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IS THE GROWTH OF REGIONALISM AS SIGNIFICANT AS THE HEADLINES SUGGEST? LESSONS FROM AGRICULTURAL TRADE

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Abstract

The proliferation of regional trade agreements (RTAs) has motivated a significant number of *ex post* econometric studies investigating their agricultural trade impacts. The general conclusion is that RTAs increase members' trade by as much as 150 percent, on average. In this article, we demonstrate that previous empirical work likely misrepresents the impact of RTAs because of considerable heterogeneity in the depth of economic integration pursued by these agreements. Contrary to previous studies, the results reveal that RTAs are not universally trade creating, and some agreements appear to provide very little benefit. "Deep integration agreements", on the other hand, are largely responsible for the impressive agricultural trade flow increases reported in the literature. Testing the hierarchy of RTAs largely confirms the theory: the benefits of regionalism are an increasing function of the depth of economic integration.

Keywords: *Agricultural trade, regional trade agreements, customs unions, free trade agreements, partial scope arrangements, gravity equation*

JEL Classification: *F1, Q10*

1. Introduction

Regional trade agreements (RTAs) are not new, but many commentators agree that their importance in global trade is once again on the rise (Crawford and Fiorentino 2005; Fiorentino, Verdeja, and Toqueboeuf 2007). While RTAs have been at the forefront of the trade policy agenda for over 50 years, beginning with the Treaty of Rome which kick-started European integration in 1958, the recent proliferation of RTAs is one of the major international developments in the world economy since the post-war era. As of May 15, 2011, the World Trade Organization (WTO) notifications show that it is monitoring some 489 RTAs with 297 agreements in operation. This is up from 180 agreements in 2003, less than 100 agreements in 1995, and just 23 agreements in 1990. Since the advent of the WTO in 1995, the WTO has received an average of 11 notifications per year - almost one per month – and many countries participate in multiple RTAs.¹

The term ‘regional trade agreement’ is often used to classify any arrangement that grants some form of preference beyond the WTO’s Most Favored Nation (MFN) status.² This terminology, however, can be misleading because it ignores considerable differences in the depth of economic integration RTAs pursue (Fulponi, Shearer, and Almeida 2011). At their simplest, RTAs extend tariff preferences to member countries. At their deepest, RTAs progress towards an economic union harmonizing domestic and non-tariff policies, investment procedures, migration, intellectual property, and the creation of shared political, fiscal, and monetary policy (De Rosa 1998). While the reduction of trade barriers among member nations is a common goal of RTAs, lack of political will, divergent liberalization agendas, product exclusions (especially in agriculture), and excessively long transitional periods of trade liberalization might render an RTA large with respect to the number of

¹ Over the course of just four months ending in September 2009, the WTO’s chairperson of the Council for Trade in Goods announced that 10 new notifications of RTAs had been received.

² Use of the word “regional” is a bit of a misnomer. Many recent RTAs are not “regional” in the geographical sense of the word because they stretch across continental divides (i.e., EU-Chile, U.S.-Australia, U.S.-Morocco, etc.).

countries and its share in global trade, but economically insignificant (Pomfret 2006). Some free trade agreements (FTAs), for example, do not lead to trade that is “free” and agriculture is often the exception rather than rule.

Recent advances in the specification of the gravity equation has shed new light on the trade creating benefits of regionalism (Baltagi, Egger, and Pfaffermayr 2003; Santos-Silva and Tenreyro 2006; Baier and Bergstrand (B&B) 2007, Grant and Lambert 2008; Sun and Reed 2010). B&B (2007) demonstrated that RTAs approximately double members’ trade. However, the authors focused almost all of their attention on FTAs (Roy 2010). Focusing on agriculture, Grant and Lambert (2008) find even larger intra-regional trade effects: *“The cumulative effect of RTAs is to increase members’ agricultural trade by 149% after 12 years of phase-in”* (p.779). Koo, Kenedy, and Skripnitchenko (2006) find that the average RTA increases members’ agricultural trade by 95 percent. Lambert and McKoy (2009) report a 153 and 101 percent increase in agriculture and food-based trade, respectively. Equally impressive RTA effects have been documented in Vollrath and Hallahan (2011), Sun and Reed (2010), Karemera and Koo (2007), Vollrath, Hallahan and Gelhar (2009), Jayasinghe and Sarker (2008), and Sarker and Jayasinghe (2007).

While these studies have advanced our understanding of the trade creating potential of RTAs, an important policy question is: what factors are responsible for the impressive agricultural trade increases RTAs seem to generate? One important, although largely untested, factor is whether the depth of economic integration explains the success of these agreements. Since the pioneering work of Viner (1950), Meade (1955) and Balassa (1961), economists have placed RTAs along a continuum extending from autarky to a perfectly integrated zone with member countries reaping greater benefits the further they move along this hierarchy (Do and Watson 2006). Despite

numerous empirical estimates, however, we have very little evidence to suggest whether the benefits of RTAs are an increasing function of the depth of economic integration.³

This article investigates the effects of RTAs on agricultural trade conditional on the depth of economic integration pursued by the agreement. Drawing on the WTO's comprehensive database of RTA notifications permits us to group agreements into one of three depths of economic integration: "Deep" (i.e., customs unions, common markets and single economic unions), "Moderate" (i.e., free trade agreements), or "Shallow" (i.e., partial or limited scope) integration agreements (DIAs, MIAs, and SIAs, respectively). We then match these agreements to a new global dataset of agricultural trade flows covering 44 years of data (1964-2008) and estimate a more flexible specification of the gravity equation to control for heterogeneity in the depth of regional integration. To preview the results, we find that deep integration agreements are largely responsible for the sizeable agricultural trade flow increases reported in the literature, whereas moderate and shallow agreements are largely inconsequential, despite the fact that the latter two account for nearly 90 percent of RTAs notified to the WTO. With relatively modest, and oftentimes insignificant agricultural trade effects of MIAs and SIAs, the results cast doubt on the significance of regionalism and its threat to the multilateral system.

2. The Growth and Depth of Regionalism

The WTO recognizes three hierarchical categories of RTAs according to their trade liberalization ambition. At the lowest level, partial scope agreements (PSAs) offer preferential tariff rates to member nations but the agreement covers a limited set of products. The 2005 agreement between Chile and India (CHL-IND) is a useful example. India offered Chile preferential tariff rates

³ As noted by Krueger (1997) more than a decade ago: "Surprisingly, ... there has been little [empirical] analysis of different types of preferential arrangements, and in particular, of free trade agreements in contrast to customs unions" (p. 171).

ranging from ten to 50 percent for a total of 178 tariff lines but livestock and meat were the only beneficiaries in agriculture.⁴ Chile's offer to India covers just 7 agricultural tariff lines.⁵ The ASEAN-China agreement similarly includes only a handful of agricultural tariff lines falling under the Harmonized System's (HS) 2-digit chapters 09 (Coffee, Tea, and Spices), 12(Oil Seeds), 15 (Animal/Vegetable Fats and Oils), 20 (Vegetable/Fruit Preparations), and 22(Beverages). Other agricultural products are either excluded or are categorized on a sensitive products list.⁶ Because of the limited scope and coverage of these agreements, we shall refer to partial scope RTAs as "Shallow Integration Agreements" (SIAs).

At the next level of integration, FTAs reduce or eliminate trade barriers on "substantially all trade" within the agreement. However, the meaning and interpretation of the word "substantial" in GATT Article XXIV is not clear and has led to a number of systematic issues for the WTO's Committee on Regional Trade Agreements (CRTA) (Crawford and Laird 2000; WTO 2000). Because of this ambiguity, most FTAs have exceptions. Signed in 1992, the Association of Southeast Asian Nations (ASEAN) FTA excluded agricultural trade altogether. It wasn't until 1996, when members agreed to a gradual liberalization process with the eventual goal of becoming a customs union by 2015. Contentious issues remain in the North American Free Trade Agreement (NAFTA) in areas such as dairy, beef, sugar, tobacco, peanuts, poultry and eggs, lumber, and transportation and labor migration (Vollrath 2004). For these reasons we shall refer to FTAs as "Moderate Integration Agreements" (MIAs).

⁴ To put this into perspective, there are more than 5,000 tariff lines classified at the six digit level of the Harmonized System of Trade Classification (HTS or HS).

⁵ See http://commerce.nic.in/flac/PTA_with_chile.htm for details. For a list of all other shallow integration agreements see Appendix Table A.

⁶ See <http://fta.mofcom.gov.cn/topic/chinaasean.shtml> for the text of this agreement.

Customs Unions, Common Markets, and Economic Unions are the deepest form of integration where members adopt a common external tariff (in the case of a customs union), permit the free movement of capital and labor as well as adopting a common currency (in the case of a common market) and unify their fiscal, monetary and political policies (in the case of an economic union). Because these agreements move beyond tariffs and other border measures, we shall refer to them collectively as “Deep Integration Agreements” (DIAs). The European Union (EU) is the largest and perhaps best known DIA. The EU has evolved from an economic community in 1957, to the European Monetary System in 1979, and a Single European Market in 1992. Moreover, the EU is one of the only agreements with full integration of agriculture under the harmonized Common Agricultural Policy (CAP) system.

Another important distinction between DIAs and MIAs is that the latter allow members to erect independent external trade barriers, as long as these barriers are not higher than the period prior to ratification of the agreement. Thus, rules of origin (ROO) are needed to prevent a product from entering a low tariff country and subsequently being re-exported to a member with a higher external tariff. DIAs avoid costly ROO because members share a common external tariff. Because of this, Krueger (1997) notes that in theory MIAs can never be *Pareto* superior to DIAs. Crawford and Fiorentino (2005) go as far to say that DIAs are “out of touch” with today’s trading climate because they eliminate a country’s ability to protect (see also Krueger 1999).

