

# The impact of regional trade agreements on bilateral trade flows: A Systemic Literature Review

SIBULELE MCHANI

*Phd-student, University of Debrecen, Károly Ihrig Doctoral School of Management and Business  
sibulele.mchani@econ.unideb.hu*

This paper reviews the theoretical and empirical literature on the impact of regional trade agreements on trade. The empirical literature is arranged based on the econometric methods used to estimate the gravity model. Advantages and disadvantages of each method were highlighted. Papers covering RTAs from Africa, Asia, the Americas, and Europe were reviewed to gain a more representative understanding. The covered empirical literature suggests that the Poisson Pseudo Maximum Likelihood (PPML) estimator is more reliable than OLS in estimating gravity models, as it can deal with zero trade flows. The Fixed Effects (FE) approach produces more consistent estimates than the Random Effects (RE) approach when quantifying the effects of RTAs. This is because it allows one to control for the unobserved time-invariant variables. Surprisingly, the covered literature suggests that a great majority of African RTAs generated trade, regardless of the method of estimation used.

**Keywords:** gravity model, RTA, OLS, PPML

**Journal of Economic Literature (JEL) codes:** F13, F15

## 1. Introduction

Over the past decades, regional trade agreements have noticeably increased. Between 1984-2018, the number of RTAs in force was 302 (WTO 2018a). As of 2020, 496 regional trade agreements were reported to the World Trade Organization (WTO 2020). Regional trade agreements can be classified as free trade areas, customs unions, common markets, economic unions, and total economic unions (Balassa 1961). Regional trade agreements have become a common feature of international trade. Currently, regional trade agreements go beyond trade and cover

other areas, such as investment, human rights, and environmental protection. The top five traders of 2017 (in terms of exports and imports) were all members of several regional trade agreements: China (19), the USA (13), Germany (46), Japan (16), and the Netherlands (46) (WTO 2018b).

The formation of regional trade agreements (RTAs) can result in trade creation or trade diversion (Viner 1950), with trade creation being the welfare-enhancing outcome. Trade diversion occurs when there is a shift in production from efficient external suppliers to non-efficient suppliers in the trading bloc. This outcome generates inefficiency in the world economy and has negative consequences for non-member countries. In contrast, trade creation occurs when the RTA shifts production from inefficient domestic suppliers to efficient ones within the trading bloc.

The considerable increase in regional trade agreements (RTAs) has stimulated great interest in the empirical literature that examines their effects. This paper presents a critical review of the literature and identifies gaps in the literature that could be filled by further research. This article is organized as follows: first, the factors that could generate welfare-enhancing regional trade agreements (RTAs) are presented. Then, the paper covers empirical literature from papers that quantify the effects of regional trade agreements on trade flows. The empirical literature is arranged based on the estimation method and the covered geographic area.

## 2. Determinants of trade creating/diverting RTAs

### 2.1. Geographical factors

The most important question is why a country would choose to gain membership to a certain trading bloc. The answer is that regional trade agreements have the potential to enhance welfare. However, as highlighted before, the formation of regional trade agreements can also result in trade diversion. Regional trade agreements established between countries who are geographically close to each other and who were trading heavily with each other prior to the agreement are more likely to improve welfare.

Krugman (1991) notes how countries are located on many continents, thus creating natural trading regions. According to his model, differences in transport costs mean that some regions trade relatively more with each other, even in the absence of RTAs. Krugman then suggests that if trading blocs are formed between natural partners, trade diversion is less likely to occur, and RTAs can be expected to improve welfare, given that the gains obtained from freeing intraregional trade

will be substantial while the costs associated with reducing interregional trade will be smaller<sup>1</sup>.

In contrast, Bhagwati and Panagariya (1996) argue that the volume of trade and transport costs criteria are not enough to guarantee that a regional trade agreement will enhance welfare. They point out that volumes are unreliable predictors of trade diversion, and that comparative advantage could change with time. Their paper demonstrates that a country could be better off by forming an RTA with a distant country instead of a nearby country, if the two countries are identical in terms of economic structure.

