Journal of Economic Integration
Vol. 37, No. 4, December 2022, 734-789
https://doi.org/10.11130/jei.2022.37.4.734

pISSN: 1225-651X eISSN: 1976-5525

Trade Liberalization Schedules and Members' Development Characteristics: How are They Connected and Why do They Matter to Trade Agreements?

Khac Lich Hoang[1], and Duc Bao Nguyen[1+]

[1]*VNU University of Economics and Business, Vietnam National University, Hanoi, Vietnam*

Abstract This study examines whether the length of the implementation periods of regional trade agreement (RTA) in relation to trade liberalization schedules and the level of development of member countries affect members' trade. The analysis finds that RTAs formed by partner countries with a similar level of economic development lead to increased trade among members than among North-South RTAs during a shorter transition period of trade and tariff liberalization, regardless of the degree of integration being shallow or deep. The average long-term effects of RTAs formed by developing countries on members' trade diminish 15 years after their implementation. In distinguishing trade direction from developed to developing countries and vice versa, we noted that direction-specific South-North RTAs appear to take less time to see larger increases in Southern exports to the Northern members than direction-specific North-South RTAs do.

Keywords: North-South integration, regional trade agreements, trade liberalization, government procurement

JEL Classifications: F10, F13, F15

Received 22 December 2021, Revised 29 August 2022, Accepted 13 October 2022

I. Introduction

Since the early 1990s, the number of regional trade agreements (RTAs)[1)] has increased dramatically. Particularly, most countries are involved in the worldwide proliferation of RTAs. According to the World Trade Organization (WTO), all 164 members have participated in at least one RTA.[2)]

+Corresponding Author: Duc Bao Nguyen
Professor, VNU University of Economics and Business, Vietnam National University, 144 Xuan Thuy Street, Hanoi, Viet Nam. Email: baond@vnu.edu.vn
Co-Author: Khac Lich Hoang
VNU University of Economics and Business, Vietnam National University, 144 Xuan Thuy Street, Hanoi, Viet Nam. Email: lichhk@vnu.edu.vn
Acknowledgment: We thank Antoine Bouët, Anne-Gaël Vaubourg, François Combarnous, and participants at the 19th European Trade Study Group Conference (Florence), the 8th Doctoriades Workshop (Toulon), the 67th Association Française de Sciences Economiques (AFSE) Congress (Paris), the 28th International Trade and Finance Association Conference (Beijing) and the seminar at GREThA (Bordeaux) for useful suggestions and comments. The author is also grateful to Jeffrey Bergstrand for insightful conversations on an earlier draft of this paper. Any errors or omissions are solely the responsibility of the author. This work was supported by the Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant numbers 502.01-2018.308.

This study aims to answer the following research question: Could the duration of the implementation period of tariff concessions and level of development of member countries affect the impact of RTA on members' trade? Specifically, we examine whether such an implementation period determines the RTA's dynamic effects on trade and whether an RTA's trade impact is affected by the differences in partner characteristics, that is, the level of development.

Since the 1990s, not only developed countries but also developing countries have been involved in RTAs. RTAs have become an omnipresent and key feature of the global trading system owing to the insubstantial breakthrough of the Doha Round of multilateral trade negotiations. Initially, most RTAs were formed regionally to foster and formalize existing trade relationships with members that were geographically close to each other. In recent RTA developments, many countries and regional blocs have looked beyond their own regional boundaries and entered cross-regional agreements with other geographically distant partners (e.g., Chile-Japan free trade agreement (FTA), European Union (EU)-Vietnam FTA). Both developed and developing countries could sign RTAs to leverage their similarities or differences related to their products or per-capita gross domestic product (GDP) (Baier and Bergstrand, 2004). More potential trade is generated between two trading partners having similar and larger economic sizes in terms of intra-industry trading factors through the use of economies of scale due to differentiated products. Trade-creating effects between two countries also tend to be largely when they differ greatly from each other in their factor endowment due to Heckscher-Ohlin comparative advantage in terms of inter-industry trade.

From a North (advanced economy)-South (developing economy) perspective, North-South trade agreements and South-South trade agreements occupy a more prominent position among RTAs currently in force in the post-WTO era. Developing countries have considerably renewed their interest in reciprocal North-South trade agreements instead of focusing on unilateral programs such as the Generalized System of Preferences (GSP) (Acharya et al., 2011). As these GSP programs are characterized by unilateral concessions from developed to developing countries, importing countries (advanced economies granting preferences) can set a collection of standards and rules.[3] Consequently, developing countries have faced many stringent restrictions within these preference-

1) Different forms of integration for RTAs are reviewed by Limão (2016). In practice, RTAs are used to cover a set of trade agreements, such as FTAs, customs unions (CUs), and common markets. These forms indicate an increase in economic integration among member countries by the degree of trade liberalization. In an FTA, countries give two-way preferential tariffs and liberalize most of the intra-bloc trade and tariffs. CUs correspond to FTAs with common external tariffs. Common markets enhance CUs by allowing the free movement of capital and labor.

2) Mongolia is the last member of the WTO to have an RTA in force after the signing of a bilateral trade agreement with Japan in June 2016.

3) These conditions and standards stipulate which developing economies can export their products under different grades of preferential coverage, which goods are eligible, which goods are covered, and criteria requiring labor and environmental standards or protection of intellectual property. In most cases, agriculture products and some sensitive goods are regularly excluded from the scope of these preferential programs initiated by Northern partners (World Bank, 2005).

granting programs. Alternatively, they can become more involved in negotiations with developed countries through RTAs, where both sides can help set the terms of trade agreements. For instance, the United States and the EU have recently formed RTAs with developing countries in Central America and the Caribbean region that had already benefited from their GSP programs, such as the Dominican Republic-Central America-United States free trade agreement (CAFTA-DR), EU-Central America FTA, and EU-Caribbean Community (EU-CARICOM) FTA.

Trade among Southern partners has also become a predominant feature of the world economy since the beginning of the new millennium. Several countries, particularly developing countries, are dissatisfied with the advancement of the WTO because most of the Uruguay Round pledges to bolster worldwide trade have not borne fruit in practice. Furthermore, developed countries' reluctance to open market access and expand multilateral trade has provoked developing countries to seek regional-based agreements.

Greenaway and Milner (1990) highlighted some sources of trade among Southern trading partners and found that South-South trade could thrive despite having to confront strong heterogeneity across countries and an inter-industry specialization based on comparative advantage, production differences, and factor endowments. Regolo (2013) noted that trading partners with similar factor endowments and a comparable level of development are more likely to sharply increase bilateral trade than trading partners with dissimilar economies. Additionally, developing countries seem to have to accept unfavorable terms when signing trade deals with Northern countries owing to the disparity in negotiation power, as suggested by Perroni and Whalley (2000).

The key question is whether RTAs formed between Southern countries foster more trade among themselves than do RTAs formed by Southern countries and their Northern partners. Therefore, we study the differences in levels of development of member countries involved in trade agreements.

Moreover, the scope and coverage of RTAs tend to vary from each other in terms of products, tariff lines, and trade liberalization schedules. The trade liberalization implementation period for a given RTA is the time of final implementation of tariff concessions made by the slowest liberalizing member countries (Crawford, 2016). In some RTAs, such implementation occurs when the agreement is enforced. In others, member countries choose to use a phased implementation in which tariff liberalization occurs over a transition period. For instance, the China-New Zealand FTA was enforced in 2008, and its implementation period ended in 2019. In other words, this RTA had a transition period of 11 years, during which its members gradually and mutually reduced their trade barriers through several duty phase-out periods. By the end of the agreement's implementation period in 2029, both countries will have eliminated almost all their tariffs.[4)]

This study bridges several recent strands of literature on the effects of RTAs. The idea of the impacts of an RTA over the phase-in period has been approached by Baier and Bergstrand

4) We discuss RTA implementation periods in detail in Section 2. Examples of the process of liberalization of trade and tariff lines applied in RTAs are provided in Appendix 4.

(2007) and Kohl (2014). Several studies have focused on the general effects of RTAs on members' trade and found evidence of a trade-promoting effect (Frankel, 1997; Baier and Bergstrand, 2007; Magee, 2008). RTAs' trade-promoting effect may vary according to the types of RTA based on the dissimilarity between members' characteristics, as demonstrated in some *ex ante* studies, such as Ethier (1998), Krueger (1999), and Baier and Bergstrand (2004). However, few papers have addressed the *ex post* heterogeneous impacts of RTAs on trade by dissecting RTAs based on different levels of development of member countries. To the best of our knowledge, Vicard (2011), Behar and Cirera-i Crivillé (2013), and Cheong et al. (2015) are the only three studies that explicitly empirically estimate how the effects of RTAs on trade vary across North-North, North-South, and South-South RTAs. While Vicard (2011) found no evidence of a relationship between the RTA effect and country characteristics, Behar and Cirera-i Crivillé (2013) and Cheong et al. (2015) showed that the impacts of an RTA on trade are quite different for South-South agreements than for North-South agreements.

Our study differs from existing studies in several aspects. First, this study was designed by examining almost all RTAs currently in force to systematically generalize the heterogeneous impact of RTAs based on members' economic development.

Second, we use the theoretically motivated gravity model (J. E. Anderson and van Wincoop, 2003) and use Poisson pseudo-maximum-likelihood (PPML) fixed effects (Santos Silva and Tenreyro, 2006, 2011; Fally, 2015) to address the main problems encountered in the empirical literature involving the gravity model: multilateral resistance terms, endogeneity of RTAs, presence of zero trade flows, and heteroskedasticity in trade data. This study is one of the few studies that applies some of the most recent methodological advances in the literature to examine the heterogeneous impacts of RTAs on trade according to members' development characteristics.

Third, we emphasize the importance of considering the phase-in period of RTAs in our specifications to fully capture the dynamic *ex post* RTA effects on trade (a shortcoming of Vicard, 2011; Cheong et al., 2015) because trade agreements are likely to generate different effects at specific times.

Fourth, this study empirically answers our research question by recognizing some peculiarities of RTAs (e.g., deep integration and government procurement provisions). Although trade agreements commonly focus on expanding trade in goods by eliminating tariffs on imports, new-generation RTAs aim for deeper integration covering broader issues well beyond tariff barriers and existing multilateral rules, for example, liberalization of investment, movement of capital and persons, competition and state-owned enterprises, e-commerce, intellectual property rights, anti-corruption, and harmonization of nontariff measures and environment policies. These topics are crucial policy issues that should be addressed in today's more interconnected markets. For example, in this study, we examine the provisions of government procurement in RTAs, as not all RTA members are also party to the WTO Government Procurement Agreement (GPA). Therefore, provisions

on government procurement in RTAs are essential to set the prevailing conditions of trade and competition in public procurement markets-the process by which governments around the world purchase goods, services, and works from the private sector (R. Anderson et al., 2011). These provisions can directly affect economy-wide development and growth as, according to the Doing Business project of World Bank, government procurement amounted to approximately 12% of the global GDP, while middle-income and high-income countries procure 13.2% and 14% of their GDP, respectively.

This study contributes to the literature by explaining the RTA impacts through the implementation period of tariff and trade liberalization on members' trade across various kinds of RTAs and providing additional convincing *empirical* evidence supporting this line of research. Using structural gravity equations and a worldwide database with 160 countries from 1960 to 2015, we find distinct patterns of *ex post* RTA effects on trade across different types of RTAs categorized by the member countries' level of economic development. Our study findings are threefold. First, RTAs formed by partner countries with similar levels of economic development lead to greater increase in trade during a shorter transition period of trade and tariff liberalization than do North-South RTAs, regardless of whether the degree of integration is shallow or deep. We find disparity in impacts on members' trade between North-North RTAs, South-South RTAs, and North-South RTAs. Second, the average long-term effects of RTAs formed by developing countries on members' trade tend to diminish 15 years after their implementation. In contrast, we empirically validate that trade agreements between Northern and Southern countries tend to generate more favorable effects in intra-bloc trade if these agreements have long-term implementation periods for trade and tariff liberalization than those formed by exclusively developing countries. Third, we provide econometric evidence that direction-specific South-North RTAs appear to quickly increase in Southern exports to the Northern members than do direction-specific North-South RTAs by distinguishing between the trade direction from developed to developing countries and vice versa. Our findings are reinforced by allowing for agreements related to shallow versus deep integration or controlling for RTAs' government procurement provisions.

This study is presented as follows. Section 2 briefly describes some stylized facts about the breakdown of the implementation period of RTAs by member countries' development characteristics. Section 3 presents a review the relevant literature. Section 4 explains the empirical framework and describes the data set. The main results are presented and discussed in Section 5. Section 6 provides some extensions of our basic model. Section 7 presents the conclusion.

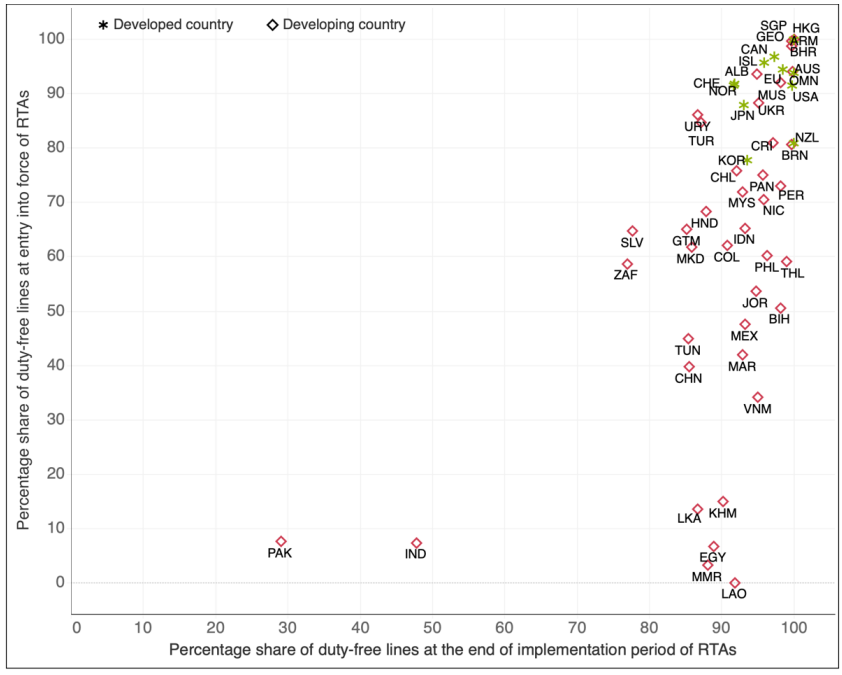
II. RTA Implementation Periods of Trade Liberalization: Some Stylized Facts

Focusing on the trade and tariff liberalization process, we observe different approaches of the RTA member countries. Figure 1 presents the average tariff liberalization for 61 WTO member countries applied in their RTAs by showing the average percentage share of duty-free lines on implementation of trade agreement and comparing it to that at the end of the liberalization period. Several countries achieve high tariff liberalization for their RTA partners on signing trade agreements; specifically, it reaches 100%, especially at large transport hubs for merchandises such as Hong Kong and Singapore. Others have the percentage share of duty-free lines across all goods gradually increasing from enforcing RTAs until the end of the liberalization period. A more conventional pattern among developing member countries in their RTAs is a phased implementation of tariff concessions over a specified transition period, suggesting that the degree of tariff and trade liberalization across RTAs in developing countries has been phased in over RTA implementation periods. For instance, China, Mexico, Morocco, and Vietnam liberalize, on average, 40% of their tariff lines on implementing their RTAs and reach, on average, approximately 90% by the end of the liberalization process. In contrast, developed countries (e.g., Canada, Norway, and New Zealand) tend to substantially eliminate restrictions and tariff barriers on their RTA trading partners from enforcing trade agreements.

The worldwide breakdown of RTAs until 2015 according to the length of their implementation period is shown in Figure 2. We analyze 230 RTAs consisting details about the end of their liberalization period from the WTO Regional Trade Agreements Information System (RTA-IS).[5] Trade agreements generally take an average of 9.5 years to liberalize tariffs and trade among member countries after they come into effect. Of those RTAs, 17% depend on an implementation period starting immediately after implementation, 13.9% have implementation periods of up to five years, and 24.3% of RTAs have an implementation period varying between six and ten years. Additionally, 44.8% of RTAs have a phase-in period of trade and tariff liberalization exceeding ten years.

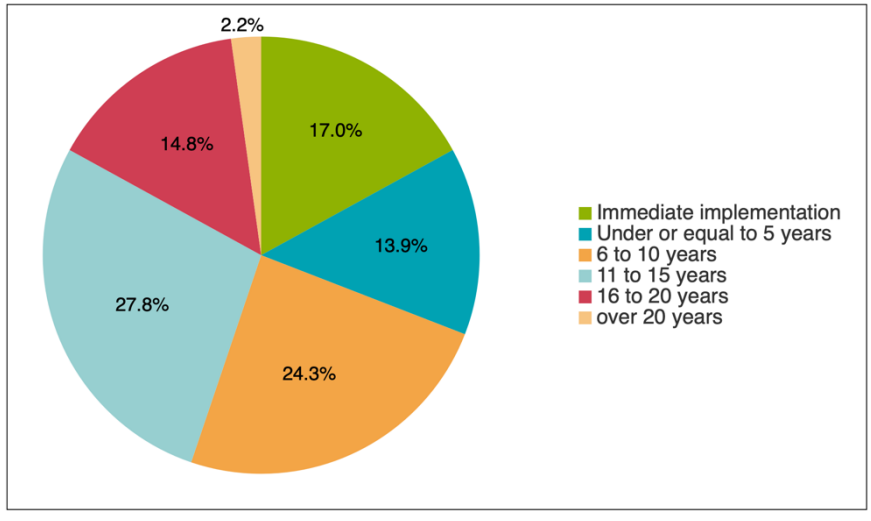
5) In this analysis, we follow the definition of the WTO, which refers to RTAs encompassing reciprocal agreements that involve the elimination of restrictions on a "substantial" part of the goods trade and are notified to the WTO under General Agreement on Tariffs and Trade (GATT) Article XXIV or the Enabling Clause for developing countries, i.e., FTAs and CUs. We exclude agreements covering unilateral trade preferences, which are defined by the WTO as preferential trade agreements (PTAs).

Figure 1. Average tariff liberalization for WTO member countries in their RTAs



(Source) Based on data from Crawford (2016).

