of the country’s total imports on average in year five
of the trade deal. Estimates of the trade diverting effects of regional agreements are much smaller and are
sensitive to the specification of the model. Finally, the paper uses predicted values from the regressions
and actual trade flows to show separate measures of the effect of an agreement on each country’s imports.
The results indicate that the impacts on each country differ greatly even within a common regional
agreement.

2. Data and Empirical Methods
The trade flow data used in this study come from Statistics Canada’s World Trade Analyzer data set, which provides bilateral trade flows (measured in millions of 1998 dollars) for each year from 1980 to 1998 between 133 countries that are members or observer governments of the WTO. The WTO provides a list of the regional agreements about which they have been notified at www.wto.org and it classifies each agreement as a customs union, free trade agreement, or “preferential arrangement.”

The gravity model introduced by Tinbergen (1962) has long been the most prominently used method of measuring the trade effects of regional trade agreements. The simplest form of the gravity model assumes that trade between two countries depends on the distance between them and the size of the countries’ economies. The effects of regional agreements are then measured by including dummy variables for each RTA. Most researchers also include some other variables presumed to affect bilateral trade such as the countries’ populations or income levels and whether the countries are landlocked, share a common border, speak the same language, and have a colonial tie. Thus, a typical gravity model specification is

\[
\ln(m_{ijt}) = \alpha_t + \beta_1 \ln(D_{ij}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(Y_{jt}) + \sum_k (\beta_{RTA_{ijt}}^k + \beta_{TD_{ijt}}^k) + \alpha X_{ijt} + \epsilon_{ijt},
\]

where \( m_{ijt} \) is the trade flow from country i to j in year t, \( D_{ij} \) is the bilateral distance, \( Y_{it} \) and \( Y_{jt} \) are the GDP levels of the two countries, \( RTA_{ijt}^k = 1 \) if countries i and j belong to regional trade agreement k, \( TD_{ijt}^k = 1 \) if one of the two countries is a member of regional agreement k, and \( X_{ijt} \) is a vector of other dyad characteristics. A positive coefficient estimate of \( \beta_{RTA_{ijt}}^k \) indicates that trade is rising between members of the regional bloc while a negative coefficient estimate of \( \beta_{TD_{ijt}}^k \) suggests imports from countries outside the trading bloc are falling. Including fixed effects for each year (\( \alpha_t \) in equation 1) captures the time trend in trade and any shocks that affect global trade flows in a particular year.

Santos Silva and Tenreyo (2006) discuss several problems with estimating equation (1) by ordinary least squares. First, when there is heteroskedasticity, OLS estimation of the log-linearized
gravity model provides biased estimates. Second, trade values can be zero. Since the natural log of zero is undefined, the researcher must either drop the country pairs with no trade (the most common solution), estimate the model using \( \ln(1 + m_{ijt}) \) as the dependent variable, or set up a nonlinear estimator. Santos Silva and Tenreyo show that a Poisson pseudo-maximum likelihood estimator of the gravity model provides consistent estimates of the parameters even with heteroskedastic errors, is robust to measurement error in the dependent variable, and allows the country pairs with no trade to be included in the analysis.

A separate problem with estimating equation (1) is that a pair of countries with strong cultural and historical ties is likely to have greater than normal trade and is also more likely to form a regional trade agreement. Thus, the error term is correlated with the RTA dummy variables and the coefficient estimates are biased. Including variables such as whether the countries speak the same language and have a common colonial relationship is one way researchers have attempted to address this issue, but there remain many unobserved ties between nations that both increase trade and make regional agreements more likely. An alternative method of dealing with unobserved country-pair characteristics that affect trade flows is to include a fixed effect for each dyad (\( \alpha_{ij} \)). This fixed effect will capture the impact on trade of any factors that are specific to the country pair but constant over the time period being examined (such as distance, sharing a border, being landlocked or an island, having a common language, and any other unobserved historical or cultural ties). Equation (1) thus becomes:

\[
\ln(m_{ijt}) = \alpha_{ij} + \alpha_t + \beta_2 \ln(Y_{it}) + \beta_3 \ln(Y_{jt}) + \sum_k (\beta^{k}_{rt}RTA_{ijt}^{k} + \beta^{k}_{td}TD_{ijt}^{k}) + \alpha X_{ijt} + \epsilon_{ijt}.
\]

Equations (1) and (2) estimate RTA trade effects by using the group of countries signing regional agreements as the treatment group and using country pairs that do not have an RTA as the control group. This estimation method assumes that RTA formation is uncorrelated with the error term. In the typical gravity model without country pair fixed effects (equation 1), this assumption means that the level of trade between two countries has no impact on whether they form a regional agreement. By including country pair fixed effects, the error term in equation (2) measures differences between actual imports and a predicted level of imports that controls for any historical, time-constant factors affecting the level of...
trade between partner countries. Assuming that RTA formation is exogenous in the context of equation (2), then, means that countries do not sign regional agreements in order to take advantage of a big anticipated increase in trade, a much more plausible assumption than that the level of bilateral trade is uncorrelated with the decision to sign a trade deal.

While the treatment of regional trade agreements in equations (1) and (2) is consistent in principle with most previous studies of regionalism, they make an implicit assumption that is often not recognized: that trade flows jump immediately to a new long-run equilibrium when a new regional agreement is implemented and then remain unchanged after the first year the RTA is in place. This assumption rules out the possibilities that anticipation of the agreement may influence trade flows and that the effects of the agreement may materialize slowly over time. As Frankel (1997, 78) argues, however, “There is a tendency for trade flows to be affected in advance of the date when the agreement goes into effect, as businesses position themselves for future markets.” The fact that regional agreements often have a gradual reduction in tariffs over time rather than eliminating trade barriers immediately also makes it unrealistic to assume that the trade effects of RTAs are immediate.

Figure 1 uses the sample average growth rates of trade in the data set to show how rapidly trade was increasing during 1980 – 1998 for country pairs in various stages of regional trade agreement formation. Time period 0 in the graph is the year the RTA came into effect, while period –1 is the year prior to the RTA’s formation and period 1 indicates the year after RTA formation. The anticipation effect of a regional agreement on trade flows is clearly visible. Trade growth rates within the new trading bloc begin increasing sharply about two years before trade deals go into effect, with the growth during the two years prior to the enactment of the deal being comparable to the growth rates after the agreement comes into force.

The figure also shows that trade within regional trade blocs grew more rapidly than trade outside of regional trading areas. Trade among countries that formed regional agreements grew at rates above 9.8 percent per year in each of the first six years after the trade bloc was formed. Trade within regional blocs overall grew by 6.7 percent per year between 1980 and 1998 compared to 5.7 percent growth among
countries without regional agreements. The results in Figure 1 are consistent with those in Freund and McLaren (1999), who find that trade patterns of countries joining the EU began to change about 3-4 years prior to accession and continued for about eight or nine years after accession. The authors also found anticipatory effects of the regional agreement on trade patterns for MERCOSUR countries.