Krishna (2003) utilizes detailed US trade data to prove that neither geography nor trade volume is significantly correlated with welfare gains, implying that they are unreliable indicators for measuring gains from trade, contradicting the natural trade bloc approach. Still, the author establishes that 80% of the hypothetical regional trade agreements he examined are welfare-enhancing.

### 2.2. The role of governments

It is important to remember that joining any regional trade agreement (RTA) is a political decision, and therefore the role played by governments is critical. According to Richard (1993), preferential tariffs result in a displacement of imports from non-members, and this lowers welfare. Governments are therefore encouraged to lower external tariffs to limit the displacement of imports from non-member countries.

Grossman and Helpman (1995) argue that governments that interest groups heavily influence through campaign contributions will most likely choose trade-diverting agreements to appease those special interest groups.

Ornelas (2005) demonstrates that a free trade agreement (FTA) reduces incentives to lobby against imports from non-member countries and thus resulting in rent reductions normally generated in lobbying processes. Given that governments can anticipate those rent reductions, they start to become “conservative” in their decisions to join FTAs. This means that some welfare-enhancing arrangements will lack political support, but the political feasibility of welfare-reducing FTAs will become even more undermined. The author suggests that if industry lobbyists incur high costs when trying to influence the outcome of proposed FTAs, only welfare-enhancing FTAs will become politically feasible.

<sup>1</sup> Zissimos (2009) points out that forming an RTA with a close by country can generate rent-shifting due to lower transportation costs.

### 2.3. *The political and strategic reasons behind RTAs*

Much less attention has been devoted to the political and strategic motivations behind creating regional trade agreements (RTAs). However, some researchers have studied the connection between foreign trade and conflict. Take Mansfield and Pevehouse (2000) for an example, who argue that parties to the same preferential trade agreement (PTA) are less likely to have disputes compared to countries that do not belong to any PTA and that the rise in trade flows between them limits the likelihood of hostilities.

Martin et al. (2008) suggest that multilateral trade openness limits bilateral dependence on any given trade partner and thus lowers the cost of a bilateral conflict. Whereas RTAs increase the opportunity cost of a war by enhancing intra-regional trade.

Vicard (2012) demonstrates that security issues drive the formation of deep regional trade agreements (RTAs). He indicates that deep RTAs are more efficient in preventing wars, while shallow RTAs have no impact on war probabilities.

According to James Thomson (2014), the end of the cold war meant a paradigm shift for states around the globe. The fall of the USSR made the US the only remaining superpower. Countries like Mexico and other Central and South American states feared that the US would be hostile towards their governments due to their close ties with the Soviet Union. Thomson suggests that this fear was the primary motivation behind the formation of the North American Free Trade Agreement (NAFTA).

Schlegel (2018) reveals that the Israel-U.S. FTA was driven by security considerations. The main objective of the US is to bolster its strategic ally in the Middle East. The finalization of the Israel-US FTA also generated benefits for the US, such as intelligence sharing on terrorism, military collaboration, and the promotion of shared values. Some researchers have focused on the relationship between participation in a free trade agreement and the sustainability of democracy.

Liu and Ornelas (2014) constructed a model focusing on the destruction of rents due to RTAs. Their model produced two key findings. First, engaging in FTAs increases the duration of democracies. Second, political instability incentivizes countries to participate in FTAs.

### 3. The empirical literature on trade creating and trade diverting RTAs

In this section, I present empirical papers that examine the effects of regional trade agreements on trade. The pieces are arranged based on the estimation method employed. The estimation methods are arranged as follows: OLS cross-section

analysis; OLS with Fixed Effects (FE); OLS with Random Effects (RE); and PPML with Fixed Effects (FE).

#### 3.1. *OLS cross-section estimation*

Most studies utilize the gravity model, which predicts that trade is influenced by income and other variables (such as distance and market size) and insert a dummy variable for RTA to examine whether the presence of a trade agreement significantly impacts trade flows. I first review papers that examine the impact of African regional trade agreements by employing OLS to estimate their gravity models.

