

Sokolova, Maria V.

Working Paper

Exchange rates, international trade, and growth: Re-evaluation of undervaluation

ADB Working Paper, No. 684

Provided in Cooperation with:

Asian Development Bank Institute (ADBI), Tokyo

Suggested Citation: Sokolova, Maria V. (2017) : Exchange rates, international trade, and growth: Re-evaluation of undervaluation, ADB Working Paper, No. 684, Asian Development Bank Institute (ADBI), Tokyo

This Version is available at:

<https://hdl.handle.net/10419/163184>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by-nc-nd/3.0/igo/>



ADB Working Paper Series

**EXCHANGE RATES, INTERNATIONAL
TRADE, AND GROWTH: RE-EVALUATION
OF UNDERVALUATION**

Maria V. Sokolova

No. 684
March 2017

Asian Development Bank Institute

Maria V. Sokolova is a research assistant at The Centre for Finance and Development at The Graduate Institute of International and Development Studies in Geneva.

The views expressed in this paper are the views of the author and do not necessarily reflect the views or policies of ADBI, ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

Working papers are subject to formal revision and correction before they are finalized and considered published.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. ADBI encourages readers to post their comments on the main page for each working paper (given in the citation below). Some working papers may develop into other forms of publication.

Suggested citation:

Sokolova, M.V. 2017. Exchange Rates, International Trade and Growth: Re-Evaluation of Undervaluation. ADBI Working Paper 684. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/exchange-rates-international-trade-and-growth>

Please contact the authors for information about this paper.

Email: maria.sokolova@graduateinstitute.ch

Asian Development Bank Institute
Kasumigaseki Building, 8th Floor
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

© 2017 Asian Development Bank Institute

Exchange Rates, International Trade and Growth: Re-Evaluation of Undervaluation*

Maria V. Sokolova[†]

First version: May 2015
This version: November 2016

Abstract

This paper shows that regional trade integration shifts the burden of the exchange rate adjustment towards the less integrated trading partners. Thus, they bear the cost of trade balance expansion, while competitive exchange rate moves vis-à-vis RTA trading partners result in no expansion or deterioration of the overall trade balance.

First, using the data on 138 countries since 1990 that have been involved in regional trade integration through signing regional trade agreements (RTAs), this paper shows that upon a 10% depreciation towards non-RTA trading partners results in a 4.4% improvement of the aggregate trade balance. A similar competitive depreciation towards RTA trading partners has resulted on average 3.7% deterioration of the aggregate trade balance. Second, I confirm that RTA participation can act as a good proxy for trade integration, and test the results with alternative measures of trade balance. Third, I use a simple model framework based on the current account adjustments to put the empirical findings into the theoretical frame.

Altogether, this paper indicates that regional trade integration in the form of RTA should be taken into account in questions related to the competitive exchange rate effects and trade balance adjustment.

Keywords: trade balance, regional trade agreements, competitive depreciation, economic integration, terms-of-trade

JEL classification: F10, F13, F14, F15, F40, F41, F45

*This research would not have been possible without advice and help of Nicolas Berman, Cedric Tille and Joost Pauwelyn. Comments of Ugo Panizza and Tim Schmidt-Eisenlohr were very helpful. The financial help of the Graduate Institute and Swiss National Science Foundation is gratefully acknowledged.

[†]The Graduate Institute of International and Development Studies (Geneva, Switzerland) and Georgetown University (DC, USA) (maria.sokolova@graduateinstitute.ch).

1 Introduction

The idea that a competitive real exchange rate¹ fosters economic growth has received a lot of attention both in academic and policy circles. In particular, it has gained increasing interest recently with respect to the currency movements of the biggest economies and a seeming disconnect with developing countries, and due to the mixed evidence on its impact on trade.

This paper contributes to the discussion by combining the question of favorable effects of a competitive exchange rate – the change in terms of trade – with the trade linkages and integration of countries through regional trade agreements (RTAs). Specifically, the main specification tests whether the long-term improvement of the trade balance – as measured by the ration of exports to imports as in Rose & Yellen (1989) – was associated with depreciations vis-à-vis RTA trading partners or non-RTA trading partners. Previewing the results, for a sample of 138 countries since 1990 that were involved in regional trade integration a 10% depreciation vis-à-vis non-RTA trading partners has increased the aggregate trade balance by 4.4%, while a similar decrease versus RTA trading partners resulted in 3.7% lower trade balance. The diverging elasticities are robust to alternative measures of trade balance.

While the positive result of the long-term trade balance reaction to a more competitive exchange rate is in line with the predictions of conventional macroeconomics, the negative (or in some specifications insignificant) effect of depreciations vis-à-vis RTA trading partners is, at the first sight, puzzling. As this paper assesses, the newest advances in international trade - especially in the area of trade integration via the means of regional trade agreements (RTAs) - should be taken into account to explain these findings. This paper sets forth the argument that in the world of complex trade and production links, the connection between trade balances and exchange rate depreciation - the so-called "currency wars" - needs to be reconceptualized. Integration between the countries that have an RTA leads to neutralization of the favorable effect depreciation through the terms of trade effect and can in turn lead to a worsening of trade balance of the depreciating country.

There has been no consensus on the effects of exchange rates on trade – and thus on trade balances – with theory usually overstating actual results.² The most commonly cited fact for the disconnect is the expansion of the global production networks (Ahmed *et al.*, 2015). The question of this paper is related to one of the latest World Economic Outlook reports (IMF, 2015) that has also been concerned with the disconnect between exchange rates and trade, and the role of global value chains in this disconnect. The report's findings revealed the complete disconnect between exchange rates and trade, while establishing some evidence of the distortive role of global production networks. Nedoncelle (2016) finds a strong connection between the current account improvements and changes in industrial structure provoked by regional integration.

¹Here and throughout this paper, "exchange rate" is defined as the units of domestic currency needed to acquire a unit of foreign currency. "Competitive exchange rate" is defined as an exchange rate that allows for beggar-thy-neighbor monetary policy by means of currency devaluations.

²See, for example, the argument of Krugman (2015) on forecasting large adjustments; The analysis of Huchet-Bourdon & Korinek (2011); Haddad & Pancaro (2010) shows that the evidence is, at best, highly scarce and not convincing. An example of the match between the exchange rate change and trade balance is the Japanese-US after the Plaza Accord adjustment.

The effect of trade liberalization on trade balances across the world is heterogeneous: while the positive effect has traditionally been found (Gourinchas & Rey, 2014), for developing countries the evidence is usually negative (Santos-Paulino & Thirlwall, 2004), mixed (Wu & Zeng, 2008) or insignificant (Ostry & Rose, 1992). This asymmetry of trade liberalization on trade balances is due to the use of different data sets, time spans, theoretical models, estimation techniques, measures and sample selection. In their cross-country analysis almost all of the previous empirical studies assumed a homogenous effect of trade liberalization, overlooking the existence of deeper trade integration. This paper incorporates regional trade integration to explain the heterogeneous effect of trade liberalization on the trade balance. In that regard Nedoncelle (2016) finds that changes in production structure as proxied by RTAs exacerbate the effect of the trade liberalization on current accounts. This finding supports the argument put forward in this paper – that the integration within RTA countries results in a higher correlation between the RTA countries’ current account through the changes in specialization, and that this will make the trade balance of a given country less elastic or negatively elastic to the competitiveness changes towards the RTA trading partners.

As a multitude of models and empirical investigations show, preferential terms within an RTA result in increased trade flows between countries that enter the RTA relationship. Preferential treatment of goods produced in other RTA members’ economies indicates their greater preference share in the consumption basket.

Additionally, some of the literature has discussed the role of vertical trade and global value chains (GVCs) in changing trade balance elasticities, (Kose & Yi, 2001; Ahmed *et al.*, 2015) but as the most recent studies show it cannot account for the full spectrum of different findings (IMF, 2015). The influence of vertical trade is in line with the more aggregate approach adopted in this paper. Vertical trade and GVC activity are more likely within RTAs, which create stronger production links through specialization within RTAs (Nedoncelle, 2016)³ and neutralize the terms-of-trade within RTAs.⁴

The empirical findings of this paper – the differences in elasticities vis-à-vis RTA and non-RTA trading partners – are afterwards put into the theoretical domain through augmenting the model of Obstfeld & Rogoff (2005) by including into the analysis a concept of regional bias. Regional bias in a multicountry exchange rate adjustment model with flexible prices can be seen as lower trade costs within the region, or as the result from the deeper integration between the RTA partners. The flexible price assumption allows one to track the effect of depreciations without regarding currency pricing, which can be a subject to further extensions. Greater sensitivity to particular terms-of-trade indicates the source of the welfare gain from a competitive depreciation.