Figure 2. Duration of RTA implementation periods

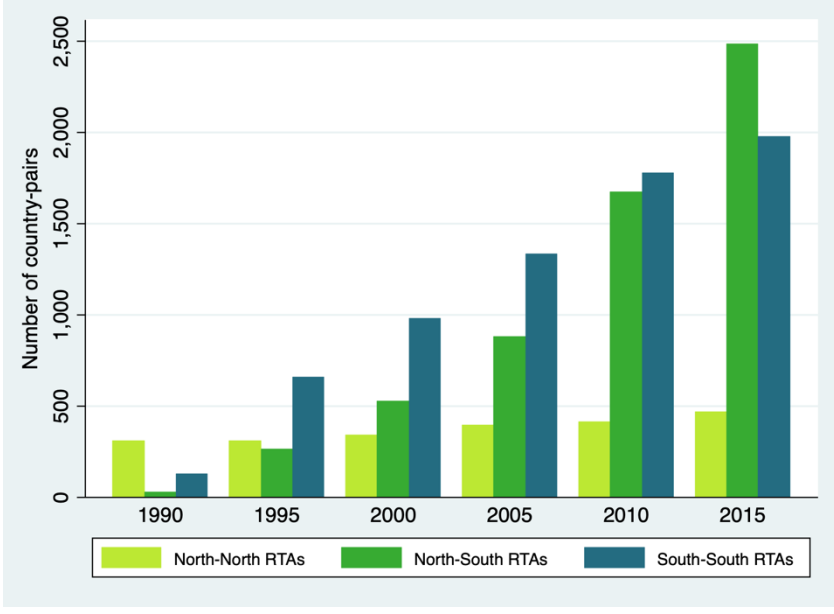


(Source) Authors' calculations.

We focus on key variables related to the three RTA types according to the partner countries' levels of economic development. Of all country pairs in our sample, on average, approximately

2.4% have entered a South-South RTA. This figure is approximately 1% and 1.9% for North-North RTAs and North-South RTAs, respectively. Figure 3 shows the evolution of the number of country pairs that have entered North-North RTAs, North-South RTAs, and South-South RTAs from 1990 to 2015.

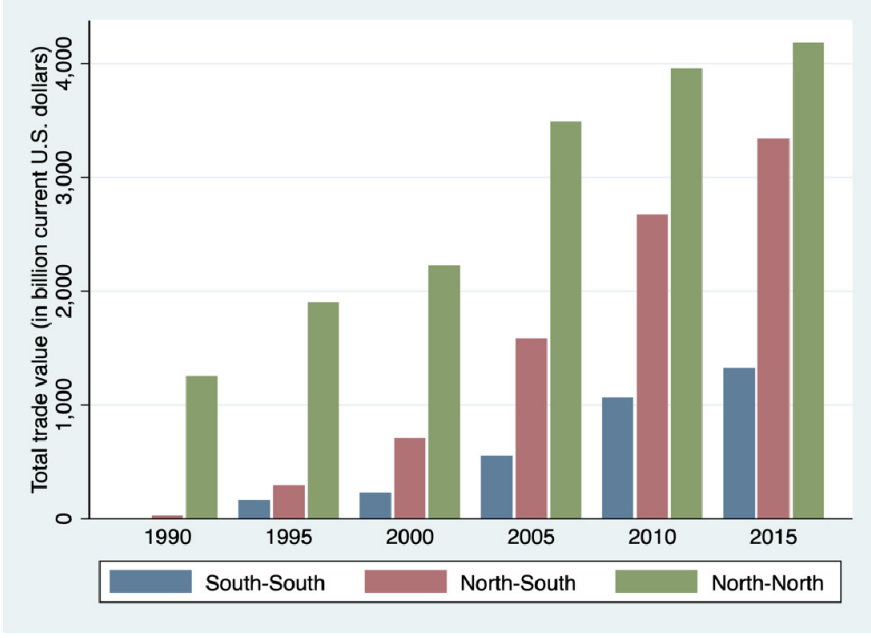
Figure 3. Evolution in the number of North-North, North-South, and South-South RTAs, 1990-2015



(Source) Authors' calculations.

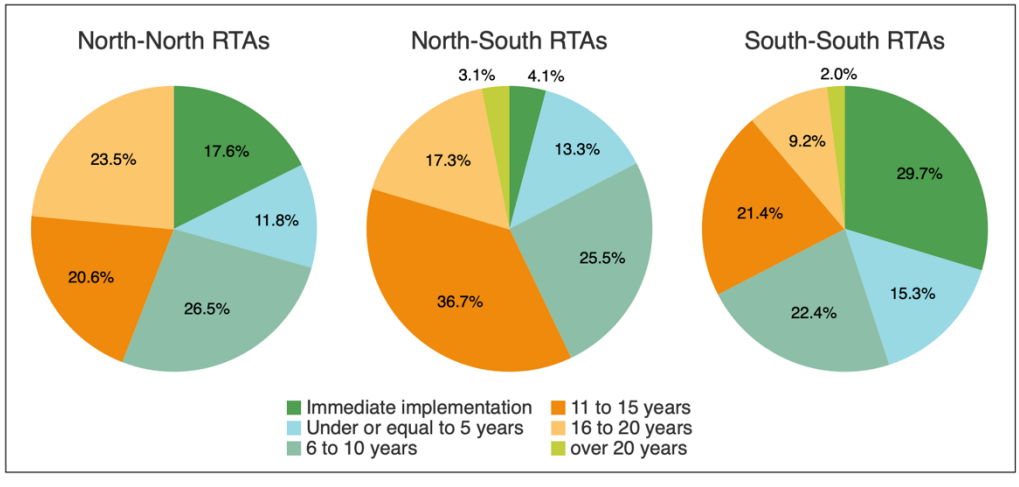
Interestingly, the number of country pairs involved in trade deals formed by developed and developing countries and exclusively by developing countries has steadily grown over time, especially after the establishment of the WTO in 1995. This trend may reflect developing countries' motivation to participate in RTAs owing to WTO's disappointing advancement, particularly the slow progress of the Doha Round of multilateral trade negotiations. As of 2015, 2,482 country pairs have participated in at least one North-South RTA, which is the highest number, followed by South-South RTAs with 1,976 country pairs, and trade agreements between developed countries with only 470 country pairs. Moreover, North-South and South-South RTAs also saw strong growth in total intra-regional trade (Figure 4). In 2015, the combined total intra-regional trade of North-South and South-South RTAs surpassed that of North-North RTAs for the first time, which was approximately 47 times higher than that of North-South and South-South RTAs in 1990.

Figure 4. Evolution in total trade value of North-North, North-South, and South-South RTAs, 1990-2015



(Source) Authors' calculations.

Figure 5. RTA implementation periods based on different types in terms of partners' level of development



(Source) Authors' calculations.

Figure 5 elucidates RTA implementation periods based on different types in terms of the level of development of partners. South-South RTAs take an average of 7.4 years to liberalize tariffs and trade. Concerning North-North and North-South RTAs, the average length of their

implementation period is 10.1 years and 11.3 years, respectively. Thus, RTAs between developing countries probably achieve a faster end of their liberalization phase than North-North and North-South RTAs. Trade agreements between partners with similar characteristics in terms of their level of development appear to have a shorter transition period. Of the RTAs studied, 55.9% of North-North RTAs and 67.3% of South-South RTAs are subject to a transition period of up to ten years. In contrast, RTAs among members with asymmetric economic development characteristics, such as North-South RTAs, tend to have a longer transition period. Phase-in periods of less than ten years occurred in only 42.9% of North-South RTAs.

Given these facts, we expect to find evidence of smaller, more-delayed impacts of North-South RTAs on members' trade than that of North-North and South-South RTAs.

III. Related Literature

This study relates to two recent strands of literature involving the following: (1) implementation period of trade agreements and time lags and (2) RTA effects with a development focus.

A. Implementation period of trade agreements and time lags

As documented in numerous studies on international economics, importers and exporters cannot instantaneously respond to adjustments in trade costs and relative prices of imports to domestic goods (Goldstein and Khan, 1985). Hence, including time lags in trade equations is important for evaluating many trade policy issues related to changes in tariffs barriers, exchange rates, etc. The prices of imports relative to domestic goods also play a major role in the demand for total imports and exports of a given country, especially in the long-term (see Houthakker and Magee, 1969; Samuelson, 1973; Stern et al., 1976; Goldstein and Khan, 1978). Goldstein and Khan (1985) claimed that short term price elasticities of demand for imports and exports are significantly smaller than long-term elasticities and emphasized that only approximately 50% of the final relative price alteration occurs within a one-year period. Particularly, the long-term (more than two years) price elasticities of demand for imports and exports were approximately twice that measured in the short term (zero to six months), as showed in Beenstock and Minford (1976), Lawrence (1978), and Deppler and Ripley (1978).

Alternatively, tariffs and trade liberalization can be gradually implemented over several years after enforcing the trade agreement. Aitken (1973) was among the first to empirically examine the lagged effect of trade agreements and found a potential lagged effect of European trade liberalization when analyzing the effects of the European Economic Community (EEC) and the European Free Trade Association (EFTA) on European countries' trade. Additionally, Mundell

(1964) found impacts of RTAs on member countries' terms of trade. Changes in terms of trade due to RTA formations could later induce lagged effects on trade volumes, as argued by Bergstrand et al. (2015). Consequently, RTAs do not expect to have full economic effect immediately in their year of entry into force but expect completed effect after their implementation period of trade and tariff liberalization.

Covering 587 trade agreements concluded between 1945 and 2009, Dür et al. (2014) found that the tariff eliminations procedure of an FTA and a CU takes and average of 5.7 years and 4.5 years, respectively, to be fully implemented. Baier and Bergstrand (2007), Olivero and Yotov (2012), Kohl (2014), J. E. Anderson and Yotov (2016), and Nguyen (2019) empirically examined the effects of the implementation period of various RTAs. Most studies showed significant lagged effects of RTAs on intra-bloc trade. These studies confirmed the impacts of the gradual liberalization of trade and tariffs in various RTAs. Using the first-differencing technique, Baier and Bergstrand (2007) showed that FTAs can affect trade among members 15 years after implementation. Kohl (2014) found that trade agreements boost trade by approximately 50% when recognizing the broader period for phase-in effects of RTAs. Using 3-year and 6-year lags, Nguyen (2019) confirmed that the addition of the RTA lagged variables leads to the emergence of RTA phased in effects that cannot be obtained in the year of entry but only after a certain time. J. E. Anderson and Yotov (2016) stated that, from an economic perspective, the intuition for the phasing-in effects is that private agents working with the trading partners increasingly adjust to the new economic conditions under newly implemented trade agreement. In contrast, Olivero and Yotov (2012) showed that contemporaneous RTA and their lagged effects should be contradictory, as predicted by their theory related to dynamic gravity framework with asset accumulation. In their work, the authors found a negative lagged RTA effect, but it was not statistically significant.

B. RTA effects based on the development characteristics of member countries

We have focused on the contributions that revolve around the effects of RTAs on trade volume and consider the development aspects. Concerning theoretical studies, Baier and Bergstrand (2004) used a computational general equilibrium model to indicate that, besides the distance between countries (geographical factors), more potential trade is generated between two trading partners having similar and larger economic sizes in terms of intra-industry trade factors from using economies of scale due to differentiated products. Geographically closer countries are likely to show similar development characteristics. Therefore, trade agreements between those countries are expected to be promoting trade. Moreover, Baier and Bergstrand (2004) argued that trade creation tends to be greater between two countries when they largely differ *ex ante* in their factor endowments due to Heckscher-Ohlin comparative advantage in inter-industry trade.

Ethier (1998) and Krueger (1999) showed that developed and developing countries appeared to benefit more from North-South RTAs than from trade agreements implemented only among developed or developing countries, because North-South agreements involve trading partners with significant differences in factor endowments. Moreover, developing countries tend to adopt open trade policies as they cannot benefit from access to larger markets unless they are open and internationally competitive. Thus, greater openness to international trade can be expected from Southern countries (Kuznets, 1960; Alesina and Wacziarg, 1998; Armstrong and Read, 1998).

Additionally, Grossman and Helpman (1991) and Krugman (1995) emphasized that trade agreements between Northern and Southern partners are mutually more beneficial because North-South trade integration leads to the exploitation of economies of scale and accelerates vertical specialization, adoption of newer technologies and skills, or value-chain fragmentation. Otsubo (1998) and Schiff and Wang (2006, 2008) also suggested that trade between developed and developing countries can enable an increase in developing countries' total factor productivity.

As noted by Chauffour and Maur (2011), the reasons for the formation of North-South, South-South, and North-North RTAs diverge remarkably. The United Nations Conference on Trade and Development (UNCTAD, 2007) focuses on the motivations of developing economies for enter into RTAs with developed countries. First, Southern countries are hoping to gain more concessions not granted to other countries, especially a more advantageous market access for their goods. Second, according to Shadlen (2008), another incentive for joining an RTA is the fear of losing competitiveness to other developing countries that might entered an RTA with the same trading partners. Lawrence (1996) highlighted that although there is an asymmetrical power relationship in North-South RTAs, small countries do not necessarily lose in these agreements. Instead, they can reap larger gains from realizing economies of scale.

In contrast, Panagariya (1999) found that when there is deep integration in North-South RTAs, there is no welfare enhancement within RTAs between partners with unequal negotiation power because the timeline for liberalization and harmonization of regulations may be imposed by developed economies; thereafter, poor, small economies have to adjust their standards, regardless of whether those adjustments are appropriate to their own conditions (Perroni and Whalley, 2000). Thus, the North-South RTAs, by virtue of the reciprocity condition, have placed Southern states in an unfavorable position compared with their developed partners (UNCTAD, 2007).

Kee et al. (2009) found that trade barriers to imports of manufactured products from developing countries are higher in Southern partner markets than in the Northern partner markets. According to Behar and Cirera-i Crivillé (2013) and Baier et al. (2018), South-South trade agreements may have greater trade-enhancing effects than North-South trade agreements because developing countries commonly face higher fixed trade costs in the absence of South-South agreements. However, the implementation of South-South RTAs is often weak, with time-consuming and costly tariff liberalization schedules and a lack of improvement in customs procedures and trade

facilities (World Bank, 2005; South Center, 2005).

In a global analysis on the effects of RTAs distinguished by the characteristics of members' economic development, Behar and Cirera-i Crivillé (2013) found that trade creation affects members' trade from all types of RTAs and they estimated that South-South trade agreements increase bilateral trade by at most 107%, whereas the effect of North-South trade deals is only 53%. Controlling for lagged RTA variables and multilateral resistance terms, the authors find that South-South RTAs tend to increase bilateral trade more than North-South RTAs. Using a set of model interaction terms, Cheong et al. (2015) estimated that developing countries could gain about twice as much from trade deals among themselves than from deals with developed countries. Based on the new quantitative trade models,[6] Baier et al. (2018) explained the heterogeneous effects of trade agreements depending on various theoretically motivated factors and found that two developing economies typically have higher partial effects of trade agreement. In contrast, Vicard (2011) showed that impacts on trade from North-North, North-South, and South-South RTAs are found to have similar effects on trade.

Studies comparing the trade creation effects of North-South and South-South agreements covering economic integration agreements (EIAs) and manufactured goods exports are more distantly connected. Disdier et al. (2015) examined the effects of North-South and South-South RTAs in the context of deep integration and found that the trade volume within North-South trade deals is negatively affected when these trade agreements include provisions to harmonize regional standards in terms of nontariff measures (NTMs) and other technical barriers. Dahi and Demir (2013) showed that RTAs formed by developing countries have a significant trade-creating effect on manufactured products; in contrast, no such impact is observed within RTAs signed by advanced economies.

The empirical evidence proposed in this study could provide more insights to explain the differences in the trade-boosting effects between trade deals among member countries having diverse levels of development.

IV. Methodology Framework and Data Description

A. Econometric specification and estimation issues

To investigate the effects of different types of RTAs on trade flows based on the member countries' level of development, we use a structural gravity model. Indeed, over time, there have been many attempts to develop strong theoretical foundations for the gravity model. Tinbergen's (1962) basic model derived from Newton's law of gravity has been gradually revised

6) See Head and Mayer (2014) and Costinot and Rodríguez-Clare (2014) for more details.

by incorporating various microeconomic components and supporting the new models of international trade theory.[7)]

Recently, studies focusing on proper economic foundations for the theoretical gravity equation have highlighted the need to account for price levels to prevent bias arising from the omission of multilateral resistance terms involving exporting and importing countries (J. E. Anderson and van Wincoop, 2003; Head and Mayer, 2014). In a seminal study, J. E. Anderson and van Wincoop (2003) popularized a theoretical gravity equation derived from the Armington hypotheses on specialization, using a constant elasticity of substitution among goods from different countries (σ) as follows:

$$X_{ij} = \frac{Y_i E_j}{Y_w}\left(\frac{\tau_{ij}}{P_i P_j}\right)^{1-\sigma} \tag{1}$$

Equation (1) demonstrates the positive and proportional impact of the economic size of two trading partners (Y_i and E_j) on bilateral trade flows (X_{ij}) and the contradicting effects of bilateral trade costs (τ_{ij}) and trade costs between trading partners and other exporting and importing countries due to the relative price effects (P_i and P_j). To account for J. E. Anderson and van Wincoop's (2003) multilateral resistance terms within a panel data framework, we use country-time fixed effects, following Hummels (1999), Feenstra (2004), and Baier and Bergstrand (2007).

In the gravity model, one of the predominant issues faced by many analyses on trade policies involves the presence of potential endogeneity and may have been derived by including political variables in the gravity specification. By examining the economic determinants of RTAs, Baier and Bergstrand (2004) found significant cross-sectional evidence that trading partners tend to choose their RTA partners; that is, countries participating in an RTA tend to share their economic characteristics to increase the benefits derived from the regional trade integration. However, their study did not identify several unobserved factors between country pairs that may increase bilateral trade and promote the establishment of an RTA concurrently, which leads to significant heterogeneity. Baier and Bergstrand (2007) emphasized that the issue of heterogeneity related to the commonly unobservable determinant of trade in gravity equations is negatively associated with the decision to implement an RTA.

To address this endogeneity issue, Baier and Bergstrand (2007) proposed the use of panel data analysis with bilateral fixed effects and first-differencing, both with country-time fixed effects.[8)] On the one hand, these econometric methods help eliminate bias resulting from the

7) See Head and Mayer (2014) for a comprehensive survey of the improvement of the structural gravity model.