I start with Cernat (2001), who utilized cross-sectional data covering the years 1994-98 to examine the potential impact of South-South RTAs on intra-trade and extra-trade. Standard OLS with White heteroskedastic-consistent errors was applied to estimate his gravity model. Findings revealed that both COMESA<sup>2</sup> and SADC<sup>3</sup> had significantly positive effects on both intra-trade and extra-trade, while ECOWAS<sup>4</sup> had a significantly positive impact only on intra-trade.

The second paper that focused on African RTAs is from Musila (2005), who utilized annual data from 1991 to 1998 to measure the intensity of trade creation and trade diversion in COMESA, ECCAS, and ECOWAS. In his paper, White's heteroskedasticity test was run to address the heteroskedasticity problem. His OLS estimates for the gravity model demonstrated that trade creation intensity was greater in the ECOWAS followed by COMESA. Meanwhile, no trade creation effect in ECCAS was empirically established. The results produced by both papers are clearly in contrast to theoretical work on African RTAs. Take Yang and Gupta (2005) for an example, who argued that African regional trade agreements (RTAs) generate low intra-regional trade as they fail to exploit economies of scale and promote competition, due to lack of complementarity between trade partners, small market size, poor infrastructure, and high trading costs.

Some researchers evaluated the impact of Asian integration on trade by conducting OLS estimations for gravity models. Like Sohn (2001), who examined whether membership to APEC would significantly improve the bilateral trade of South Korea with other member countries. The cross-section analysis for his gravity model suggested that South Korea's bilateral trade with a member country would be three times as much as that with a non-member country.

Otsubo and Umemura (2003) analyzed the impact of different RTAs on the trade flows of 113 countries, utilizing data covering the years 1984-1993. The cross-section estimations for the gravity model revealed that, among the tested

<sup>2</sup> Common Market for Eastern and Southern Africa

<sup>3</sup> Southern African Development Community

<sup>4</sup> Economic Community of West African States

RTA dummy variables, APEC<sup>5</sup> was the most significant. The findings further established a positive correlation between intra-APEC trade and FDI flows as well as between trade flows and trade complementarities.

### 3.2. OLS estimation with Fixed Effects (FE)

This section mentions papers that estimate gravity models by employing OLS with fixed effects. It starts with Afesorgbor (2019), who evaluated the impact of regional integration and commercial diplomacy on trade among African countries. He investigated whether there is a trade-off or a complementarity between these tools in generating trade by utilizing the gravity model for 45 African countries covering the time period 1980-2005. The estimation results demonstrated that diplomatic exchange had positive and statistically significant effects on bilateral exports. In contrast, regional trade agreements effects were statistically insignificant.

As regards Asia, Wong et al. (2017) examined the effects of AFTA on manufacturing trade between 10 ASEAN countries and 39 of their trading partners outside ASEAN. The authors utilized panel data that covered the period 1995-2014. OLS estimations with fixed effects and random effects were carried out. Results from the fixed effects model indicate that AFTA has trade creation effects in terms of exports.

As for integration in the Americas, Zahniser et al. (2002) analyzed the impact of regionalism in the western hemisphere on US agricultural exports. Their OLS estimates with fixed effects results revealed that NAFTA had significantly positive effects on US agricultural exports to Mexico, while other findings suggested that Mercosur decreased US agricultural exports to Brazil. Further estimations demonstrated that there is no evidence to suggest that CFTA<sup>6</sup> and NAFTA<sup>7</sup> had a significant impact on US exports to Canada.

Coughlin and Wall (2003) examined how trade liberalization effects associated with NAFTA impacted US exports. Their OLS estimates with fixed effects illustrate that NAFTA had large and significant effects on US exports. While exports to Mexico and Canada had increased by 16% and 15%, those to Europe and Latin America decreased by 6% and 3%. Additionally, estimates revealed that NAFTA increased US exports to Asia by 15%. Interested in North American integration, Geldi (2012) quantified the likely effects of the North American Free Trade Agreement (NAFTA) on a selected number of countries. Her gravity model was estimated by utilizing OLS with fixed effects. The dummy variable represent-

ing intra-NAFTA trade was positive but insignificant. At the same time, exports from NAFTA to non-member countries were 38.8% less than the normal levels.