This paper contributes to the literature in several ways. First, I show that trade integration

³For a more detailed discussion, see the companion paper “Trade Re(Im)Balanced: The Role of Regional Trade Agreements.”

⁴This refers to the effect first discussed by Staiger & Bagwell (1999): by forming RTAs countries “locks out” other countries that are not participating in regional integration, making it harder for them to enter while increasing the overall competitiveness (the market price lowers with RTA). A more detailed discussion is available in the companion paper.

has shifted the burden of adjustment to the trade balance with the less integrated trading partners. This means that a competitive depreciation increases the trade balance of a depreciating country in the long term at the expense of the less integrated trading partners. Second, this trade integration can be proxied by RTA activity between the country and its trading partners. An RTA is a good proxy for measuring trade integration because RTA countries have similar (or the same) external trade policy, more beneficial trading terms compared to the rest of the world and more stable institutional links. The trade links that bind the countries within the RTA reduce the efficiency of depreciation and may result in negative elasticities, as the depreciating country will have now to pay more domestic currency for the same amount of goods. As mentioned above, this paper links argumentation and empirical findings by adding the “regional bias” (which encompasses the benefits of RTA) into the exchange rate adjustment model of Obstfeld & Rogoff (2005).

The rest of the paper is organized as follows: Section 2 discusses the background literature on trade balances, exchange rates, and regional trade agreements; Sections 3 and 4 provide the empirical specification and results; Section 5 provides a theoretical channel that captures the patterns of the empiric; and, Section 6 concludes.

2 Literature Review

There is no doubt that rapid globalization has changed the links between the countries within the last decades. A big indicator is the expansion of the trade links between the countries. French Brie can be found (at least somewhere) in almost every country in the world, while a Korean Kia or German Volkswagen is assembled from parts produced in a great number of countries. While some countries see trade flows with many new countries, others have strengthened and deepened many of their existing strong ties. A major factor contributing to trade expansion is the conclusion of the Uruguay Round of the General Agreement on Tariffs and Trade that established the World Trade Organization (WTO) in 1994. However, since then, many countries have been engaging themselves in plurilateral trade agreements that have deepened these links. These RTAs⁵ have proliferated from around 20 in 1990 to over 150 in 2010.

Rapid globalization is not bringing stability for the countries. The major move from fixed to floating exchange rate regimes in the end of the twentieth century has been associated with greater risks of exchange rate risk exposures.

Even though the importance of both of these occurrences - trade expansion and floating exchange rates - have been well discussed in the literature, the evidence, as shown below, on the link between the two is by no means universal. Theory predicts that a depreciating exchange rate boosts exports and countries can grow (in terms of GDP) in such circumstances - but this holds mostly for developing countries (Rodrik, 2008). Developed countries are less likely to see gains through undervaluation of the exchange rates. At the same time, some of

⁵Many of the agreements are not strictly “regional” as they join the countries in different regions of the world, and recently many professionals have preferred to call them Preferential Trade Agreements (PTAs). I use these terms interchangeably, but prefer to use “regional” in accordance to the Bergstrand dataset of trade agreements that is used in this paper.

the developing countries could never grow from an undervaluation, while the opposite move of the exchange rate does not always harm developed countries. This section brings together the literature on exchange rates and regional trade agreements. First, I review the evidence that exchange rate reaction is dependent on the links between the countries. Second, I argue that this trade integration between the countries can be proxied by the RTAs. In the next section this argumentation is used to provide a simple empirical methodology that accounts for RTA integration in calculating price elasticities of trade balance.

2.1 Exchange Rates and Trade Balances

In the recent era of trade liberalization, the positive trade balance of a country has usually been a sign of a growing and improving economy. Rodriguez & Rodrik (2001) have found a disconnect in such thinking, and later economists started worrying about the economies that are running persistent positive or negative trade balances, since in some cases this may provoke economic crises if countries cannot finance them (Obstfeld & Rogoff, 2009).

A trade balance is a part of a country's GDP and an important indicator of the economic state of the country. While the positive values have – until recently – rarely been a concern to local governments, negative values have been seen as a threat to economic growth. Since changing the total factor productivity or revealing the comparative advantage in the economy is obviously a complex task, and does not lie directly in the hands of the government, the historical problem has been a threat of artificial manipulation of the exchange rate – and thus the prices of exports – in order to improve the value of the trade balance.

The traditional open economy interpretation of exchange rates is that a depreciation of the real effective exchange rate makes exports relatively cheaper, while making imports relatively more expensive (as compared to the selected set of countries). This boosts the net exports and therefore improves the income in the economy. Even though the scientific evidence of such relationships has been diverse⁶, the talk about “currency wars” has traditionally had at its heart a concern about trade balances and economic growth.

The argument is then put forward that in the world of complex trade and production links, the connection between trade balances and such manipulation needs to be reconceptualized. While trade balances are still a concern for governments, this concern instead should focus on two scenarios: the trade balance with deeply integrated trading partners and that with non-integrated trading partners (i.e. partners not having an RTA in place). As Figure 4 illustrates, the trade balances within the RTA relationship are much lower, while the deepest RTAs are associated with the lowest imbalances.⁷ Within RTAs countries are linked more through their trade networks,⁸ and their trade balance adjustment will be different as compared to the non-RTA trade balance adjustment. More precisely, a depreciation against an RTA partner will enhance the exports to the RTA trading partner, but will also increase the price that has to be

⁶See, for example, (Leonard & Stockman, 2002) for the discussion of the recent advances.

⁷A full investigation is available in the companion paper “Trade Re(Im)Balanced: The Role of Regional Trade Agreements”.

⁸In my definition, trade networks relate to the fact that some countries drop or decrease production of some goods – final or intermediate – as they can import them from their RTA partners at a cheaper price.

paid for imports and thus there will be a lower trade balance improvement, making it less elastic to price changes. To illustrate this example, one can imagine a country producing one good, for example pillows, and having an RTA with a neighbor to import cotton as an intermediate input. Upon depreciation, the pillows will become relatively cheaper to all countries in the world, and thus the trade balance of the country will adjust, but to a lesser extent with the RTA trading partner, as there will be more intermediate inputs needed but cotton will have to be imported at higher prices.

The concern about the exchange rate is that it can be overvalued or undervalued – thus, it is not reflecting the actual state⁹ of the host economy. This then favors (harms) the exchange terms with other economies through benefitting (harming) a country’s trade. Since the era of the Bretton-Woods system and the shift to the system of floating exchange rates, this started potentially posing an even greater threat, and, as mentioned before, led to a discussion of the possibility of “currency wars”. However, there is an opposing point of view on the relevance and extent of the possibility of exchange rate manipulation. One line of argument is that the real and nominal exchange rates can be disconnected from other macroeconomic fundamentals, – and thus exchange rate depreciation may not have the desired impact.¹⁰ The other line of argument refers to the expansion of world integration and breakdown of goods (and services) production which makes the reactions more heterogeneous and not as beneficial to the host economy.¹¹

The majority of papers studying exchange rate elasticities have been looking at the bilateral exchange rate of some currency to the USD.¹² The nature of the exchange rate is bilateral – it is the price of one currency in terms of another. Yet, since virtually all currencies can be traded against one another, the effect of the change in the exchange rate cannot be isolated to a bilateral relationship. Thus, I take a less common¹³ – albeit more suitable for the purpose of the paper – approach of looking at the effective exchange rates. This allows the derived elasticities to capture the composition of trade flows and the multi-country nature of RTAs.

This differentiation between the RTA and non-RTA trading partners underlays the methodology presented below of the separate real effective exchange rate (REER) indices¹⁴ that indicate the relative price competitiveness of countries to their RTA and non-RTA trading partners, respectively. This takes into account the trade integration that the country is facing. Having two exchange rate indices allows one to test the assumption of relevance of trade integration with real data, as RTAs indeed are associated with trade integration and higher preferences for the goods produced within RTA.