Counting RTAs, as has been popularized by the WTO, is often used to highlight the growth and significance of regionalism. Figure 1 illustrates this trend by tracing out the cumulative number of RTAs notified to the WTO over the period 1960-2010.⁷ Also illustrated is the number of DIAs, MIAs, and SIAs making up the total, and the number of bilateral RTAs in existence. The table

⁷ For a list of all countries and RTAs considered in this article, see Appendices A and B.

embedded within Figure 1 provides summary totals at ten year intervals. At first glance, the growth of regionalism is striking. In 1960, just two RTAs existed (the original EU and the European Free Trade Agreement (EFTA)). By 1990, 24 RTAs were in force of which 33 percent (8/24) were DIAs, 46 percent (11/24) were MIAs and 20 percent (5/24) were SIAs. In 2000, just ten years later, the number of RTAs totaled 86 with MIAs increasing over five-fold to 60 agreements, whereas DIAs and SIAs roughly doubled to 17 and 9 agreements, respectively. By 2010, the WTO recognized 206 RTAs in force, almost three times the level just ten years earlier.⁸ The increasing popularity of MIAs (i.e., FTAs) is clear. These agreements now account for over 80 percent (170/206 agreements) of all RTAs currently in force, whereas DIAs and SIAs account for 10 (21/206) and seven percent (15/206), respectively. The other striking feature of Figure 1 is that over half of the 206 RTAs that were in force in 2010 are bilateral agreements (105/206). This is a three-fold increase from the 34 bilateral RTAs that existed in the year 2000. Thus, the majority of RTAs are being negotiated between fewer members and countries are stopping short of deep integration.

Counting agreements to illustrate the growth of regionalism, however, is not necessarily that illuminating because equal weight is assigned to each agreement and no attention is given to its economic significance.⁹ An alternative is to plot the share of world trade taking place within RTAs (Frankel, 1997). Figure 2 illustrates this share using an area graph decomposed by RTA type. The peak of the graph represents the share of world agricultural trade occurring within RTAs, which reached an unprecedented 60 percent in 2008 (the final year in our empirical sample). Deep integration agreements continue to account for the largest share in world agricultural trade, largely

⁸ Note that the 206 RTAs in force in 2010 (Figure 1) is less than what the WTO reports. As explained in the data section of this article, this is because the WTO double-counts a number of RTAs when they cover trade in both goods and services.

⁹ Pomfret (2006) similarly criticizes the WTO's method as an exaggeration of the economic significance of regionalism.

due to the expanding membership of the EU. However, does this mean that DIAs stimulate more intra-regional trade? Or, do DIAs, particularly the EU, encompass a much larger set of predominantly developed economies compared to MIAs and SIAs? This is the fundamental problem with trade shares – they do not control for the agreement’s size in world trade. By definition, adding more members will always increase the intra-regional trade share of RTAs.

To overcome this limitation a trade intensity index, or what is sometimes called a concentration index, can be developed (Frankel 1997; Frankel and Rose 1998). The bilateral trade intensity index (BTTI) identifies destination countries for which the reporting country’s exports are concentrated. Let i (j) denote the exporting (importing) country. The numerator in the BTTI is the share of i ’s exports sent to j . The denominator is the share of world (w) export’s sent to j . Thus the BTTI weights the share of i ’s exports to j by the relative importance of the world’s exports to j . Because both numerator and denominator are shares – one in terms of the partner country (numerator) and one in terms of the world market (denominator) – the BTTI ranges from zero to infinity. The symmetric BTTI (SBTTI), which has a more intuitive appeal, normalizes the BTTI on the domain $\{-1,+1\}$, indicating a more intense trade relationship as the SBTTI approaches plus one and a relatively weak trade relationship when the SBTTI approaches minus one.¹⁰

Figure 3 traces out the average SBTTI for each RTA type.¹¹ The trade intensity indices largely confirm the conventional theory of economic integration. The SBTTI for DIA members is everywhere positive and larger than that of MIAs and the trade intensity of MIAs is greater than

¹⁰ Formally, and letting X denote exports, the BTTI = $\frac{X_{ij} / X_{iw}}{X_{wj} / X_{ww}}$ ranges between zero and infinity. The symmetric

version (SBTTI) normalizes the BTTI on the $(-1,+1)$ interval as: $-1 < SBTTI = \frac{BTTI - 1}{BTTI + 1} < 1$

¹¹ That is, we computed the SBTTI for each of the 206 RTAs in the database and then computed the mean of the SBTTI for each category of regional integration (DIAs, MIAs, and SIAs)

that of SIAs. However, the SBTTIs are generally falling, particularly since the recent wave of regionalism began in the mid-1990s, which leads one to question whether the proliferation of RTAs is as significant as the WTO suggests. First, members may be relatively more open on a multilateral basis which would increase the denominator, and therefore, reflect a smaller SBTTI. Evidence of this openness can be found in Estevadeordal, Freund and Ornelas (2008) who show that some agreements not only lower their tariffs with their RTA partners, they also reduce tariffs on imports from countries outside the agreement. As Baldwin (2002) puts it, “liberalization (either regional or multilateral) begets more liberalization” (p. 1). Second, the falling SBTTIs could reflect less ambition towards agricultural trade liberalization in the latest wave of regionalism.¹²

The qualitative analysis generally supports the theory of economic integration. As one reviewer noted, however, it would be interesting to explore other factors potentially responsible for the effectiveness of RTAs. Horn, Mavroidis, and Sapir (2010) explore the sectors and topics covered by U.S. and EU RTAs. Grant and Lambert (2008) underscore the issue of pre-existing distortions as a likely factor responsible for the large agricultural trade increases of RTAs. Vicard (2011) used dummy variable interactions to investigate similarities in preferences and geographic proximity as possible determinants of successful RTAs. Finally, Nicita (2011) showed that the number and extent of tariff preferences granted in RTAs are important factors affecting intra- and extra-regional trade flows. To our knowledge, however, none of these studies have systematically associated these topics with the depth of economic integration. Moreover, a detailed treatment of the possible topics and factors that determine the success of RTAs is beyond the scope of the current paper, but is viewed as a fruitful area of further research.

¹² This is true of many of the recent Asian RTAs that were entered into force for the primary reason of liberalizing services and financial transactions rather than specifically tackling international trade in goods (Pomfret 2006).

3. Gravity and the Depth of Regional Integration

The gravity equation continues to be the workhorse model in international economics (see Cipollina and Salvatici (2010) for a survey). Its continued popularity is not only due to its consistent results, but also because of its relatively compact specification which makes it appealing for analyzing multilateral and regional integration initiatives. A popular class of trade models derives economic welfare from the constant elasticity of substitution (CES) framework (Feentra 2004):

$$(1) \quad U_{jt} = \sum_{i=1}^C N_{it} c_{ijt}^{\frac{\sigma-1}{\sigma}}$$

where, U_{jt} is the representative utility of country j in year t , N_{it} is the number of product varieties shipped by country i , c_{ijt} is the consumption of any product sold by country i and consumed in country j , and σ is the elasticity of substitution between varieties. Consumers in country j maximize (1) subject to their budget constraint:

$$(2) \quad E_{jt} = \sum_{i=1}^C N_{it} p_{it} t_{ijt} c_{ijt}$$

where, E_{jt} represents aggregate expenditure in country j , and $p_{it} t_{ijt} = p_{jt}$ is the price linkage equation that determines destination prices in importer j 's market (p_{jt}) inclusive of the exporter's origin price (p_{it}) and bilateral *ad-valorem* trade costs (t_{ijt}). Maximizing (1) subject to (2) leads to an expression for the demand for each product:

$$(3) \quad c_{ijt} = E_{jt} (t_{ijt})^{-\sigma} \left(\frac{p_{it}}{P_{jt}^{-1/\sigma}} \right)^{-\sigma}, \text{ where, } P_{jt} \text{ is country } j\text{'s CES price index defined as:}$$

$$(4) \quad P_{jt} = \left(\sum_{i=1}^C N_{it} (p_{it} t_{ijt})^{1-\sigma} \right)^{\frac{1}{1-\sigma}}.$$

In the Dixit-Stiglitz (1977) and Krugman (1980) monopolistic competition framework, demand is symmetric for all varieties from country i , so we can multiply the quantity purchased (c_{ijt})

by the number of varieties available (N_{it}) and price of each variety (p_{jt}) to arrive at a familiar expression for the total value of bilateral trade in year t (X_{ijt}):

$$(5) \quad x_{ijt} = \mu_{it} E_{jt} (t_{ijt})^{1-\sigma} P_{jt}^{\sigma-1}$$

where, $\mu_{it} = N_{it} p_{it}^{1-\sigma}$ is a competitiveness indicator of the exporter because it determines the number of product varieties and price of each product shipped. In this (partial equilibrium) framework, we seek to understand the agricultural trade flow impacts of RTAs with differing depths of economic integration.¹³ The formation of an RTA affects the price index (P_{jt}) through the *ad-valorem* trade cost component (t_{ijt}) which depends on the depth of economic integration as follows:

$$(6) \quad t_{ijt} = \exp(-\rho^r RTA_{ijt}^r) z_{ijt}$$

where, RTA_{ijt}^r is a dummy variable equal to 1 if i and j belong to a regional trade agreement of depth r in year t , and zero otherwise, and z_{ijt} is a residual component of all other trade cost or promoting factors affecting bilateral trade. The parameter ρ and the RTA dummy variable are indexed by the superscript r which we use to denote one of three depths of economic integration. More specifically, RTA_{ijt}^{DIA} ($r = DIA$), RTA_{ijt}^{MIA} ($r = MIA$), and RTA_{ijt}^{SIA} ($r = SIA$) correspond to the formation of a deep, moderate, and shallow integration agreement, respectively.

Combining the trade cost specification in (6) with (5), we obtain a logarithmic gravity equation to evaluate the trade flow effects of heterogeneous RTAs:

$$(7) \quad \ln x_{ijt} = \ln \mu_{it} + \ln E_{jt} + (\sigma - 1) \ln P_{jt} + (\sigma - 1) \rho^r RTA_{ijt}^r + (1 - \sigma) \ln z_{ijt} .$$

¹³ Because we focus on agricultural trade, we remain in a partial equilibrium framework. However, the general equilibrium case, particularly in Anderson and van Wincoop (2003) or Feenstra (2004), is appealing but raises a number of complexities that are beyond the scope of this paper. In particular, expenditure or aggregate income (E_{jt}) is assumed to remain constant after the formation of an RTA whereas the general equilibrium case would bring about changes in aggregate expenditure and production through changes in tariffs, wages, product variety, and tariff revenues.