Equation (2) can be modified to allow regional trade agreements’ effects to vary over time, both before and after the trade deals begin. In order to focus on the dynamics of regional agreements, suppose that each regional agreement generates the same percentage change in bilateral trade but that these impacts can vary over time. The dynamic version of equation (2) then becomes:

\[
\ln(m_{ijt}) = \alpha_{ij} + \alpha_t + \beta_2 \ln(Y_{it}) + \beta_3 \ln(Y_{jt}) + \sum_{s=-4}^{17} (\beta_{rta,s}RTA_{ij(t-s)} + \beta_{td,s}TD_{ij(t-s)}) + \alpha X_{ijt} + \epsilon_{ijt},
\]

where \(\beta_{rta,s}\) and \(\beta_{td,s}\) are the intra-RTA and extra-RTA effects in year \(s\) of the average trade deal. Equation (3) thus measure the effects of a regional agreement on trade flows from four years prior to its start up to the 18th year it is in existence (\(s = 0\) is the first year of the RTA). The trade diversion variable in equation (3), \(TD_{ij(t-s)} = \sum_k TD^k_{ij(t-s)}\), equals the number of preferential trading partners (other than each other) that countries \(i\) and \(j\) have in year \(t-s\). Using this definition, the coefficient \(\beta_{td,s}\) captures the effect on bilateral trade between \(i\) and \(j\) if one of the countries signs a new regional agreement with a third party.

Equation (3) treats importers and exporters symmetrically in that a new regional agreement with a third country is assumed to have the same impact on trade flows from \(i\) to \(j\) whether the new RTA is signed by the importing country \(j\) or the exporting country \(i\). Defining the trade diversion variable to include the number of other preferential trading partners for both the importing and the exporting country allows the coefficient \(\beta_{td,s}\) to capture what Soloaga and Winters (2001) refer to as “export diversion.” They argue that a regional agreement that reduces a country’s imports from outside the trading bloc will also reduce
its exports to those countries. These authors find evidence of export diversion in two (EU and EFTA) of the nine regional trade agreements they examine.

Equations (1) – (3) suffer from the problem, common in gravity-model specifications, that time-specific shocks to a country’s bilateral trade flows are not controlled for. As long as these shocks are unrelated to the country’s decisions to form regional agreements, the coefficient estimates will not be biased. Controlling for such shocks would, however, improve the accuracy of the estimates. A simple way to deal with the many factors affecting trade flows that are specific to the importer or exporter in a particular year is to include exporter-year ($\alpha_{it}$) and importer-year ($\alpha_{jt}$) fixed effects in the model of bilateral trade.

\begin{equation}
\ln(m_{ijt}) = \alpha_{ij} + \alpha_{jt} + \alpha_{it} + \sum_{s=-4}^{17} \beta_{rtas}RTA_{ij(t-s)} + \varepsilon_{ijt}.
\end{equation}

Equation (4) cannot include the trade diversion variables, and this represents a significant drawback of including exporter-year and importer-year fixed effects. The fixed effect $\alpha_{jt}$ captures the change in country j’s overall imports in year t. Controlling for the country’s change in overall imports, it is not possible to measure both the change in within-RTA imports and the change in extra-RTA imports since the latter two add up to the change in total imports. Thus, one advantage of the gravity model specification omitting exporter-year and importer-year fixed effects is that it allows the estimation of both intra-RTA and extra-RTA effects of regional agreements. In other ways, however, equation (4) greatly improves on the typical gravity model specification. The country pair fixed effect ($\alpha_{ij}$) controls for the impact on trade of the distance between countries, a common language, pre-existing regional trade agreements, colonial status or other historical ties between the countries, and any unobserved characteristics of the country pair that are constant over time. The effects on trade of not only GDP and population but also other variables that are more difficult to measure such as infrastructure, factor endowments, multilateral trade liberalization or openness, and unobserved time-specific shocks are captured by the importer-year and exporter-year fixed effects. Equation (4) thus controls for nearly every
variable included in gravity models, plus many unobserved factors, and it does so without forcing upon
researchers a difficult choice about which of the many possible variables they should include. This last
advantage is a considerable one since Ghosh and Yamarik (2004, 372) argue that model choice has led to
a consensus in the literature that “reflects not the information content of the data but rather the
unacknowledged prior beliefs of the researchers.”

Taking the first difference of equation (4) eliminates the over 18,000 country pair fixed effects.

\[
\Delta m_{ijt} = \alpha_{jt} + \alpha_{it} + \sum_{s=-4}^{17} \beta_{rta,s} \Delta RTA_{ij(t-s)} + \Delta \epsilon_{ijt}
\]

In equation (5), $\Delta RTA_{ij(t-s)} = 1$ if countries $i$ and $j$ sign a new regional agreement in year $t-s$ and
$\Delta RTA_{ij(t-s)} = 0$ in all other years. The coefficient $\beta_{rta,s}$ is thus a difference-in-differences estimator. It
is estimated by comparing the change in trade between countries signing an RTA and the change in trade
between countries that do not begin a new regional agreement with each other. Equation (5) is similar to
the econometric model in Bayoumi and Eichengreen (1995), who estimate a gravity model in first
differences. There are several important differences between this study and theirs, however. First, they
do not control for unobserved time-specific effects through exporter-year and importer-year fixed effects.
Second, Bayoumi and Eichengreen examine trade among only 21 industrial countries whereas this study
uses a much larger data set of 133 advanced and developing countries. They also do not investigate the
dynamic path of regional agreement trade effects as this paper does.

In order to examine how a regional agreement has affected the imports of a particular country, it
is possible to compare the actual level of trade with several counterfactual predicted levels of trade based
on the estimates in equation (2). Wooldridge (2006) discusses two different ways of getting consistent
predictions of imports when $ln(m)$ is the dependent variable. In the data set used here, one of these
methods underpredicts imports on average while the other overpredicts the level of trade. The predicted
level of imports used in this paper is a weighted average of these two consistent predictions, where the
weights are chosen so that the predicted global imports in the data set matches the actual imports on
average ($\overline{m} = \overline{\hat{m}}$). Setting $RTA_{ijt}^k = 0$ and $TD_{ijt}^k = 0$ in equation (2) then provides a prediction of the imports a country could have received in the absence of the agreement, $\hat{m}_{ijt}^k$. The effect of the regional agreement on country $j$’s imports in year $t$ is measured by the difference between the actual imports and the predicted counterfactual imports in the absence of the agreement, $(m_{ijt} - \hat{m}_{ijt}^k)$. Summing this difference over all countries within a regional trade bloc provides a measure of how the agreement has affected intra-bloc trade. This intra-bloc trade change is generally expected to be positive since trade barriers are being removed, although it is possible in theory for the intra-bloc trade effect to be negative if investment liberalization in the trade deal leads firms to set up local production in the target country rather than exporting to it.

\[
(6) \quad \text{Intra-bloc change}^k_{jt} = \sum_{i \in RTA^k} (m_{ijt} - \hat{m}_{ijt}^k)
\]

Summing over all countries other than those in the new regional agreement provides a measure of how extra-bloc imports are affected.

\[
(7) \quad \text{Extra-bloc change}^k_{jt} = \sum_{i \notin RTA^k} (m_{ijt} - \hat{m}_{ijt}^k)
\]

The logic of trade diversion suggests that the change in extra-bloc trade measured in equation (7) will be negative. This prediction may not always be true in the case of customs unions. Because customs unions harmonize their external tariffs, a country joining a CU may lower its external tariffs and thus cause an increase in imports from outside the trading region. Another possible reason extra-bloc trade may not fall after a regional agreement is if the RTA raises national income sufficiently to increase imports from all sources. The gravity model estimates will treat such a rise in national income as unrelated to the RTA and capture its impact in the importer and exporter GDP or GDP per capita variables, and thus some of the external trade effects of the RTA will be missed if the agreement raises national or per-capita incomes by a large amount. These indirect effects of a trade agreement on imports are likely to be minor, however, because computable general equilibrium models of trade agreements
typically find relatively small effects on income. Kehoe and Kehoe (1994), for instance, provide a survey of CGE estimates of NAFTA, which found that the overall impact of the agreement would be to raise Mexican GDP by 2-5 percent, raise U.S. GDP by 0.1 percent, and leave Canadian output unchanged. Furthermore, these CGE estimates are long-run effects of the trade deal. Over the first few years of an RTA’s existence, the income effects are likely to be considerably smaller.