I finalize this section by reviewing papers that employed OLS with fixed effects to estimate the impact of European integration. Egger and Pfaffermayr (2002) analyzed the effects of EU integration on intra-EU6 trade and periphery trade. The coefficients from OLS estimations with fixed effects demonstrated that the expansion of the EU by including Southern European countries (Greece, Spain, Portugal) had a significantly negative impact on the intra-trade of the six founding members. The findings further established that the EU integration had a more substantial positive impact on the intra-trade of non-founding members.

### 3.3. OLS with Random Effects (RE)

The use of OLS with random effects to estimate gravity models is uncommon. In this section, I will mention the very few papers that adopted such an estimation method. I begin Shinyekwa and Othieno (2013), who examined the potential impact of EAC<sup>8</sup> on trade creation and trade diversion. They utilized panel data from 2001 to 2011 on 70 countries that extensively trade with EAC member countries. Their estimation results suggested that the EAC significantly increased intra-trade by 77% from 2001-2004, while between 2005-2010, intra-trade rose by 46%. Overall, the results established that EAC had trade creation effects.

To study the determinants of US imports, Yuan Ma (2015) employed an augmented gravity model using panel data from 50 countries for the period 1993-2012. The OLS estimates with random effects (RE) showed that NAFTA does not significantly influence trade between Mexico and Canada with the US. These findings were surprising because other papers from researchers such as Ting and Peter (2010) had established that NAFTA has positive and statistically significant effects.

All the papers covered above employed the OLS approach to estimate their gravity models. The papers that dealt with cross-sectional data carried out a cross-section gravity analysis. In their article, Breuss and Egger (1999) argue that the use of cross-section gravity analysis is not reliable to make judgements on trade potential levels. They discovered that the forecast interval was greater than 350% in terms of predicted values. The authors highlighted that such a result did not depend on a certain type of specifications. They concluded that intervals of such size made any estimation about absolute trade potentials disputable.

The papers that dealt with panel data either employed OLS with fixed effects or random effects. Fixed effects capture the influence of the unobserved time-invariant variables that are correlated to the RTA dummy variable. However, the fixed

<sup>5</sup> Asia-Pacific Economic Cooperation

<sup>6</sup> Canadian Free Trade Agreement

<sup>7</sup> North American Free Trade Agreement

<sup>8</sup> East African Community

effects approach has one major disadvantage: it cannot estimate exporter-and importer-invariant variables. On the other hand, the random effects (RE) approach has a heterogeneity bias. The independence assumption of residuals and covariates is not met (Bell and Jones, 2015).

Santos Silva and Tenreyro (2006) demonstrated that the use of Ordinary Least Square (OLS) to estimate gravity models is inappropriate. They highlighted that log-linearisation of the gravity model while there is heteroskedasticity generates inconsistent estimates. The authors concluded that the Pseudo Poisson Maximum Likelihood (PPML) is the most reliable estimator for gravity models. The Pseudo Poisson Maximum Likelihood (PPML) estimator appropriately deals with heteroscedasticity, model misspecifications, and excess zero trade flows.

### 3.4. PPML with Fixed Effects

In this section, papers that employed PPML with fixed effects to estimate the gravity model are reviewed. I begin with papers that focus on African RTAs. Ngepah and Udegha (2018) investigated African regional trade agreements using panel data from 1995 to 2014. The PPML estimations with fixed effects for the gravity model suggested that the African RTA with the highest trade creation effect was ECOWAS, an agreement that governs trade between Western African states. SADC, which regulates trade among Southern African nations, increased trade between its member countries by seven-folds, while COMESA generated a three-fold increase in intra-trade.

Still, on African integration, Abafita and Tadesse (2020) examined the impact of RTAs on the coffee trade of 18 major coffee exporters (4 of which are African) for the period 2001-2015. PPML estimations with fixed effects were carried out for the gravity model, and the results revealed that RTAs had no significant effect on coffee exports from African countries.

Other researchers analyzed Asian RTAs by utilizing panel data and employing the PPM estimator with fixed effects for their gravity models. Macanas (2015) examined the impact of AFTA<sup>9</sup> on intra- and extra- ASEAN trade in textiles and clothing. His paper utilized four-digit disaggregated data. The Pseudo Poisson Maximum Likelihood (PPML) estimation with fixed effects (FE) was applied to estimate the gravity model. The results demonstrated that, while AFTA was trade creating in terms of both intra- and extra-ASEAN trade, it also had trade diversion effects on the trade of clothing.