Equation (7) is often estimated in a panel data framework using agricultural trade flows but ignoring heterogeneity in the depth of regional integration as follows:

$$(8) \quad \ln x_{ijt} = \alpha_1 \ln y_{it} + \alpha_2 \ln y_{jt} + \sum_{m=1}^M \beta_m z_{ij(t)}^m + \lambda_1 RTA_{ijt} + \varepsilon_{ijt}$$

where ε_{ijt} is a log-normal error term, x_{ijt} is the nominal value of i 's agricultural exports to j in year t , y_{it} (y_{jt}) is i 's (j 's) gross domestic product as a proxy for the competitiveness (μ_{it}) of exporter i (aggregate expenditure of importer j (E_{jt})), $z_{ij(t)}^m$ is a vector of M observable trade cost variables including the distance between i and j ($Dist_{ij}$), i and j 's arable land base ($Area_i$, $Area_j$), dummy variables for countries that share a contiguous border ($Contig_{ij}$), speak the same language ($Lang_{ij}$), have a previous colonial linkage ($Colony_{ij}$), or whether i and j are landlocked countries (LL_i and LL_j , respectively). The policy parameter of interest, $\lambda_1 = (\sigma - 1)\rho$, yields the extent to which the average RTA increases trade among member countries. If RTAs stimulate intra-bloc trade then we expect λ_1 to be greater than zero.

The traditional gravity equation in (8) has several shortcomings. First, use of a generic RTA dummy variable masks considerable heterogeneity in the depth of regional integration pursued by these agreements. Contrary to previous studies, the average RTA may not be universally trade creating. Second, equation (1) is plagued by an omitted variable bias because it does not include controls for multilateral prices (P_{jt}) (Anderson and van Wincoop (AvW) 2003; Feenstra 2004), "natural trading partner" effects, and unobservable trade cost factors (Baldwin and Taglioni 2006). Because multilateral price data are difficult to measure, much less observe, recent research suggests the inclusion of time-varying country-specific fixed effects as a consistent alternative (Subramanian and Wei 2007).¹⁴

¹⁴ Furthermore, the use of country-and-time fixed effects absorbs the influence of and eliminates the need to obtain suitable controls for E_{jt} , P_{jt} , and μ_{it} affecting agricultural trade.

The “natural trading partner” bias arises when country-pairs are more likely to select into RTAs for trade cost reasons other than those observed on the right-hand side of equation (8) (Baldwin and Taglioni 2006; Magee 2008).¹⁵ For example, the U.S. and Canada are often considered “natural trading partners”, even in the absence of the Canada-U.S. (CUSTA) or North American Free Trade Agreement (NAFTA), because both countries share a land border, speak the same language and have a similar set of tastes and preferences. If these residual trade costs factors do not change a lot over time, Baldwin and Taglioni (2006) suggest the use of country-pair (*ij*) fixed effects which allows for a time-invariant U.S.-Canada (and Canada-U.S.) specific intercept to control for “naturally” higher (and also lower) levels of trade, irrespective of whether an RTA is signed.¹⁶

Third, one of the distinguishing features of most RTAs is the fact that they are phased-in over time, particularly for agriculture, as members complete their schedule of trade liberalization commitments (Grant and Lambert 2008; Sun and Reed 2010). As Frankel (1997) notes, “... the year an agreement is negotiated is different from the year it is ratified, which is in turn different from the year it goes into effect, which is in turn different from the year that the transition period of trade liberalization is completed” (p.78).

Finally, the canonical gravity equation in (8) has recently been challenged in the empirical trade literature because of a nontrivial selection bias (Santos-Silva and Tenreyro (SST) 2006; Helpman, Melitz and Rubinstein (HMR) 2008). Because the log of zero is undefined, the dependent variable in (8) is limited to country-pairs where trade is strictly positive. However, if there are large

¹⁵ A host of factors could potentially influence countries’ decision to enter into an RTA that do not appear in the right-hand side of equation (8) such as domestic policy issues behind a nation’s border, non-tariff measures, shipping regulations, and product standards, to name a few.

¹⁶ In fact, Baldwin and Taglioni (2006) refer to the omission of country-pair fixed effects in gravity equation studies as the “Gold Medal Error”.

unobservable trade barriers that are correlated with the variables in $z_{ij(t)}^m$, then countries may not select into exporting. This explains why zeros exist in the trade data, but not for random reasons.

To address these concerns, we estimate a more flexible specification of the gravity equation that controls for the depth of economic integration as well as countries' "multilateral resistance", "natural trading partner" effects, and RTA phase-in periods as follows:

$$(9) \quad \ln x_{ijt} = \alpha_{ij} + \alpha_{it} + \alpha_{jt} + \sum_{r=1}^3 \sum_{n=0}^3 \lambda_n^r RTA_{ijt-n}^r + \varepsilon_{ijt}$$

where, α_{it} and α_{jt} are time-varying exporter and importer fixed effects, respectively, and α_{ij} is a comprehensive set of dyadic (country-pair) fixed effects ($ij \neq ji$). The double summation in (9) reflects the fact that there is now a concurrent and three-period lagged structure for each RTA type (r). That is, $n = 0$ corresponds to the date the agreement enters into force ($t-0$); $n = 1$ is the first period lag ($t-1$); $n = 2$ is the second period lag ($t-2$); and $n = 3$ is the final period lag ($t-3$). As described in the next section, we use a four-year panel of bilateral trade flows from 1964-2008. Thus, one, two, and three lags represent four, eight and 12 years of RTA implementation and phase-in, respectively.

Conventional theory of economic integration motivates our core hypothesis (H_1):

$$(10) \quad H_1: \sum_{n=0}^3 \lambda_n^{DIA} > \sum_{n=0}^3 \lambda_n^{MIA} > \sum_{n=0}^3 \lambda_n^{SIA}$$

The ranking of regional trade agreements in terms of their effect on members' agricultural trade follows the conventional theory of economic integration whereby DIAs have the largest effect followed by MIAs, and finally, SIAs.

If the benefits of regionalism are increasing in the degree of economic integration then our null hypothesis (H_1) is illustrated by a series of strict inequalities. Because there is no well-developed null distribution for testing simultaneous inequalities, we resort to a multiple

comparisons framework with the appropriate adjustment to the significance level due to the increase in Type I error rates (Davis 2003).¹⁷ Multiple testing problems arise when N individual hypotheses, H_1, H_2, \dots, H_N are being tested at the α_i significance level with corresponding p -values p_1, p_2, \dots, p_N . To control for the H_0 error rate, Bonferonni or Šidák adjustments can be implemented as follows:

$$(11) \quad \tilde{\alpha}_B = \bar{\alpha} / N \text{ (Bonferonni); } \tilde{\alpha}_S = 1 - (1 - \bar{\alpha})^{1/N} \text{ (Šidák)}$$

where, $\bar{\alpha}$ is the chosen significance level, and $\tilde{\alpha}_B$ ($\tilde{\alpha}_S$) is the Bonferonni (Šidák) adjusted significance level after conducting N comparisons. Testing regional integration involves comparing three types of RTAs (DIAs, MIAs, and SIAs), in which case $N = 3$ and $\tilde{\alpha}_B \approx \tilde{\alpha}_S = 0.017$ assuming a normal Type I Error rate ($\bar{\alpha}$) of five percent.

While equation (9) addresses most of the concerns in the empirical trade literature, it does not tackle the “zeros” issue. Santos Silva and Tenreyro (SST 2006) present the Poisson Pseudo-Maximum Likelihood (PPML) model as an appealing solution to deal with the bias associated with omitting zero trade flows. The PPML method estimates the gravity equation multiplicatively without taking the logarithm of x_{ijt} along with the additional assumption that the conditional variance is proportional to the conditional mean. According to SST (2006), the PPML model is robust to different patterns of heteroskedasticity and provides a natural way to address the “zeros” issue. The PPML model is estimated by solving the following first order conditions:

$$(12) \quad \sum_{ij} \left(X^{ij} - \exp(Z^{ij} \hat{\beta}) \right) = 0$$

¹⁷ The more tests we perform on a sample of data the more likely we are to reject the null when it is true. In a purely statistical sense, null hypotheses are rejected when an unusual event occurs, but the larger the number of tests the easier it is to find such unusual events. This problem is also referred to as inflation of the alpha significance level.

where, ij denotes country-pairs, X^{ij} is the levels value of unidirectional exports, Z^{ij} is the full vector of gravity equation covariates, including the RTA variables, and $E(\exp)$ is the expected value (exponentiation) function. The variables in Z^{ij} can be in logarithms and the estimated coefficients can be interpreted as elasticities even though the dependent variable is in levels. Importantly, the PPML model produces consistent estimates provided, $E(X^{ij} | Z^{ij}) = \exp(Z^{ij} \hat{\beta})$ is satisfied even if the data are not count variables (see Wooldridge 2002, p. 676).¹⁸

4. Data

We assemble a novel dataset of agricultural trade flows covering 44 years of data (1964-2008), 206 countries, and 206 bilateral and regional trade agreements (see Appendix Tables A and B, respectively). The trade data are based on countries' reported import notifications to the United Nation's Commodity Trade Statistics (Comtrade) using Standard Industrial Trade Classification (SITC, revision 1) product codes. Bilateral import values are collected on a nominal basis since inappropriate deflation of trade flows – Baldwin and Taglioni's (2006) so called “Bronze Medal Error” – can be corrected by employing time-varying country fixed effects (equation (9)). Following Feenstra et al. (2005), mirrored trade flows, defined as the exporters' reported exports, are employed when the reporting countries' imports are missing. The WTO's Multilateral Trade Negotiation (MTN) categories are used to classify agricultural goods.¹⁹

¹⁸ Sun and Reed (2010) provide a recent application of the PPML estimator to regional integration issues in agriculture but considered only five RTAs (one DIA, three MIAs and one SIA). Moreover, the authors considered a much shorter timeframe from 1993-2007 (at three-year intervals) which leads one to question whether the authors have sufficient data to identify RTA trade impacts in a “before-and-after” style analysis (i.e. NAFTA entered into force in 1994, the very first year of their three-year averaged panel (i.e., 1993-1995)).

¹⁹ The WTO's MTN categories for agriculture are: (1) animal and meat products; (2) dairy; (3) fruits, vegetables and plants; (4) coffee, tea, and spices; (5) cereals and preparations; (6) oilseeds, fats and oils; (7) sugar; (8) beverages and tobacco; (9) cotton; and (10) other agriculture (confectionary products, hides and skins, etc.). See http://www.wto.org/english/res_e/booksp_e/tariff_profiles06_e.pdf (pgs. 24-25) for more details.