The trade effects measured in equations (6) and (7) do not match a strict definition of trade creation and trade diversion. Viner (1950, p. 43) discussed trade creation as being increased imports from within a trading bloc that the country “formerly did not import at all.” Trade diversion, on the other hand, means the goods “which one of the members of the customs union will now newly import from the other whereas before the customs union it imported them from a third country.” The empirical literature often describes any decline in trade with countries outside a regional trading area as trade diversion, but it is clear from the quotation in Viner that a decline in extra-bloc trade measured by equation (7) must be accompanied by a rise in intra-bloc imports to be accurately described as trade diversion.

A method of measuring trade creation and trade diversion that is tightly connected to their definitions is to take any observed increases in intra-bloc trade and classify them as trade diversion or trade creation depending on whether or not they are accompanied by declines in imports from outside the trading region. Let \( m_{jt}^k = \sum_{i \in RTA^k} m_{ij} \) be country j’s total imports from other countries within preferential trading area k and \( \hat{m}_{jt}^k = \sum_{i \in RTA^k} \hat{m}_{ij} \) be the predicted level of imports from its new preferential partners if the trade deal had not been signed. Define \( TE_{jt}^k \) (for trade expansion) to be any increases in imports within the regional bloc above the counterfactual predicted level, bounded below by zero:

\[
TE_{jt}^k = \begin{cases} 
    m_{jt}^k - \hat{m}_{jt}^k & \text{if } m_{jt}^k \geq \hat{m}_{jt}^k \\
    0 & \text{if } m_{jt}^k < \hat{m}_{jt}^k 
\end{cases}
\]

Trade diversion is implied if the rise in intra-bloc imports is accompanied by a fall in extra-bloc imports:
\[
TD^k_{jt} = \begin{cases} 
TE^k_{jt} & \text{if } \hat{m}^\epsilon^k_{jt} - m^\epsilon^k_{jt} \geq TE^k_{jt} \\
\hat{m}^\epsilon^k_{jt} - m^\epsilon^k_{jt} & \text{if } TE^k_{jt} > \hat{m}^\epsilon^k_{jt} - m^\epsilon^k_{jt} > 0 , \\
0 & \text{if } \hat{m}^\epsilon^k_{jt} - m^\epsilon^k_{jt} \leq 0 
\end{cases}
\]

where \( m^\epsilon_{jt} = \sum_{i \notin RTA^k} m_{ijt} \) and \( \hat{m}^\epsilon_{jt} = \sum_{i \notin RTA^k} \hat{m}_{ijt} \) measure actual and predicted imports from countries outside the trading area. If the increase in intra-bloc imports is not offset by a decline in extra-bloc imports, then trade creation is occurring:

\[
TC^k_{jt} = TE^k_{jt} - TD^k_{jt}.
\]

Thus, no trade creation or trade diversion is indicated in equations (9) and (10) for countries that do not see an increase in imports from their new preferential trading partners.

Nearly all studies examining the effects of regional agreements (including this one) use data on import values rather than quantities. One concern in using import values is that import prices may change after the creation of a regional bloc. Prior to a regional agreement, imports entering a country from all sources are valued at the world price. When tariffs are eliminated with a preferential trading partner, however, imports from the partner country may now enter at a price up to \( p_w + t \) and still remain competitive. If import prices were to increase, some of the expanded value of trade within the regional trading bloc would be due to the rise in import prices rather than being due to increased quantities. There does not appear to be any evidence that intra-bloc import prices rise following a regional agreement, however. Trefler (2004) examines how the 1989 CUSFTA affected import prices in Canada, and he finds that, if anything, the agreement reduced import prices by approximately 7 percent in the most impacted industries. Thus, the existing evidence on import price changes in response to a trade agreement suggests that prices are either unaffected or fall slightly. If import prices decline, then the impact of regional agreements on intra-bloc trade in this paper is slightly understated.

3. Results
Table 1 presents estimates of the trade impact of regionalism based on the gravity model described above. The coefficients are estimated using the poisson pseudo-maximum likelihood estimator suggested by Santos Silva and Tenreyos (2006) and the standard errors are bootstrapped to deal with heteroskedasticity. The results are presented first for the simplest form of the gravity model including only the RTA variables and the logs of distance and GDP as explanatory variables. The impact of adding extra control variables and incorporating fixed effects is then investigated.

Model 1 presents the results of the basic gravity model. The coefficient on the RTA variable of 0.597 means that bilateral trade flows are estimated to increase by 82 percent \( e^{0.597} = 1.82 \) if the pair of countries has a regional agreement. The coefficient on the trade diversion variable indicates that a trade deal reduces imports from outside the RTA by 2.9 percent. Both coefficients are significant at the 1 percent level, and the results thus fit the conventional wisdom that regional agreements increase trade within the bloc and reduce trade from countries outside the preferential trading area on average.

Models 2 through 5 add fixed effects for each dyad into the analysis. Model 2 shows that when country pair fixed effects are controlled for, the impact of an RTA on intra-bloc trade declines to only 42 percent, about half that in model 1. These results are consistent with the idea that regional agreements tend to be signed between country pairs that have high levels of bilateral trade for historical reasons, which means that gravity models without dyad fixed effects overestimate the impact of regional agreements on trade. Imports from a country’s new preferential trading partners are $2.24 billion on average in the year prior to the start of the RTA, so the 42 percent increase translates into $946 million worth of expanded intra-bloc trade. The estimates in model 2 provide no statistically significant evidence that regional agreements reduce imports from countries outside the trading bloc. The coefficient on the trade diversion variable is not statistically significant, and the point estimate indicates that extra-bloc imports decline by only 0.3 percent when a new regional agreement is signed. For the average country signing a new regional agreement, imports from countries other than their new preferential partners are

\[ ^2 \text{Santos Silva and Tenreyos (2006) suggest using the robust covariance matrix estimator in STATA, but the robust estimator of the standard errors is not available for fixed-effect Poisson estimation.} \]
nearly $40 billion, so a 0.3 percent decline means a fall of $120 million in external trade. These numbers imply that trade creation ($826 million) is roughly seven times larger than trade diversion on average.

Model 3 estimates the dynamic effects of regional agreements. The RTA coefficients are jointly significant as a group, but most of them are statistically insignificant individually due to the collinearity between the RTA variables. Collinearity is not a major concern here, however, because the main object of interest is the cumulative effect of regional agreements on trade flows, and collinearity can actually improve inference about the sum of coefficients, as Goldberger (1991, p. 219) points out. The bottom rows of the table show the cumulative RTA effects on trade: \[ \sum_{s=-4}^{17} \beta_{RTA_{ijt-s}} = 0.638. \] This estimate means that the average RTA raises intra-bloc trade by 89 percent after being in place for 18 years. All of this impact on trade occurs by year 11 of the regional agreement’s existence – there is no significant change in the cumulative effect of the RTA after that point. Model 3 provides strong evidence that the anticipation of regional agreements influences trade flows. The anticipatory effect of the RTA is to raise trade by 26 percent in the four years prior to the trade deal’s start. Trade then increases on average by another 50 percent over the first 18 years of the agreement. Each of these cumulative impacts on trade is statistically significant at the 1 percent level. As in model 2, there is little evidence of trade diversion. Imports from countries outside of a regional trading bloc increase slightly (by 0.7 percent) in the four years leading up to the start of the RTA and then fall by 0.9 percent in the first 18 years of the agreement. Neither effect is significantly different from zero at the one percent level.