8) Wooldridge (2010) recommended reporting using both methods—panel data analysis with bilateral fixed effects and first differencing—when the number of observed periods is greater than two, because choosing between these two techniques is difficult.

omission of unobserved variables affecting both bilateral trade flows and the RTA membership indicator variable and consider the issue of endogeneity and the multilateral resistance terms. On the other hand, using the complete set of fixed effects, the sensitivity of the gravity model estimates of RTA impacts in terms of control variables and country coverage may be ignored.[9] Head and Mayer (2014) also stated that the use of time-varying country-specific fixed effects and country-pair fixed effects within a structural gravity model is the most used in the literature.

Our theory-consistent structural gravity equation will be log-linearized in the following form:

$$\begin{aligned}\ln X_t^{ij} = \; & \beta_0 + \beta_1 M_t^{i(j)} + \beta_2 D^{ij} + \alpha_1 NN\_RTA_t^{ij} + \alpha_2 NN \\ & + \alpha_2 NN\_RTA_{t-k}^{ij} + \delta_1 NS\_RTA_t^{ij} + \delta_2 NS\_RTA_{t-k}^{ij} \\ & + \theta_1 SS\_RTA_t^{ij} + \theta_2 SS\_RTA_{t-k}^{ij} + \gamma_t^i + \eta_t^j + \lambda^{ij} + \epsilon_t^{ij}\end{aligned} \tag{2}$$

where X_t^{ij} is the value of exports of country i to country j at time t. The vector $M_t^{i(j)}$ includes the traditional time-varying monadic variables such as the log of GDP of the exporter and the importer countries ($GDP_t^{i(j)}$). D^{ij} is a vector representing conventional time-invariant dyadic determinants (i.e., the log of the geographical distance between the two trading partners, common colony, common border, colonial relationship, and shared language).

Considering our variables of interest, $NN\_RTA_t^{ij}$ is a binary variable taking the value of one if both trading partners are developed countries and both have joined a North-North RTA (RTA formed by exclusively developed countries) at time t, and zero otherwise. $SS\_RTA_t^{ij}$ equals one if i and j are both developing countries and participate in the common South-South trade agreement (RTA formed by exclusively developing countries) at time t, and zero otherwise. $NS\_RTA_t^{ij}$ takes the value of one if the exporting and importing countries are from the North and the South (or vice versa) and they are involved in a North-South RTA, and zero otherwise.

As argued in the previous section, the enforcement date of an RTA does not result in its full implementation of trade and tariff liberalization because trade agreements generally take time to become fully effective. Furthermore, the trading partners also need time to adjust trade costs and relative prices of imports to domestic goods, as underlined in the literature. Therefore, RTA dummy variables at time t (contemporaneous effect) cannot justify the effect over the phase-in period and the cumulative average treatment effect of a trade arrangement. Our specification of the structural gravity model in Equation (2) allows for phasing-in of the RTA effects. The term k denotes the lagged level of each type of RTA dummy. In our simplest specification, we only include one lag using $t-1$ (i.e., k equals one). Then, we have also

9) Ghosh and Yamarik (2004) stressed that the gravity model results are quite sensitive to the variables included in the model and to the beliefs of the researchers.

attempted to extend our gravity equation to two and three lagged RTA variables ($t-2$ and $t-3$). To assess the cumulative average treatment effects of RTAs, it is reasonable to jointly evaluate all concurrent and lagged values of RTAs (Baier and Bergstrand, 2007; Kohl, 2014).

We found that RTA implementation period is likely to vary by RTA type based on the dissimilarity between members' level of development, as shown in Figures 2 and 5. To properly investigate the potential heterogeneity in the impact of RTAs on members' trade by the length of implementation period, we assess the RTA lagged effects based on the specific data related to the length of the actual implementation periods of each trade agreement included in the three groups of RTAs (North-North, North-South, and South-South RTAs). Thus, for RTAs subject to an implementation period of up to five years, we use a lagged RTA variable.[10] Because RTAs have transition periods of more than five years and up to ten years or more than ten years, we use two and three lagged RTA variables, respectively, to capture the RTA effects on trade in the years after implementation.

Additionally, in Equation (2), λ^{ij} is the bilateral fixed effects, which control for any time-invariant country-pair heterogeneity; γ_t^i and η_t^j are the exporter-time and importer-time fixed effects, respectively that control for any time-varying country heterogeneity, that is, the multilateral resistance terms, unilateral policy adjustments, or business cycles, as recommended by J. E. Anderson and van Wincoop (2003), Baldwin and Taglioni (2006), Baier and Bergstrand (2007), and Magee (2008).[11] Finally, ϵ_t^{ij} denotes the error term.

The specification of our first-differencing gravity model is given in the following form:

$$\begin{aligned} d\ln X_{t-(t-1)}^{ij} = \quad & \beta_1 dM_{t-(t-1)}^{i(j)} + \alpha_1 dNN\_RTA_{t-(t-1)}^{ij} + \alpha_2 dNN\_RTA_{t-k-(t-k-1)}^{ij} \\ & + \delta_1 dNS\_RTA_{t-(t-1)}^{ij} + \delta_2 dNS\_RTA_{t-k-(t-k-1)}^{ij} \\ & + \theta_1 dSS\_RTA_{t-(t-1)}^{ij} + \theta_2 dSS\_RTA_{t-k-(t-k-1)}^{ij} \\ & + d\gamma_{t-(t-1)}^{i} + d\eta_{t-(t-1)}^{j} + d\epsilon_{t-(t-1)}^{ij} \end{aligned} \tag{3}$$

Consistent with the estimation procedure in Baier and Bergstrand (2007), this first-differencing equation will also solve the problem related to time-invariant unobserved variables.

As we have a significant proportion of zero trade flows in our dataset and face the issue of heteroskedasticity due to Jensen's inequality, which is widely recognized in trade databases, we use the PPML estimator. Compared with the other conventional techniques,[12] this method

10) For this study, we use only five-year interval data. Thus, one lag in our study captures a five-year period.

11) When country-pair and time-varying country-specific fixed effects are both controlled for, the variables included in vectors $M_t^{i(j)}$ and D^{ij} will inevitably be omitted as they are absorbed by the set of fixed effects.

12) The conventional methods to deal with the zero-trade problem involve adding a value of one to the zero-trade values, simply truncating them to account for only positive trade flows, and using a Tobit model. However, as

is the most effective at addressing the presence of zero trade values and heteroskedasticity (Santos Silva and Tenreyro, 2006, 2011; Head and Mayer, 2014; Fally, 2015).

In summary, our study addresses these significant issues in the gravity model using the econometric techniques mentioned earlier. Country-time fixed effects are included in our specifications to consider the unobserved multilateral resistance terms. Country-pair fixed effects are also used to address the potential endogeneity of RTAs. Finally, we use the PPML estimator to explain zero trade flows and heteroskedasticity bias. As the PPML estimator is more convenient than other methods, we use it as a benchmark, and we report the results from panel data analysis with fixed effects and from the first-differencing techniques for comparison.

Hence, we use the PPML method with fixed effects to estimate Equation (4), described as follows:

$$\begin{aligned} X_t^{ij} = \quad & \exp\left[\beta_0 + \beta_1 M_t^{i(j)} + \beta_2 D^{ij} + \alpha_1 NN\_RTA_t^{ij} + \alpha_2 NN\_RTA_{t-k}^{ij}\right] \\ & \times \exp\left[\delta_1 NS\_RTA_t^{ij} + \delta_2 NS\_RTA_{t-k}^{ij}\right] \\ & \times \exp\left[\theta_1 SS\_RTA_t^{ij} + \theta_2 SS\_RTA_{t-k}^{ij} + \gamma_t^i + \eta_t^j + \lambda^{ij}\right] \times \epsilon_t^{ij} \end{aligned} \tag{4}$$

As suggested in the studies discussed in the previous section, our hypothesis is that North-North and South-South RTAs will have positive and significant estimated coefficients at the current trade level and at earlier lagged levels, while North-South RTAs lead to a lower positive impact on trade than that relating to the others and require a certain amount of time to increase intra-bloc trade. Thus, we should then expect to find a positive and significant estimated coefficients for the dummy relating to North-North and South-South RTAs at the current trade level ($\alpha_1 > 0, \theta_1 > 0$) and/or at earlier lagged levels (e.g., $\alpha_2 > 0$ with $k = 1$, $\theta_2 > 0$ with $k = 1$). In contrast, we should expect to find a positive and significant coefficient estimate for the dummy related to North-South RTAs at latter lags than that related to North-North and South-South RTAs ($\delta_2 > 0$ with greater k, i.e., $k \geq 2$).

As highlighted by Baier, Yotov, and Zylkin (2019), it is critical to consider direction-specific RTA effects. We also aim to break down the overall North-South RTAs into distinct trade agreements that separately control for the direction of trade from developing economies to developed economies (via $SN\_RTA_t^{ij}$ and $SN\_RTA_{t-k}^{ij}$) and vice versa (via $NS\_RTA_t^{ij}$ and $NS\_RTA_{t-k}^{ij}$).

---

pointed out by Santos Silva and Tenreyro (2006, 2011) and Westerlund and Wilhelmsson (2011), these techniques may lead to sample selection bias, loss of interesting insight related to true zero-trade flows, and then induce misleading estimated coefficients for variables of interest, particularly in the case of heteroskedasticity.

B. Data description

The model is estimated based on a data set including 160 countries and examined from 1960 to 2015.[13] On average, these countries accounted for over 95% of the world's annual total trade over a 56-year period. For this analysis, we only use the studied period at five-year intervals, leading to a sample of potentially 160 countries over 12 periods with gaps (1960, 1965, 1970,…, 2015). As emphasized by Cheng and Wall (2005, p.52, Footnote 8), "fixed effects estimation is sometimes criticized when applied to data pooled over consecutive years on the grounds that dependent and independent variables cannot fully adjust in a single year's time." Our method is consistent with the five-year intervals in Baier and Bergstrand (2007), the four-year intervals in J. E. Anderson and Yotov (2016), and the three-year intervals in Trefler (1993) and Olivero and Yotov (2012). Moreover, Wooldridge (2012, p.463) confirmed the reduction in the standard errors of coefficient estimates using changes over longer periods than using "year-to-year" changes.

The nominal bilateral flows are taken from the International Monetary Fund's (IMF) Direction of Trade Statistics.[14] Concerning the issue of zero trade flows, approximately 18.1% of the observations in the dataset at five-year intervals are zero. The exporter and the importer GDPs are collected from the World Bank's World Development Indicators (WDI) and complemented with Head et al. (2010) when the World Bank's WDI is unavailable. The set of dyadic control variables for geographical, cultural, and historical ties can affect the probability of an RTA are sourced from the CEPII gravity dataset presented by Head et al. (2010).[15] The WTO's Regional Trade Agreement Information System (RTA-IS),[16] complemented with the dataset of Head et al. (2010) and Baier and Bergstrand (2007), is used to collect information of all implemented RTAs relevant to our analysis. Ultimately, 245 RTAs were in force between 1960 and 2015. The RTA variable is constructed using the date when a given RTA is implemented, that is, when this dummy takes the value of one or zero.

In this study, the econometric specifications does not consider intranational trade flows, as suggested by Yotov (2012), Bergstrand et al. (2015), Yotov, Piermartini, Monteiro, and Larch (2016), and Heid, Larch, and Yotov (2021). Excluding unobservable exogenous time-varying country-pair-specific variables (i.e., other than RTA variable) that account for changes in

13) See Appendix 1 for a list of countries used in this analysis.

14) As advocated by Baldwin and Taglioni (2006), we use undeflated trade values and the set of country-time and bilateral fixed effects to overcome any problems related to the absence of the deflation of trade. Thus, we obtain identical coefficient estimates resulting from the use of nominal or real trade flows.

15) CEPII gravity dataset provides comprehensive data on gravity variables for more than 200 countries from 1948 and 2015. Both IMF's Direction of Trade Statistics dataset and CEPII dataset carefully account for territorial transformations of countries (splits and merges) to harmonize historical trade data, GDP data, or other standard gravity variables for each country between before and after a country's territorial changes. For example, CEPII gravity dataset includes one observation each for West Germany, East Germany, and the unified Germany from 1948 to 2015.

16) The WTO's Regional Trade Agreement Information System (RTA-IS) can be accessed from https://rtais.wto.org/UI/PublicMaintainRTAHome.aspx. See Appendix 2 for a list of trade agreement used in this analysis.

bilateral export costs (some of the increase in international trade relative to intranational trade) could bias estimates of RTA coefficient upward.[17] However, owing to a lack of publicly available data on intranational trade flows for numerous developing economies over the entire study period (1960-2015), we only use conventional international trade data.

To categorize and define the Northern and Southern countries, especially for the post-1990 period, we consider the IMF classification as presented in Cheong et al. (2015). The IMF classification includes 36 advanced economies in this study. Some countries in this category have transitioned from a developing to an advanced country based on the IMF's criteria. In this case, we consider a country as Northern from the year it became a developed economy. Consequently, it became a Northern member within its subsequent RTA after the year this country was defined as developed economy. However, for its previous trade agreements that country remained a developing country, implying that the nature of RTA dummy and its lagged RTA variables remain unaffected in this situation. A possible reason is that tariff and trade liberalization schedules relative to members' economic characteristics are negotiated between member countries before entering into trade agreements. Additionally, as we aim to assess the cumulative average treatment effects of each type of RTA (North-North, North-South, and South-South RTAs) over the implementation period, we want to avoid changing the type of RTAs already in force owing to the change in a member country's status from a Southern to Northern country in a given year for any country and country-pair.[18]

V. Main Results

Our findings on the effects of RTAs on member countries' trade during their implementation period are presented in Table 1. We present the estimated results by lagging the RTA variables by one, two, and three periods. We aim to analyze the results of the PPML estimator with fixed effects for its robustness properties, as discussed earlier.

17) The potential bias induced by time-varying bilateral fixed export costs is especially crucial in light of their prominence in the "new new" trade theory (see Redding, 2011; Melitz and Redding, 2014).

18) For instance, Israel, Hong Kong, Korea, and Singapore were added to the advanced economies group in the late 1990s to reflect their rapid economic development and their characteristics, which are akin to those from other advanced economies in terms of "relatively high income levels (comfortably within the range of those in the industrial country group), well-developed financial markets and high degrees of financial intermediation, and diversified economic structures with rapidly growing service sectors" (IMF, 1997, p.118). Since 2000, several European countries were included by the IMF as developed economies as a result of their participation in the EU. We refer readers to Nielsen (2011) for a useful discussion of how international organizations build their country classification systems based on countries' level of development.

Table 1. *Coefficient Estimates for Baseline Specification*

Variables	(1) PPML	(2) PPML	(3) PPML	(4) Fixed effects	(5) Fixed effects	(6) Fixed effects	(7) First-differencing	(8) First-differencing	(9) First-differencing
	X_t^{ij}	X_t^{ij}	X_t^{ij}	$\ln X_t^{ij}$	$\ln X_t^{ij}$	$\ln X_t^{ij}$	$d \ln X_{t-(t-1)}^{ij}$	$d \ln X_{t-(t-1)}^{ij}$	$d \ln X_{t-(t-1)}^{ij}$
North-North RTAs									
$NN\_RTA_t^{ij}$	0.124**	0.105**	0.102**	0.283***	0.168***	0.122***	0.156***	0.158***	0.156***
	(0.053)	(0.051)	(0.051)	(0.047)	(0.045)	(0.042)	(0.043)	(0.043)	(0.043)
$NN\_RTA_{t-1}^{ij}$	0.145	0.196**	0.192**	0.112	0.250***	0.294***	0.064	0.066	0.065
	(0.092)	(0.091)	(0.092)	(0.076)	(0.075)	(0.074)	(0.065)	(0.065)	(0.065)
$NN\_RTA_{t-2}^{ij}$		0.166***	0.161***		0.499***	0.532***		0.138***	0.138***
		(0.056)	(0.057)		(0.056)	(0.056)		(0.047)	(0.047)
$NN\_RTA_{t-3}^{ij}$			0.005			0.309***			-0.066
			(0.039)			(0.086)			(0.053)
North-South RTAs (overall)									
$NS\_RTA_t^{ij}$	-0.017	-0.048	-0.051	0.108***	0.020	0.024	0.050	0.052	0.050
	(0.081)	(0.080)	(0.082)	(0.035)	(0.034)	(0.033)	(0.037)	(0.037)	(0.037)
$NS\_RTA_{t-1}^{ij}$	0.137	0.167*	0.160*	0.516***	0.593***	0.582***	0.235***	0.237***	0.236***
	(0.086)	(0.088)	(0.089)	(0.067)	(0.067)	(0.067)	(0.065)	(0.065)	(0.065)
$NS\_RTA_{t-2}^{ij}$		0.451***	0.435***		1.060***	1.053***		0.164***	0.162***
		(0.077)	(0.080)		(0.072)	(0.071)		(0.061)	(0.061)
$NS\_RTA_{t-3}^{ij}$			-0.080			0.070			-0.198***
			(0.060)			(0.100)			(0.071)
South-South RTAs									
$SS\_RTA_t^{ij}$	0.206***	0.202***	0.209***	0.462***	0.424***	0.370***	0.068	0.068	0.068
	(0.052)	(0.053)	(0.051)	(0.045)	(0.046)	(0.046)	(0.052)	(0.052)	(0.052)
$SS\_RTA_{t-1}^{ij}$	-0.281***	-0.161*	-0.173*	0.296***	0.342***	0.370***	0.187***	0.189***	0.188***
	(0.092)	(0.095)	(0.096)	(0.073)	(0.073)	(0.073)	(0.072)	(0.072)	(0.072)
$SS\_RTA_{t-2}^{ij}$		0.169**	0.160**		0.262***	0.295***		0.077	0.078
		(0.077)	(0.077)		(0.080)	(0.079)		(0.093)	(0.093)
$SS\_RTA_{t-3}^{ij}$			-0.106			0.591***			0.005
			(0.083)			(0.097)			(0.106)

Table 1. *Continued*

Variables	(1) PPML	(2) PPML	(3) PPML	(4) Fixed effects	(5) Fixed effects	(6) Fixed effects	(7) First-differencing	(8) First-differencing	(9) First-differencing
	X_t^{ij}	X_t^{ij}	X_t^{ij}	$\ln X_t^{ij}$	$\ln X_t^{ij}$	$\ln X_t^{ij}$	$d \ln X_{t-(t-1)}^{ij}$	$d \ln X_{t-(t-1)}^{ij}$	$d \ln X_{t-(t-1)}^{ij}$
Cumulative NN_RTA effect	0.268*** (0.095)	0.468*** (0.113)	0.460*** (0.121)	0.394*** (0.078)	0.916*** (0.098)	1.258*** (0.138)	0.220*** (0.074)	0.362*** (0.087)	0.294*** (0.105)
Cumulative NS_RTA effect	0.12 (0.108)	0.570*** (0.128)	0.463*** (0.148)	0.624*** (0.071)	1.672*** (0.102)	1.730*** (0.143)	0.285*** (0.074)	0.453*** (0.097)	0.250*** (0.122)
Cumulative SS_RTA effect	-0.076 (0.101)	0.211 (0.134)	0.089 (0.167)	0.758*** (0.077)	1.03*** (0.107)	1.630*** (0.143)	0.255*** (0.086)	0.334*** (0.126)	0.340*** (0.164)
Observations	202,041	202,041	202,041	153,157	153,157	153,157	122,296	122,296	122,296
R^2				0.475	0.476	0.476	0.156	0.156	0.156
Exporter-year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FEs	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
First-differencing	No	No	No	No	No	No	Yes	Yes	Yes

Notes. All estimates are obtained with the dataset at five-year intervals from 1960 to 2015. Columns (1), (2), and (3) use the PPML estimator. Columns (4), (5), and (6) use the panel data technique with the bilateral fixed effects estimator. Columns (7), (8), and (9) use the first-differencing technique. The dependent variable in the PPML regression is the export flows in levels. The dependent variable in the fixed effects and the first-differencing regressions is the natural log of the export flows. All specifications control for phasing-in of the RTA effects. In this study, the Northern countries, as defined by the IMF, include 36 advanced economies: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States, Israel (since 1996), Hong Kong (since 1996), Singapore (since 1996), South-Korea (since 1996), Cyprus (since 2000), Slovenia (since 2006), Malta (since 2007), Czech Republic (since 2008), Slovakia (since 2008), Estonia (since 2010), Latvia (since 2013), Lithuania (since 2014), Macao (since 2015). The coefficient estimates for the RTA cumulative average treatment effect are computed using the Delta method. Standard errors are reported in parentheses and clustered by country-pair. Respectively, *, **, and *** denote significance at the level of 10%, 5%, and 1%.