Distance, arable land areas, common borders and language, landlocked countries, and colonial linkages are taken from the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII) geo-distance dataset developed by Mayer and Zignago (2006).²⁰ GDP data are taken from two sources: the World Bank's (WB) World Development Indicators (WDI) and the United Nation's National Accounts Main Aggregates Database.²¹ Information on regional trade agreements is taken from the WTO's newly enhanced Regional Trade Agreements Information System (RTA-IS).²² In 2010, the WTO reports that 286 RTAs were in force. However, because RTAs covering trade in services are also required to be notified, some agreements are double counted – once when the RTA is notified under Article XXIV covering trade in goods and again if the same RTA is notified under Article V covering trade in services. The US-Morocco FTA, all seven EU enlargements (6 members in 1958, 9 members in 1973, 10 members in 1981, 12 members in 1986, 15 members in 1995, 25 members in 2004, and 27 members in 2007), and many others appear twice for this reason.²³ Removing 80 duplicate agreements leaves a total of 206 agreements ($286 - 80 = 206$) as shown in Appendix Table A. However, the final year in the bilateral trade dataset is 2008, which leaves us with 180 agreements for use in the empirical analysis.

The completed (unbalanced) dataset spans the period 1964-2008 at four year intervals (1964, 1968, 1972, ..., 2008) and contains a total 302,289 observations. Of this total, 48 (52)

²⁰ CEPII is an independent European research institute on the international economy stationed in Paris, France. CEPII's research program and datasets can be accessed at www.cepii.com. CEPII uses the great circle formula to calculate the geographic distance between countries, referenced by latitudes and longitudes of the largest urban agglomerations in terms of population.

²¹ In some cases (i.e., Taiwan), we use GDP data from the Penn World Tables (6.3) to supplement WB and UN data when it is incomplete or missing. WB Development Indicators can be accessed at:

<http://databank.worldbank.org/data/home.aspx>, and UN GDP data can be retrieved at:

<http://unstats.un.org/unsd/snaama/dnllist.asp>. Penn World Tables can be accessed at the Center for International Comparisons at the University of Pennsylvania's website: <http://pwt.econ.upenn.edu/>

²² Available at: <http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx>

²³ One could also make the case that the various EU expansions from six to 27 members should be treated as a single agreement with accessions. However, in Appendix Table A we follow the WTO and count each EU enlargement as a separate RTA. In the empirical analysis, the EU is dynamically coded to reflect its changing membership over time.

percent, or 146,504 (155,785) are zero (positive) trade flows.²⁴ Eleven percent (16,514) of positive bilateral trade occurs between RTA partners. The number of positive trade flows for DIAs, MIAs, and SIAs corresponds to 5,048, 6,890, and 4,576 observations, respectively. Interestingly, the number of MIAs in force is more than eight times that of DIAs and SIAs (Figure 1). Yet, the number of country-pair observations in MIAs (6,890) is not eight times larger than the number of observations making up DIAs (5,048) and SIAs (4,576). This suggests that the latter encompass more countries *per agreement* whereas bilateral relationships dominate the former.

5. Results

The econometric results are organized in three sections. Section one (*The Hierarchy of RTAs*) compares the canonical gravity equation with a more flexible specification that controls for RTAs with varying depths of regional integration. Section two (*The Hierarchy of RTAs with Phase-ins*) controls for phase-in periods of RTA trade liberalization. Finally, section three (*Robustness Checks*) proceeds to a set of robustness checks that hinge on: (i) subsets of the data; (ii) bilateral RTAs; (iii) regional disaggregation of DIAs; and (iv) zero trade flow values.

5.1 *The Hierarchy of RTAs*

We begin by investigating whether deeper integration explains the large agricultural trade flow effects of RTAs. Table 1 presents the econometric results along with robust standard errors in parentheses. Two regressions are reported in each column: *Generic* and *Depth*. The *Generic* scenario implicitly restricts the trade flow effect of RTAs to be equal across all agreements, whereas the *Depth* scenario allows the RTA coefficient to vary by the depth of regional integration pursued. A multiple comparisons framework is used to test the conventional theory of economic integration.

²⁴ This is consistent with Santos-Silva and Tenreyro (2006) and HMR (2008) who evaluated countries' total merchandise trade and found that nearly 51 percent of country-pairs do not trade.

The gravity equation applied to agricultural trade produces consistent estimates. Economic size (GDP) is positive and statistically significant in all scenarios. Doubling the economic distance between countries roughly halves trade whereas sharing (speaking) a common border (language) and colonial linkages facilitate trade, as expected. Landlocked countries trade less and a larger (smaller) land base in the exporting (importing) nation encourages agricultural trade.

Consistent with previous studies the results reveal that the average RTA significantly increases members' agricultural trade (Grant and Lambert 2008; Vollrath and Hallahan 2011). Focusing on the *Generic* RTA effects (Table 1), the results suggest that RTAs increase members' agricultural trade by 68 percent $((\exp(0.52)-1)*100)$, on average, compared to trade between nonmembers (column 1). With year fixed effects (column 2, *Generic*), RTAs stimulate intra-regional trade by 114 percent $((\exp(0.76)-1)*100)$. Adding country-and-time (*it, jt*) fixed effects to control for multilateral prices (column 3, *Generic*) results in an 82 percent increase in members' trade. Column 4 addresses both multilateral prices and "natural trading partner" effects by incorporating country-and-time (*it, jt*) and bilateral-pair (*ij*) fixed effects (equation (9)). The results are robust. Membership in an RTA increases trade by 51 percent, on average (column 4, generic).²⁵

However, are all RTAs this successful with respect to their effect on members' agricultural trade? Or, do RTA trade increases depend on the depth of trade liberalization pursued by the agreement? The *Depth* scenarios reported in Table 1 shed considerable light and provide new insight on the factors that explain the success of regional integration. Using our preferred specification (column 4, *Depth*), the results suggests that DIAs increase members' trade by a remarkable 127 $((\exp(0.82)-1)*100)$ percent. In other words, deep integration agreements more than doubles members' agricultural trade! By comparison, MIAs (i.e., FTAs) increased members'

²⁵ As expected, Baldwin and Taglioni's (2006) "gold medal error" committed in columns (1) through (3) results in somewhat larger RTA coefficients compared to our preferred specification in column (4).

trade by 31 percent and the effect for SIAs (i.e., partial scope agreements) was economically small and statistically insignificant. Multiple comparisons tests of the hierarchy of RTAs provide further support of the benefits of deeper integration (H_1 - H_3 , Table 1).²⁶ In short, it appears that RTA trade increases are driven almost entirely by the formation of deep integration agreements.

5.2 The Hierarchy of RTAs with Phase-Ins

While illuminating, the results in the previous section may not reflect the cumulative effect of regional integration since almost all RTAs are phased-in over a 10-15 year time horizon. If MIAs and SIAs contain longer transitional periods of trade liberalization compared to DIAs then a binary variable that changes from zero to one using the date the agreement entered into force may underestimate the agreement's long run impact. In Table 2 we consider four, eight, and 12 years of RTA phase-in using one ($t-4$), two ($t-8$), and three ($t-12$) RTA lags, respectively. All regressions reported in Table 2 are estimated on positive trade flows with a comprehensive set of time-varying country specific (it, jt) and bilateral-pair (ij) fixed effects.

Two important results stand out. First, deep integration agreements (DIAs) have persistent effects on trade that are significant up to 12 years (or more) compared to moderate and shallow agreements (MIAs and SIAs). The cumulative effect of DIAs is to increase members' trade by 175 percent $((\exp(0.51+0.50)-1)*100)$ after four years (Scenario 1), increasing to 210 percent $((\exp(0.51+0.35+0.27)-1)*100)$ after eight years (Scenario 2) and a remarkable 246 percent $((\exp(0.56+0.35+0.13+0.20)-1)*100)$ after 12 years (Scenario 3). This compares to trade increases of 46 percent for MIAs after four years and increasing only slightly to 58 percent after 12 years. However, the eight and 12 period lagged MIA coefficients in scenario 3 are not significant. Further, the cumulative effect of SIAs is small and statistically *insignificant* throughout.

²⁶ The one exception is H_3 ($MIA = SIA$) which could not be rejected with a Bonferonni- or Šidák-adjusted significance level of 0.017.

Second, the ranking of RTAs continues to support the theory of economic integration. Table 2 provides the results of our multiple comparisons tests.²⁷ All pairwise tests inclusive of RTA lags support the benefits of deeper integration. DIAs have significantly outperformed their MIA and SIA counterparts, both economically and statistically, in all scenarios. Thus, not only do the results confirm the hierarchical structure of RTAs, they also underscore two important findings. First, MIAs and SIAs (i.e., free trade and partial scope agreements) are limited in their trade creating ability despite the fact that they represent the majority of RTAs in force (Figure 1). Second, previous studies have likely underestimated the impact of deeper integration and overestimated the impacts of moderate and shallow integration agreements.

5.3 Robustness Checks

The forgoing results provide a lot of clarity regarding the proliferation of regionalism. However, it is possible that the results depend on other factors not accounted for in the previous section. First, the recent proliferation of FTAs is characterized by numerous bilateral arrangements. Because these agreements involve only two members, it may be easier to reach an agreement that ambitiously liberalizes agricultural trade. On the other hand, the surge in bilateral agreements may reflect the desire of RTA partners to cover topics outside of the purview of agricultural trade (i.e., national security, migration, financial liberalization, etc.). Second, the impressive trade increases of DIAs could be the result of an “EU effect”. Finally, the previous results may be plagued by sample selection issues due to the omission of zero trade flows (HMR 2008). This final section examines these and other issues. The results are presented in Table 3.

²⁷ Note that the appropriate *Bonferroni* and *Šidák* significance levels are not an issue since the tests (namely H_1 and H_2) are highly significant (p -values < 0.01) or highly insignificant (namely H_3).

Column (1) incorporates country-pair random effects.²⁸ The results indicate that MIAs and SIAs increased bilateral trade by 34 and 45 percent, respectively. However, the trade increase of DIAs exceeds that of MIAs and SIAs by a factor of almost four ($(\exp(0.85)-1)*100 = 134\%$). Column (2) excludes trade less than \$0.5 million since low import values may be subject to large measurement error. The results and ranking of RTAs continues to be robust (H_1-H_3).

Columns (3) through (5) consider potential heterogeneity in the structure of RTAs. Column (3) excludes bilateral MIAs and SIAs and focuses on regional blocs within these categories. This delineation is important because most bilateral FTAs have been implemented very recently compared to long-standing FTA blocs such as the EFTA (1960), CUSTA/NAFTA (1988 and 1994, respectively), and the ASEAN agreement (1992). Interestingly, however, omitting bilateral MIAs and SIAs changes the results very little (column (3); H_1-H_3).