Models 4 and 5 estimate separate RTA effects for customs unions, free trade areas, and preferential trading arrangements. Customs unions are estimated in model 4 to raise intra-bloc trade by 37 percent, while free trade areas increase imports by 51 percent. Preferential trading arrangements, on the other hand, have no significant impact on trade flows. There are no significant declines in extra-bloc trade for any of the three types of regional agreements. Model 5 investigates the dynamic effects separately for each type of regional agreement. The long-run cumulative effect of customs unions is to increase intra-bloc trade by 129 percent while free trade areas are estimated to raise trade within the bloc
by 66 percent. Preferential trading arrangements are estimated to raise intra-bloc trade in the long run by only 18 percent, and this effect is not statistically significantly different from zero. None of the three types of agreements reveal statistically significant evidence of trade diversion at the one percent level, although the point estimates show some small declines in extra-bloc trade among customs unions and free trade areas during the 18 years after the trade deals begin.

The dynamic time paths of the intra-bloc trade effects from model 5 for customs unions, free trade areas, and preferential arrangements are illustrated in Figure 2. Customs unions lead to a steady increase in trade from about one year prior to their start to 11 years after they have begun. By that point, intra-bloc trade is estimated to be 120 percent higher due to the customs union. By year 18, trade within the customs union has risen by 129 percent on average. For free trade areas, imports increase by more than 40 percent in the four years prior to the start of the trade deal, and the cumulative effect peaks in the seventh year after its start. The cumulative impacts on trade over the first seven years are very similar for customs unions (a 92 percent average increase) and free trade areas (96 percent), so the larger long-run effects caused by customs unions are due to the fact that intra-CU trade continues to rise for a longer period of time while the impact of free trade areas declines somewhat after year seven. For the average preferential trading arrangement, there is no estimated increase in trade until after it has been in force for five years. The impact on imports then peaks at 30 percent in year 13 of its existence and declines to below 20 percent by year 18.

Table 2 investigates the RTA trade effects for alternative specifications of the gravity model. Model 1 shows estimates using the simplest form of the gravity model while model 2 adds in variables such as population, land area, and dummies for adjacency, same language use, colonial history, and landlocked countries that are commonly used in the literature. Model 3 then replaces the variables specific to each country pair with dyad fixed effects. Model 4 replaces the variables that are specific to the importing and exporting countries in each year with exporter-year and importer-year fixed effects, and model 5 includes exporter-year and importer-year fixed effects as well as fixed effects for each dyad.
Model 5 is estimated in first differences as shown in equation (5), which means that the $R^2$ value is not comparable to the first four columns. The trade diversion variables are omitted from the regressions since they can not be included in models 4 and 5. The models are estimated by ordinary least squares because nonlinear regression is difficult with the thousands of dummy variables for the exporter-year and importer-year fixed effects. The OLS approach also allows a direct comparison of the results in Table 2 to most of the previous literature on the gravity model.

Table 2 reinforces several results from Table 1. First, adding fixed effects into the regressions reduces the estimated impact of regional agreements on trade. This result can be seen most clearly in the row at the bottom of the table showing the cumulative long-run effect of regional agreements. In model 1, the simplest form of the gravity model, the cumulative effect of a regional agreement is to raise trade within the trading bloc by about 200 percent. Adding commonly used control variables in model 2 means an RTA is estimated to raise trade by 86 percent. These large estimated effects of regional agreements on trade flows in gravity models are often found in the literature: Frankel and Rose (2002), for example estimate that regional agreements increase trade flows by over 2.9 times. Adding dyad fixed effects to the model reduces the estimated long-run impact of regional agreements on trade from 86 percent in model 2 to 60 percent in model 3. Introducing exporter-year and importer-year fixed effects in model 4 means that the average regional agreement is estimated to raise imports by only 15.8 percent after 18 years in existence. While that is a statistically significant increase in trade, it is a far cry from the much larger estimated trade effects in the typical formulation of the gravity model. In model 5, which controls for both time-specific shocks to each country’s trade flows and dyad-specific variables, the estimated RTA effects are similar to those in model 4. Trade flows are estimated to rise by 21.7 percent after a regional agreement has been in place for 18 years, although this cumulative effect is not statistically significantly different from zero.

A second result from Table 1 that also finds some support in Table 2 is that regional agreements have anticipatory effects on trade. In both models 1 and 2, trade rises considerably (by between 37
percent and 44 percent) in the four years prior to the beginning of the trade deal and then continues to increase following its enactment. In model 3, most of the estimated long-run increase in trade (34 percent) actually occurs in the 4 years leading up to the start of the agreement, with a smaller 19 percent increase occurring in the 18 years after it begins. Models 4 and 5 estimate that trade increases by 10.5 and 7.5 percent, respectively, in the years immediately prior to the start of regional agreements, although these impacts are not statistically significant.

In order to investigate the dynamic effects of regional agreements on average, the estimates in Tables 1 and 2 were based on the assumption that all RTAs had a similar impact on trade. Table 3 presents the more common method of allowing separate estimates of the trade effects for each regional agreement. The models are comparable to those in Table 2: columns (1) and (2) present basic gravity model estimates, column (3) includes dyad fixed effects, column (4) adds exporter-year and importer-year fixed effects, and column (5) includes exporter-year and importer-year fixed effects and estimates the equation in first differences to control for dyad fixed effects.

As in Tables 1 and 2, Table 3 reveals that controlling for unobserved factors affecting trade between country pairs through dyad fixed effects generally reduces the estimated impacts of regional trade agreements. The Canada-US Free Trade Agreement is estimated in the standard gravity model to raise trade between Canada and the US by more than 200 percent in columns 1 and 2, but it has no significant impact on trade once the dyad fixed effects are included in the regression in column 3. Large reductions in the estimated impacts on trade are also found for the US-Israel free trade agreement, the 1986 expansion of the European Free Trade Area, the Southern Common Market (MERCOSUR), the Common Market of Eastern and Southern Africa (COMESA), the Economic Community of West African States (ECOWAS), and the Melanesian Spearhead Group (MSG). The last three regional agreements are merely preferential trading arrangements, so the negligible impacts on trade in model 3 are more plausible than the very large effects estimated by the standard gravity model. The median RTA is estimated to raise intra-bloc trade by 172 and 131 percent in models 1 and 2, but by only 48 percent when the country pair fixed effects are included in model 3. As in Table 2, controlling for exporter-year and importer-year
fixed effects in models 4 and 5 also tends to reduce the estimated impacts of regional agreements on
trade. The median regional bloc is estimated to raise intra-bloc trade by 53 percent in model 4 while
model 5 finds no significant trade effects for any of the regional agreements.

While Table 1 found no significant declines in imports from countries outside the average
preferential trading area, Table 3 finds that extra-bloc trade fell for some individual agreements. As with
intra-bloc trade, the estimated impact of the agreements on extra-bloc trade declines when dyad fixed
effects are included. The median agreement is estimated to reduce extra-bloc trade by 9.9 percent and 5.6
percent respectively in models 1 and 2, but by only 2.6 percent in model 3. Seven of the 16 coefficients
on the “trade diversion” variables are significantly negative in model 3. Notice, though, that only two of
the seven regional agreements with significant negative coefficients on the TD variables (the 1986 EC
expansion and the 1993 EC trade deals with Romania and Bulgaria) have significant positive coefficients
on the RTA variables. For those two agreements, the estimates provide evidence of trade diversion –
imports from countries outside the area have been replaced by trade within the region. For the other five
agreements, there is no significant rise in trade within the preferential trading area, so the lost extra-bloc
trade can not have been diverted into intra-bloc trade. For these agreements, it is much more likely that
region-specific shocks to trade caused a significant decline in extra-bloc imports (just as the four
agreements with significant positive coefficients on the trade diversion variables likely experienced
positive shocks to trade in the years following the trade deals).