Altogether, this paper’s concern about trade balances is twofold: first, to link the trade

⁹Some literature refers to it as the “fundamental state”.

¹⁰See Devereux & Engel (2002) for an example of causes and consequences.

¹¹The work of Kose & Yi (2001) highlighted the importance of accounting not only for trade, but also for the type of trade links – meaning the existence of vertical specialization – between the countries in order to explain the transmission of business cycles between the countries.

¹²Di Nino *et al.* (2011); Rodrik (2008); Dollar (1992) are some examples.

¹³This approach in the context of RTAs is used only by Fernandez-Arias *et al.* (2002), while as a reference any of the J-curve or Marshall-Lehner effect estimation literature can be used.

¹⁴Described in the methodology and in the Appendix II

integration to the exchange rate adjustment process; and second, to show that the legal interrelation between the countries in trade – having an RTA in place – can act as a proxy for a more accurate trade balance assessment. Thus, I continue with the discussion with the key recent literature on the RTAs next.

2.2 Regional Trade Agreements

Regional trade agreements exist of different types, as classified in Table 10. There is diverse information on the efficiency of RTAs for trade expansion. Baier *et al.* (2015), Carrere (2006) along with other researchers find that an ex post assessment of RTAs shows a significant increase in trade flows and the increase is greater for the deeper RTA agreements. Other researchers find that RTAs are by nature a predetermined occurrence and the signature an agreement has no effect on the existing trend behavior. While Vicard (2009), as some others have discussed, indicates that there is no homogenous effect of all RTAs by type, this point of view was further contested by the study of Baier *et al.* (2015) who show that the inaction of an RTA decreases such trade dampening characteristics as distance, language, legal and cultural differences.

The traditional approach to the effects of RTAs is using the standard gravity framework, which is a workhorse of trade economists¹⁵. Apart from the general simplicity of application, there are two major drawbacks of such methodology for the aggregate analysis. First, RTAs (with the exception of the bilateral PTA) are plurilateral in nature, while the application of a gravity analysis, generally, considers only two poles. One exception is the study of Carrere (2006) in which she modified the gravity framework to include RTA-specific relationships - differentiating between such agreements as MERCOSUR, EU, etc. She shows that different FTAs have different impacts, and moreover, they impact the relationships outside of the FTAs (from FTA to outside, and among those countries on the outside). This introduces the second drawback of the gravity approach to study the effect of RTAs: the gravity theory is a partial equilibrium framework which ignores the existence of trade balances. To put it in simpler terms, while there is vast evidence that RTA changes trade links for the participating partners, it does not capture the relative effect on the outside of the agreement nor what should be the aggregate effect of an RTA on the bilateral trade balance of the signing pair.¹⁶ Some of the newest research (Blanchard *et al.* , 2016) suggests that there is indeed a certain political economy in the tariff liberalization in RTAs that is driven by value-added considerations of countries signing an RTA: a country is more likely to have a lower tariff on the intermediate products that are used in the production of the final goods with higher domestic value added.

Leaving aside the question of selection into the RTAs,¹⁷ this paper asks the question whether the RTA relationship is associated with benefits from “beggar-thy-neighbor” policies or not. The

¹⁵Examples include Vicard (2009); Carrere (2006); Baier *et al.* (2015)

¹⁶While this question is asked in greater detail and investigated in the companion paper “Trade Re(Im)Balanced”, in this paper I investigate how this changing trade relationships - proxied by the “within” and “outside” RTA participation - have changed the transmission of the aggregate exchange rate shocks on the global scale.

¹⁷There may exist self-selection bias into signing an RTA between trading partners with relatively more stable bilateral exchange rates (Frankel & Wei, 1998; Frankel *et al.* , 1996)

standard and main concern with entering into an RTA is that, while the RTA promotes more stable and transparent trade-related terms, there are - with the exception of the recently signed but not yet in force Trans-Pacific-Partnership (TPP) – no clauses on exchange rate supervision or management. Thus, this provides incentives to depreciate the domestic exchange rate in order to boost exports to other RTA-members.

Figure 7 presents a comparison of the average real effective exchange rate indices (REER, normalized to 2005) among the RTA and non-RTA members for subsamples of countries by their level of development. While on the aggregate, they appear to be similar, by-country split indicates several traits, such as: a) advanced economies¹⁸ saw average increase in competitiveness towards their non-RTA trading partners, while b) emerging economies were more competitive to their RTA trading partners than non-RTA ones. Low-income countries appear not to have a consistent pattern, but (including the crisis periods of 1996-1998) most commonly they were more competitive in their RTA trade than in non-RTA trade. But what are the real implications of such behaviors on the trade values of these countries?

All in all, while some evidence is mixed, an overwhelming majority of scientists and researchers believes that regional integration is beneficial for freer trade because, it enhances efficiency of the economies in question.

3 Empirical Estimation

The main hypothesis is that trade integration has changed the trade balances elasticities among the countries that implemented regional integration through RTAs – channeling the adjustment of trade balance upon exchange rate shock to the less integrated trading partners. The empirical basis for the investigation is a reduced form trade balance regression adjusted to evaluate the price effects of RTAs. As the previous section highlights, there could be different trade-offs from competitive behavior towards less and more integrated trading partners.

3.1 Data

As the main data source I use the Direction of Trade bilateral trade statistics (DOTS) and International Financial Statistics of the International Monetary Fund database. I aggregate the monthly exchange rates to the yearly average and use CPI yearly values to calculate the real exchange rate between countries.

The DOTS data covers the time period between 1960 and 2009. As RTA-s became a relatively widespread occurrence only in the last couple of decades. To make the assessment full, I only use the time period between 1990 and 2010.¹⁹ As I am interested in investigating different patterns of exchange rate elasticity vis-à-vis RTA and non-RTA trading partners, only the countries who have been engaged in RTA-activity as defined below are considered. This results in a different sample year-by-year.

¹⁸I use the IMF definitions of the country groups.

¹⁹That allows me to capture the integration after the Soviet Union collapse and insures the quality and comparability of the data.

RTA data comes from the publicly available Bergstrand dataset. The classifications of the agreements, list of countries and agreements in the original dataset are provided in tables 2, 9 and 10 in Appendix III and are publicly available. In the Bergstrand dataset, information is available for heterogeneous RTAs as described in table 10. For the purpose of this paper, I use RTAs of medium and deep integration types: free trade agreements (FTAs), custom unions (CUs), common markets (CMs) and economic unions (EUNs). Lower integration RTAs (one-way preferential trade agreements and bilateral preferential trade agreements) are not considered as they do not provide for a common tariff schedule and seldom create vast tariff cuts.

Other data is from the World Development Indicators dataset of the World Bank. The data on contingency is taken from the gravity dataset provided by CEPII. When looking at the Eurozone countries after the introduction of the Euro, I use the conversion rates set by the ECB to convert the Euro rate and use it for uninterrupted time series of the exchange rates.

3.2 Real Effective Exchange Rates

This paper tests the existence of the different price elasticities between the most and the least integrated trading partners. The previous section argued that in the current globalized world this could be achieved by looking at the RTA versus non-RTA trading partners of each country, since RTAs²⁰ can be used as a proxy for trade integration.

Price elasticity in terms of trade balance refers to the exchange rate of a country. With the notable exception of (Fernandez-Arias *et al.*, 2002) most of the researchers use the bilateral exchange rate of a country vis-à-vis the United States Dollar (USD). Even though it may appear to be a good proxy, it may bias the results of the estimations, and it does not allow the separation of the trading partners in subsamples. For that purpose I base my estimations on the REER (real effective exchange rate). Most commonly, an RTA is conducted between a number of countries, therefore I am interested in estimating the effect of the more competitive exchange rate vis-à-vis a certain group of trading partners. Using the REER indices allows me to combine all RTA-partners and all non-RTA partners in separate price indices that depict the sample-specific competitive price behavior. Another advantage, apart from the ability of selecting a certain subgroup of countries, is that REER is comparable across countries and years.²¹

Therefore, for any given country i in year t that has an RTA signed with the subset J_1 of its trading partners, I calculate the following measures:

$$REER_{i,t}^{RTA} = \prod_{j \in J_1} (brer_{i,j})^{\omega_j}$$

$$REER_{i,t}^{noRTA} = \prod_{j \in J_2} (brer_{i,j})^{\omega_j}$$

²⁰As explained in the previous Data subsection, I do not look at the GSP concessions and bilateral preferential trade agreements, as they have less bounding nature and/or do not have a statutory two-way duties or concessions. It should be noted that results including the PTAs hold, but less robustly.