Conversely, column (4) considers only bilateral MIAs and SIAs. Compared to regional blocs, bilateral agreements may be able to secure deeper trade liberalization commitments because there are fewer stakeholders involved. Again, however, this modification does not affect the results. Column (5) considers OECD (industrialized) and non-OECD (developing countries) trade within each RTA type. Two interesting results emerge. First, non-OECD MIA members trade significantly more than their OECD counterparts, suggesting that MIAs yield important market access opportunities for trade between developing countries. On the other hand, it could also suggest that pre-existing trade policies among OECD members were already liberalized before the formation of an RTA. Second, not reported in Table 3 is the fact that differences between OECD and non-OECD member trade within DIAs could not be rejected ($F\text{-Statistic} = 0.32$, $p\text{-value} = 0.57$). This suggests that, in

²⁸ The use of fixed effects is well supported in the empirical trade literature since a random effects specification assumes all unobserved country-pair factors are uncorrelated with the explanatory variables (Egger 2000; Egger and Pfaffermayr 2003). The Hausman Test of fixed versus random effects is easily rejected in column (1) of Table 3, thus supporting the use of fixed effects.

contrast to MIAs, deeper integration benefits both sets of countries relatively equally. Thus, the results continue to support the hierarchy of regionalism (H₁-H₆).

In column (6), we consider an “EU effect”. The large and robust DIA effect reported in all previous scenarios may be driven by the deepening and continuous expansion of the European Union. In this specification, two DIA variables are created: (i) a dummy variable for all DIAs *excluding* the EU, and (ii) a dummy variable for the EU and its various enlargements. The results confirm the fact that the EU has been one of the strongest trade creating DIA formations (H₇ and H₈) in world agricultural trade, increasing members’ agricultural trade by 177 percent, on average.²⁹ However, non-EU DIAs increased members’ trade by 82 percent, which is more than double the modest 32 percent increase in MIA trade and the insignificant effect for SIAs. More importantly, the ranking of regional integration that compares DIAs (purged of an EU effect) with MIAs and SIAs remains unchanged (H₁-H₃, column (6)).

If DIAs provide such tantalizing benefits, then it seems reasonable to examine which of these agreements is responsible for the large agricultural trade flow effects. To facilitate this comparison, column (7) groups each DIA into a geographical region (Americas, Africa, Middle East/Former Soviet Union countries (ME/Svt. Union), and Europe (including the EU) (see footnote to Table 3 for a list of DIAs in each region). The results are striking: with the exception of the Gulf Cooperation Council (GCC) and the Eurasian Economic Community (EAEC) agreements in the ME/Svt. Union region, deep integration agreements are equally responsible for the large agricultural trade flow increase among member countries!

While the above results provide a lot of clarity with respect to the effects of regionalism, it is possible that they are biased because of the log-linearization of the gravity equation. The final

²⁹ Although not reported in Table 3, testing the equality of the trade flow effect of DIAs (excluding the EU) and the EU coefficient is easily rejected (F-Stat = 13.8; p-value = 0.00).

two specifications in Table 3 (columns (8) and (9)) consider nonlinear PPML and negative binomial models, inclusive of zero trade flows.³⁰ The results are remarkably robust. The PPML fixed effects estimator suggests that DIAs double members' trade (103 percent or $(\exp(0.71)-1)*100$). The negative binomial model changes the results very little, with the exception of a negative and significant SIA coefficient. Hence, countries looking to expand existing agricultural markets and open new ones can do so by deepening their regional integration initiatives.

6. Conclusions

The proliferation of regional trade agreements is not only viewed as one of the most important international economic developments since the post-war era but it has also intensified the debate on the desirability of these agreements vis-à-vis the multilateral system (Panagariya 2002; Baldwin and Thorton 2008). Counting RTAs, as has been popularized by the WTO, reveals that most countries, and all WTO Members, are party to at least one RTA and many belong to multiple alliances. Crawford and Fiorentino (2005) surveyed the state of RTAs and concluded that we have entered "one of the most prolific RTA periods in recorded history" (p. 1).

However, the trade liberalizing ambition of RTAs differs dramatically which leaves open the question of whether the world economy is actually becoming more regionalized? Focusing on agricultural trade, a sensitive sector both regionally and multilaterally, this article investigated the trade creating potential of three types of RTAs with varying levels of trade liberalization ambition: "shallow" (i.e., partial scope arrangements), "moderate" (i.e., free trade agreements), and "deep" (i.e., customs unions, common markets and single economic unions) integration agreements. Despite increased attention being paid to the growth of regionalism, the results reveal that while

³⁰ The PPML model has been criticized because it assumes equal dispersion between the conditional mean and variance (Cameron and Trivedi 1990). The negative binomial estimator allows for the second conditional moment to differ from the first and therefore can accommodate problems of over or under dispersion in the data.

some agreements are important, others are largely inconsequential. Deep integration agreements, on the other hand, are largely responsible for the impressive agricultural trade increases reported in the literature. These agreements increased members' agricultural trade by 127 percent on average and by a remarkable 246 percent after 12 years of implementation and phase-in. Moreover, multiple comparisons tests of the hierarchy of RTAs largely confirm the theory (Balassa 1961; Viner 1950; Meade 1955): the benefits of regionalism are an increasing function of the depth of economic integration.

The implication is clear. Although partial scope and free trade agreements appear to be the trade policy instrument of choice, policy-makers would do well to reflect on the positive benefits of deeper integration. Moving beyond shallow and moderate integration generates sizeable trade flow gains and creates an atmosphere conducive to commercial exchange. This suggests that deepening free trade agreements such as NAFTA will offer important benefits for agricultural trade.

But there is perhaps a more important policy implication that has surfaced in this article. Much of the policy debate concerns the fact that regionalism is a force competing with, and potentially surpassing, the multilateral framework. Yet, tabulating the RTA statistics reveals that "shallow" and "moderate" integration agreements collectively account for 90 percent of RTAs currently in force (Figure 1). With relatively modest trade flow impacts, perhaps these agreements are being motivated for reasons other than agricultural trade liberalization. Such factors could include bargaining power whereby regional blocs are able to secure more in international negotiations than each country acting independently (Baldwin 2008), confronting cross-border problems such as national security, migration, or service sector liberalization. On the other hand, it is hard to escape the conclusion that the growth of regionalism may not be as significant as the headlines suggest, at least with respect to agricultural trade.

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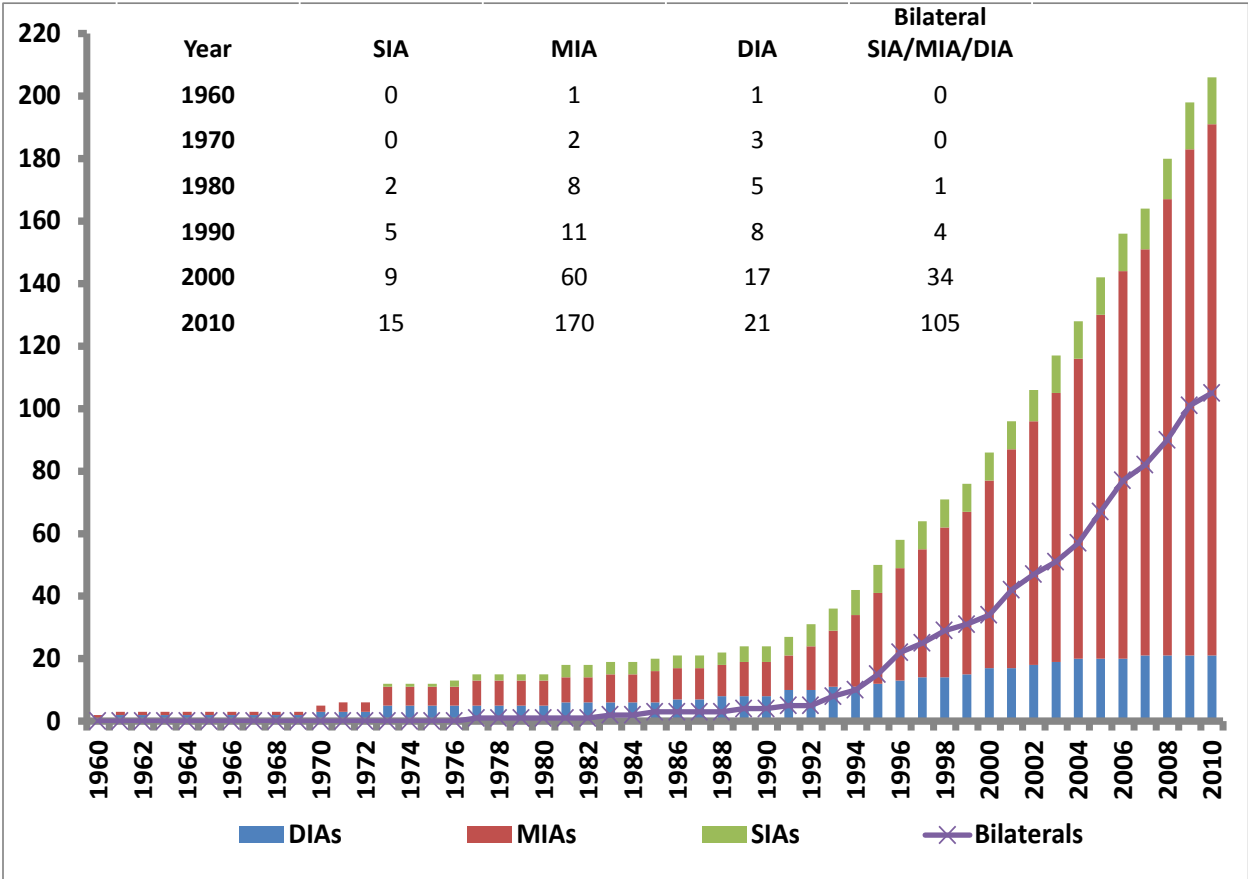
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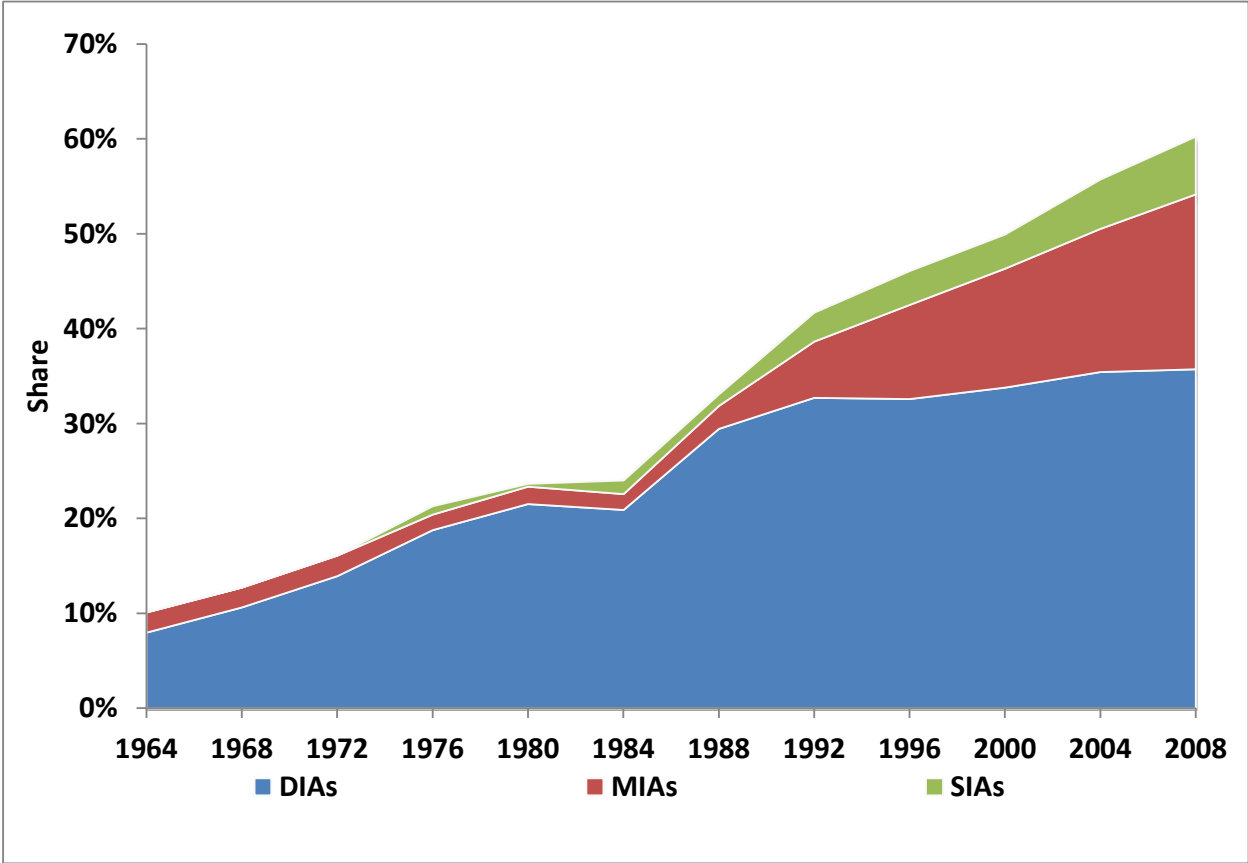
Figure 1. Regional Trade Agreement Notifications by Type of Agreement, 1960-2010