In this study, we choose to use fixed effects rather than random effects estimation because the Hausman test for a gravity model with fixed effects rejects the existence of random effects (as commonly underlined in the literature, e.g., Egger, 2000; Baier and Bergstrand, 2007). Moreover, we prefer the fixed effects model because the assumption of a correlation between the RTA indicator variable and unobserved time-invariant bilateral variables is less restrictive than that in the random effects model, which sets this correlation to zero.

Focusing on key variables of interest, South-South RTAs lead to a significant increase in intra-bloc trade at the 1% level by approximately 22% ($e^{0.206}$ = 1.229; $e^{0.202}$ = 1.224; $e^{0.209}$ = 1.232, from columns (1), (2), and (3), respectively) at their implementation in all three specifications, with the lagged RTA values estimated by the PPML estimator. This result agrees with the fact that South-South RTAs often implement trade and tariff liberalization over shorter periods than other types of RTAs. Thus, the positive impacts of South-South RTAs on member countries' intra-bloc trade are realized enter into force.

However, the beneficial effects of South-South RTAs then decrease by nearly 15% in year 5 after their entry into force (100 * ($e^{-0.161}$ - 1) = 14.8; 100 * ($e^{-0.173}$ - 1) = 15.9, from columns (2) and (3), respectively). All PPML specifications show a negative and significant coefficient for $SS\_RTA_{t-3}^{ij}$. South-South RTAs do not appear to have significant long-term impacts on the growth momentum of trade. This outcome can be explained by the fact that some developing countries, despite having formed mutual trade agreements long ago[19], have not sufficiently improved their intra-bloc trade owing to a lack of commitment to eliminating trade barriers or simplifying customs procedures and to a lack of development in trade infrastructure.[20] This problem with RTAs among developing countries has been extensively discussed in the literature (World Bank, 2005; South Center, 2005). Because most South-South RTAs are only free trade area, they are is likely to have a lower degree of trade liberalization and economic integration.

South-South RTAs with a longer implementation period (more than five years) tend to save their positive impacts on member countries' intra-bloc trade even after ten years of enforcement, which implies that RTAs formed between developing countries typically take longer to liberalize trade and reduce tariffs than their implementation period. Additionally, there are insignificant effects for South-South RTAs at further lagged levels. As most South-South RTAs were created after 2000, their effect at the third lagged level is not fully captured in our period of investigation.

In contrast, North-North RTAs results at their lagged levels have a positive and significant impact on intra-bloc trade. According to the estimation results in column (3) of Table 1, bilateral trade flows increase by approximately 21% ($e^{0.192}$ = 1.212) in year 5 after their entry into force and by about 17.5% ($e^{0.161}$ = 1.175) in year 10 if the country-pair has a North-North RTA.

19) The existence of these RTAs is long enough to be observed at the third lagged level (15 years after enforcement).

20) For instance, there are developing countries involved in the Central American Common Market (CACM) in the 1960s, the CARICOM in the 1970s, and the Common Market for Eastern and Southern Africa (COMESA) in the 1990s.

All PPML specifications show a marginal increase in intra-bloc trade at the enforcement of North-North RTAs, which reflects the slow start of RTAs between developed countries and the fact that the average implementation period in North-North RTAs is up to ten years. Hence, the impact of trade agreements between developed countries at further lagged levels is likely to be more profound than the immediate impact of these trade agreements on their entry into force. However, there are insignificant effects for North-North RTAs with longer phasing-in periods of more than ten years and slower tariff reductions at the third lagged levels.

Unlike North-North and South-South RTAs, the overall North-South RTAs do not experience any significant effect on members' trade on their enforcement. All PPML specifications report a marginal negative effect of North-South RTAs at the current trade level but statistically insignificant. This finding appears to be consistent with Dahi and Demir (2013) because the authors found no evidence that North-South trade agreements have any significant positive effect on Southern exports in terms of manufactured goods to the Northern members om the enforcement, perhaps because developing countries appears to benefit more trade-creating effects from South-South RTAs than North-South RTAs owing to larger reduction in fixed export costs, which are initially higher before South-South agreements (Baier et al., 2018).[21] Additionally, the negotiation strength by which Southern countries tend to accept unfavorable trade terms imposed by developed countries may differ (Perroni and Whalley, 2000). At this stage, the contemporaneous effects of RTAs formed within the developed and the developing countries are significantly higher than those formed by Northern and Southern countries, which is consistent with the findings by Cheong et al. (2015) and the conclusion by Baier and Bergstrand (2004).

The PPML specifications with two and three lags of overall North-South RTAs reveal approximately 18% increase in bilateral trade flows between developed and developing economies in year 5 and about 55% in year 10 after their entry into force. This outcome confirms that North-South RTAs tend to have a longer transition period than others as the members' levels of economic development are less symmetrical than those of North-North and South-South RTAs. Thus, trade agreements with Northern partners take longer to realize trade gains. There is also tentative evidence that North-South RTAs having more than a five-year transition period often see larger increases in members' trade after ten years of enforcement. North-South RTAs effects at the second lagged level are greater than that at the first lagged level. This result is consistent with the neoclassical new trade theory, which argues that trade agreements between Northern and Southern partners are mutually more beneficial because North-South trade integration leads to use of economies of scale and accelerates vertical specialization, adoption of newer technologies, and skills or value-chain fragmentation (Grossman and Helpman, 1991; Krugman, 1995; Otsubo, 1998). Schiff and Wang (2006, 2008) also suggested that trade between developed and developing

21) Developing economies are likely to experience higher fixed export costs (e.g., customs procedures and border-crossing costs, and weaker trade infrastructures).

countries can helps increase the total factor productivity in developing countries. The prospects of gaining access to larger and more affluent export markets and of acquiring transfer of technology within North-South RTAs may take longer after their entry into force. Interestingly, similar to the North-North and South-South RTAs, insignificant impacts for North-South RTAs with longer phasing-in periods of more than ten years at the third lagged levels are observed, which is consistent with the result in Behar and Cirera-i Crivillé (2013).

Focusing on the cumulative average effects on trade for each type of RTA, the total average effects on trade for RTAs between exclusively developed countries and those between developed and developing countries are both significant. The average North-North RTAs increase intra-bloc trade by 58.4% after being effective for 15 years ($e^{0.460} = 1.584$), while the overall North-South RTAs improve trade among members by 58.9% ($e^{0.463} = 1.584$), on average, after being effective for 15 years. The coefficients for North-North and overall North-South RTAs presented in Table 1 (column (3)) imply that the dynamic long-term effects of North-North RTAs and North-South RTAs peak at the tenth year after commencement and then marginally decline after that point. Thus, accounting for RTA lagged levels tends to increase the long-run estimated impact of North-North and North-South RTAs. Interestingly, the cumulative average effects of RTAs on the developed countries are comparable to those on Northern and Southern countries due to the positive impacts on member countries' trade of the overall North-South RTAs have a more than a 5-year implementation period.

Conversely, PPML estimations do not provide significant cumulative average trade effects for South-South RTAs, regardless of how many lagged levels of RTA dummy are included in the regression. Column (3) shows a positive coefficient for the cumulative South-South RTA effect after 15 years of being in force, but its magnitude is marginal and statistically negligible. Interestingly, all PPML specifications with one, two, and three lags for RTA variables reveal that the significantly negative impact of South-South RTAs on intra-bloc trade in year 5 of their existence has offset their own positive effect at the beginning, resulting in a negligible and small cumulative average effect on trade for South-South RTA after being enforced for more ten years. A possible explanation could be an overlap of tariff preferences among developing partners, demonstrating the so-called spaghetti bowl of RTAs (Bhagwati, 1995; Bhagwati, Greenaway, and Panagariya, 1998). As suggested by Hayakawa and Kimura (2015) and (Limão, 2016), this phenomenon may delay long-term improvements in tariff and trade liberalization, especially in the case of South-South RTAs.

Panel data with fixed effects (columns (4)-(6)) and first-differencing data (columns (7)-(9)) help in a direct comparison to our benchmark specifications with the PPML estimator. The number of observations included in these specifications dropped considerably compared with the PPML estimator because they cannot address zero trade flows. Results from these methods are consistent with those from PPML specifications for the impact of North-North and overall

North-South RTAs on intra-bloc trade at their enforcement, lagged levels, and their total average effect. However, fixed effects estimations produce more statistically significant coefficients at RTA lagged levels and higher magnitudes for RTA coefficients. The magnitude of the RTA effects from our fixed effects specifications are similar to the results in Behar and Cirera-i Crivillé (2013) as they use the same method with country-time and bilateral fixed effects. Interestingly, results from fixed effects and first-differencing methods are consistent with those from PPML estimator in terms of the North-South RTA contemporaneous effect. All estimation methods do not show any significant impact on intra-bloc trade at enforcement for North-South RTAs. However, the results from PPML specifications diverge greatly from fixed effects and first-differencing specifications on the impact of South-South RTAs at the first lagged due to the statistically significant and negative coefficients.

Bergstrand et al. (2015) argued that the PPML gravity equation coefficient often differs from its equivalents in different methods (e.g., OLS). Unlike panel data with fixed effects and first-differencing techniques, the PPML estimator can manage the presence of zero trade values and the issue of heteroskedasticity. The findings related to the effect of South-South RTAs at the first lagged level appear sensitive to the treatment of zero trade using the PPML estimator because the issue of zero trade flows is crucial for South-South trade deals. We observe some zero trade flows between Southern partners during the study period even after an RTA formed by these developing countries becoming effective as no real effort was made to promote intra-bloc trade between members of South-South RTAs, for example, reducing tariff barriers or enhancing transportation networks.

Table 2. *Wald Tests of Equality of Estimates of the RTA Cumulative Average Effect*

Specifications	Cumulative RTA effect			
	NN - NS	*NS - SS*	*NN - SS*	All types of RTA
With one lag of RTA				
(1) PPML	1.26	2.76*	6.35**	6.65**
(4) Fixed effects	5.19**	1.99	10.67***	5.41***
(7) First-differencing	0.42	0.09	0.09	0.21
With two lags of RTA				
(2) PPML	0.39	6.80***	2.13	6.85**
(5) Fixed effects	32.71***	21.67***	0.56	19.75***
(8) First-differencing	0.53	0.64	0.03	0.43
With three lags of RTA				
(3) PPML	0.00	5.02**	3.31*	5.64*
(6) Fixed effects	6.27**	0.27	3.25*	3.34**
(9) First-differencing	0.08	0.21	0.05	0.11

Notes. *, **, and *** indicate that the null hypothesis of equality of estimates can be rejected at the level of 10%, 5%, and 1%, respectively. North-South RTAs in the baseline specification consist of both directions of trade.

We use the Wald test to examine the equality of estimates of the cumulative effect on trade for the three types of RTA in all specifications. Table 2 shows that the hypothesis of equality of the coefficients of various types of RTA in first-differencing specifications cannot be rejected when checking in pairs or as a whole. For fixed effects estimation, the Wald test shows that the outcomes vary widely across specifications with one, two, or three RTA lagged levels. In contrast, only PPML specifications agree with the results from the Wald test. The hypothesis of equality of estimates for North-South and South-South RTAs and for North-North and South-South RTAs can be rejected at traditional levels of significance in the PPML specifications with one and three RTA lagged levels. In other words, the cumulative trade impacts of North-North and North-South RTAs differ from that of South-South RTAs. Furthermore, it is likely that the RTA impact on members' trade may be sensitive and overestimated by not addressing the zero trade flows and heteroskedasticity bias using the PPML estimator. Additionally, Appendix 3 shows that the problem of multicollinearity between our coefficients of interest is not serious.

Overall, using the PPML estimator with fixed effects, we find that RTAs reflecting the North-North trade relation and the South-South trade often increase intra-bloc trade on enforcement. These RTAs take a shorter time to increase members' trade than overall North-South RTAs, which experience a difference in their members' level of economic development. This disparity may result in RTAs involving Northern and Southern partners to prolong liberalization of trade and tariffs among them; consequently, the beneficial impact of this type of RTA appears delayed. These findings appear consistent with the predictions of several theoretical studies favoring South-South trade (Perroni and Whalley, 2000; Regolo, 2013; Baier et al., 2018) and with the outcomes from several empirical analyses finding a higher impact on trade of South-South RTAs than of North-South RTAs (Behar and Cirera-i Crivillé, 2013; Dahi and Demir, 2013; Cheong et al., 2015). However, South-South RTAs have weak long-term impacts on the trade growth momentum in case of long implementation period. In contrast, North-South RTAs often have more favorable effects in terms of market access conditions for member countries if these agreements are implemented long enough for trade and tariff liberalization than those formed by exclusively developing countries, reflecting Stender's (2019) findings.[22)]

As highlighted by Baier et al. (2019), it is important to consider direction-specific RTA effects. We also distinguish the RTA direction of trade by decomposing the overall North-South RTAs into distinct trade agreements that separately allow trade from developed to developing countries (North-South RTAs) and the other way around (South-North RTAs). Initially, Table 3 shows that the estimated impacts of North-North and South-South RTAs on members' trade at enforcement and lagged levels are consistent and comparable with the previous findings presented in Table

22) We also use the World Bank's definition of developed and developing countries based on a country's income level as a robustness check. Because there is no much difference between the IMF and World Bank definitions, we find that the RTA coefficient estimates are more robust. Results using the World Bank's classification are available on request.

1. Additionally, direction-specific North-South and South-North RTAs still do not produce any statistically significant effect on members' trade on implementation.

Table 3. *Coefficient Estimates when Distinguishing North-South RTAs and South-North RTAs*

Variables	(1) PPML 1 lag	(2) PPML 2 lags	(3) PPML 3 lags
North-North RTAs			
$NN\_RTA_t^{ij}$	0.124** (0.053)	0.105** (0.051)	0.101** (0.051)
$NN\_RTA_{t-1}^{ij}$	0.146 (0.092)	0.197** (0.091)	0.192** (0.092)
$NN\_RTA_{t-2}^{ij}$		0.166*** (0.056)	0.160*** (0.057)
$NN\_RTA_{t-3}^{ij}$			0.004 (0.039)
North-South RTAs (*direction-specific*)			
$NS\_RTA_t^{ij}$	0.065 (0.063)	0.036 (0.058)	0.036 (0.059)
$NS\_RTA_{t-1}^{ij}$	0.023 (0.115)	0.045 (0.116)	0.023 (0.118)
$NS\_RTA_{t-2}^{ij}$		0.403*** (0.101)	0.341*** (0.11)
$NS\_RTA_{t-3}^{ij}$			-0.239*** (0.077)
South-North RTAs (*direction-specific*)			
$SN\_RTA_t^{ij}$	-0.111 (0.152)	-0.146 (0.15)	-0.153 (0.15)
$SN\_RTA_{t-1}^{ij}$	0.283*** (0.094)	0.324*** (0.097)	0.339*** (0.097)
$SN\_RTA_{t-2}^{ij}$		0.516*** (0.137)	0.560*** (0.134)
$SN\_RTA_{t-3}^{ij}$			0.140** (0.068)
South-South RTAs			
$SS\_RTA_t^{ij}$	0.206*** (0.052)	0.203*** (0.053)	0.212*** (0.051)
$SS\_RTA_{t-1}^{ij}$	-0.280*** (0.091)	-0.156 (0.095)	-0.165* (0.095)
$SS\_RTA_{t-2}^{ij}$		0.172** (0.077)	0.163** (0.078)
$SS\_RTA_{t-3}^{ij}$			-0.103 (0.081)
Cumulative NN_RTA effect	0.270*** (0.094)	0.468*** (0.113)	0.458*** (0.120)
Cumulative NS_RTA effect	0.088 (0.125)	0.484*** (0.171)	0.161 (0.211)
Cumulative SN_RTA effect	0.173 (0.143)	0.695*** (0.188)	0.886*** (0.195)
Cumulative SS_RTA effect	-0.074 (0.100)	0.219 (0.134)	0.106 (0.164)

Table 3. *Continued*

Variables	(1) PPML 1 lag	(2) PPML 2 lags	(3) PPML 3 lags
Observations	202,041	202,041	202,041
Exporter-year FEs	Yes	Yes	Yes
Importer-year FEs	Yes	Yes	Yes
Country-pair FEs	Yes	Yes	Yes

Notes. All estimates are obtained using the PPML estimator with country-pair and country-time fixed effects. All specifications control for phasing-in of the RTA effects. Standard errors are reported in parentheses and clustered by country-pair. Respectively, *, **, and *** denote significance at the level of 10%, 5%, and 1%.