Table 4 presents estimates of the trade effects of regional agreements on individual countries.
These use the estimates from model 3 in Table 3 to predict trade flows in the absence of each agreement
and then measure the RTA effects based on equations (6) – (10). The first two columns show the intra-
bloc and extra-bloc trade effects, while the last four columns reveal the trade creation and trade diversion
that are implied by the trade effects.

One result from Table 4 is that regional agreements are estimated to have very different impacts
on each of the countries within a trading bloc. The 1986 expansion of the European Community
generated large increases in imports by 1990 for the new entrants Spain and Portugal (nearly 30 percent
of their total imports) and for France, which borders Spain. Other countries in the EC such as Denmark, Belgium, and Ireland saw little or no increase in imports from their new preferential trading partners. The 1992 free trade agreements the EC signed with Hungary and Poland also had varying impacts on the countries involved. Imports into Poland and Hungary from the EC increased dramatically, but only Germany (which borders Poland) experienced large increases in imports from Poland and Hungary. The North American Free Trade Agreement generated much greater increases in imports for the United States and for Mexico than for Canada. These results are not surprising, but they illustrate that constraining a regional agreement to have the same effect on each country’s imports, as the RTA dummy variable approach does, is often inappropriate. Countries with the largest gains from trade agreements (Spain and Portugal joining the EC, Poland signing a free trade agreement with the EC, and Mexico joining the United States and Canada in the NAFTA) are usually joining a trading bloc with an overall economy many times larger than their own and whose countries are nearby and thus “natural trading partners.”

The aggregate effects of all regional agreements, customs unions, free trade agreements, and preferential agreements signed during this time period are shown in the final rows of the table. In total, the intra-bloc imports of the new agreements are estimated to have risen by $182 billion while imports from countries other than the new preferential partners rose by $126 billion. The aggregate intra-bloc RTA effect is relatively small – it amounts to 2.7 percent of the countries’ total imports.

Consistent with the estimates in Tables 1 and 3, aggregate trade creation is found to outweigh trade diversion by a good margin. The implied trade creation in the table may, however, be overstated relative to the implied trade diversion. Consider a country signing a regional agreement that has no impact on trade. A positive shock to its aggregate imports will lead to higher trade with all countries and will thus be counted as trade creation because the higher trade within the region is not offset by a decline in imports from outside the bloc. A negative shock to the country’s imports, however, would lead to a fall in both intra-bloc and extra-bloc trade, which is not counted as trade diversion. Positive and negative shocks to trade (if they are unrelated to the formation of regional agreements) should roughly cancel each other out in summing the intra-bloc and extra-bloc trade effects over all the regional agreements in the
first two columns. The positive aggregate intra-bloc and extra-bloc trade effects support the view that the regional agreements signed in the 1980’s and early 1990’s were trade creating on average.

4. Conclusion

There are a number of complications in examining the trade effects of regional agreements that have prevented any consensus from forming on the appropriate empirical methodology for measuring trade creation and trade diversion. Aggregate shocks to a country’s imports can be large relative to the effects of a regional trade agreement; it is difficult to establish a counterfactual level of trade that would have occurred in the absence of the agreement; the impact of an agreement can vary considerably across countries within a trade bloc; and the effects of the trade preferences can change over time. The estimates in this paper improve on those in previous studies by using fixed effects to account for historical trade patterns and for aggregate shocks to countries’ imports and exports, measuring the trade effects in a dynamic framework, and by providing separate measures of agreements’ trade effects on each country. The fixed effects for each dyad help solve for the problem that country pairs with greater than normal bilateral trade are more likely to sign regional trade deals. Including dyad, exporter-year, and importer-year fixed effects controls for all of the variables normally used in gravity models and many other unobserved ones, and it removes the difficult choices about which of the hypothesized variables should be included. The results presented in this paper consistently show that adding the fixed effects reduces the estimated impacts of regional agreements on trade.

The estimates also reveal a number of other interesting results. First, there are clear anticipatory effects of regional trade agreements, with trade estimated to increase by 26 percent on average in the four years leading up to the start of a trade deal. Trade continues to rise significantly over the first 11 years a regional agreement is in place, and the long-run impact of the average regional agreement is estimated to be an 89 percent increase in trade flows. A second result is that there are plausible differences in the effects of customs unions, free trade agreements, and preferential trading arrangements. Customs unions generate the largest long-run increase in intra-bloc trade on average, with free trade agreements having
smaller long-run effects. The advantage of customs unions is that intra-CU trade continues to increase over longer periods of time. While both customs unions and free trade areas have similar impacts on trade after seven years in existence, by year 18 the customs union effect on trade is nearly double that of a free trade area. Preferential trading arrangements, on the other hand, lead to much smaller (and statistically insignificant) increases in trade flows, and trade does not begin to rise until after the preferential arrangement has been in place for five years. The dynamic models estimated in the paper suggest that the long-run impacts of regional agreements are more positive than the short-run impacts in general.

The estimates for individual countries reveal that a trade deal can have very different impacts on the countries involved. Countries signing regional agreements with partners who are both nearby and large tend to experience sizable increases in trade while agreements between less natural trading partners have much smaller effects. For the typical country signing a regional agreement, the trade effects are small relative to the participating countries’ total imports, with intra-RTA imports estimated to rise by about 2.7 percent of a country’s total imports in year five.
Figure 1

Import growth by RTA status

Figure 2

Dynamic intra-bloc trade effects of regional trade agreements
Table 1: Gravity model estimates of RTA trade effects

<table>
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<tr>
<th></th>
<th>Model 1</th>
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<th>Model 4</th>
<th>Model 5</th>
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<td>0.004</td>
<td>-0.011 *</td>
<td>0.002</td>
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</tr>
</tbody>
</table>

Dyad fixed effects No Yes Yes Yes Yes

Cumulative RTA effect: \( \sum_{s=-4}^{2} \beta_{RTA_{jit-s}} \) 0.638 * 0.829 * 0.508 * 0.169
Anticipatory RTA effect: \( \sum_{s=-4}^{-1} \beta_{RTA_{jit-s}} \) 0.231 * 0.050 0.367 * -0.003
Post-enactment RTA effect: \( \sum_{s=0}^{17} \beta_{RTA_{jit-s}} \) 0.407 * 0.779 * 0.141 0.172

Cumulative TD effect: \( \sum_{s=-4}^{2} \beta_{TD_{jit-s}} \) -0.002 -0.010 -0.004 0.039
Anticipatory TD effect: \( \sum_{s=-4}^{-1} \beta_{TD_{jit-s}} \) 0.007 0.002 0.027 0.019
Post-enactment TD effect: \( \sum_{s=0}^{17} \beta_{TD_{jit-s}} \) -0.009 -0.012 -0.031 0.020

* indicates that the coefficients are statistically significant at the 1% significance level

Each regression includes year fixed effects

Standard errors are bootstrapped

Coefficients are estimated using the fixed effect Poisson pseudo-maximum likelihood estimator
Table 2: Gravity model alternative specifications