Notes: The figure and embedded table depicts cumulative RTAs entered into force by year and type of agreement. DIA denotes deep integration agreements (i.e., customs, common markets and economic unions); MIA denotes moderate integration agreements (i.e., free trade agreements); and SIA denotes shallow integration agreements (i.e., partial scope arrangements). Bilateral RTAs are defined as those agreements encompassing only two countries and are not in addition to the totals of the columns labeled DIA, MIA and SIAs.

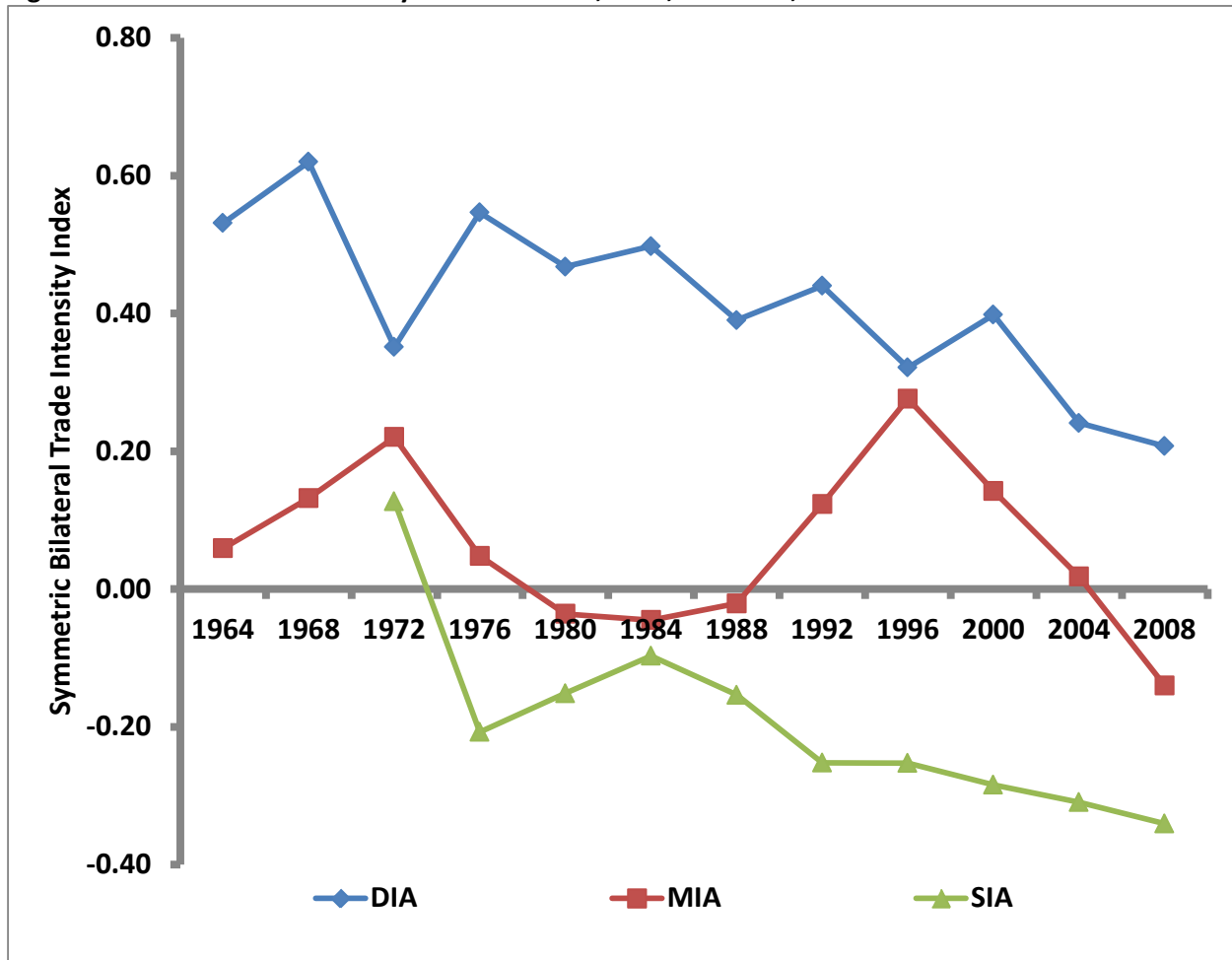
Source: http://www.wto.org/english/tratop_e/region_e/region_e.htm

Figure 2. Share of RTA Trade in World Agricultural Trade by Type of Agreement, 1964-2008



Source: Authors' calculation based on a new bilateral dataset of agricultural trade from 1964-2008, collected from the United Nation's Commodity Trade Statistics Database (Comtrade) using the Standard Industrial Trade Classification (SITC, revision 1)

Figure 3. Bilateral Trade Intensity Indices for CUs, FTAs, and PSAs, 1964-2008.



Notes: Plotted are the mean symmetric bilateral trade indices (SBTTI) of deep integration agreements (i.e., customs unions), moderate integration agreements (i.e., free trade agreements), and shallow integration agreements (i.e., partial scope arrangements). The SBTTI is a bilateral intensity index on the domain $\{-1,+1\}$ reflecting partner countries for which the reporter's exports are concentrated. Averaging the SBTTI by year and RTA type yields the values plotted in the figure for DIAs, MIAs and SIAs.

Table 1. Trade Flow Effects of Heterogeneous RTAs, Panel Data 1964-2008

	(1) No FE		(2) Year FE		(3) Country-Time FE		(4) Bilateral-Pair & Country-Time FE	
	<i>Generic</i>	<i>Depth</i>	<i>Generic</i>	<i>Depth</i>	<i>Generic</i>	<i>Depth</i>	<i>Generic</i>	<i>Depth</i>
<i>GDP (it)</i>	0.52*** (0.00)	0.51*** (0.00)	0.62*** (0.01)	0.62*** (0.01)				
<i>GDP (jt)</i>	0.58*** (0.00)	0.58*** (0.00)	0.68*** (0.01)	0.68*** (0.01)				
<i>Distance (ij)</i>	-0.83*** (0.01)	-0.80*** (0.01)	-0.80*** (0.02)	-0.76*** (0.02)	-1.03*** (0.01)	-1.00*** (0.01)		
<i>Contiguity (ij)</i>	0.75*** (0.04)	0.75*** (0.04)	0.78*** (0.08)	0.78*** (0.08)	0.60*** (0.03)	0.61*** (0.03)		
<i>Language (ij)</i>	0.59*** (0.02)	0.59*** (0.02)	0.68*** (0.03)	0.68*** (0.03)	0.52*** (0.02)	0.52*** (0.02)		
<i>Colony (ij)</i>	1.75*** (0.04)	1.76*** (0.03)	1.51*** (0.09)	1.52*** (0.09)	1.38*** (0.03)	1.40*** (0.03)		
<i>Landlocked (i)</i>	-0.32*** (0.02)	-0.31*** (0.02)	-0.12*** (0.03)	-0.12*** (0.03)				
<i>Landlocked (j)</i>	-0.46*** (0.02)	-0.45*** (0.02)	-0.28*** (0.03)	-0.27*** (0.03)				
<i>Land Area (i)</i>	0.15*** (0.00)	0.15*** (0.00)	0.09*** (0.01)	0.09*** (0.01)				
<i>Land Area (j)</i>	-0.02*** (0.00)	-0.01*** (0.00)	-0.08*** (0.01)	-0.07*** (0.01)				
<i>RTA (ijt)</i>	0.52*** (0.02)		0.76*** (0.04)		0.60*** (0.02)		0.41*** (0.04)	
<i>DIA (ijt)</i>		1.20*** (0.03)		1.44*** (0.06)		1.02*** (0.03)		0.82*** (0.05)
<i>MIA (ijt)</i>		0.37*** (0.03)		0.68*** (0.05)		0.69*** (0.03)		0.27*** (0.04)
<i>SIA (ijt)</i>		0.01 (0.04)		0.12 (0.08)		0.01 (0.04)		0.04 (0.10)
<i>H₁: DIA = MIA</i>		465.4*** (0.00)		134.3*** (0.00)		82.6*** (0.00)		76.4*** (0.00)
<i>H₂: DIA = SIA</i>		542.9*** (0.00)		187.7*** (0.00)		370.8*** (0.00)		50.6*** (0.00)
<i>H₃: MIA = SIA</i>		51.9*** (0.00)		36.8*** (0.00)		175.5*** (0.00)		4.89 (0.03)
<i>N</i>	152,041	152,041	152,041	152,041	155,146	155,146	155,785	155,785
<i>Adj. R²</i>	0.43	0.43	0.45	0.46	0.54	0.54	0.83	0.83
<i>RMSE</i>	2.31	2.31	2.27	2.26	2.09	2.08	1.42	1.42