The results in Table 3 further indicate that RTAs concluded between developed and developing economies do not symmetrically affect trade in both directions. South-North RTAs with developed country importers would see larger increases in trade in short term than North-South RTAs with developing country importers. This outcome corroborates that developed countries often liberalize trade and tariff lines quicker than developing partners within the framework of their trade arrangements.[23] As the Northern members can grant more market access for goods coming from the Southern members during a shorter period of transition, the positive impact of RTAs on Southern exports is revealed right after five years of enforcement. The coefficients for South-North RTAs remain positive and significant at the second and third lagged levels.

In contrast, direction-specific North-South RTAs take longer to generate favorable effects on Northern exports to Southern members (ten years after enforcement). However, the beneficial effect of this type of RTA seems to decline by the third lagged level, implying direction-specific North-South RTAs with rather long phasing-in periods of more than ten years may not improve trade flows from the developed countries to their developing partners. As emphasized by Baier et al. (2018), less developed economies are expected to benefit more from an RTA than advanced economies due to the considerable reduction of policy export fixed costs. Additionally, lowering entry barriers to developed country markets makes it easier for developing countries' firms to export, enter, diversify, and grow (J. E. Anderson and Marcouiller, 2002; Levchenko, 2007; Söderlund and Tingvall, 2014; Fernandes, Freund, and Pierola, 2016). Therefore, the cumulative average effects on trade for direction-specific South-North RTAs are comparatively more favorable than those of direction-specific North-South RTAs. As a further check, Table 4 also includes the results of the Wald test, which indicate that the hypothesis of equality of estimates for several pairs of RTA and all types of RTA can be rejected at traditional levels of significance

23) For example, Appendix 4 shows that New Zealand (a developed country) has liberalized trade and tariff lines quicker than China (a developing country) has within the framework of their FTA. Within RTAs concluded between developed and developing countries, the economies having higher levels of economic development have a propensity to grant more market access for goods coming from developing partners during a shorter implementation period, based on the WTO RTA-IS database.

in the PPML specifications with three RTA lagged levels.

Table 4. *Wald Tests of Equality of PPML Estimates of the RTA Cumulative Average Effect When Distinguishing North-South RTAs from South-North RTAs*

Specifications	Cumulative RTA effect						
	NN-NS	NN-SN	NS-SN	NS-SS	SN-SS	NN-SS	All types of RTA
With 1 lag of RTA	1.44	0.37	0.22	1.31	2.79*	6.33**	6.95*
With 2 lags of RTA	0.01	1.13	0.64	2.02	6.28**	2.00	8.24**
With 3 lags of RTA	1.55	3.57*	5.55**	0.06	13.63***	3.00*	13.70***

Notes. *, **, and *** indicate that the null hypothesis of equality of estimates can be rejected at the level of 10%, 5%, and 1%, respectively. North-South RTAs and South-North RTAs separately consider the direction of trade from developed to developing countries and vice versa, respectively.

Interestingly, the coefficients of RTA impact at the year of enforcement and at lagged levels do not indicate an evolution of such impact over time, especially in the case of RTAs concluded between developing countries. RTAs do not gradually increase their intra-bloc trade after enforcement, with stronger RTA effects achieved at subsequent lags than those at previous lags. This result is consistent with findings from Baier and Bergstrand (2007) and J. E. Anderson and Yotov (2016). Indeed, this outcome is consistent with the fact that each stage during the implementation period of RTAs has a different percentage of tariff lines (i.e., products) that become duty-free among member countries. The next step of liberalization may not have more impact on the RTA's trade-promoting effects than the previous liberalization step.

VI. Extensions

In Section A, we try to control for shallow versus deep integration. In sections B and C, we test for potentially reverse causality between trade and RTAs and the impacts of RTAs' government procurement provisions on bilateral trade flows.

A. Test for shallow integration versus deep integration

We tried to capture diverse RTA effects by distinguishing between deep and shallow RTAs.[24] An RTA is categorized as deep if it is also an economic integration agreement. Otherwise,

24) Deep integration within RTAs indicates a greater degree of policies and standards harmonization among member countries that exceed tariff barriers. In recent years, we have witnessed a rise in the number of EIAs, which depict a deeper integration than do FTAs and CUs. See Mattoo, Rocha, and Ruta (2020) for an insightful survey of recent definitions of shallow and deep integration.

we consider it shallow integration only (i.e., an FTA or a CU). J. E. Anderson and Yotov (2016) used the same method to distinguish between deep and shallow RTAs. Consistent with the previous results regarding shallow RTAs, Table 5 (column (1)-(6)) shows an increase in intra-bloc trade for North-North EIAs on their date of implementation and during their implementation period, except at their third lagged level. As highlighted by Chen and Mattoo (2008), standards harmonization and mutual recognition could significantly enhance the probability and volume of intra-regional trade between developed economies.

Table 5. *Estimated Impacts of RTAs When Controlling for Deep and Shallow RTAs*

Variables	(1) PPML 1 lag	(2) PPML 2 lags	(3) PPML 3 lags	(4) PPML 1 lag	(5) PPML 2 lags	(6) PPML 3 lags
North-North EIAs						
$NN\_EIA_t^{ij}$	0.092**	0.082**	0.087**	0.092**	0.081**	0.087**
	(0.042)	(0.041)	(0.04)	(0.041)	(0.041)	(0.040)
$NN\_EIA_{t-1}^{ij}$	0.094*	0.111**	0.105**	0.094*	0.111**	0.104**
	(0.048)	(0.05)	(0.049)	(0.048)	(0.050)	(0.049)
$NN\_EIA_{t-2}^{ij}$		0.085**	0.078**		0.085**	0.077**
		(0.035)	(0.035)		(0.035)	(0.035)
$NN\_EIA_{t-3}^{ij}$			-0.026			-0.026
			(0.031)			(0.031)
North-South EIAs *(overall)*						
$NS\_EIA_t^{ij}$	0.018	0.012	0.016			
	(0.09)	(0.091)	(0.091)			
$NS\_EIA_{t-1}^{ij}$	0.08	0.092	0.087			
	(0.073)	(0.074)	(0.073)			
$NS\_EIA_{t-2}^{ij}$		0.143**	0.09			
		(0.057)	(0.062)			
$NS\_EIA_{t-3}^{ij}$			-0.188*			
			(0.11)			
North-South EIAs *(direction-specific)*						
$NS\_EIA_t^{ij}$				0.129*	0.122*	0.124*
				(0.071)	(0.071)	(0.071)
$NS\_EIA_{t-1}^{ij}$				-0.054	-0.040	-0.051
				(0.098)	(0.099)	(0.098)
$NS\_EIA_{t-2}^{ij}$					0.163**	0.058
					(0.076)	(0.082)
$NS\_EIA_{t-3}^{ij}$						-0.379***
						(0.121)
South-North EIAs *(direction-specific)*						
$SN\_EIA_t^{ij}$				-0.105	-0.109	-0.104
				(0.160)	(0.161)	(0.161)
$SN\_EIA_{t-1}^{ij}$				0.231***	0.239***	0.243***
				(0.080)	(0.082)	(0.082)
$SN\_EIA_{t-2}^{ij}$					0.114	0.142*
					(0.084)	(0.083)
$SN\_EIA_{t-3}^{ij}$						0.125
						(0.082)

Table 5. *Continued*

Variables	(1) PPML 1 lag	(2) PPML 2 lags	(3) PPML 3 lags	(4) PPML 1 lag	(5) PPML 2 lags	(6) PPML 3 lags
South-South EIAs						
$SS\_EIA_t^{ij}$	0.057	0.057	0.062	0.059	0.058	0.065
	(0.058)	(0.058)	(0.058)	(0.057)	(0.057)	(0.057)
$SS\_EIA_{t-1}^{ij}$	-0.039	-0.011	-0.019	-0.036	-0.010	-0.013
	(0.084)	(0.085)	(0.086)	(0.082)	(0.082)	(0.083)
$SS\_EIA_{t-2}^{ij}$		0.011	-0.071		0.006	-0.048
		(0.111)	(0.123)		(0.112)	(0.126)
$SS\_EIA_{t-3}^{ij}$			-0.047			0.087
			(0.129)			(0.121)
Observations	202,041	202,041	202,041	202,041	202,041	202,041
Exporter-year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Importer-year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FEs	Yes	Yes	Yes	Yes	Yes	Yes

Notes. All estimates are obtained by using the PPML estimator with country-pair and country-time fixed effects. All specifications control for phasing-in of the RTA effects. Standard errors are reported in parentheses and clustered by country-pair. Respectively, *, **, and *** denote significance at the level of 10%, 5%, and 1%.

In contrast, EIAs formed by Northern and Southern countries and exclusively developing countries do not have strong impact on their member countries' trade. All estimated coefficients for South-South EIAs are marginal and insignificantly different from zero, while the intra-bloc trade of EIAs formed by developed and developing countries starts to increase ten years after enforcement. However, there is tentatively proven that the overall North-South EIAs, which take a rather long phasing-in period of more than ten years, often negatively affect members' trade owing to their slow pace of tariff reduction and a lack of commitment to promoting economic integration between members (i.e., without improving standards harmonization or lowering NTMs). This result appears consistent with the findings in Disdier et al. (2015) that trade volume within North-South trade deals is negatively affected when these trade agreements include provisions on regional standards harmonization.

An observation of Table 5 (columns (4)-(6)), however, puts this interpretation into perspective. Allowing for the distinction between the direction of trade from developed to developing countries (North-South EIAs) and the other way around (South-North EIAs), we noted that direction-specific North-South EIAs often have a positive effect on intra-bloc trade on enforcement, implying that EIAs could lead to a favorable effect for trade flows from advanced to developing economies when both Northern and Southern partners begin liberalizing trade and tariffs and fostering more profound economic integration measures on enforcement.

Regarding the direction-specific South-North EIAs, beneficial impacts of this type of EIA can be found on members' trade at its first and second lagged levels, suggesting that Southern partners take longer to standards applied by the Northern partners. We still do not observe any

significant effects of South-South EIAs on members' trade. As the compliance of the Southern partner with Northern standards in an EIA is costlier to produce for other markets (i.e., other Southern markets), deep North-South integration covering standards harmonization may be harmful for the actual or potential South-South trade, as highlighted by Disdier et al. (2015).

B. Strict exogeneity of RTAs

To test for the strict exogeneity of RTAs, we consider the suggestion of Wooldridge (2010) and Baier and Bergstrand (2007) by including in the regression a future level of RTA. There is no potential reverse causality between trade changes and RTA changes when the future level of RTAs (RTA_{t+1}^{ij}) is uncorrelated with the current trade flows at time t when trade deals begin. Table 6 presents the baseline PPML results with various specifications involving only one future level of RTA dummies (column (1)), and one future level of RTA dummies and two or three RTA lagged levels (columns (2) and (3), respectively). The coefficients for all RTAs at enforcement and lagged levels are consistent with previous findings presented in Table 1. The results from the first three columns confirm the strict exogeneity in the case of North-North RTAs and RTAs formed by developed and developing countries because the effects of $NN\_RTA_{t+1}^{ij}$ and $NS\_RTA_{t+1}^{ij}$ are marginal and insignificantly different from zero.[25)]

Comparing the results obtained in columns (1)-(3) of Table 6 to those obtained in columns (4) and (5) with fixed effects and first-differencing techniques, our estimated coefficients for the future level of North-North and overall North-South RTAs from PPML specifications are consistent with those from first-differencing method. The first-differencing results in column (5) also provide marginal and insignificant effects of $NN\_RTA_{t+1}^{ij}$ and $NS\_RTA_{t+1}^{ij}$ on members' trade, while the coefficients for future level of RTAs from fixed effects technique are statistically significant. However, as Baier and Bergstrand (2007) noted, first-differencing the panel data yields more robust estimates of RTA effects than fixed effects estimation.

25) The estimated coefficient of -0.039 for North-North RTAs and -0.047 for North-South RTAs could hint that firms have the propensity to delay trade in anticipation of upcoming trade agreements formed by exclusively developed countries as well as by developed and developing countries or of new phases of tariff and trade liberalization.

Table 6. *Coefficient Estimates for Sensitivity Analyses*

Variables	(1) PPML	(2) PPML	(3) PPML	(4) Fixed effects	(5) First-differencing	(6) PPML	(7) PPML (EIA)
North-North RTAs							
$NN\_RTA_{t+1}^{ij}$	-0.045	-0.041	-0.039	-0.114**	-0.006	-0.039	-0.0001
	(0.048)	(0.048)	(0.048)	(0.050)	(0.042)	(0.048)	(0.041)
$NN\_RTA_{t}^{ij}$	0.164***	0.129***	0.124***	0.200***	0.156***	0.124***	0.089**
	(0.047)	(0.046)	(0.046)	(0.044)	(0.043)	(0.046)	(0.035)
$NN\_RTA_{t-1}^{ij}$		0.194**	0.189**	0.283***	0.066	0.189**	0.105**
		(0.091)	(0.092)	(0.074)	(0.065)	(0.092)	(0.049)
$NN\_RTA_{t-2}^{ij}$		0.164***	0.159***	0.513***	0.138***	0.159***	0.077**
		(0.056)	(0.057)	(0.056)	(0.048)	(0.057)	(0.035)
$NN\_RTA_{t-3}^{ij}$			0.003	0.290***	-0.065	0.002	-0.026
			(0.038)	(0.085)	(0.053)	(0.038)	(0.031)
North-South RTAs *(overall)*							
$NS\_RTA_{t+1}^{ij}$	-0.041	-0.044	-0.047	-0.065*	0.001		
	(0.034)	(0.033)	(0.034)	(0.036)	(0.041)		
$NS\_RTA_{t}^{ij}$	0.014	-0.022	-0.023	0.074**	0.050		
	(0.069)	(0.069)	(0.070)	(0.036)	(0.037)		
$NS\_RTA_{t-1}^{ij}$		0.161*	0.153*	0.572***	0.236***		
		(0.088)	(0.089)	(0.067)	(0.065)		
$NS\_RTA_{t-2}^{ij}$		0.453***	0.437***	1.063***	0.161***		
		(0.077)	(0.080)	(0.072)	(0.061)		
$NS\_RTA_{t-3}^{ij}$			-0.080	0.067	-0.198***		
			(0.061)	(0.100)	(0.070)		
North-South RTAs *(direction-specific)*							
$NS\_RTA_{t+1}^{ij}$						-0.027	0.081
						(0.042)	(0.055)
$NS\_RTA_{t}^{ij}$						0.053	0.080
						(0.050)	(0.056)
$NS\_RTA_{t-1}^{ij}$						0.018	-0.047
						(0.117)	(0.098)
$NS\_RTA_{t-2}^{ij}$						0.343***	0.057
						(0.110)	(0.082)
$NS\_RTA_{t-3}^{ij}$						-0.239***	-0.379***
						(0.077)	(0.120)
South-North RTAs *(direction-specific)*							
$SN\_RTA_{t+1}^{ij}$						-0.073	0.023
						(0.055)	(0.074)
$SN\_RTA_{t}^{ij}$						-0.111	-0.117
						(0.129)	(0.131)
$SN\_RTA_{t-1}^{ij}$						0.330***	0.247***
						(0.096)	(0.080)
$SN\_RTA_{t-2}^{ij}$						0.565***	0.142*
						(0.135)	(0.083)
$SN\_RTA_{t-3}^{ij}$						0.141**	0.124
						(0.068)	(0.083)

Table 6. *Continued*

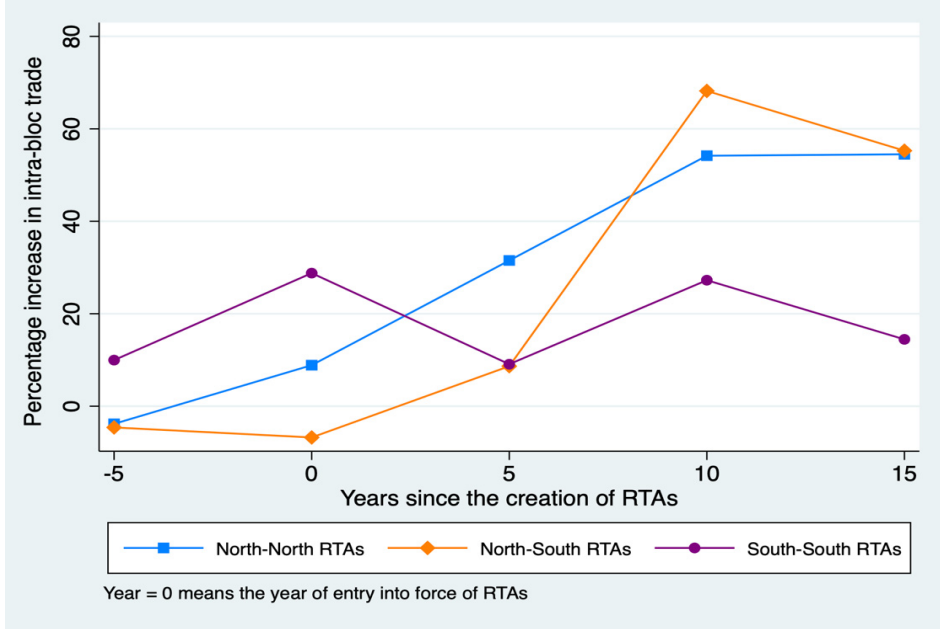
Variables	(1) PPML	(2) PPML	(3) PPML	(4) Fixed effects	(5) First-differencing	(6) PPML	(7) PPML (EIA)
South-South RTAs							
$SS\_RTA_{t+1}^{ij}$	0.098**	0.097**	0.095**	0.191***	-0.010	0.092	0.009
	(0.046)	(0.045)	(0.046)	(0.055)	(0.057)	(0.043)	(0.068)
$SS\_RTA_{t}^{ij}$	0.120**	0.147***	0.154***	0.233***	0.068	0.158***	0.062
	(0.048)	(0.050)	(0.048)	(0.050)	(0.051)	(0.048)	(0.047)
$SS\_RTA_{t-1}^{ij}$		-0.161*	-0.174*	0.387***	0.188***	-0.166*	-0.012
		(0.096)	(0.097)	(0.073)	(0.072)	(0.096)	(0.083)
$SS\_RTA_{t-2}^{ij}$		0.160**	0.151**	0.293***	0.078	0.154**	-0.048
		(0.076)	(0.077)	(0.080)	(0.093)	(0.077)	(0.126)
$SS\_RTA_{t-3}^{ij}$			-0.108	0.590***	0.005	-0.106	0.104
			(0.083)	(0.097)	(0.106)	(0.082)	(0.128)
Cumulative NN_RTA effect	0.119*	0.447***	0.437***	1.172***	0.288***	0.435***	0.244***
	(0.063)	(0.118)	(0.125)	(0.141)	(0.112)	(0.124)	(0.091)
Cumulative NS_RTA effect	-0.027	0.548***	0.441***	1.711***	0.250**	0.148	-0.207
	(0.092)	(0.135)	(0.154)	(0.145)	(0.125)	(0.216)	(0.220)
Cumulative SN_RTA effect						0.852***	0.419**
						(0.210)	(0.199)
Cumulative SS_RTA effect	0.218***	0.243***	0.119	1.693***	0.328*	0.135	0.115
	(0.065)	(0.141)	(0.174)	(0.145)	(0.169)	(0.171)	(0.260)
Observations	202,041	202,041	202,041	122,296	153,157	202,041	202,041
Exporter-year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Columns (1), (2), (3), (6), and (7) employ the PPML estimator. Column (4) uses the panel data technique with the bilateral fixed effects estimator. Column (5) uses the first-differencing technique. All estimates are obtained using country-pair and country-time fixed effects. All specifications control for both periods—before and after the entry into force of RTAs—by including RTA future and lagged levels in the regressions. Column (7) provides the results for economic integration agreements (EIAs). The coefficient estimates for the RTA cumulative average treatment effect are computed using the Delta method. Standard errors are reported in parentheses and clustered by country-pair. Respectively, *, **, and *** denote significance at the level of 10%, 5%, and 1%.