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
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<td>-0.987 *</td>
<td>-1.392 *</td>
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<td>-1.392 *</td>
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<td>Ln(GDP$_{j}$)</td>
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<td>Ln(Population$_{i}$)</td>
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<tr>
<td>Ln(Population$_{j}$)</td>
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<tr>
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<tr>
<td>RTA$_{ijt+4}$</td>
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<td>0.190 *</td>
<td>0.089</td>
<td>0.078</td>
<td>0.017</td>
</tr>
<tr>
<td>RTA$_{ijt+3}$</td>
<td>0.139</td>
<td>0.122</td>
<td>0.081</td>
<td>0.070</td>
<td>0.043</td>
</tr>
<tr>
<td>RTA$_{ijt+2}$</td>
<td>0.032</td>
<td>0.047</td>
<td>0.011</td>
<td>0.015</td>
<td>0.009</td>
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<tr>
<td>RTA$_{ijt+1}$</td>
<td>-0.033</td>
<td>-0.048</td>
<td>0.110</td>
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<tr>
<td>RTA$_{ijt}$</td>
<td>-0.004</td>
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<td>RTA$_{ijt-1}$</td>
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<td>RTA$_{ijt-2}$</td>
<td>0.103</td>
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<td>RTA$_{ijt-3}$</td>
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<td>RTA$_{ijt-4}$</td>
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<td>-0.014</td>
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<td>-0.015</td>
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<td>RTA$_{ijt-5}$</td>
<td>0.191</td>
<td>0.157</td>
<td>0.206 *</td>
<td>0.085</td>
<td>0.076</td>
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<tr>
<td>RTA$_{ijt-6}$</td>
<td>0.280 *</td>
<td>0.235</td>
<td>0.019</td>
<td>0.164</td>
<td>0.005</td>
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<tr>
<td>RTA$_{ijt-7}$</td>
<td>-0.188</td>
<td>-0.331 *</td>
<td>-0.196 *</td>
<td>-0.169</td>
<td>-0.018</td>
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<tr>
<td>RTA$_{ijt-8}$</td>
<td>0.133</td>
<td>0.137</td>
<td>0.097</td>
<td>0.111</td>
<td>0.079</td>
</tr>
<tr>
<td>RTA$_{ijt-9}$</td>
<td>0.096</td>
<td>0.057</td>
<td>0.083</td>
<td>0.023</td>
<td>0.010</td>
</tr>
<tr>
<td>RTA$_{ijt-10}$</td>
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<td>0.041</td>
<td>0.035</td>
<td>0.041</td>
<td>-0.030</td>
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<tr>
<td>RTA$_{ijt-11}$</td>
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<td>0.083</td>
<td>0.039</td>
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<tr>
<td>RTA$_{ijt-12}$</td>
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<td>0.002</td>
<td>0.005</td>
<td>0.077</td>
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</tr>
<tr>
<td>RTA$_{ijt-13}$</td>
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<td>-0.021</td>
<td>-0.030</td>
<td>0.027</td>
<td>-0.095</td>
</tr>
<tr>
<td>RTA$_{ijt-14}$</td>
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<td>0.017</td>
<td>-0.008</td>
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<tr>
<td>RTA$_{ijt-15}$</td>
<td>0.011</td>
<td>-0.011</td>
<td>0.005</td>
<td>-0.045</td>
<td>-0.023</td>
</tr>
<tr>
<td>RTA$_{ijt-16}$</td>
<td>-0.003</td>
<td>0.003</td>
<td>0.032</td>
<td>0.036</td>
<td>-0.012</td>
</tr>
<tr>
<td>RTA$_{ijt-17}$</td>
<td>0.064</td>
<td>-0.028</td>
<td>-0.188 *</td>
<td>-0.379 *</td>
<td>0.011</td>
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</table>

Cumulative RTA effect 1.101 * 0.621 * 0.467 * 0.147 * 0.196
Anticipatory effect 0.362 * 0.312 * 0.292 * 0.100 0.072
Post-enactment effect 0.739 * 0.309 * 0.175 * 0.048 0.125

Observations 172,439 172,439 172,439 172,439 146,594
$R^2$ 0.5973 0.6236 0.8062 0.7394 0.1073
Dyad fixed effects No No Yes No Yes
Exp-year, imp-year fixed eff. No No No Yes Yes

Cumulative, anticipatory, and post-enactment effects are $\sum_{s=-4}^{17}\beta_{RTA_{ijt-s}}$, $\sum_{s=-4}^{-1}\beta_{RTA_{ijt-s}}$, and $\sum_{s=0}^{17}\beta_{RTA_{ijt-s}}$.

* indicates that the coefficients are statistically significant at the 1% significance level.
Table 3: Estimated trade effects for individual regional trade agreements