²¹The full process and data used in the construction REERs is presented in the Appendix II.

As discussed above, I use RTA²² as a proxy for the integrated subsample J_1 and the non-integrated subsample J_2 .

For the main specification, I calculate the three year averaged trade weights ω_j , which sum to unity over the subset I also conduct a robustness check with a five year chain averages for the REER calculation. In order to benefit from the data and have the largest country coverage, I do not limit to a subset of countries but take into account all existing trading partners in every year (as reported by DoTS trade flows). By doing so I aim to expand the country coverage from the conventional focus on developed countries.

I calculate CPI-based REERs. The use of CPI-based REER is necessitated by the availability of data, though I recognise that the use of the GDP-deflator would be more reputable. All REERs for all countries are indexed to 2005 for purposes of ease in estimation and comparison.²³ The increase in the given REER indicates that the domestic country is becoming more competitive relative to the subsample of trading partners. Similarly, the decrease in REER is associated with appreciation of the currency relative to the subset of trading partners.

As I am working in a panel setup, I estimate within-country time-variance controlling for all time-variant non-country specific shocks.

3.3 Empirical Specification

$$TB_{it} = \gamma_0 + \gamma_1 \ln(REER^{RTA}) + \gamma_2 \ln(REER^{noRTA}) + controls + \lambda_i + \lambda_t + \epsilon_{it} \quad (1)$$

Equation 1 relates the trade balance of a country i at time t to the two-price competitiveness indices of the RTA and the non-RTA trading partners. As the assumption of constant country sizes is not realistic in the long-term estimations, I add controls for domestic and world income. The regressions in the main specification are run on 3-year averaged values due to the short timespan of the data – while the panel dates back to 1990, the number of countries with RTAs picks up only after 2000 (as illustrated in figure 9).

The REERs are constructed as described above. I include the country-variant time-invariant and time-variant country-invariant fixed effects. As I aim to investigate whether the greater (more positive) trade balance is associated with the more competitive (thus more depreciated) effective exchange rates to the non-RTA trading partners, the higher value of $\gamma_2 > \gamma_1$ suggests that on average the greater values of trade balance are associated with more competitive exchange rates to the non-RTA partners. This is interpreted to mean that there is a higher elasticity of the trade balance to the non-RTA trading partners. The *controls* are the levels of domestic income (measured through nominal GDP), foreign income (measured as trade-weighted nominal GDP of trading partners) and the initial (t-1) level of trade balance.

There are several widely used trade balance measures, and I follow the literature in this

²²From here on by referring to RTAs I imply the types of RTAs described in the previous subsection as seen in table 2.

²³Indexing to 2000 does not change the general findings, but decreases the sample size as I lose countries that did not have an RTA in effect at that date.

regard. The first measure is

$$TB_1 = \ln\left(\frac{Exp_{it}}{Imp_{it}}\right)$$

– this measure is commonly used in J-curve literature (Rose & Yellen, 1989; Bahmani-Oskooee & Malixi, 1992). Alternatively, I present the estimations with the following measures:

$$TB_2 = \frac{Exp_{it} - Imp_{it}}{GDP_{it}} \quad \text{and} \quad TB_3 = \frac{Exp_{it} - Imp_{it}}{Exp_{it} + Imp_{it}}$$

The two latter measures represent the proportions (shares) of net export to either trade or GDP of the country. In contrast to measure TB_1 , they can take negative values and are symmetrical around zero. Therefore, I consider estimations with only the positive parts of the distribution (same results are achieved when taking the absolute value of the trade balance). All standard errors are clustered at the country level. The controls included in the regression are the standard controls used in the literature – domestic and foreign income. In order to keep the sample of countries, income is measured by the log GDP (in USD). Foreign income is measured as the trade-weighted GDP of the trading partners as in Ahmed *et al.* (2015), but results are robust to using the non-weighted GDP in most of the specifications.

The main specification is concerned with estimating the long-term elasticities of trade balance vis-à-vis RTA and non-RTA trading partners. The main hypothesis is that these elasticities will differ between the samples, but one could be concerned about the influence of the historical level of trade balance of a country. For that purpose in an alternative estimation in robustness checks I augment equation 1 with a control for the level effect of the previous value of trade balance. I use yearly data while adding the lagged trade balance $TB_{i,t-1}$. This contains more information (especially since RTAs pick up after 2000), but turns the panel into a dynamic panel with a high level of endogeneity, and therefore I perform Arellano-Bond type GMM estimations.

As a further robustness check, I also run separate regressions on the imports, exports and value added generated in the economy. If trade integration via trade agreements changes the price elasticity of trade balances, the coefficients next to RTA and no-RTA subsamples will differ in their sign.

The above stated estimations all refer to the long-term elasticities of the trade balance. Given that the model refers to the already existing regional preference – level of parameter a – it is not wrong to limit the estimations to only the long-term elasticities. The simple log changes on log changes estimation of 1 (adding lagged trade balance does not increase endogeneity with changes on changes regression) is performed to check whether the effect holds in a dynamic setting:

$$\Delta TB_{it} = \gamma_0 + \gamma_1 \Delta \ln(REER^{RTA}) + \gamma_2 \Delta \ln(REER^{noRTA}) + controls + \lambda_i + \lambda_t + \epsilon_{it}$$

I acknowledge that the proper investigation of the short-run elasticities can make the picture more complete, but, given the availability of existing empirical evidence, this is left for further

research.²⁴

4 Results

4.1 Trade Balance Elasticities

The results of the main specification on the different measures of the trade balance are presented in Table 3. I provide two set of results for each of the measures of trade balance - without the controls (columns (1), (3) and (5)) and with the world and domestic income controls (columns (2),(4) and (6)). Country and time fixed effects are included in every regression.

Using the Rose & Yellen (1989) measure of trade balance - log of ratio of exports to imports - a 10% depreciation²⁵ results in 3.1-4.4%% increase in the aggregate trade balance if the depreciation occurs vis-à-vis non-RTA trading partners. In case this depreciation occurs vis-à-vis RTA trading partners, the trade balance decreases by 3.7%. These results confirm the hypothesis of this paper that trade integration has shifted the burden of adjustment towards less integrated trading partners, and these partners can be proxied by the (non-)participation in RTAs.

The two alternative measures are percentage measures of their own (net exports as a share of GDP and as a share of total trade), hence the coefficient interpretation should be as follows: if we define the aggregate trade balance as the share of net exports in a country's GDP, then a 10% depreciation against the non-RTA trading partners increases the trade balance by 1.3% ($= (\frac{0.13}{100} * 10) * 100\%$). An analogous interpretation is possible for the share of net exports in trade and the increase of 1.1% following a 10% depreciation. The coefficient of RTA depreciation $\ln REER^{RTA}$ for the alternative measures of trade balance is not significant. This is in line with the main hypothesis of different elasticities, as the burden of adjustment lies on the non-RTA trading partners. It should be noted that due to the symmetry of the distributions of TB_2 and TB_3 around zero, only the estimations of the $[0; \infty)$ are used, and therefore the sample is reduced to about a half of sample in (1)-(2) columns.

The positive values of $\ln WorldIncome$ control for the two alternative measures appear to be puzzling at the first sight. The positive values of the world income can be explained by the absence of the values of the previous trade balance of the country in the estimation. For that reason I augment the main equation 1 with lag value of trade balance and run GMM estimation on yearly data, and the first-differences regression on the three-year averages. The main findings are confirmed when I add the lag-dependency on the size of trade balance. The first differences regression results in table 4 indicate that the burden of adjustment lies fully on the non-RTA trading partners, and every 10% change in the competitiveness to the relevant sample was matched with 0.9-4.2%% change in the trade balance.