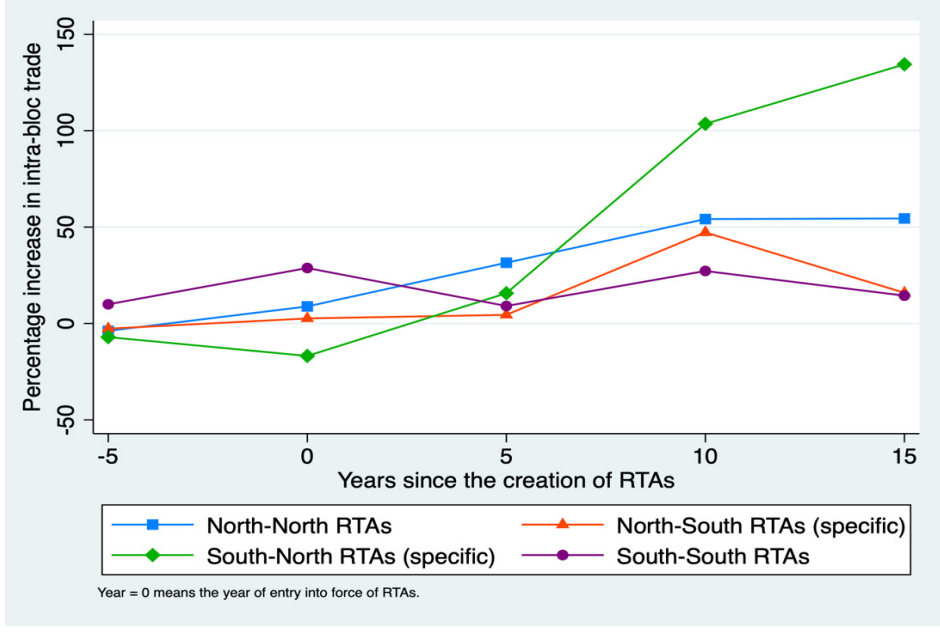
Concerning South-South RTAs, Table 6 (columns (1)-(3)) presents a marginal positive future level of the RTA effect on trade, which exhibits an anticipatory effect of this type of RTA when firms are likely to promote trade even before a trade deal becomes effective, as argued in McLaren (1997) and Baier and Bergstrand (2007). A possible explanation could be an overlap of tariff preferences among current and impending South-South RTAs owing to the "spaghetti bowl" phenomenon involving Southern partners. However, columns (6) and (7) show strict exogeneity in the case of trade agreements formed by exclusively developing countries when controlling for direction-specific North-South RTAs and for EIAs as the effect of $SS\_RTA_{t+1}^{ij}$ turns marginal and insignificantly different from zero. Moreover, when we introduce the future level of RTA in the model, the contemporaneous and lagged RTA coefficient estimates do not vary much.[26)]

26) The results concerning only two lagged levels of RTA dummy for specifications (4), (5), (6), and (7) are very consistent and comparable with the findings including three lagged levels showed in Table 6.

Figure 6. Time paths of the dynamic cumulative effects of North-North, North-South, and South-South RTAs on intra-bloc trade



(a) with North-South RTAs (overall)



(b) with direction-specific North-South and South-North RTAs

(Source) Authors' calculations.

The dynamic cumulative effects over the years of North-North RTAs, North-South RTAs, and South-South RTAs on intra-bloc trade are illustrated in Figure 6. North-North RTAs result in a steady increase in members' trade from five years before their enforcement to fifteen years after they have commenced (Figure 6a). By year 15, trade within RTAs between developed countries had increase by 54.6%, on average, although it began with a decrease of 3.8%, on average, before implementing North-North RTAs. The intra-bloc trade of overall North-South RTAs increases five years after enforcement, and their cumulative effect peaks after ten years from their start. After that point, trade within such RTAs declines to approximately 12.5% by the third lagged level. For South-South RTAs, these RTAs do not provide a steady increase in members' trade after enforcement. Their cumulative effect peaks at 25.3% after ten years from implementation and declines to approximately 12.5% by year 15. When allowing for direction-specific North-South RTAs, Figure 6b reveals that South-North RTAs with developed country importers would see larger increases in intra-bloc trade, and their cumulative effect peaks at approximately 134.4% after 15 years from enforcement.

C. Impacts of RTAs government procurement provisions

Following the strand of literature that includes the association between the economy's openness and the government size, we test whether the existence of government procurement provisions in RTAs affects bilateral trade flows. Cameron (1978) observed that increasing trade openness may lead to an expansion of the public sector. In a widely cited paper, Rodrik (1998) argued that a positive empirical relationship exists between trade openness and government expenditure on goods and services, as more open countries need a larger public sector that could absorb external shocks. Alesina and Wacziarg (1998) showed that smaller countries often have a larger share of public expenditure on goods and services in GDP and are more open to trade. However, Liberati (2007) did not support the Cameron and Rodrik's hypothesis concerning the governments' stabilizing role in more open economies.

Government procurement provisions included in RTAs deal with behind-the-border issues and are designed to improve access to government procurement markets, reciprocity, and transparency between parties' government and suppliers. Presumably, few have studied the impact of RTA provisions dealing with government procurement on trade flows. The implementation of RTAs government procurement procedures could encourage the entry of both domestic and foreign suppliers; however, they may result in ambiguous effects, reflecting either increases or reductions in the share of public contracts allocated to RTAs members' suppliers (Dawar and Evenett, 2011). Government procurement measures help in reducing discrimination in procurement markets and facilitating negotiation between trade agreement members on investment agreements in parallel (Gourdon and Messent, 2019). Furthermore, for many developing countries, RTA government

procurement provisions could introduce efficiency, improvements to bid challenge procedures, and institutional innovations.

We thus use the PPML estimator to estimate the following gravity equation:

$$\begin{aligned} X_t^{ij} = \; & \exp\left[\beta_0 + \beta_1 M_t^{i(j)} + \beta_2 D^{ij} + \alpha_1 NN\_RTA_t^{ij} + \alpha_2 NNNN\_RTA_{t-k}^{ij}\right] \times \\ & \exp\left[\delta_1 NS\_RTA_t^{ij} + \delta_2 NS\_RTA_{t-k}^{ij} + \theta_1 SS\_RTA_t^{ij} + \theta_2 SS\_RTA_{t-k}^{ij}\right] \times \\ & \exp\left[\varkappa_1 NN\_RTA_t^{ij} \times GOV_t^{ij} + \varkappa_2 NN\_RTA_{t-k}^{ij} \times GOV_{t-k}^{ij}\right] \times \\ & \exp\left[\varkappa_3 NS\_RTA_t^{ij} \times GOV_t^{ij} + \varkappa_4 NS\_RTA_{t-k}^{ij} \times GOV_{t-k}^{ij}\right] \times \\ & \exp\left[\varkappa_5 SS\_RTA_t^{ij} \times GOV_t^{ij} + \varkappa_6 SS\_RTA_{t-k}^{ij} \times GOV_{t-k}^{ij}\right] \times \\ & \exp\left[\gamma_t^i + \eta_t^j + \lambda^{ij}\right] \times \epsilon_t^{ij} \end{aligned} \tag{5}$$

In Equation 5, GOV_t^{ij} and GOV_{t-k}^{ij} present the existence of government procurement provisions in RTAs at the contemporaneous trade level and at lagged levels. The data for government procurement provisions are sourced from the Design of Trade Agreements (DESTA) database (Dür et al., 2014). GOV_t^{ij} and GOV_{t-k}^{ij} are the binary variables taking the value of one if the trade agreement has a general aim and concrete provisions for government procurement since time t, and zero otherwise. Approximately 31.5% of extant RTAs comprehensively codify government procurement.

Table 7 shows that government procurement provisions included in trade agreements generate larger increase in member countries' trade within RTAs concluded by developed and developing countries than in members' trade within North-North and South-South RTAs. Interestingly, both results with overall North-South RTAs and direction-specific North-South RTAs reveal beneficial impacts of the inclusion of government procurement provisions in trade deals between developed and developing countries on enforcement and during implementation. Concerning trade agreements formed by exclusively developed and developing economies, government procurement provisions may take longer for effective implementation. The evidence suggests that government procurement provisions included in trade deals could boost trade flows from the Southern to the Northern countries markets through improved market access, transparency, and equal opportunity to compete for public contracts.

Table 7. *Impacts of RTAs Government Procurement Provisions*

Variables	(1) PPML with 2 lags	(2) PPML with 3 lags	(3) PPML with 2 lags	(4) PPML with 3 lags
North-North RTAs				
$NN\_RTA_t^{ij}$	0.093* (0.056)	0.093* (0.056)	0.093* (0.056)	0.092* (0.055)
$NN\_RTA_{t-1}^{ij}$	0.119 (0.082)	0.125 (0.083)	0.119 (0.082)	0.125 (0.083)
$NN\_RTA_{t-2}^{ij}$	0.095 (0.072)	0.087 (0.073)	0.095 (0.072)	0.086 (0.073)
$NN\_RTA_{t-3}^{ij}$		0.014 (0.048)		0.012 (0.048)
North-South RTAs *(overall)*				
$NS\_RTA_t^{ij}$	-0.286** (0.127)	-0.306** (0.127)		
$NS\_RTA_{t-1}^{ij}$	0.058 (0.072)	0.042 (0.072)		
$NS\_RTA_{t-2}^{ij}$	0.239 (0.168)	0.212 (0.168)		
$NS\_RTA_{t-3}^{ij}$		-0.285*** (0.069)		
South-South RTAs				
$SS\_RTA_t^{ij}$	0.203*** (0.054)	0.211*** (0.053)	0.206*** (0.054)	0.217*** (0.053)
$SS\_RTA_{t-1}^{ij}$	-0.174* (0.102)	-0.206** (0.103)	-0.174* (0.102)	-0.209** (0.102)
$SS\_RTA_{t-2}^{ij}$	0.200** (0.091)	0.197** (0.091)	0.201** (0.091)	0.195** (0.091)
$SS\_RTA_{t-3}^{ij}$		-0.131 (0.087)		-0.128 (0.085)
North-South RTAs *(direction-specific)*				
$NS\_RTA_t^{ij}$			-0.142* (0.083)	-0.163** (0.080)
$NS\_RTA_{t-1}^{ij}$			-0.007 (0.092)	-0.022 (0.093)
$NS\_RTA_{t-2}^{ij}$			0.291** (0.125)	0.262** (0.123)
$NS\_RTA_{t-3}^{ij}$				-0.385*** (0.082)
South-North RTAs *(direction-specific)*				
$SN\_RTA_t^{ij}$			-0.433** (0.218)	-0.447** (0.215)
$SN\_RTA_{t-1}^{ij}$			0.148 (0.119)	0.131 (0.119)
$SN\_RTA_{t-2}^{ij}$			-0.194 (0.184)	-0.229 (0.192)
$SN\_RTA_{t-3}^{ij}$				-0.149 (0.091)
North-North RTAs × Government procurement				
$NN\_RTA_t^{ij} \times GOV_t^{ij}$	0.005 (0.039)	0.002 (0.038)	0.006 (0.039)	0.003 (0.038)
$NN\_RTA_{t-1}^{ij} \times GOV_{t-1}t^{ij}$	0.099** (0.043)	0.096** (0.043)	0.099** (0.043)	0.097** (0.043)
$NN\_RTA_{t-2}^{ij} \times GOV_{t-2}^{ij}$	0.110* (0.067)	0.109 (0.069)	0.110* (0.067)	0.109 (0.069)
$NN\_RTA_{t-3}^{ij} \times GOV_{t-3}^{ij}$		-0.005 (0.043)		-0.005 (0.043)
North-South RTAs *(overall)* × Government procurement				
$NS\_RTA_t^{ij} \times GOV_t^{ij}$	0.396*** (0.114)	0.424*** (0.114)		
$NS\_RTA_{t-1}^{ij} \times GOV_{t-1}t^{ij}$	0.005 (0.074)	0.003 (0.077)		
$NS\_RTA_{t-2}^{ij} \times GOV_{t-2}^{ij}$	0.174 (0.180)	0.073 (0.180)		
$NS\_RTA_{t-3}^{ij} \times GOV_{t-3}^{ij}$		0.188*** (0.044)		

Table 7. *Continued*

Variables	(1) PPML with 2 lags	(2) PPML with 3 lags	(3) PPML with 2 lags	(4) PPML with 3 lags
South-South RTAs × Government procurement				
$SS\_RTA_t^{ij} \times GOV_t^{ij}$	-0.002 (0.066)	0.011 (0.069)	0.002 (0.066)	0.016 (0.069)
$SS\_RTA_{t-1}^{ij} \times GOV_{t-1}{}^{ij}$	0.158 (0.097)	0.233** (0.108)	0.168* (0.095)	0.261** (0.105)
$SS\_RTA_{t-2}^{ij} \times GOV_{t-2}^{ij}$	-0.065 (0.158)	-0.084 (0.170)	-0.062 (0.160)	-0.059 (0.171)
$SS\_RTA_{t-3}^{ij} \times GOV_{t-3}^{ij}$		0.078 (0.131)		0.141 (0.139)
North-South RTAs *(direction-specific)* × Government procurement				
$NS\_RTA_t^{ij} \times GOV_t^{ij}$			0.284*** (0.085)	0.317*** (0.082)
$NS\_RTA_{t-1}^{ij} \times GOV_{t-1}{}^{ij}$			-0.023 (0.097)	-0.049 (0.100)
$NS\_RTA_{t-2}^{ij} \times GOV_{t-2}^{ij}$			0.084 (0.151)	-0.024 (0.148)
$NS\_RTA_{t-3}^{ij} \times GOV_{t-3}^{ij}$				0.136** (0.055)
South-North RTAs *(direction-specific)* × Government procurement				
$SN\_RTA_t^{ij} \times GOV_t^{ij}$			0.504** (0.196)	0.514*** (0.194)
$SN\_RTA_{t-1}^{ij} \times GOV_{t-1}{}^{ij}$			0.048 (0.091)	0.087 (0.093)
$SN\_RTA_{t-2}^{ij} \times GOV_{t-2}^{ij}$			0.659*** (0.202)	0.579*** (0.209)
$SN\_RTA_{t-3}^{ij} \times GOV_{t-3}^{ij}$				0.274*** (0.066)
Observations	202,041	202,041	202,041	202,041
Exporter-year effects	Yes	Yes	Yes	Yes
Importer-year effects	Yes	Yes	Yes	Yes
Country-pair effects	Yes	Yes	Yes	Yes

Notes. All estimates are obtained using the PPML estimator with country-pair and country-time fixed effects. Respectively, *, **, and *** denote significance at the level of 10%, 5%, and 1%. All specifications control for periods after the entry into force of RTAs—by including RTA lagged levels in the regressions.

VII. Concluding Remarks

This study examines whether the implementation period of trade liberalization and economic development characteristics of member countries influence the effects of RTAs on members' trade. Applying the PPML techniques on a theoretically motivated gravity model, the key finding of this empirical analysis is that RTAs formed by trading partners with similar economic development characteristics (North-North and South-South RTAs) result in a greater increase in members' trade during a shorter implementation period (i.e., even on enforcement) than North-South trade arrangements, which experience longer phasing-in periods. However, South-South RTAs have weak long-term impacts on the growth momentum of members' trade if take longer to implement. In contrast, trade agreements formed by Northern and Southern countries often have more favorable effects in intra-bloc trade if these agreements take long

enough time for implementing trade and tariff liberalization than those formed by exclusively developing countries. Our PPML specifications with bilateral fixed effects and country-time fixed effects are robust across various sensitivity analyses. When allowing for the distinction between the direction of trade from developed to developing countries and vice versa, we emphasized that direction-specific South-North RTAs take lesser time to see larger increases in Southern exports to the Northern members than direction-specific North-South RTAs.