Jagdambe and Kannan (2020) quantified the trade creation and diversion effects of AIFTA<sup>10</sup>. Data on fifty countries with five mega RTAs spanning from 2005

to 2014 was utilized. The PPML estimations with fixed effects (FE) showed that the agreement increased trade by 77% more than the rest of the world if the trading partners were part of AIFTA. The agreement also displayed overall trade creation effects on the rest of the world.

I proceeded to papers that examined the impact of RTAs in the Americas by employing PPML with fixed effects to estimate gravity models. Ghazali et al. (2011) constructed a commodity-specific gravity equation and estimated it with PPML to evaluate the impact of trade agreements on meat commodities. The results revealed that both MERCOSUR and NAFTA substantially enhanced intraregional trade in meat commodities. While substantially decreasing trade with the rest of the world.

Palmer (2016) evaluated the effects of Caribbean countries developing trade relations with non-English speaking countries through the implementation of relevant RTAs. The PPML estimates with fixed effects demonstrated that such attempts resulted in more intra-Caribbean exports. Coefficients further established that the Caribbean was more interconnected than NAFTA.

To finalize this section, I reviewed papers that evaluated the impact of European integration by using PPML with fixed effects to estimate gravity models. Mensah (2019) analyzed the impact of the “Euro effect” on trade flows of new and old EMU<sup>11</sup> members. The models utilized panel data from 38 countries covering the years 1988-2015. Coefficients from the PPML estimator with fixed effects suggested that the euro had statistically significant and positive effects on the trade of “new” EMU countries. In comparison, it had a negative and statistically insignificant impact on “old” EMU countries.

Esteve-Perez et al. (2020) examined the impact of EMU on the eleven countries that joined early and Greece utilizing data that covers international and intra-national trade flows. The gravity model's PPML estimates with fixed effects (exporter time, importer time, and country pair) established no positive trade effects. However, when they added intra-national trade flows, they discovered significantly positive effects on trade among EMU countries. Thus, the results highlighted that not considering intra-national trade flows resulted in a downward bias when the overall impact of EMU was estimated.

The papers covered above all employed the Pseudo Poisson Maximum Likelihood (PPML) approach to estimate their gravity models because of its robustness. Despite its robustness, the PPML approach has its own shortcomings. Accordingly, Santos Silva and Tenreyro (2006) pointed out that even though PPML generates consistent estimates irrespective of the heteroscedasticity pattern, it only shows efficiency when there is proportionality between trade variance and trade mean. That means that efficiency issues exist if the true trade variance is not in

<sup>9</sup> Association of Southeast Asian Nations Free Trade Area

<sup>10</sup> ASEAN-India Free Trade Agreement

<sup>11</sup> European Monetary Union

conformity with the previous assumption. Additionally, even though the PPML makes estimating data with zero trade flows possible, it cannot precisely model them. This exposes the PPML to misspecification and self-selection bias, especially when zero trade flows correlate with the gravity equation's explanatory variables. Santos Silva and Tenreyro (2011) demonstrated that the Poisson Pseudo Maximum Likelihood (PPML) estimator generally behaved well even when the conditional variance was not proportional to the conditional mean. In addition, they showed that a large proportion of zeros in the sample does not impact the performance of the estimator.<sup>12</sup>

#### 4. Conclusion and final remarks

This paper reviews the theoretical and empirical literature on regional trade agreements. The covered empirical is arranged based on the method utilized to estimate gravity models and encompasses four geographical regions: Africa, Asia, the Americas, and Europe. In the past, researchers who investigated the impact of regional trade agreements utilized OLS to estimate gravity models. With time, the shortcomings of such an approach became apparent, mainly that it failed to consider zero trade flows, and as a result, the use of PPML was seen as the solution (see Silva and Tenreyro 2006). The Poisson Pseudo Maximum Likelihood (PPML) estimation appropriately deals with heteroscedasticity, model misspecification, and access zero trade flows. Another important point highlighted in the empirical literature is whether to use the fixed effects (FE) or random effects (RE) approach to estimate the gravity model. Before deciding, a Hausman test needs to be conducted, and if the test indicates the existence of a correlation between random errors and explanatory variables, then the fixed effects (FE) approach will be preferable. Baier and Bergstrand (2009) argue that the fixed effects (FE) approach produces more consistent estimates because it allows one to control for the unobserved time-invariant variables that are likely correlated with the RTA dummy variable.