GMM estimations (table 5) performed on yearly data indicate that the deterioration of trade

²⁴The usual techniques involve the J-curve estimations using ARDL or other approaches – see, for example, Bahmani-Oskooee & Fariditavana (2016)

²⁵I use terms "depreciation" and "increase in the price competitiveness" interchangeably as they both refer to the rise in the price levels

balance by 1-3.5% when a 10% depreciation is faced by the RTA partners, and only two-step difference estimations for 2 of 3 measures indicate the positive elasticity vis-à-vis the non-RTA trading partners. This is due to so-called J-curve effect which is observed in a shorter-term estimations. In the conventional J-curve estimation literature the evidence is mixed - for some countries the evidence was found Bahmani-Oskooee & Fariditavana (2016), while for others the absence of the effect was documented (Rose & Yellen, 1989; Leonard & Stockman, 2002). The results of this paper highlight an important insight on this mixed evidence: the J-curve effect is dependent on the trade integration of the country in question. The negative "balance effect" will be persistent for the integrated trading partners and hence will result in a deterioration of the aggregate trade balance, though it will be lower for the less integrated trading partners.

4.2 Other Robustness Tests

The main result of this paper relies on the fact that integration is higher between RTA partners, and this changes the elasticities of trade balance, shifting the burden of adjustment towards the non-RTA trading partners. The trade literature raises questions about the drivers of RTAs - whether their effects relate to the already existing trade relationships and if there are truly RTA-driven (Vicard, 2009). The main argument of this paper relies on the contrast between RTA and non-RTA relationships, and therefore the question of the average treatment effect of different types of RTAs is not in the scope of this paper.

The question remains whether the non-RTA and RTA differences in trade balance adjustments are not driven by the contiguity between the main trading partners or the size of bilateral trade imbalances. To test the former, I split all trading partner countries by their contiguity, and to test the latter, by the relation to the median size of the bilateral trade imbalances. Then I construct the real effective exchange rates for these subsamples. If the heterogeneous effect is driven purely by the relevance of the neighboring countries or the size of the bilateral imbalances, the results will be similar to the results in table 3.

The results in tables 8 and 7 show that the patterns of the effect disappear. This means that the change in elasticities is indeed driven by the trade integration changes between RTA and non-RTA trading partners.

Another way of confirming the trade integrative effect of RTAs and how they change the trade balance elasticities between the trading partners is to run the main specifications on the general aggregate trade flows - exports, imports and value added exported directly and indirectly. The data on value added generated in the economy is taken from the OECD, but it is only available for 50 economies. Table 6 provides the results. The results confirm the hypothesis of different elasticities against the two subsamples of trading partners.

5 Theoretical Motivation

This paper shows that trade integration has a substantial impact on the burden of the exchange rate adjustment. As highlighted in the literature review, there are many aspects of trade

that produce such result in the shift of the burden of adjustment. Recent trade models have concentrated on the value-added aspect of trade, which constitutes to the part of the effect. Other models have highlighted the costs to export influence, relationship durations, and the standard RTA investigations have looked at the expansion of trade flows. The drawback of these models – even though they look at the overall trade effect – is that they do not account for trade balances. Therefore, to explain the findings of this paper, I use the standard model of the current account adjustments and exchange rate effects in the multi-country setting model of Obstfeld & Rogoff (2005) (from now on an OR model). The OR model is augmented with regional preferences in consumption, and then the elasticities of trade balance with respect to RTA and non-RTA trading partners are derived. The extension to incorporate regionalism into the OR model provides several insights: in a world where some countries are more integrated than others, the real exchange rate adjustment is asymmetric among trading partners. It should be noted that the proposed model represents only one of the many ways to generate the empirical results of this paper. Alternative interpretations are left for further research and the individual scientific preferences of the researchers.

The model below is based on the fact that “regionalism” - meaning existence of a regional policy - creates *regional bias* against non-regional goods. Prior to laying out the set up and the main results of the model, it would be helpful to give an explanation for this link. Firstly, regional bias is an extension of an idea behind home bias in OR-type models. This implies that the existence of regionalism can be seen as the lower trade costs from the regional area as compared to the outside world - a valid assumption as this is the backbone of all types of RTAs considered in this paper, and has been verified by many researchers. Secondly, the model concerns itself only with the final good consumption, while it is argued that there is a GVC-enhancing effect within a region that has an RTA. The rationale there is a simplification purpose - the result of the changing elasticities can be achieved by looking at the final goods only, while taking into account further intermediate good preference will magnify the result further. Viner’s theory of comparative advantage can also be used for further evidence that the higher preference in the final good can be an indicator of deeper trade links. These two factors contribute to what is called “positive regional bias”. This positive regional bias generates the result that was observed in the empirical part - the change in the trade balance elasticity to the price changes (or terms of trade changes).

5.1 General setup

I focus solely on the intra-temporal price consequences of trade integration and assume (as Obstfeld & Rogoff (2005)) fully flexible nominal prices in order to highlight the importance of integration on the exchange rate adjustment.

As the discussion above has highlighted, RTAs have fostered greater and more linked trade between the participating countries – in the case of relatively more integrative trade agreements the gains go far beyond the fixed and variable cost gains of trade by expanding the production across borders.

The consumption basket of a country A in the Northern region takes the following form:

$$C_A = \left[\begin{array}{l} \left(\frac{1}{4}(1+\alpha)(1+a)\right)^{\frac{1}{\lambda}} (C_{AA})^{\frac{\lambda-1}{\lambda}} + \left(\frac{1}{4}(1-\alpha)(1+a)\right)^{\frac{1}{\lambda}} (C_{AB})^{\frac{\lambda-1}{\lambda}} \\ + \left(\frac{1}{4}(1-a)\right)^{\frac{1}{\lambda}} (C_{AC})^{\frac{\lambda-1}{\lambda}} + \left(\frac{1}{4}(1-a)\right)^{\frac{1}{\lambda}} (C_{AD})^{\frac{\lambda-1}{\lambda}} \end{array} \right]^{\frac{\lambda}{\lambda-1}} \quad (2)$$

C_{ij} represents the good of country j consumed in country i , a is regional bias and α is domestic bias within the Northern region. Every country produces one single good. The model is based on four countries within two regions – “North” and “South” with countries A and B , and C and D , respectively. The countries can be seen as two integrated regions: A and B in the North have an RTA between them, and likewise for C and D in the South. As I concentrate my analysis on country A , for simplicity the RTA in the South is disregarded, as for A country consumption goods from South will be similar irrespective to the origin from C or D . Therefore, the shares of countries C and D in the consumption basket are the same.

The existence of the positive regional bias $a \in [0; 1]$ that increases the share of RTA goods in the consumption basket of the member countries is supported by findings in the literature as discussed above. First, signing an RTA increases gross trade flows between RTA member countries(); second, there is an increase in the GVC activity between RTA members(); and third, RTAs address issues beyond fixed and variable costs of trade that synchronize the business cycles between RTA members(). All these facts stipulate the higher preferences share for the goods produced within the region in a country’s consumption basket. Although the argument can be extended to the intermediate goods trade as the region engages in production networks, the intuition can be captured in the model with final goods only and nested CES preferences in consumption.

In the equations below ρ represents the price level in a given country (country indicated as an index). As is common in the steady-state equations, “hat” sign indicates the deviation from the steady state.

Trade value of exports and imports of country A respectively is:

$$X_A^{Val} = \rho_A \frac{(1-\alpha)(1+a)}{4} \left[\frac{\rho_A}{P_B} \right]^{-\lambda} C_B + \rho_A \frac{1-a}{4} \left[\frac{\rho_A}{P_C} \right]^{-\lambda} C_C + \rho_A \frac{1-a}{4} \left[\frac{\rho_A}{P_D} \right]^{-\lambda} C_D$$

$$M_A^{Val} = \rho_B \frac{(1-\alpha)(1+a)}{4} \left[\frac{\rho_B}{P_A} \right]^{-\lambda} C_A + \rho_C \frac{1-a}{4} \left[\frac{\rho_C}{P_A} \right]^{-\lambda} C_A + \rho_D \frac{1-a}{4} \left[\frac{\rho_D}{P_A} \right]^{-\lambda} C_A$$

When the final consumption is set up as in 2, the price index approximation relates to the consumption shares in the consumption basket of a country A can be approximated as the following:

$$\hat{P}_A = \frac{(1+\alpha)(1+a)}{4}\hat{\rho}_A + \frac{(1-\alpha)(1+a)}{4}\hat{\rho}_B + \frac{1-a}{4}\hat{\rho}_C + \frac{1-a}{4}\hat{\rho}_D$$

Term $(\hat{\rho}_A - \hat{\rho}_B)$ then depicts the change of prices in A relative to the change in prices in B, and represents the terms-of-trade of A versus B (as the good is tradable).