Notes: the dependent variable is the natural log of bilateral imports. Robust standard errors are in parentheses except for hypotheses tests H_1 - H_3 which report p-values. One, two, and three asterisks denote significance at the ten, five and one percent levels, respectively. FE denotes fixed effects. Two regressions are reported in each of the four scenarios. The *Generic* scenarios present the average treatment effect of all RTAs and the *Depth* scenarios allow the trade flow effect of RTAs to differ depending on whether the agreement is a DIA, MIA, or SIA.

Table 2. Trade Flow Effects of Heterogeneous RTAs with Phase-ins, Panel Data, 1964-2008

	Concurrent (t-0)	One Lag (t-4)	Two Lags (t-8)	Three Lags (t-12)	Cumulative Trade Increase (%)	H1: DIA = MIA	H2: DIA = SIA	H3: MIA = SIA	N	Adj. R ²	RMSE
Scenario 1: One Lag											
<i>RTA</i>	0.28*** (0.03)	0.24*** (0.04)			68%				147,695	0.83	1.41
<i>DIA</i>	0.51*** (0.05)	0.50*** (0.05)			174%						
<i>MIA</i>	0.20*** (0.04)	0.18*** (0.05)			46%	81.6*** (0.00)	56.4*** (0.00)	5.53*** (0.00)	147,695	0.83	1.41
<i>SIA</i>	0.14 (0.10)	-0.16 (0.10)			0%						
Scenario 2: Two Lags											
<i>RTA</i>	0.27*** (0.04)	0.20*** (0.04)	0.10*** (0.04)		77%				136,704	0.84	1.39
<i>DIA</i>	0.51*** (0.06)	0.35*** (0.05)	0.27*** (0.06)		209%						
<i>MIA</i>	0.18*** (0.04)	0.14*** (0.05)	0.10* (0.05)		52%	73.1*** (0.00)	43.9*** (0.00)	2.30 (0.13)	136,704	0.84	1.39
<i>SIA</i>	0.12 (0.10)	-0.09 (0.11)	-0.06 (0.10)		0%						
Scenario 3: Three Lags											
<i>RTA</i>	0.27*** (0.04)	0.22*** (0.04)	0.07 (0.04)	0.09* (0.05)	79%				123,738	0.85	1.36
<i>DIA</i>	0.56*** (0.06)	0.35*** (0.05)	0.13* (0.07)	0.20*** (0.07)	246%						
<i>MIA</i>	0.17*** (0.04)	0.15*** (0.05)	0.07 (0.06)	0.07 (0.07)	58%	55.5*** (0.00)	33.3*** (0.00)	1.87 (0.17)	123,738	0.85	1.36
<i>SIA</i>	0.10 (0.10)	-0.05 (0.11)	-0.01 (0.11)	-0.05 (0.11)	0%						

Notes: the dependent variable is the natural logarithm of bilateral trade. All regressions include time-varying country-specific (*it*, *jt*) and bilateral-pair (*ij*) fixed effects. Robust standard errors are in parentheses except for the hypotheses tests which report *p-values*. One, two, and three asterisks denote significance at the ten, five and one percent levels, respectively. The Cumulative Trade Increase is calculated by exponentiation of the sum of the concurrent, four (*t-4*), eight (*t-8*) and twelve (*t-12*) year lagged coefficients. DIA, MIA and SIA denote deep, moderate, and shallow integration agreements, respectively. Rows labeled RTA refer to separate regressions of the generic trade flow effects of all regional trade agreements (i.e., no differentiation according to depth).

Table 3. Robustness Checks

	(1) Country-Pair Random Effects	(2) Trade > \$0.5 Mil.	(3) Excluding Bilateral MIAs/SIAs	(4) Bilateral MIAs/SIAs	(5) OECD & Non-OECD Members	(6) "EU Effect"	(7) Regional Split of DIAs	(8) PPML Model ^a	(9) Negative Binomial Model ^a
DIA	0.85*** (0.03)	0.91*** (0.04)	0.82*** (0.05)	0.79*** (0.05)		0.60*** (0.10)		0.71*** (0.05)	0.69*** (0.02)
MIA	0.29*** (0.02)	0.27*** (0.04)	0.27*** (0.04)	0.32** (0.14)		0.28*** (0.04)	0.27*** (0.04)	0.29*** (0.08)	0.25*** (0.02)
SIA	0.37*** (0.05)	0.18** (0.08)	0.05 (0.10)	-0.48** (0.20)		0.03 (0.10)	0.04 (0.10)	0.27** (0.11)	-0.05* (0.03)
EU						1.02*** (0.06)			
DIA OECD Members					0.84*** (0.07)				
DIA Non-OECD Members					0.77*** (0.10)				
MIA OECD Members					0.10 (0.05)				
MIA Non-OECD Members					0.49*** (0.07)				
SIA OECD Members					-0.30 (0.68)				
SIA Non-OECD Members					0.07 (0.10)				
DIAs (Americas)							0.80*** (0.19)		
DIAs (Africa)							0.82*** (0.16)		
DIAs (ME/Svt. Union)							0.12 (0.19)		
DIAs (Europe)							0.89*** (0.06)		
Hypotheses Tests									
H ₁ : DIA = MIA (OECD Members, col. 5)	269.5*** (0.00)	156.7*** (0.00)	74.5*** (0.00)	9.65*** (0.00)	47.6*** (0.00)	7.72*** (0.00)		23.9*** (0.00)	18.5*** (0.00)
H ₂ : DIA = SIA (OECD Members, col. 5)	71.3*** (0.00)	60.3*** (0.00)	48.9*** (0.00)	36.9*** (0.00)	2.73* (0.10)	16.8*** (0.00)		23.7*** (0.00)	19.8*** (0.00)
H ₃ : MIA = SIA (OECD Members, col. 5)	2.05 (0.15)	0.97 (0.32)	4.33** (0.04)	10.5*** (0.00)	0.34 (0.56)	6.14** (0.01)		0.17 (0.68)	0.26 (0.61)
H ₄ : DIA = MIA (Non-OECD Members)					4.96** (0.03)				

H₅: DIA = SIA (Non-OECD Members)						24.98***			
						(0.00)			
H₆: MIA = SIA (Non-OECD Members)						12.56***			
						(0.00)			
H₇: EU = MIA							133.3***		
							(0.00)		
H₈: EU = PSA							79.8***		
							(0.00)		
H₉: DIA^{Americas} = MIA								7.07***	
								(0.00)	
H₁₀: DIA^{Africa} = MIA								10.6***	
								(0.00)	
H₁₁: DIA^{Svt/ME} = MIA								0.60	
								(0.44)	
H₁₂: DIA^{Europe} = MIA								90.5***	
								(0.00)	
H₁₃: DIA^{Americas} = SIA								13.2***	
								(0.00)	
H₁₄: DIA^{Africa} = SIA								17.3***	
								(0.00)	
H₁₅: DIA^{Svt/ME} = SIA								0.14	
								(0.71)	
H₁₆: DIA^{Europe} = SIA								57.2***	
								(0.00)	
N	152,041	75,072	155,437	155,785	155,785	155,785	155,785	266,386	266,386
Adj. R²	0.84	0.85	0.83	0.83	0.83	0.83	0.83	----	----
RMSE	1.50	0.75	1.42	1.42	1.42	1.42	1.42	----	----

Notes: the dependent variable is the natural logarithm of bilateral trade. Robust standard errors are in parentheses except for the hypothesis tests which report p-values. One, two, and three asterisks denote significance at the ten, five and one percent levels, respectively. Except for columns 1, 8, and 9 which include bilateral-pair fixed effects, all regressions include time-varying country-specific and bilateral-pair fixed effects. DIA, MIA and SIA denote deep, moderate and shallow integration agreements, respectively. Mercosur, Andean, CACM, and Caricom are considered DIAs in the Americas; CEMAC, EAC, ECOWAS, SACU, and WAEMU/UEMOA make up the DIAs in Africa; GCC and EAEC make up the DIAs in the ME/Former Svt. Union (ME = Middle East); and all EU expansions along with the EU-Andorra, EU-San Marino, and EU-Turkey agreements make up the DIAs in Europe.

^{a/} Regression includes zero trade flows.