There are several possible interpretations of why North-South trade agreements cannot produce immediate and effective trade-promoting impacts on trade between the Northern and Southern member countries. One could argue that the pre-RTA tariff rates imposed by advanced economies are already lower (close to the MFN rates). Within a North-South RTA, developing countries commonly liberalize trade and reduce tariffs over a longer period than their developed partners. Additionally, Northern countries could use nontariff barriers to neutralize the diminution of tariff impediments. Therefore, direction-specific South-North EIAs may take longer to produce beneficial effects on trade as Southern partners need an implementation period to adapt to the standards applied by Northern members. Thus, policymakers in developing countries must focus on improving productivity and capacity to domestic and exporting firms' exports. Other types of policy priority could include the reduction of export fixed costs (i.e., by simplifying customs procedures and providing insights on market access in export destinations). Negotiations on the scope of forming RTAs between developed and developing countries must also include the acceleration of the process of trade and tariff liberalization among Northern and Southern partners. These reforms are necessary for North-South RTAs to increase trade among developed and developing member countries during a shorter implementation period. Specifically, government spending on goods and services through RTA provisions including government procurement could help to boost trade flows coming from the Southern partners to the Northern countries markets through improved markets access, transparency, and competition.

However, strong long-term effects of RTAs between developed and developing countries suggest great prospects for the recent new-generation RTAs formed by Northern and Southern economies, such as the European Union-Vietnam FTA and the European Union-Eastern and Southern Africa States FTA.

Our findings related to the effect of South-South RTAs are consistent with the arguments related to a great openness to international trade of developing countries. However, we find that the average long-term impacts of South-South RTAs on members' trade show a propensity to decline 15 years after effective implementation. Thus, to maintain South-South RTAs' long-term trade-creating effects, developing states should continue to facilitate trade in goods by not only persistent commitments to reduce trade barriers but also modernizing trade infrastructures. The opportunities of South-South RTAs have been a major subject of the United Nations' 2030 Agenda for Sustainable Development to encourage the involvement of developing

countries in global trade, as the Doha Round talks are stalled (United Nations, 2015).

Accordingly, further research may be motivated. One drawback of our study is that it solely emphasizes the tariff barriers and transition period of RTAs in terms of tariff reduction. However, it does not focus on the question of nontariff barriers and other behind-the-border regulations that currently significantly contribute to the scope of trade policy of the new-generation of RTAs, as suggested by Disdier et al. (2015). Thus, future research could pursue this direction. Moreover, how the implementation period of RTAs and members' development characteristics affect the RTA impacts on disaggregated trade data covering several specific goods (i.e., from agricultural products to manufactured products), as proposed by Baier et al. (2018), need further study.

References

Acharya, R., Crawford, J.-A., & Maliszewska, M. (2011). Landscape. In J.-P. Chauffour & J. C. Maur (Eds.), *Preferential trade agreement policies for development: A handbook* (pp. 37-76). Washington, DC: World Bank.

Aitken, N. D. (1973). The effect of the EEC and EFTA on European trade: A temporal cross-section analysis. *The American Economic Review, 63*(5), 881-892.

Alesina, A., & Wacziarg, R. (1998). Openness, country size and government. *Journal of Public Economics, 69*(3), 305-321.

Anderson, J. E., & Marcouiller, D. (2002). Insecurity and the pattern of trade: An empirical investigation. *Review of Economics and Statistics, 84*(2), 342-352.

Anderson, J. E., & van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review, 93*(1), 170-192.

Anderson, J. E., & Yotov, Y. V. (2016). Terms of trade and global efficiency effects of free trade agreements, 1990-2002. *Journal of International Economics, 99*, 279-298.

Anderson, R., Müller, A., Osei-Lah, K., De León, J., & Pelletier, P. (2011). Government procurement provisions in regional trade agreements: A stepping stone to GPA accession? In M. S. Arrowsmith & R. Anderson (Eds.), *The WTO regime on government procurement: Challenge and reform*. Cambridge: Cambridge University Press.

Armstrong, H. W., & Read, R. (1998). Trade and growth in small states: The impact of global trade liberalisation. *The World Economy, 21*(4), 563-585.

Baier, S. L., & Bergstrand, J. H. (2004). Economic determinants of free trade agreements. *Journal of International Economics, 64*(1), 29-63.

Baier, S. L., & Bergstrand, J. H. (2007). Do free trade agreements actually increase members' international trade? *Journal of International Economics, 71*(1), 72-95.

Baier, S. L., Bergstrand, J. H., & Clance, M. W. (2018). Heterogeneous effects of economic integration agreements. *Journal of Development Economics, 135*, 587-608.

Baier, S. L., Yotov, Y. V., & Zylkin, T. (2019). On the widely differing effects of free trade agreements:

Lessons from twenty years of trade integration. *Journal of International Economics, 116*, 206-226.

Baldwin, R. E., & Taglioni, D. (2006). *Gravity for dummies and dummies for gravity equations* (NBER Working Papers No. 12516). NBER.

Beenstock, M., & Minford, P. (1976). A quarterly econometric model of trade and prices 1955-72. In M. Parkin & G. Zis (Eds.), *Inflation in open economies* (pp. 85-125). Manchester: Manchester University Press.

Behar, A., & Cirera-i-Crivillé, L. (2013). Does it matter who you sign with? Comparing the impacts of North-South and South-South trade agreements on bilateral trade. *Review of International Economics, 21*(4), 765-782.

Bergstrand, J. H., Larch, M., & Yotov, Y. V. (2015). Economic integration agreements, border effects, and distance elasticities in the gravity equation. *European Economic Review, 78*, 307-327.

Bhagwati, J. (1995). U.S. Trade policy: The infatuation with free trade areas. In J. Bhagwati & A. Krueger (Eds.), *The dangerous drift to preferential trade agreements* (pp. 1-18). Washington, DC: AEI Press.

Bhagwati, J., Greenaway, D., & Panagariya, A. (1998). Trading preferentially: Theory and policy. *Economic Journal, 108*(449), 1128-1148.

Cameron, D. R. (1978). The expansion of the public economy: A comparative analysis. *American Political Science Review, 72*(4), 1243-1261.

Chauffour, J.-P., & Maur, J.-C. (2011). Overview. In J.-P. Chauffour & J.-C. Maur (Eds.), *Preferential trade agreement policies for development: A handbook* (pp. 1-16). Washington, DC: World Bank.

Chen, M. X., & Mattoo, A. (2008). Regionalism in standards: Good or bad for trade? *Canadian Journal of Economics/Revue Canadienne d'Économique, 41*(3), 838-863.

Cheng, I., & Wall, H. J. (2005). Controlling for heterogeneity in gravity models of trade and integration. *Review, 87*(1), 49-63.

Cheong, J., Kwak, D. W., & Tang, K. K. (2015). Heterogeneous effects of preferential trade agreements: How does partner similarity matter?. *World Development, 66*, 222-236.

Costinot, A., & Rodríguez-Clare, A. (2014). Trade theory with numbers: Quantifying the consequences of globalization. In G. Gopinath, E. Helpman, & K. Rogoff (Eds.), *Handbook of international economics* (Vol. 4, pp. 197-261). Oxford: Elsevier.

Crawford, J.-A. (2016). Market Access Provisions on Trade in Goods in Regional Trade Agreements. In R. Acharya (Ed.), *Regional Trade Agreements and the Multilateral Trading System* (pp. 21−57). Cambridge: Cambridge University Press.

Dahi, O. S., & Demir, F. (2013). Preferential trade agreements and manufactured goods exports: Does it matter whom you PTA with? *Applied Economics, 45*(34), 4754-4772.

Dawar, K., & Evenett, S. J. (2011). Government procurement. In J.-P. Chauffour & J.-C. Maur (Eds.), *Preferential trade agreement policies for development: A handbook* (pp. 367-386). Washington, DC: World Bank.

Deppler, M. C., & Ripley, D. M. (1978). The world trade model: Merchandise trade. *Staff Papers - International Monetary Fund, 25*(1), 147-206.

Disdier, A.-C., Fontagné, L., & Cadot, O. (2015). North-South standards harmonization and international trade. *The World Bank Economic Review, 29*(2), 327-352.

Dür, A., Baccini, L., & Elsig, M. (2014). The design of international trade agreements: Introducing a new dataset. *The Review of International Organizations, 9*(3), 353-375.

Egger, P. (2000). A note on the proper econometric specification of the gravity equation. *Economics Letters, 66*(1), 25-31.

Ethier, W. J. (1998). Regionalism in a multilateral world. *Journal of Political Economy, 106*(6), 1214-1245.

Fally, T. (2015). Structural gravity and fixed effects. *Journal of International Economics, 97*(1), 76-85.

Feenstra, R. C. (2004). *Advanced international trade: Theory and evidence*. Princeton, NJ: Princeton University Press.

Fernandes, A. M., Freund, C., & Pierola, M. D. (2016). Exporter behavior, country size and stage of development: Evidence from the exporter dynamics database. *Journal of Development Economics, 119*, 121-137.

Frankel, J. A. (1997). *Regional trading blocs in the world economic system.* Washington, DC: Peterson Institute for International Economics.

Ghosh, S., & Yamarik, S. (2004). Are regional trading arrangements trade creating. *Journal of International Economics, 63*(2), 369-395.

Goldstein, M., & Khan, M. S. (1978). The supply and demand for exports: A simultaneous approach. *The Review of Economics and Statistics, 60*(2), 275-286.

Goldstein, M., & Khan, M. S. (1985). Income and price effects in foreign trade. In R. W. Jones & P. B. Kenen (Eds.), *Handbook of international economics* (Vol. 2, pp. 1041-1105). Oxford: Elsevier.

Gourdon, J., & Messent, J. (2019). How government procurement measures can affect trade. *Journal of World Trade, 53*(5), 679-757.

Greenaway, D., & Milner, C. (1990). South-South trade: Theory, evidence, and policy. *The World Bank Research Observer, 5*(1), 47-68.

Grossman, G., & Helpman, E. (1991). *Innovation and growth in the global economy.* Cambridge, MA: MIT Press.

Hayakawa, K., & Kimura, F. (2015). How much do free trade agreements reduce impediments to trade? *Open Economies Review, 26*(4), 711-729.

Head, K., & Mayer, T. (2014). Gravity equations: Workhorse, toolkit, and cookbook. In G. Gopinath, E. Helpman, & K. Rogoff (Eds.), *Handbook of international economics* (Vol. 4, pp. 131-195). Oxford: Elsevier.

Head, K., Mayer, T., & Ries, J. (2010). The erosion of colonial trade linkages after independence. *Journal of International Economics, 81*(1), 1-14.

Heid, B., Larch, M., & Yotov, Y. V. (2021). Estimating the effects of non-discriminatory trade policies within structural gravity models. *Canadian Journal of Economics/Revue Canadienne d'Économique, 54*(1), 376-409.

Houthakker, H. S., & Magee, S. P. (1969). Income and price elasticities in world trade. *The Review of Economics and Statistics, 51*(2), 111-125.

Hummels, D. L. (1999). *Toward a geography of trade costs* (GTAP Working Papers No. 1162). SSRN Electronic Journal, Center for Global Trade Analysis, Purdue University.

IMF. (1997). *World economic outlook.* Washington, DC: International Monetary Fund.

Looi Kee, H. L., Nicita, A., & Olarreaga, M. (2009). Estimating trade restrictiveness indices. *The Economic Journal, 119*(534), 172-199.

Kohl, T. (2014). Do we really know that trade agreements increase trade? *Review of World Economics, 150*(3), 443-469.

Krueger, A. O. (1999). Are preferential trading arrangements trade-liberalizing or protectionist? *Journal of Economic Perspectives, 13*(4), 105-124.

Krugman, P. (1995). Growing world trade: Causes and consequences. *Brookings Papers on Economic Activity, 1*, 327-377.

Kuznets, S. (1960). Economic growth of small nations. In E. A. G. Robinson (Ed.), *Economic consequences of the size of nations.* London: Macmillan.

Lawrence, R. (1978). An analysis of the 1977 U.S. trade deficit. *Brookings Papers on Economic Activity, 1*, pp. 159-190.

Lawrence, R. (1996). *Regionalism, multilateralism, and deeper integration.* Washington, DC: Brookings Institution.

Levchenko, A. A. (2007). Institutional quality and international trade. *Review of Economic Studies, 74*(3), 791-819.

Liberati, P. (2007). Trade openness, capital openness and government size. *Journal of Public Policy, 27*(2), 215-247.

Limão, N. (2016). Preferential trade agreements. In K. Bagwell & R. W. Staiger (Eds.), *Handbook of commercial policy* (Vol. 1b, pp. 279-367). Amsterdam: North-Holland.

Magee, C. S. P. (2008). New measures of trade creation and trade diversion. *Journal of International Economics, 75*(2), 349-362.

Mattoo, A., Rocha, N., & Ruta, M. (2020). *Handbook of deep trade agreements.* Washington, DC: World Bank.

McLaren, J. (1997). Size, sunk costs, and judge Bowker's objection to free trade. *The American Economic Review, 87*(3), 400-420.

Melitz, M. J., & Redding, S. J. (2014). Heterogeneous firms and trade. In G. Gopinath, E. Helpman, & K. Rogoff (Eds.), *Handbook of international economics* (Vol. 4, pp. 1-54). Oxford: Elsevier.

Mundell, RoA. (1964). Tariff preferences and the terms of trade. *The Manchester School, 32*(1), 1-13.

Nguyen, D. B. (2019). A new examination of the impacts of regional trade agreements on international trade patterns. *Journal of Economic Integration, 34*(2), 236-279.

Nielsen, L. (2011). *Classifications of countries based on their level of development: How it is done and how it could be done* (IMF Working Paper No. WP/11/31). Washington, DC: IMF.

Olivero, M. P., & Yotov, Y. V. (2012). Dynamic gravity: Endogenous country size and asset accumulation. *Canadian Journal of Economics/Revue Canadienne d'Économique, 45*(1), 64-92.

Otsubo, S. (1998). *New regionalism and South-South trade: Could it be an entry point for the South toward global integration?* (APEC Discussion Paper No. 18). Nagoya, Japan: APEC Study Center, Nagoya University.

Panagariya, A. (1999). The regionalism debate: An overview. *The World Economy, 22*(4), 455-476.

Perroni, C., & Whalley, J. (2000). The new regionalism: Trade liberalization or insurance? *Canadian*

Journal of Economics/Revue Canadienne d'Economique, 33(1), 1-24.

Redding, S. J. (2011). Theories of heterogeneous firms and trade. *Annual Review of Economics, 3*(1), 77-105.

Regolo, J. (2013). Export diversification: How much does the choice of the trading partner matter? *Journal of International Economics, 91*(2), 329-342.

Rodrik, D. (1998). Why do more open economies have bigger governments? *Journal of Political Economy, 106*(5), 997-1032.

Samuelson, L. (1973). *A new model of world trade.* Paris: Organization for Economic Co-operation and Development.

Santos Silva, J. M. C., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics, 88*(4), 641-658.

Santos Silva, J. M. C., & Tenreyro, S. (2011). Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator. *Economics Letters, 112*(2), 220-222.

Schiff, M., & Wang, Y. (2006). North-South and South-South trade-related technology diffusion. An industry-level analysis of direct and indirect effects. *Canadian Journal of Economics, 39*(3), 831-844.

Schiff, M., & Wang, Y. (2008). North-South and South-South trade-related technology diffusion: How important are they in improving TFP growth? *Journal of Development Studies, 44*(1), 49-59.

Shadlen, K. (2008). Globalisation, power and integration: The political economy of regional and bilateral trade agreements in the Americas. *The Journal of Development Studies, 44*(1), 1-20.

Söderlund, B., & Tingvall, P. G. (2014). Dynamic effects of institutions on firm-level exports. *Review of World Economics, 150*(2), 277-308.

South Centre. (2005). *South-South cooperation: The challenge of implementation (Background policy paper to the Eleventh Meeting of the Intergovernmental Follow-up and Coordination Committee on Economic Cooperation among Developing Countries (IFCC-XI) Havana, 21-23 March 2005)*. Geneva: South Center.

Stender, F. (2019). Sign here, please! On developing countries' market access conditions in regional trade agreements. *Review of Development Economics, 23*(3), 1347-1367.

Stern, R. M., Francis, J., & Schumacher, B. (1976). *Price elasticities in international trade.* London: Palgrave Macmillan UK.

Tinbergen, J. (1962). *Shaping the world economy.* New York, NY: The Twentieth Century Fund.

Trefler, D. (1993). Trade liberalization and the theory of endogenous protection: An econometric study of U.S. import policy. *Journal of Political Economy, 101*(1), 138-160.

UNCTAD. (2007). *Trade and development report 2007: United nations conference on trade and development.* Geneva: Regional Cooperation for Development.

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development.* New York, NY: United Nations.

Vicard, V. (2011). Determinants of successful regional trade agreements. *Economics Letters, 111*(3), 188-190.

Westerlund, J., & Wilhelmsson, F. (2011). Estimating the gravity model without gravity using panel data. *Applied Economics, 43*(6), 641-649.

Wooldridge, J. (2010). *Econometric analysis of cross-section and panel data.* Cambridge, MA: MIT Press.

Wooldridge, J. (2012). *Introductory econometrics: A modern approach* (5th ed.). Mason, OH: SouthWestern. Cengage Learning.

World, B. (2005). *Global economic prospects 2005: Trade, regionalism and development.* Washington, DC: World Bank.

WTO. (2010a). *Factual presentation: Free Trade Agreement between China and New Zealand (Goods and services)* (WT/REG266/1). World Trade Organization, Committee on Regional Trade Agreements.

WTO. (2010b). *Factual presentation: Free Trade Agreement between Peru and China (Goods and services)* (WT/REG281/1). World Trade Organization, Committee on Regional Trade Agreements.

WTO. (2014). *Factual presentation: Free Trade Agreement between United States and the republic of Korea (Goods and services)* (WT/REG311/1). WTO, Committee on Regional Trade Agreements.

Yotov, Y. V. (2012). A simple solution to the distance puzzle in international trade. *Economics Letters, 117*(3), 794-798.

Yotov, Y. V., Piermartini, R., Monteiro, J.-A., & Larch, M. (2016). *An advanced guide to trade policy analysis: The structural gravity model*. Geneva: United Nations and World Trade Organization.