Appendix I provides all derivation steps following the steps of the OR model, and additional information on the role of domestic and regional bias in the model. The main result is that the existence of the regional bias (a) provokes non-symmetric adjustments from the regional and non-regional trading partners.

Dropping the α for the presentation purposes, assuming there is no difference between C and D from the standpoint of A and that country sizes are constant in the steady state (full equations in Appendix I), the trade balance (as the absolute value of bilateral net exports) of country A is equal to:

$$\begin{aligned} T\hat{B}_A &= T\hat{B}_{AB} + T\hat{B}_{AC} + T\hat{B}_{AD} \\ &= P_0C_0 \left[\frac{1+a}{4}(1-\lambda_C) + \frac{a(1-a)}{4}\lambda \right] (\hat{\rho}_A - \hat{\rho}_B) \\ &\quad + \frac{1-a}{4}P_0C_0 \left[\lambda a(\hat{\rho}_A - \hat{\rho}_B) + 2(1-\lambda_C(1+a))(\hat{\rho}_A - \hat{\rho}_C) \right] \end{aligned} \quad (3)$$

The trade balance of country A is composed of the bilateral trade balances to the RTA trading partner (the first term above) and to the non-RTA trading partners (the second term above). Equation 3 indicates that the effect of the price change in A will effect the trade balances of the regional and non-regional trading partners in a different way when the regional bias a is present. The reaction of TB_a to the change in the terms of trade with B , and will be lower the higher is a , and will not depend on the price change in the Southern region. The reaction of the trade balance TB_a will be dependent on the change in terms-of-trade of A to both of the Southern countries ($(\hat{\rho}_A - \hat{\rho}_C)$ and $(\hat{\rho}_A - \hat{\rho}_D)$) and also on the terms-of-trade in the domestic Northern region.

In more general terms, the more a country is integrated with its RTA partners (the higher is a), the less trade with them will react to terms-of-trade changes, while becoming more elastic to the less integrated trading partners. Having same λ (elasticity of substitution) for all trading partners in this context yields different results, as λ is being scaled by the term that includes the regional bias.

Another insight is provided by the inclusion of α (within region preference for goods bias): if countries within the RTA have a bias against the goods produced within the other RTA member, then the effect on the elasticity of trade flows will be lower. This captures the effect that different RTAs may actually be less efficient unless they effectively liberalize trade within the RTA.

To further illustrate the effect, figure 1 provides the estimation of the effect of a on the elasticity of the trade balance to a Southern country. Figure 1 shows the results of the simulation with no α , $\lambda = 2$ and a 10% change in the price of the good produced in country A. In order to measure the *sensitivity* of price elasticity depending on the value of the regional bias, I scale the bilateral trade balance by the size of trade between the partners in the steady state. The price elasticity of bilateral trade balance to country A thus remains constant (as trade will grow at the constant pace determined by the elasticity of substitution λ between the goods), while the elasticity of the trade balance to the non-regional partner increases.

Figure 1: Sensitivity of the initial elasticities simulation

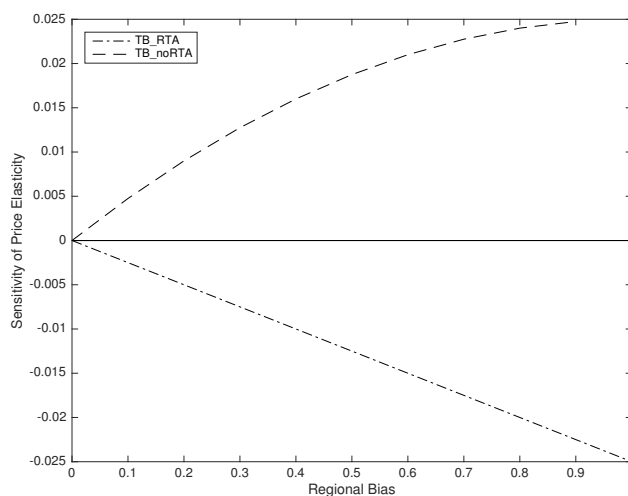


Figure 2: Relation of regional and within region bias

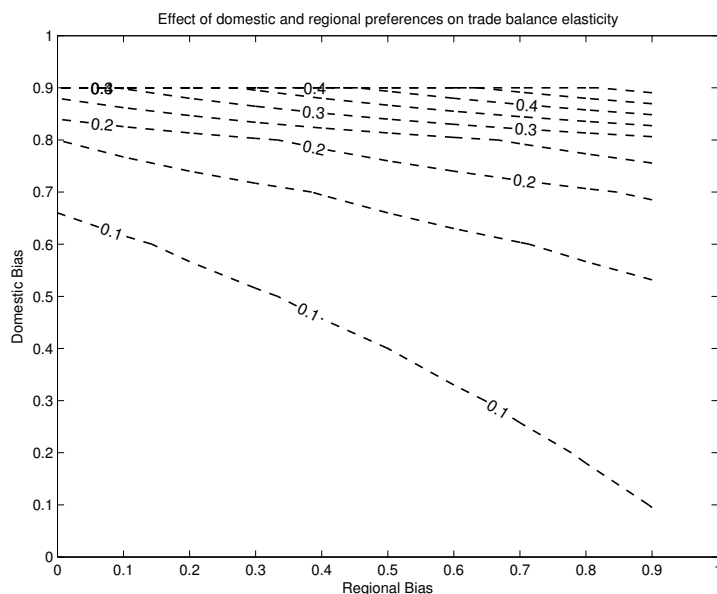


Figure 2 projects the change in the elasticity of trade balance to the non-RTA trading

partner C with the combinations of the regional bias a and the within regional domestic bias α . It indicates that the elasticity-increasing effect of the presence of a will be lower when there is a greater α . The more the country A prefers the domestically produced good over the good produced in the RTA partner, the lower will be the effect of the presence of regional bias a on the elasticity of trade flows to the outside of the RTA. This implies that unless an RTA is efficient – meaning it decreases the trade costs and liberalizes trade within the RTA – the change of the elasticity will be lower. Long-term price elasticities of trade balance are the main consideration of this paper, and they can be treated as the steady-state reactions to the price level changes (change in the terms-of-trade) versus RTA and non-RTA partners. Therefore the reduced form empirical specification (holding the same assumptions) relies on the accompanying form of trade balance adjustment (derivation and fuller version with α in the Appendix I):

$$\begin{aligned} T\hat{B}_{A,3} &= \frac{T\hat{B}_{AB} + T\hat{B}_{AC} + T\hat{B}_{AD}}{X_{A,0} + M_{A,0}} \\ &= \left(\frac{2}{3-a} \right) \left[\left(\Phi - \lambda \left[\Phi \left(1 + \frac{a}{2} \right) - \frac{a}{2} \right] \right) (\hat{\rho}_A - \hat{\rho}_B) + (1 - \Phi) (1 - \lambda [1 + a]) (\hat{\rho}_A - \hat{\rho}_C) \right] \end{aligned} \quad (4)$$

where Φ is the share of trade between A and B in A 's total trade:

$$\Phi = \frac{1+a}{3-a}$$

Equation 4 provides the equation for the main measure of the trade balance used in the estimations – the net exports over the total trade of the country. The full analysis includes alternative measures of the trade balance, such as total exports to imports and net exports over GDP:

$$\begin{aligned} T\hat{B}_{A,1} &= \frac{\hat{X}_{AB}}{\hat{M}_{AB}} \\ &= \lambda (s_0 (\hat{\rho}_A - \hat{\rho}_B) - (1 - s_0) ((\hat{\rho}_A - \hat{\rho}_C) + (\hat{\rho}_A - \hat{\rho}_D))) \end{aligned} \quad (5)$$

where:

$$s_0 = \frac{(1-\alpha)(1+a)}{(1-\alpha)(1+a) + 2(1-a)}$$

$$\begin{aligned} T\hat{B}_{A,2} &= \frac{TB_{AB} + TB_{AC} + TB_{AD}}{P_0 C_0} \\ &= \left(\Phi - \lambda \left[\Phi \left(1 + \frac{a}{2} \right) - \frac{a}{2} \right] \right) (\hat{\rho}_A - \hat{\rho}_B) + (1 - \Phi) (1 - \lambda [1 + a]) (\hat{\rho}_A - \hat{\rho}_C) \end{aligned} \quad (6)$$

All three measures 4 - 6 (full derivations with α and country sizes in Appendix I) indicate that with the presence of regional bias there are different price elasticities of the trade balance with respect to the terms of trade movement. With the absence of the non-tradeable goods sector in the consumption basket and home bias, the terms of trade co-move with the exchange

rates. To go from the terms of trade to the exchange rate reactions, equations 4 - 6 equations need to be multiplied by the share of A good domestically consumed to the total traded good A. Assuming symmetric countries and no α , the scaling parameter is:

$$\Theta = \frac{1 + a}{3 - a}$$

I also run separate regressions on imports and exports so as to further confirm that the trade between the RTA partners indeed is less sensitive to price changes. In the empirics, I use the effective exchange rate indices constructed to RTA and non-RTA trading partners as the measures of prices to the RTA and non-RTA trading partners.