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
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<tr>
<td>Constant</td>
<td>3.468 *</td>
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<td>5.567 *</td>
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<td>-1.074 *</td>
<td>-1.016 *</td>
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<td>-1.401 *</td>
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<tr>
<td>Ln(GDP$_i$)</td>
<td>0.971 *</td>
<td>1.137 *</td>
<td>0.491 *</td>
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<tr>
<td>Ln(GDP$_j$)</td>
<td>0.799 *</td>
<td>0.930 *</td>
<td>0.283 *</td>
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<td></td>
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<tr>
<td>Ln(Population$_{ij}$)</td>
<td></td>
<td>-0.214 *</td>
<td>-0.119</td>
<td></td>
<td></td>
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<tr>
<td>Ln(Population$_{ij}$)</td>
<td></td>
<td>-0.180 *</td>
<td>-0.102</td>
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<tr>
<td>Adjacent$_{ij}$</td>
<td>0.444 *</td>
<td></td>
<td></td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>Same language$_{ij}$</td>
<td>0.571 *</td>
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<td></td>
<td>0.409 *</td>
<td></td>
</tr>
<tr>
<td>Colony$_{ij}$</td>
<td>1.076 *</td>
<td></td>
<td></td>
<td>1.199 *</td>
<td></td>
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<tr>
<td>Land Area$_i$</td>
<td>-0.022</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Area$_j$</td>
<td>-0.019</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landlocked$_i$</td>
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</tr>
<tr>
<td>Landlocked$_j$</td>
<td>-0.595</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US-Israel FTA</td>
<td>2.075 *</td>
<td>1.095 *</td>
<td>0.342</td>
<td>1.543 *</td>
<td>0.218</td>
</tr>
<tr>
<td>EC 1986 expansion</td>
<td>0.672 *</td>
<td>0.286 *</td>
<td>0.577 *</td>
<td>-0.255 *</td>
<td>0.209</td>
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<tr>
<td>EFTA 1986 expansion</td>
<td>1.087 *</td>
<td>0.169 *</td>
<td>-0.112</td>
<td>0.445 *</td>
<td>-0.194</td>
</tr>
<tr>
<td>Andean Community</td>
<td>1.218 *</td>
<td>0.941 *</td>
<td>1.021 *</td>
<td>1.331 *</td>
<td>-0.191</td>
</tr>
<tr>
<td>Canada-US FTA</td>
<td>1.950 *</td>
<td>1.111 *</td>
<td>-0.086</td>
<td>0.408</td>
<td>-0.126</td>
</tr>
<tr>
<td>MERCOSUR</td>
<td>1.722 *</td>
<td>1.480 *</td>
<td>0.441 *</td>
<td>1.657 *</td>
<td>0.093</td>
</tr>
<tr>
<td>ASEAN FTA</td>
<td>1.695 *</td>
<td>1.929 *</td>
<td>1.165 *</td>
<td>0.111</td>
<td>-0.398</td>
</tr>
<tr>
<td>EC 1992 trade deals</td>
<td>-0.392 *</td>
<td>-0.120</td>
<td>0.810 *</td>
<td>-0.400 *</td>
<td>-0.085</td>
</tr>
<tr>
<td>EFTA 1992 trade deals</td>
<td>0.142</td>
<td>0.192</td>
<td>0.522 *</td>
<td>0.358</td>
<td>-0.002</td>
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<tr>
<td>EC 1993 trade deals</td>
<td>0.184 *</td>
<td>0.274 *</td>
<td>0.601 *</td>
<td>-0.478 *</td>
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<tr>
<td>EFTA 1993 trade deals</td>
<td>-0.024</td>
<td>0.074</td>
<td>0.069</td>
<td>-0.082</td>
<td>-0.032</td>
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<tr>
<td>ECOWAS</td>
<td>1.281 *</td>
<td>1.413 *</td>
<td>-0.319</td>
<td>1.564 *</td>
<td>-0.522</td>
</tr>
<tr>
<td>MSG</td>
<td>3.120 *</td>
<td>3.377 *</td>
<td>-0.380</td>
<td>2.990</td>
<td>-0.898</td>
</tr>
<tr>
<td>NAFTA</td>
<td>0.917 *</td>
<td>0.945 *</td>
<td>0.829 *</td>
<td>1.077 *</td>
<td>-0.242</td>
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<tr>
<td>COMESA</td>
<td>0.434 *</td>
<td>0.733 *</td>
<td>-0.155</td>
<td>0.522 *</td>
<td>-0.149</td>
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<tr>
<td>Other RTA</td>
<td>0.861 *</td>
<td>0.309 *</td>
<td>0.130</td>
<td>0.243 *</td>
<td>0.091</td>
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<tr>
<td>US-Israel TD</td>
<td>0.234 *</td>
<td>-0.092 *</td>
<td>0.023</td>
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<tr>
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<td>EFTA 1986 TD</td>
<td>-0.142 *</td>
<td>-0.299 *</td>
<td>-0.105 *</td>
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<tr>
<td>Andean Community TD</td>
<td>-0.471 *</td>
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</tr>
<tr>
<td>Canada-US TD</td>
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<tr>
<td>MERCOSUR TD</td>
<td>-0.342 *</td>
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<td>ASEAN TD</td>
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<td>0.740 *</td>
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<td>-0.211 *</td>
<td>-0.111 *</td>
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<td>0.078 *</td>
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<tr>
<td>EC 1993 TD</td>
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<td>0.168 *</td>
<td>-0.087 *</td>
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<tr>
<td>EFTA 1993 TD</td>
<td>-0.210 *</td>
<td>-0.113 *</td>
<td>-0.086 *</td>
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<tr>
<td>ECOWAS TD</td>
<td>-0.285 *</td>
<td>-0.006</td>
<td>-0.075 *</td>
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<tr>
<td>MSG TD</td>
<td>0.281 *</td>
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<td>-0.330 *</td>
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<td>0.189 *</td>
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<tr>
<td>Other TD</td>
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<td>-0.213 *</td>
<td>0.072 *</td>
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Observations: 172,439 172,439 172,439 172,439 146,594
<table>
<thead>
<tr>
<th>$R^2$</th>
<th>0.6053</th>
<th>0.6300</th>
<th>0.8075</th>
<th>0.7398</th>
<th>0.1074</th>
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<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Exp-year, imp-year fixed eff.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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</table>

* indicates that the coefficients are statistically significant at the 1% significance level
Each regression includes year fixed effects
## Table 4: Measures of the trade effects on each country in year 5 of selected regional agreements