Appendix Table A. RTA Database (sorted by date of entry into force)

Customs Unions, Common Markets and Economic Unions (21)			
EC Treaty(1958)	EC (12) Enlargement(1986)	EC - Turkey(1996)	Gulf Cooperation Council(2003)
Central Amer. Common Market(1961)	Andean Community(1988)	Eurasian Economic Community(1997)	EC (25) Enlargement (2004)
Southern African Customs Union(1970)	South Common Market (Mercosur)(1991)	Ec./Monetary Comm. of Central Africa(1999)	EC (27) Enlargement(2007)
EC (9) Enlargement(1973)	EC - Andorra(1991)	East African Community(2000)	
Caribbean Common Market (1973)	Ec. Community of West Africa (1993)	West Africa Economic/Monetary Union(2000)	
EC (10) Enlargement(1981)	EC (15) Enlargement(1995)	EU - San Marino(2002)	
Free Trade Agreements (170)			
European Free Trade Assoc.(EFTA)(1960)	Kyrgyz Republic - Ukraine(1998)	China - Hong Kong, China(2004)	Turkey - Syria(2007)
EFTA - Iceland(1970)	Kyrgyz Republic - Uzbekistan(1998)	China - Macao, China(2004)	ASEAN - Japan(2008)
EC – Overseas Territories(1971)	Mexico - Nicaragua(1998)	Common Economic Zone(2004)	Brunei Darussalam - Japan(2008)
EC - Iceland(1973)	Pan-Arab Free Trade Area(1998)	EC - Egypt(2004)	China - New Zealand(2008)
EC - Norway(1973)	Ukraine - Kazakhstan(1998)	EC - Macedonia (2004)	EC – Bosnia/Herzegovina(2008)
EC - Switzerland - Liechtenstein(1973)	Chile - Mexico(1999)	EFTA - Chile(2004)	EC - CARIFORUM States (2008)
Australia - Papua New Guinea(1977)	EFTA - Morocco(1999)	Korea, Republic of - Chile(2004)	EFTA - SACU(2008)
EC - Syria(1977)	EFTA - Palestinian Authority(1999)	Panama Taiwan (2004)	Honduras – Taiwan (2008)
Australia - New Zealand(1983)	Georgia - Kazakhstan(1999)	US - Chile(2004)	El Salvador – Taiwan (2008)
US - Israel(1985)	EC - Israel(2000)	US - Singapore(2004)	Japan – Indonesia (2008)
Canada-US Free Trade Agreement(1989)	EC - Mexico(2000)	EC - Algeria(2005)	Japan - Philippines(2008)
ASEAN Free Trade Area(1992)	EC - Morocco(2000)	EC - Chile(2005)	Nicaragua Taiwan (2008)
Central Europe Free Trade Assoc.(1960)	EC - South Africa(2000)	EC - Croatia(2005)	Pakistan – Malaysia(2008)
EFTA - Turkey(1992)	Georgia - Turkmenistan(2000)	EFTA - Tunisia(2005)	Panama - Chile(2008)
Armenia - Russian Federation(1993)	Israel - Mexico(2000)	India - Singapore(2005)	Panama - Costa Rica(2008)
EFTA - Israel(1993)	South African Dev. Community(2000)	Japan - Mexico(2005)	Turkey - Albania(2008)
Faroe Islands - Norway(1993)	Turkey - Macedonia(2000)	Jordan - Singapore(2005)	Turkey - Georgia(2008)
Kyrgyz Rep. - Russian Federation(1993)	Armenia - Kazakhstan(2001)	Pakistan - Sri Lanka(2005)	Australia - Chile(2009)
Common Mkt. East/South Africa(1994)	EFTA - Macedonia(2001)	Thailand - Australia(2005)	Canada - EFTA(2009)
Commonwealth of Indep. States (1994)	EFTA - Mexico(2001)	Thailand - New Zealand(2005)	Canada - Peru(2009)
Georgia - Russian Federation(1994)	India - Sri Lanka(2001)	Turkey - Palestinian Authority(2005)	Chile - Colombia(2009)
N. Amer. Free Trade Agreement(1994)	Mexico - El Salvador(2001)	Turkey - Tunisia(2005)	China - Singapore(2009)
Ukraine - Russian Federation(1994)	Mexico – Guatemala(2001)	Ukraine - Moldova(2005)	EC - Albania(2009)
Armenia - Moldova(1995)	Mexico - Honduras(2001)	US - Australia(2005)	EC - Cameroon(2009)
Costa Rica - Mexico(1995)	New Zealand - Singapore(2001)	Chile - China(2006)	EC - Côte d'Ivoire(2009)
Faroe Islands - Switzerland(1995)	Ukraine - Macedonia (2001)	Dominican Rep.-Central America-USA(2006)	Japan - Switzerland (2009)
Kyrgyz Republic - Armenia(1995)	US - Jordan (2001)	EFTA - Korea, Republic of(2006)	Japan - Viet Nam (2009)
Kyrgyz Republic - Kazakhstan(1995)	Canada - Costa Rica(2002)	Iceland - Faroe Islands(2006)	Korea, Republic of - ASEAN(2009)
Ukraine -Turkmenistan(1995)	Chile - Costa Rica(2002)	India - Bhutan(2006)	Pakistan - China(2009)
Armenia - Turkmenistan(1996)	Chile - El Salvador (2002)	Japan - Malaysia(2006)	Panama - Honduras(2009)
Armenia - Ukraine(1996)	EC - Jordan(2002)	Korea, Republic of - Singapore(2006)	Peru - Singapore(2009)
Georgia - Azerbaijan (1996)	EFTA - Croatia (2002)	Panama - Singapore(2006)	US - Oman(2009)
Georgia - Ukraine (1996)	EFTA - Jordan (2002)	South Asian Free Trade Agreement(2006)	US - Peru(2009)
Kyrgyz Republic - Moldova(1996)	Japan - Singapore(2002)	Trans-Pacific Economic Partnership(2006)	ASEAN-Australia-New Zealand(2010)
Ukraine - Azerbaijan(1996)	Ukraine - Tajikistan(2002)	Turkey - Morocco(2006)	ASEAN - India(2010)
Ukraine - Uzbekistan(1996)	CEFTA – Croatia (2003)	Ukraine - Belarus(2006)	EC - Montenegro(2010)
Canada - Chile(1997)	EC - Lebanon(2003)	US - Bahrain(2006)	EU - Serbia(2010)
Canada - Israel(1997)	EFTA - Singapore(2003)	US - Morocco(2006)	Korea, Republic of - India(2010)
EC - Faroe Islands(1997)	Pacific Island Trade Agreement(2003)	Chile - Japan(2007)	Peru - China(2010)
EC - Palestinian Authority(1997)	Panama - El Salvador(2003)	EFTA - Egypt(2007)	Turkey - Montenegro(2010)
Turkey - Israel(1997)	Singapore - Australia(2003)	EFTA - Lebanon(2007)	Turkey - Serbia(2010)
EC - Tunisia(1998)	Turkey – Bosnia/Herzegovina(2003)	Egypt - Turkey(2007)	
Georgia - Armenia (1998)	Turkey - Croatia(2003)	Japan - Thailand(2007)	
Partial Scope Arrangements (15)			
Protocol on Trade Negotiations(1973)	Global System of Trade Pref. (1989)	S. Asian Pref. Trade Arrangement(1995)	Chile - India(2007)
Asia Pacific Trade Agreement(1976)	Laos-Thailand(1991)	Asia Pacific Agreement-China(2002)	India - Nepal(2009)
Latin American Integration Assoc.(1981)	Econ. Cooperation Organization (1992)	India - Afghanistan(2003)	Mercosur - India(2009)
South Pacific Coop. Agreement(1981)	Melanesian Spearhead Group(1994)	ASEAN - China(2003)	

Note: Total = 206 RTAs

Appendix Table B. List of Countries by Region (number of countries in parentheses)

North America (3)				
Canada	Mexico	United States		
Other Americas (including Caribbean) (45)				
Anguilla	Antigua and Barbuda	Argentina	Aruba	Bahamas
Barbados	Belize	Bermuda	Bolivia	Brazil
British Virgin islands	Cayman Islands	Chile	Colombia	Costa Rica
Cuba	Dominica	Dominican Republic	Ecuador	El Salvador
Greenland	Grenada	Guadeloupe	Guatemala	Guyana
Haiti	Honduras	Jamaica	Mauritania	Montserrat
Netherlands Antilles	Nicaragua	Panama	Paraguay	Peru
Saint Kitts and Nevis	Saint Lucia	Saint Pierre & Miquelon	Saint Vincent & Grenadines	Suriname
Trinidad and Tobago	Turks and Caicos Islands	Uruguay	Venezuela	U.S. Virgin Islands
Asia (50)				
Afghanistan	Armenia	Azerbaijan	Bahrain	Bangladesh
Bhutan	Brunei Darussalam	Cambodia	China	China, Hong Kong SAR
China, Macau	Cyprus	Georgia	India	Indonesia
Iran	Iraq	Israel	Japan	Jordan
North Korea	South Korea	Kuwait	Kyrgyzstan	Laos
Kazakhstan	Latvia	Malaysia	Maldives	Mongolia
Myanmar	Nepal	Oman	Pakistan	Palestinian Territory
Philippines	Qatar	Saudi Arabia	Singapore	Sri Lanka
Syrian Arab Republic	Taiwan	Tajikistan	Thailand	Turkey
Turkmenistan	United Arab Emirates	Uzbekistan	Vietnam	Yemen
Africa (54)				
Algeria	Angola	Benin	Botswana	Burkina Faso
Burundi	Côte d'Ivoire	Cameroon	Cape Verde	Central African Republic
Chad	Comoros	Congo	Congo, DMR	Djibouti
Egypt	Equatorial Guinea	Eritrea	Ethiopia	Gabon
Gambia	Ghana	Guinea	Guinea-Bissau	Kenya
Lesotho	Liberia	Libya	Madagascar	Malawi
Mali	Mauritius	Mayotte	Morocco	Mozambique
Namibia	Niger	Nigeria	Rwanda	Saint Helena
Sao Tome and Principe	Senegal	Seychelles	Sierra Leone	Somalia
South Africa	Sudan	Swaziland	Tanzania	Togo
Tunisia	Uganda	Zambia	Zimbabwe	
Europe (39)				
Andorra	Austria	Belgium-Luxembourg	Belarus	Bosnia and Herzegovina
Bulgaria	Croatia	Czech Republic	Denmark	Estonia
Finland	France	Germany	Greece	Hungary
Iceland	Ireland	Italy	Lebanon	Lithuania
Macedonia	Malta	Moldova, Republic of	Netherlands	Norway
Poland	Portugal	Romania	Russian Federation	Serbia and Montenegro
Slovakia	Slovenia	Malta	Spain	Sweden
Switzerland	Ukraine	United Kingdom	Former Yugoslavia	
Oceania (15)				
American Samoa	Australia	Cook Islands	Fiji	French Polynesia
Guam	Martinique	New Caledonia	New Zealand	Palau
Papua New Guinea	Samoa	Solomon Islands	Tonga	Vanuatu