6 Conclusion

This paper has investigated the role of trade integration in shifting the burden of adjustment of trade balances. When trade integration is proxied by participation in RTAs, trade balance adjustment happens more at the expense of the non-RTA trading partners. Within the RTA the trade costs are much lower compared to the non-RTA relationships with the rest of the world, and cross-border trade integration is deeper. Depreciation against the RTA trading partners may result in relative deterioration of the real value of the trade balance.

Utilizing various common measures of trade balances, this paper showed that higher trade balance is associated with more competitive behavior (higher exchange rate) to the non-RTA trading partners. The empirical estimations are based on a sample of 138 countries and show that on aggregate there are different elasticities of trade balance to the change in the exchange rate. Dating the sample from 1990 and taking the Rose & Yellen (1989) measure of trade balance, a 10% depreciation towards non-RTA trading partners results in 4.4% improvement of the trade balance. A similar depreciation against the RTA trading partners results in 3.7% deterioration of the trade balance. Negative values of elasticity of trade balance to the RTA trading partners could be explained by the "balance effects" - the need to pay more local currency for the same goods imported from abroad (possibly from the same trading partner). First, the "import substitution effect" may exist in some industries, but mostly in the labor intensive ones. In the context of regionalisation, countries tend to reveal their comparative advantage not in the production of a good, but in a narrow task in a good creation - so called "GVC integration". Second, the love of variety of consumers and consumption smoothing makes the demand in the RTA countries less elastic to the price changes. These two factors lead to the inability to substitute imported/intermediate goods at all or fast enough, and this can lead to the negative reaction of trade balance to the change in competitiveness to RTA trading partners. The additional regressions on the trade and value added (available for a restricted sample of countries) confirm these results.

To put the empirical findings of this paper into the theoretical domain, I refer to one of the possible modelling explanations by adapting the workhorse model of the current account balance analysis - the Obstfeld & Rogoff (2005) model. Augmenting the model with regional

bias (that can be seen as lower trade costs within the region as compared to the rest of the world) with symmetric countries I derive the elasticities of trade balance to exchange rate (or term of trade as they are alike with home bias substituting for the non-tradable goods sector). The theoretical model confirms that the greater is the regional bias, the lower will be the elasticity of trade balance.

The contribution of this paper can be summarized in the following points: first, in the presence of regional trade integration, the adjustment of the trade balance of a country will happen mostly at the expense of the non-integrated trading partners. This implies that upon a competitive depreciation – or a price level increase – the trade balance will improve at the expense of the countries that are less integrated. Second, this split between less and more integrated trading partners can be proxied by the trade agreement in place. The empirical estimations show that since 1985 the average burden of adjustment has been on the countries that are not bound by RTAs.

The results of this paper highlight two important observations: first, the current production and trade integration has changed the conventional understanding of exchange rate transmission mechanisms; and second, the common legal environment (which, in the scope of this paper, is supplied by the RTAs) provides an important channel for the transmission of economic shocks.

The concerns about the more/less depreciated exchange rates have always been in a bright spotlight – especially concerning developing countries or during times of slower economic growth. This paper brings to the table the reason for the selectivity of these concerns: the Canadian Dollar has changed its value relative to its NAFTA trading partner’s US Dollar by about 20% between 2013 and April 2016; yet, the media and politicians are more concerned about relatively smaller changes to other economies. Benefitting from the existence of RTAs, countries can become less concerned about the “beggar-thy-neighbor” policies when they integrate (and thus together become a more integrated body in terms of economies). Freer trade might still be under fire, but at the same time freer trade (and thus more integrated production) has provided us with the greater number of allies.

7 Bibliography

References

- . 2015. Exchange rates and trade flows: disconnected? *Chap. 3 of: World Economic Outlook: Adjusting to lower commodity prices*. International Monetary Fund.
- AHMED, SWARNALI, APPENDINO, MAXIMILIANO ANDRES, & RUTA, MICHELE. 2015 (Aug.). *Depreciations without exports ? global value chains and the exchange rate elasticity of exports*. Policy Research Working Paper Series 7390. The World Bank.
- ARMINGTON, PAUL S. 1969. A Theory of Demand for Products Distinguished by Place of Production. *IMF Staff Papers*, **16**(1), 159–178.
- BAHMANI-OSKOOEE, MOHSEN, & FARIDITAVANA, HADISE. 2016. Nonlinear ARDL Approach and the J-Curve Phenomenon. *Open Economies Review*, **27**(1), 51–70.
- BAHMANI-OSKOOEE, MOHSEN, & MALIXI, MARGARET. 1992. More evidence on the J curve from LDCs. *Journal of Policy Modeling*, **14**(5), 641–653.
- BAIER, SCOTT L., BERGSTRAND, JEFFREY H., & CLANCE, MATTHEW W. 2015. *Heterogeneous Economic Integration Agreement Effects*. Tech. rept.
- BALDWIN, RICHARD. 2012 (July). *Global Supply Chains: Why They Emerged, Why They Matter, and Where They Are Going*.
- BEMS, RUDOLF, & JOHNSON, ROBERT C. 2012. Value-Added Exchange Rates. *NBER Working Paper Series*, **18498**.
- BLANCHARD, EMILY J., BOWN, CHAD P., & JOHNSON, ROBERT CHRISTOPHER. 2016 (Jan.). *Global supply chains and trade policy*. Policy Research Working Paper Series 7536. The World Bank.
- BLYDE, JUAN, GRAZIANO, ALEJANDRO, & MARTINCUS, CHRISTIAN VOLPE. 2014. Economic integration agreements and production fragmentation: evidence on the extensive margin. December, 189–226.
- CARRERE, CELINE. 2006. Revisiting the effects of regional trade agreements on trade flows with proper specification of the gravity model. *European Economic Review*, **50**(2), 223–247.
- DEVEREUX, MICHAEL B., & ENGEL, CHARLES. 2002. Exchange rate pass-through, exchange rate volatility, and exchange rate disconnect. *Journal of Monetary Economics*, **49**(5), 913–940.
- DI NINO, VIRGINIA, EICHENGREEN, BARRY, & SBRACIA, MASSIMO. 2011 (Oct.). *Real Exchange Rates, Trade, and Growth: Italy 1861-2011*. Quaderni di storia economica (Economic History Working Papers) 10. Bank of Italy, Economic Research and International Relations Area.