<table>
<thead>
<tr>
<th>Importing Country</th>
<th>New Partners</th>
<th>Intra-bloc effect</th>
<th>Extra-bloc effect</th>
<th>Implied trade creation</th>
<th>Implied trade diversion</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$000,000</td>
<td>$000,000</td>
<td>$000,000</td>
<td>%</td>
<td>$000,000</td>
</tr>
<tr>
<td><strong>US-Israel FTA (1985)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>USA</td>
<td>-555</td>
<td>507</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>USA</td>
<td>Israel</td>
<td>1,690</td>
<td>167,814</td>
<td>1,690</td>
<td>0.45%</td>
</tr>
<tr>
<td><strong>EC expansion (1986)</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belgium-Lux</td>
<td>Portugal, Spain</td>
<td>328</td>
<td>-7,790</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Denmark</td>
<td>Portugal, Spain</td>
<td>164</td>
<td>-6,241</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>France</td>
<td>Portugal, Spain</td>
<td>5,663</td>
<td>24,323</td>
<td>5,663</td>
<td>3.41%</td>
</tr>
<tr>
<td>Germany</td>
<td>Portugal, Spain</td>
<td>3,622</td>
<td>22,351</td>
<td>3,622</td>
<td>1.50%</td>
</tr>
<tr>
<td>Greece</td>
<td>Portugal, Spain</td>
<td>216</td>
<td>3,043</td>
<td>216</td>
<td>1.48%</td>
</tr>
<tr>
<td>Ireland</td>
<td>Portugal, Spain</td>
<td>-19</td>
<td>-6,039</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Italy</td>
<td>Portugal, Spain</td>
<td>2,073</td>
<td>9,490</td>
<td>2,073</td>
<td>1.71%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Portugal, Spain</td>
<td>951</td>
<td>-2,277</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Portugal</td>
<td>EC</td>
<td>5,576</td>
<td>1,677</td>
<td>5,576</td>
<td>29.29%</td>
</tr>
<tr>
<td>Spain</td>
<td>EC</td>
<td>18,027</td>
<td>7,866</td>
<td>18,027</td>
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</tr>
<tr>
<td>UK</td>
<td>Portugal, Spain</td>
<td>2,217</td>
<td>26,468</td>
<td>2,217</td>
<td>1.37%</td>
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<tr>
<td><strong>EFTA expansion (1986)</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Austria</td>
<td>Finland</td>
<td>2</td>
<td>1,993</td>
<td>2</td>
<td>0.01%</td>
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<tr>
<td>Finland</td>
<td>EFTA</td>
<td>-461</td>
<td>-2,643</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Iceland</td>
<td>Finland</td>
<td>-14</td>
<td>-793</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Norway</td>
<td>Finland</td>
<td>-176</td>
<td>-7,818</td>
<td>0</td>
<td>0.00%</td>
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<tr>
<td>Sweden</td>
<td>Finland</td>
<td>-298</td>
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</tr>
<tr>
<td>Switzerland</td>
<td>Finland</td>
<td>15</td>
<td>959</td>
<td>15</td>
<td>0.03%</td>
</tr>
<tr>
<td><strong>Andean Community (1988)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Bolivia</td>
<td>Andean Comm.</td>
<td>18</td>
<td>225</td>
<td>18</td>
<td>1.79%</td>
</tr>
<tr>
<td>Colombia</td>
<td>Andean Comm.</td>
<td>247</td>
<td>-1,897</td>
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<td>0.00%</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Andean Comm.</td>
<td>78</td>
<td>-801</td>
<td>0</td>
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<tr>
<td>Peru</td>
<td>Andean Comm.</td>
<td>303</td>
<td>-1,333</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>Andean Comm.</td>
<td>354</td>
<td>-1,523</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td><strong>Canada-US FTA (1989)</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Canada</td>
<td>USA</td>
<td>-33,879</td>
<td>209</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>USA</td>
<td>Canada</td>
<td>33,158</td>
<td>131,969</td>
<td>33,158</td>
<td>6.99%</td>
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<tr>
<td><strong>MERCOSUR (1991)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Argentina</td>
<td>MERCOSUR</td>
<td>1,152</td>
<td>886</td>
<td>1,152</td>
<td>7.41%</td>
</tr>
<tr>
<td>Brazil</td>
<td>MERCOSUR</td>
<td>3,793</td>
<td>-606</td>
<td>3,188</td>
<td>7.44%</td>
</tr>
<tr>
<td>Paraguay</td>
<td>MERCOSUR</td>
<td>822</td>
<td>1,362</td>
<td>822</td>
<td>23.69%</td>
</tr>
<tr>
<td>Uruguay</td>
<td>MERCOSUR</td>
<td>92</td>
<td>-413</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td><strong>ASEAN FTA (1992)</strong></td>
<td></td>
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<tr>
<td>Cambodia</td>
<td>AFTA</td>
<td>766</td>
<td>195</td>
<td>766</td>
<td>68.13%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>AFTA</td>
<td>1,053</td>
<td>-2,715</td>
<td>0</td>
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</tr>
<tr>
<td>Laos</td>
<td>AFTA</td>
<td>290</td>
<td>43</td>
<td>290</td>
<td>61.12%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>AFTA</td>
<td>5,947</td>
<td>5,337</td>
<td>5,947</td>
<td>12.89%</td>
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<tr>
<td>Myanmar</td>
<td>AFTA</td>
<td>826</td>
<td>252</td>
<td>826</td>
<td>39.93%</td>
</tr>
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<td>AFTA</td>
<td>2,243</td>
<td>5,282</td>
<td>2,243</td>
<td>10.06%</td>
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<td>AFTA</td>
<td>4,367</td>
<td>12,107</td>
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<td>Thailand</td>
<td>AFTA</td>
<td>4,644</td>
<td>14,631</td>
<td>4,644</td>
<td>9.66%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>AFTA</td>
<td>2,234</td>
<td>3,342</td>
<td>2,234</td>
<td>30.19%</td>
</tr>
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<td>Region</td>
<td>Partner</td>
<td>Sum (all agreements)</td>
<td>$000,000 = RTA effect during fifth year of new regional agreement in millions of dollars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td></td>
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<tr>
<td>Belgium-Lux</td>
<td>Hungary, Poland</td>
<td>338</td>
<td>338 0.28%</td>
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<tr>
<td>Denmark</td>
<td>Hungary, Poland</td>
<td>253</td>
<td>253 0.79%</td>
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<tr>
<td>France</td>
<td>Hungary, Poland</td>
<td>770</td>
<td>770 0.37%</td>
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<tr>
<td>Germany</td>
<td>Hungary, Poland</td>
<td>5,928</td>
<td>5,928 1.80%</td>
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<tr>
<td>Greece</td>
<td>Hungary, Poland</td>
<td>49</td>
<td>49 0.23%</td>
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<tr>
<td>Ireland</td>
<td>Hungary, Poland</td>
<td>20</td>
<td>20 0.08%</td>
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<tr>
<td>Italy</td>
<td>Hungary, Poland</td>
<td>1,129</td>
<td>1,129 0.82%</td>
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<tr>
<td>Netherlands</td>
<td>Hungary, Poland</td>
<td>662</td>
<td>662 0.50%</td>
<td></td>
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</tr>
<tr>
<td>Portugal</td>
<td>Hungary, Poland</td>
<td>22</td>
<td>22 0.08%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Hungary, Poland</td>
<td>140</td>
<td>140 0.15%</td>
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<tr>
<td>UK</td>
<td>Hungary, Poland</td>
<td>375</td>
<td>375 0.18%</td>
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<tr>
<td>Hungary</td>
<td>EC</td>
<td>2,327</td>
<td>2,327 20.35%</td>
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<tr>
<td>Poland</td>
<td>EC</td>
<td>11,272</td>
<td>11,272 42.24%</td>
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<tr>
<td>Canada</td>
<td>Mexico</td>
<td>2,692</td>
<td>2,692 1.76%</td>
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<tr>
<td>Mexico</td>
<td>USA, Canada</td>
<td>24,173</td>
<td>24,173 27.27%</td>
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</tr>
<tr>
<td>USA</td>
<td>Mexico</td>
<td>54,898</td>
<td>54,898 7.92%</td>
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<tr>
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<td>COMESA</td>
<td>-1</td>
<td>-1 -1,442 0 0.00%</td>
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<tr>
<td>Burundi</td>
<td>COMESA</td>
<td>-2</td>
<td>-2 -185 0 0.00%</td>
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<tr>
<td>Congo, DR</td>
<td>COMESA</td>
<td>18</td>
<td>18 -1,527 0 0.00%</td>
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<tr>
<td>Djibouti</td>
<td>COMESA</td>
<td>4</td>
<td>4 164 1.46%</td>
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</tr>
<tr>
<td>Egypt</td>
<td>COMESA</td>
<td>56</td>
<td>56 2,642 0.43%</td>
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</tr>
<tr>
<td>Kenya</td>
<td>COMESA</td>
<td>-49</td>
<td>-49 -164 0 0.00%</td>
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<tr>
<td>Madagascar</td>
<td>COMESA</td>
<td>49</td>
<td>49 -181 0 0.00%</td>
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<tr>
<td>Malawi</td>
<td>COMESA</td>
<td>2</td>
<td>2 -428 0 0.00%</td>
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<td>Mauritius</td>
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<td>32</td>
<td>32 -335 0 0.00%</td>
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<tr>
<td>Rwanda</td>
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<td>25</td>
<td>25 -144 0 0.00%</td>
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<tr>
<td>Seychelles</td>
<td>COMESA</td>
<td>3</td>
<td>3 84 1.46%</td>
<td></td>
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</tr>
<tr>
<td>Sudan</td>
<td>COMESA</td>
<td>11</td>
<td>11 101 1.07%</td>
<td></td>
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</tr>
<tr>
<td>Uganda</td>
<td>COMESA</td>
<td>221</td>
<td>221 -302 0 0.00%</td>
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</tr>
<tr>
<td>Zambia</td>
<td>COMESA</td>
<td>-4</td>
<td>-4 -631 0 0.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>COMESA</td>
<td>0</td>
<td>0 -900 0 0.00%</td>
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</tr>
<tr>
<td>Sum (all agreements)</td>
<td></td>
<td>181,588</td>
<td>181,588 126,528 197,681 2.94% 20,278 0.30%</td>
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</tr>
<tr>
<td>Sum (CU)</td>
<td></td>
<td>44,676</td>
<td>44,676 74,099 42,555 3.93% 2,141 0.20%</td>
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</tr>
<tr>
<td>Sum (FTA)</td>
<td></td>
<td>113,176</td>
<td>113,176 36,923 133,718 2.50% 15,755 0.29%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum (PTA)</td>
<td></td>
<td>23,736</td>
<td>23,736 15,506 21,409 7.21% 2,382 0.80%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$000,000 = RTA effect during fifth year of new regional agreement in millions of dollars
% = TC or TD as % of country’s total imports
Customs Unions: EC, MERCOSUR
Free Trade Agreements: Israel-USA, EFTA, EC and EFTA trade deals, CUSFTA, NAFTA
Other preferential agreements: Andean Community, ASEAN FTA, ECOWAS, MSG, COMESA

1 The EC 92 trade deals also included the Czech Republic but it is excluded from the data set
References