Another unexpected finding from the literature reviewed was that most African regional trade agreements improved intra-regional trade no matter which estimation method was employed. Some even had statistically significant positive effects on trade with the rest of the world. This contradicted the popular narrative that African regional trade agreements fail to generate trade.

On a final note, empirical literature demonstrated that very few papers examined the north-south regional trade agreements, mainly those with African

and European signatories. Future studies could explore the impact of the SADC-EU EPA, which regulates any trade between a European Union country with the Southern African Community countries. It would be interesting to quantify the effects of such arrangements, given that countries in each grouping differ in terms of development. It would help us understand who benefits from the integration of the “rich” and “poor”.

**Annex Table 1: Summary table**

Author(s)	Geographic region	RTA name(s)	Estimation method	Intra-trade	Extra-trade
Cernat (2001)	Africa	COMESA ECOWAS SADC	OLS	(+) significant (+) significant (+) significant	(+) significant (+) insignificant (+) significant
Musila (2005)	Africa	COMESA (1998) ECCAS (1998) ECOWAS (1998)	OLS	(+) significant (-) significant (+) significant	(-) insign (Exp), (-) signif (Imp) (-) insign (Exp), (+) signif (Imp) (-) insign (Exp), (-) insign (Imp)
Sohn (2001)	Asia	APEC	OLS	(+) significant	Not reported
Otsubo and Umemura (2003)	Asia	APEC	OLS	(+) significant	Not reported
Zahinser et al. (2002)	North America	NAFTA-Mexico (model 4) NAFTA-Canada (model 4)	OLS with FE	(+) significant (+) insignificant	Not reported
Coughlin and Wall (2003)	North-South America	NAFTA MERCOSUR	OLS with FE	(+) significant (+) significant	(+) significant (+) significant
Egger and Faffermayr (2002)	Europe	EU	OLS with FE	(+) significant	Not reported
Ngepah and Udeagha (2018)	Africa	COMESA ECOWAS SADC	PPML with FE	(+) significant (+) significant (+) significant	(+) significant (+) significant (+) significant

<sup>12</sup> See i.e. Márkus (2018) and Biro et al. (2019) for further empirical demonstration of the superiority of PPML

Abafita and Tadesse (2020)	Africa	COMESA ECOWAS CEMAC	PPML with FE	(-) insignificant (-) insignificant (-) insignificant	Not reported
Macanas (2015)	Asia	AFTA	PPML with FE	(+) significant	(+) significant
Jagdamba and Kannan (2020)	Asia	AIFTA	PPML with FE	(+) significant	(+) significant
Ghazalian et al. (2011)	Americas	MERCOSUR NAFTA	PPML with FE	(+) significant (+) significant	(-) significant (-) significant
Palmer (2016)	Americas	Dominic Republic- Caricom Cuba-Caricom NAFTA	PPML with FE	(+) significant (+) significant (+) significant	Not reported
Mensah (2019)	Europe	EMU	PPML with FE	(+) significant	(-) insignificant
Perez (2020)	Europe	EMU	PPML with FE	(+) significant	(+) significant
Afesorgbor (2019)	Africa	ECOWAS SADC	OLS with FE	(+) insignificant (+) insignificant	Not reported
Wong et al. (2017)	Asia	AFTA	OLS with FE	(+) significant	(+) significant
Geldi (2012)	North America	NAFTA	OLS with FE	(+) insignificant	(-) significant
Shinyekwa and Othieno (2013)	Africa	EAC	OLS with RE	(+) significant	Not reported
Yuan Ma (2015)	America	NAFTA	OLS with RE	insignificant	Not reported

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