Appendix

Table A1. *Countries Used in Analysis*

Albania	Dominica	Lao	Sao Tome and Principe
Algeria	Dominican Republic	Latvia	Saudi Arabia
Angola	Ecuador	Lebanon	Senegal
Argentina	Egypt	Lithuania	Seychelles
Armenia	El Salvador	Luxembourg	Sierra Leone
Australia	Equatorial Guinea	Macao	Singapore
Austria	Estonia	Macedonia	Slovakia
Azerbaijan	Ethiopia	Madagascar	Slovenia
Bahamas	Fiji	Malawi	Somalia
Bahrain	Finland	Malaysia	South Africa
Bangladesh	France	Mali	Spain
Barbados	Gabon	Malta	Sri Lanka
Belarus	Gambia	Mauritania	St. Kitts and Nevis
Belgium	Georgia	Mauritius	St. Lucia
Belize	Germany	Mexico	St. Vincent and the Grenadines
Benin	Ghana	Mongolia	Sudan
Bolivia	Greece	Morocco	Suriname
Bosnia and Herzegovina	Grenada	Mozambique	Sweden
Brazil	Guatemala	Myanmar	Switzerland
Brunei Darussalam	Guinea	Nepal	Tajikistan
Bulgaria	Guinea-Bissau	Netherlands	Tanzania
Burkina Faso	Guyana	New Zealand	Thailand
Burundi	Haiti	Nicaragua	Togo
Cambodia	Honduras	Niger	Tonga
Cameroon	Hong Kong	Nigeria	Trinidad and Tobago
Canada	Hungary	Norway	Tunisia
Cabo Verde	Iceland	Oman	Turkey
Central African Republic	India	Pakistan	Turkmenistan
Chad	Indonesia	Panama	Uganda
Chile	Iran	Papua New Guinea	Ukraine
China	Ireland	Paraguay	United Arab Emirates
Colombia	Israel	Peru	United Kingdom
Comoros	Italy	Philippines	United States
Congo, Republic of	Jamaica	Poland	Uruguay
Costa Rica	Japan	Portugal	Uzbekistan
Côte d'Ivoire	Jordan	Qatar	Vanuatu
Cyprus	Kazakhstan	Romania	Venezuela
Czech Republic	Kenya	Russian Federation	Vietnam
Denmark	Korea, Republic of	Rwanda	Zambia
Djibouti	Kuwait	Samoa	Zimbabwe

Table A2. *List of RTAs Included in the Estimation*

Trade agreement	Transition period
ASEAN - Australia - New Zealand	15
ASEAN - China	15
ASEAN - India	14
ASEAN - Japan	18
ASEAN - Korea, Republic of	14
ASEAN Free Trade Area (AFTA)	25
Agadir Agreement	0
Andean Community (CAN)	20
Armenia - Kazakhstan	0
Armenia - Turkmenistan	0
Armenia - Ukraine	0
Australia - Chile	6
Australia - China	14
Australia - New Zealand (ANZCERTA)	12
Australia - Papua New Guinea (PATCRA)	0
Bolivia-Mexico	4
Brunei Darussalam - Japan	15
Canada - Chile	17
Canada - Colombia	21
Canada - Costa Rica	14
Canada - Honduras	14
Canada - Israel	2
Canada - Jordan	4
Canada - Korea, Republic of	20
Canada - Panama	18
Canada - Peru	16
Caribbean Community and Common Market (CARICOM)	12
Central American Common Market (CACM)	4
Central American Common Market (CACM) - Accession of Panama	4
Central Europe FTA	8
Central European Free Trade Agreement (CEFTA) 2006	8
Chile - China	9
Chile - Colombia	3
Chile - Costa Rica (Chile - Central America)	12
Chile - El Salvador (Chile - Central America)	15
Chile - Guatemala (Chile - Central America)	19
Chile - Honduras (Chile - Central America)	9
Chile - Japan	15
Chile - Malaysia	4
Chile - Mexico	7
Chile - Nicaragua (Chile - Central America)	14
Chile - Viet Nam	15
China - Costa Rica	14

Table A2. *Continued*

Trade agreement	Transition period
China - Hong Kong, China	11
China - Korea, Republic of	1
China - Macao, China	11
China - New Zealand	11
China - Singapore	1
Colombia - Mexico	25
Colombia - Northern Triangle (El Salvador, Guatemala, Honduras)	1
Common Economic Zone (CEZ)	0
Common Market for Eastern and Southern Africa (COMESA)	6
Common Market for Eastern and Southern Africa (COMESA) - Accession of Egypt	18
Commonwealth of Independent States (CIS)	0
Costa Rica - Colombia	14
Costa Rica - Mexico	14
Costa Rica - Peru	14
Costa Rica - Singapore	9
Dominican Republic - Central America	3
[l]Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR)	19
EC (10) Enlargement	5
EC (12) Enlargement	10
EC (15) Enlargement	10
EC (25) Enlargement	5
EC (27) Enlargement	6
EC (9) Enlargement	5
EC Treaty	12
EFTA - Accession of Iceland	10
EFTA - Albania	0
EFTA - Bosnia and Herzegovina	3
EFTA - Canada	15
EFTA - Central America (Costa Rica and Panama)	14
EFTA - Chile	6
EFTA - Colombia	16
EFTA - Egypt	13
EFTA - Former Yugoslav Republic of Macedonia	9
EFTA - Hong Kong, China	0
EFTA - Israel	10
EFTA - Jordan	12
EFTA - Korea, Republic of	10
EFTA - Lebanon	8
EFTA - Mexico	10
EFTA - Morocco	12
EFTA - Peru	16
EFTA - SACU	7

Table A2. *Continued*

Trade agreement	Transition period
EFTA - Singapore	0
EFTA - Tunisia	18
EFTA - Turkey	4
EFTA - Ukraine	10
EFTA-Bulgaria	9
EFTA-Hungaria	10
EFTA-Poland	8
EFTA-Romania	9
EU - Albania	5
EU - Algeria	12
EU - Austria	10
EU - Bosnia and Herzegovina	5
EU - CARIFORUM States EPA	25
EU - Cameroon	9
EU - Central America	14
EU - Chile	10
EU - Colombia and Peru and Ecuador	18
EU - Eastern and Southern Africa States Interim EPA	10
EU - Egypt	15
EU - Former Yugoslav Republic of Macedonia	10
EU - Georgia	10
EU - Iceland	11
EU - Israel	0
EU - Jordan	11
EU - Korea, Republic of	20
EU - Lebanon	12
EU - Mexico	10
EU - Morocco	11
EU - Norway	11
EU - Papua New Guinea / Fiji	14
EU - Portugal	10
EU - South Africa	12
EU - Sweden	10
EU - Switzerland - Liechtenstein	11
EU - Tunisia	11
EU - Turkey	0
EU - Ukraine	12
EU-Bulgaria	10
EU-Hungaria	10
EU-Poland	10
EU-Romania	10
East African Community (EAC)	5
East African Community (EAC) - Accession of Burundi and Rwanda	5

Table A2. *Continued*

Trade agreement	Transition period
Economic Community of West African States (ECOWAS)	7
Economic and Monetary Community of Central Africa (CEMAC)	0
Egypt - Turkey	13
Eurasian Economic Union (EAEU)	0
European Economic Area (EEA)	0
European Free Trade Association (EFTA)	6
GUAM	0
Georgia - Armenia	0
Georgia - Azerbaijan	0
Georgia - Kazakhstan	0
Georgia - Russian Federation	0
Georgia - Turkmenistan	0
Georgia - Ukraine	0
Gulf Cooperation Council (GCC)	4
Gulf Cooperation Council (GCC) - Singapore	4
Hong Kong, China - Chile	2
Hong Kong, China - New Zealand	5
Hungaria - Israel	3
Hungaria - Turkey	3
Iceland - China	10
India - Japan	15
India - Malaysia	8
India - Singapore	4
India - Sri Lanka	7
Israel - Mexico	5
Japan - Australia	19
Japan - Indonesia	15
Japan - Malaysia	15
Japan - Mexico	10
Japan - Peru	15
Japan - Philippines	15
Japan - Singapore	20
Japan - Switzerland	15
Japan - Thailand	15
Japan - Viet Nam	17
Jordan - Singapore	9
Korea, Republic of - Australia	19
Korea, Republic of - Chile	16
Korea, Republic of - Colombia	18
Korea, Republic of - India	9
Korea, Republic of - New Zealand	19
Korea, Republic of - Singapore	10
Korea, Republic of - Turkey	10

Table A2. *Continued*

Trade agreement	Transition period
Korea, Republic of - United States	19
MERCOSUR - Bolivia	0
MERCOSUR - Chile	0
Malaysia - Australia	13
Mexico - Central America	10
Mexico - El Salvador	11
Mexico - Guatemala	11
Mexico - Honduras	11
Mexico - Nicaragua	14
Mexico - Panama	0
Mexico - Uruguay	9
New Zealand - Malaysia	6
New Zealand - Singapore	0
North American Free Trade Agreement (NAFTA)	14
Pacific Island Countries Trade Agreement (PICTA)	18
Pakistan - China	5
Pakistan - Malaysia	7
Pakistan - Sri Lanka	6
Pan-Arab Free Trade Area (PAFTA)	9
Pan-Arab Free Trade Area (PAFTA)	7
Panama - Chile	14
Panama - Costa Rica (Panama - Central America)	18
Panama - El Salvador (Panama - Central America)	10
Panama - Guatemala (Panama - Central America)	4
Panama - Honduras (Panama - Central America)	17
Panama - Nicaragua (Panama - Central America)	4
Panama - Peru	17
Panama - Singapore	10
Peru - Chile	7
Peru - China	16
Peru - Korea, Republic of	0
Peru - Mexico	11
Peru - Singapore	16
Poland - Israel	3
Poland - Turkey	3
Romania - Turkey	4
Russian Federation - Azerbaijan	0
Russian Federation - Belarus - Kazakhstan	18
Russian Federation - Turkmenistan	0
Russian Federation - Uzbekistan	0
Singapore - Australia	0
South Asian Free Trade Agreement (SAFTA)	10
Southern African Development Community (SADC)	15

Table A2. *Continued*

Trade agreement	Transition period
Southern African Development Community (SADC) - Accession of Seychelles	0
Southern Common Market (MERCOSUR)	15
Southern Common Market (MERCOSUR) - Israel	10
Switzerland - China	14
Thailand - Australia	20
Thailand - New Zealand	15
Trans-Pacific Strategic Economic Partnership	11
[l]Treaty on a Free Trade Area between members of the Commonwealth of Independent States (CIS)	8
Turkey - Albania	5
Turkey - Bosnia and Herzegovina	4
Turkey - Chile	6
Turkey - Former Yugoslav Republic of Macedonia	8
Turkey - Georgia	0
Turkey - Israel	3
Turkey - Jordan	11
Turkey - Malaysia	0
Turkey - Mauritius	9
Turkey - Morocco	9
Turkey - Tunisia	9
Ukraine - Azerbaijan	0
Ukraine - Belarus	0
Ukraine - Former Yugoslav Republic of Macedonia	9
Ukraine - Kazakhstan	0
Ukraine - Tajikistan	0
Ukraine - Uzbekistan	0
Ukraine -Turkmenistan	0
United States - Australia	18
United States - Bahrain	9
United States - Chile	12
United States - Colombia	18
United States - Israel	10
United States - Jordan	9
United States - Morocco	24
United States - Oman	9
United States - Panama	19
United States - Peru	16
United States - Singapore	10
West African Economic and Monetary Union (WAEMU)	0

(Source) WTO's Regional Trade Agreement Information System (RTA-IS) complemented with the dataset of Head et al. (2010) and Baier and Bergstrand (2007).

Table A3. *Test of Coefficient Correlation*

	$NN\_RTA_t^{ij}$	$NN\_RTA_{t-1}^{ij}$	$NN\_RTA_{t-2}^{ij}$	$NN\_RTA_{t-3}^{ij}$	$NN\_RTA_{t+1}^{ij}$
$NN\_RTA_t^{ij}$	1				
$NN\_RTA_{t-1}^{ij}$	-0.1873	1			
$NN\_RTA_{t-2}^{ij}$	0.3604	-0.0907	1		
$NN\_RTA_{t-3}^{ij}$	-0.0578	0.043	-0.0049	1	
$NN\_RTA_{t+1}^{ij}$	-0.1156	-0.1287	0.0708	-0.055	1
$NS\_RTA_t^{ij}$	0.1943	0.0604	0.1673	0.0734	0.1905
$NS\_RTA_{t-1}^{ij}$	-0.0397	0.0385	-0.0441	-0.0303	-0.0148
$NS\_RTA_{t-2}^{ij}$	-0.0828	0.0223	-0.1197	-0.156	-0.0219
$NS\_RTA_{t-3}^{ij}$	-0.0418	0.0127	0.0147	-0.0138	-0.0481
$NS\_RTA_{t+1}^{ij}$	0.1754	0.0065	0.109	0.0365	0.1449
$SS\_RTA_t^{ij}$	-0.0541	0.029	-0.0373	-0.0419	0.0422
$SS\_RTA_{t-1}^{ij}$	0.0138	0.0255	-0.0315	-0.0414	0.0279
$SS\_RTA_{t-2}^{ij}$	-0.0241	0.0111	-0.0366	-0.0311	0.0075
$SS\_RTA_{t-2}^{ij}$	0.0188	0.0843	0.0014	0.0482	0.0638
$SS\_RTA_{t+1}^{ij}$	0.0607	-0.0165	0.0523	-0.0599	0.0286
	$NS\_RTA_t^{ij}$	$NS\_RTA_{t-1}^{ij}$	$NS\_RTA_{t-2}^{ij}$	$NS\_RTA_{t-3}^{ij}$	$NS\_RTA_{t+1}^{ij}$
$NN\_RTA_t^{ij}$					
$NN\_RTA_{t-1}^{ij}$					
$NN\_RTA_{t-2}^{ij}$					
$NN\_RTA_{t-3}^{ij}$					
$NN\_RTA_{t+1}^{ij}$					
$NS\_RTA_t^{ij}$	1				
$NS\_RTA_{t-1}^{ij}$	-0.1352	1			
$NS\_RTA_{t-2}^{ij}$	-0.2316	0.0628	1		
$NS\_RTA_{t-3}^{ij}$	-0.1039	0.0349	0.1977	1	
$NS\_RTA_{t+1}^{ij}$	0.524	-0.0564	-0.0088	-0.1158	1
$SS\_RTA_t^{ij}$	0.1686	0.0408	0.0666	0.0646	0.0859
$SS\_RTA_{t-1}^{ij}$	0.1504	0.174	0.3182	0.0473	0.1488
$SS\_RTA_{t-2}^{ij}$	0.0229	0.0005	0.1811	0.0785	0.0824
$SS\_RTA_{t-3}^{ij}$	0.5421	-0.0302	-0.1272	-0.038	0.2073
$SS\_RTA_{t+1}^{ij}$	0.2079	-0.0468	0.1447	-0.0016	0.2843

Table A3. *Continued*

	$SS\_RTA_t^{ij}$	$SS\_RTA_{t-1}^{ij}$	$SS\_RTA_{t-2}^{ij}$	$SS\_RTA_{t-3}^{ij}$	$SS\_RTA_{t+1}^{ij}$
$NN\_RTA_t^{ij}$					
$NN\_RTA_{t-1}^{ij}$					
$NN\_RTA_{t-2}^{ij}$					
$NN\_RTA_{t-3}^{ij}$					
$NN\_RTA_{t+1}^{ij}$					
$NS\_RTA_t^{ij}$					
$NS\_RTA_{t-1}^{ij}$					
$NS\_RTA_{t-2}^{ij}$					
$NS\_RTA_{t-3}^{ij}$					
$NS\_RTA_{t+1}^{ij}$					
$SS\_RTA_t^{ij}$	1				
$SS\_RTA_{t-1}^{ij}$	-0.1342	1			
$SS\_RTA_{t-2}^{ij}$	-0.0734	0.1258	1		
$SS\_RTA_{t-3}^{ij}$	0.1975	0.0949	-0.0179	1	
$SS\_RTA_{t+1}^{ij}$	-0.0669	0.0727	0.0299	0.0227	1

(Source) Authors' calculation.

Table A4. *Examples of RTA Implementation Periods*

Example of North-South RTAs: Tariff elimination commitments applied by China and New Zealand under the China-New Zealand FTA

China			New Zealand		
Duty phase-out period	Number of tariff lines	Total lines in China's tariff schedule (%)	Duty phase-out period	Number of tariff lines	Total lines in New Zealand's tariff schedule (%)
MFN duty-free (2008)	639	8.4	MFN duty-free (2008)	4,190	57.6
2008-2011	1,204	15.7	2008-2011	415	5.7
2012	5,100	66.7	2012	1,967	27.1
2013-2015	437	5.7	2013	86	1.2
			2014-2015	466	6.4
2016	32	0.4	2016	146	2
2017-2018	7	0.1			
2019	4	0.1			
Remain dutiable	223	2.9			
Total	7,646	100	Total	7,270	100

(Source) WTO (2010a).

Table A4. *Continued*

Example of South-South RTAs: Tariff elimination commitments applied by China and Peru under the China-Peru FTA

China			Peru		
Duty phase-out period	Number of tariff lines	Total lines in China's tariff schedule (%)	Duty phase-out period	Number of tariff lines	Total lines in Peru's tariff schedule (%)
MFN duty-free (2010)	649	8.4	MFN duty-free (2010)	3,957	53.8
2010	4,098	52.8	2010	709	9.6
2014	908	11.7	2014	941	12.8
2016	2	0			
2017	14	0.2			
2019	1,604	20.7	2019	1,037	14.1
2021	24	0.3	2021	4	0.1
2024	12	0.2	2024	13	0.2
2025	5	0.1	2025	87	1.2
2026	20	0.3	2026	11	0.1
Remain dutiable	422	5.4	Remain dutiable	592	8.1
Total	7,758	100	Total	7,351	100

(Source) WTO (2010b).

Example of North-North RTAs: Tariff elimination commitments applied by the United States and South-Korea under the United States-South-Korea FTA

United States			South-Korea		
Duty phase-out period	Number of tariff lines	Total lines in United States' tariff schedule (%)	Duty phase-out period	Number of tariff lines	Total lines in South-Korea's tariff schedule (%)
MFN duty-free (2012)	3,866	36.8	MFN duty-free (2012)	1,983	16.2
2012	4,854	46.2	2012	7,529	61.6
2013	12	0.1	2013	9	0.1
2014	372	3.5	2014	1,019	8.3
2016	611	5.8	2016	596	4.9
2017	1	0	2017	2	0
2018	91	0.9	2018	55	0.4
2021	619	5.9	2020	1	0
2023	20	0.2	2021	802	6.6
2026	65	0.6	2023	53	0.4
			2026	137	1.1
			2027	2	0
			2028	1	0
			2029	6	0
			2031	2	0
			Remain dutiable	35	0.3
Total	10,511	100	Total	12,232	100

(Source) WTO (2010b).