- DOLLAR, DAVID. 1992. Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985. *Economic Development and Cultural Change*, **40**(3), 523–44.
- FERNANDEZ-ARIAS, EDUARDO, PANIZZA, UGO, & STEIN, ERNESTO. 2002. *Trade Agreements, Exchange Rate Disagreements*. Tech. rept.
- FRANKEL, JEFFREY A., & WEI, SHANG-JIN. 1998 (Feb.). *Open Regionalism in a World of Continental Trade Blocs*. IMF Working Papers 98/10. International Monetary Fund.
- FRANKEL, JEFFREY A, STEIN, ERNESTO, & WEI, SHANG-JIN. 1996. Regional Trading Arrangements: Natural or Supernatural. *American Economic Review*, **86**(2), 52–56.
- FREUND, CAROLINE, & ORNELAS, EMANUEL. 2010. Regional Trade Agreements. *Annual Review of Economics*, **2**(1), 139–166.
- GOURINCHAS, PIERRE-OLIVIER, & REY, HÉLÈNE. 2014. *External Adjustment, Global Imbalances, Valuation Effects*. Handbook of International Economics, vol. 4. Elsevier. Chap. 0, pages 585–645.
- HADDAD, MONA, & PANCARO, COSIMO. 2010. *Can Real Exchange Rate Undervaluation Boost Exports and Growth in Developing Countries? Yes, But Not for Long*. Economic Premise 20. The World Bank.
- HANDLEY, KYLE, & LIMÃO, NUNO. 2015. Trade and Investment under Policy Uncertainty: Theory and Firm Evidence. *American Economic Journal: Economic Policy*, **7**(4), 189–222.
- HUCHET-BOURDON, MARILYNE, & KORINEK, JANE. 2011. To What Extent Do Exchange Rates and their Volatility Affect Trade? Oct.
- KOSE, M. AYHAN, & YI, KEI-MU. 2001. International Trade and Business Cycles: Is Vertical Specialization the Missing Link? *American Economic Review*, **91**(2), 371–375.
- KRUGMAN, PAUL. 2015. Strength Is Weakness. *New York Times*, March.
- LEONARD, GREG, & STOCKMAN, ALAN C. 2002. Current Accounts and Exchange Rates: A New Look at the Evidence. *Review of International Economics*, **10**(3), 483–96.
- NEDONCELLE, CLément. 2016. Trade Costs and Current Accounts. *The World Economy*, **39**(10), 1653–1672.
- OBSTFELD, MAURICE, & ROGOFF, KENNETH. 2009. Global imbalances and the financial crisis: products of common causes. *Proceedings*, 131–172.
- OBSTFELD, MAURICE, & ROGOFF, KENNETH S. 2005. Global Current Account Imbalances and Exchange Rate Adjustments. *Brookings Papers on Economic Activity*, **36**(1), 67–146.

- OSTRY, JONATHAN D., & ROSE, ANDREW K. 1992. An empirical evaluation of the macroeconomic effects of tariffs. *Journal of International Money and Finance*, **11**(1), 63–79.
- RODRIGUEZ, FRANCISCO, & RODRIK, DANI. 2001. Trade Policy and Economic Growth: A Skeptic’s Guide to the Cross-National Evidence. *Pages 261–338 of: NBER Macroeconomics Annual 2000, Volume 15*. NBER Chapters. National Bureau of Economic Research, Inc.
- RODRIK, DANI. 2008. The Real Exchange Rate and Economic Growth. *Brookings Papers on Economic Activity*, **39**(2 (Fall)), 365–439.
- ROSE, ANDREW K., & YELLEN, JANET L. 1989. Is there a J-curve? *Journal of Monetary Economics*, **24**(1), 53–68.
- SANTOS-PAULINO, AMELIA, & THIRLWALL, A. P. 2004. The impact of trade liberalisation on exports, imports and the balance of payments of developing countries. *Economic Journal*, **114**(493), F50–F72.
- STAIGER, ROBERT W., & BAGWELL, KYLE. 1999. An Economic Theory of GATT. *American Economic Review*, **89**(1), 215–248.
- TURNER, P., & DACK, J. VAN’T. 1993 (November). *Measuring international price and cost competitiveness*. Tech. rept.
- VICARD, VINCENT. 2009. On trade creation and regional trade agreements: does depth matter? *Review of World Economics (Weltwirtschaftliches Archiv)*, **145**(2), 167–187.
- WU, YI, & ZENG, LI. 2008 (Jan.). *The Impact of Trade Liberalization on the Trade Balance in Developing Countries*. IMF Working Papers 08/14. International Monetary Fund.

Table Annex

Figure 3: World trade by the type of RTA,
(bln current USD, changing sample of RTAs)

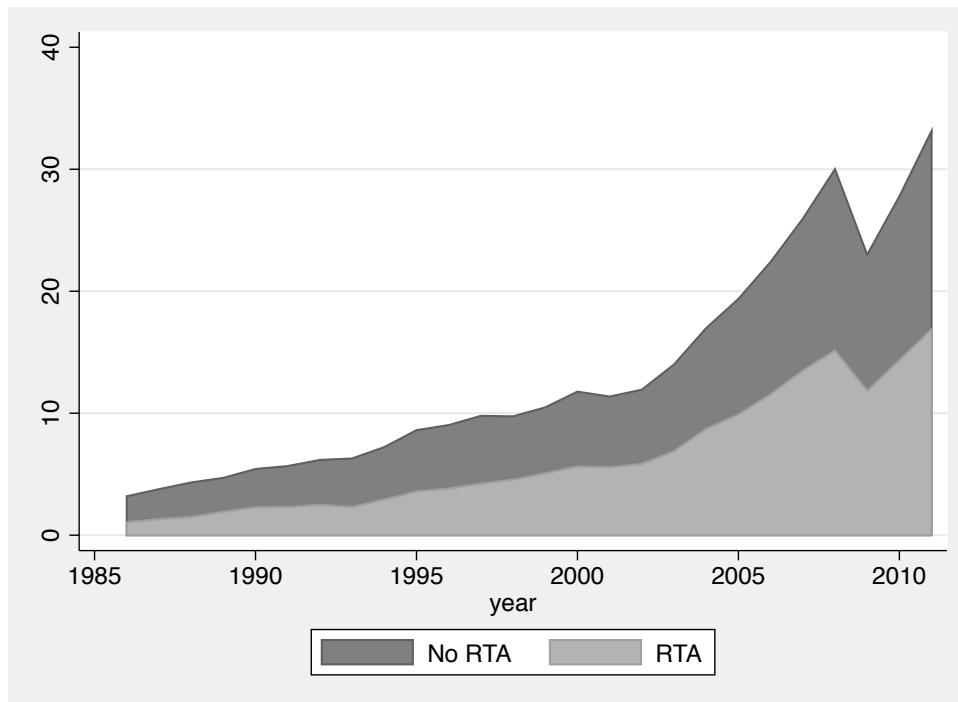


Figure 4: Dynamics of bilateral trade imbalances

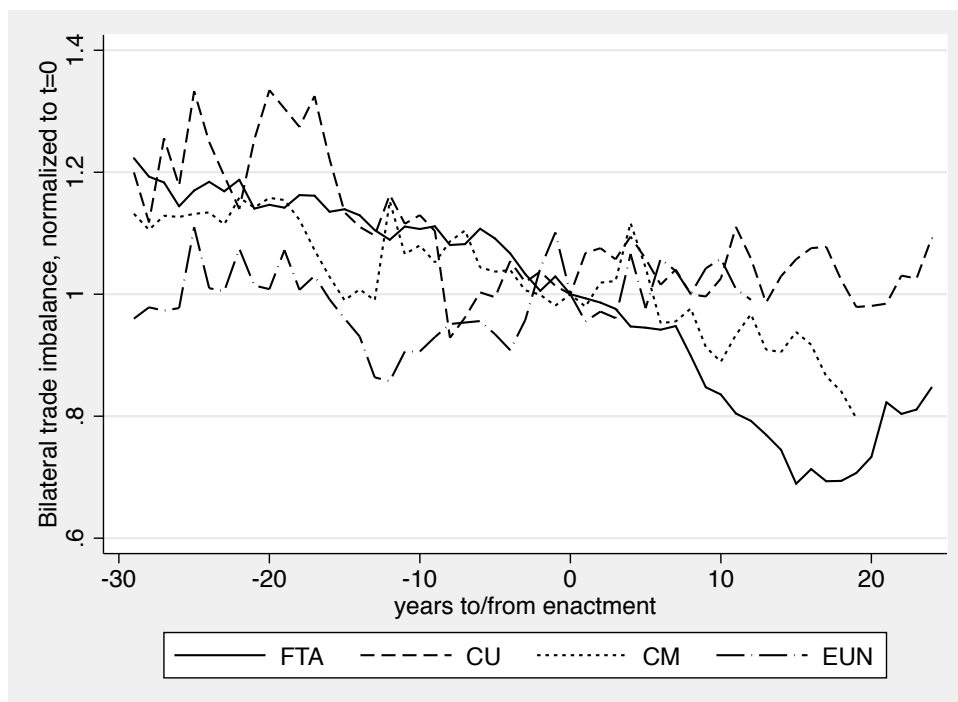


Figure 5: Average GDP-weighted RTA-associated aggregate trade imbalances (1990=1)

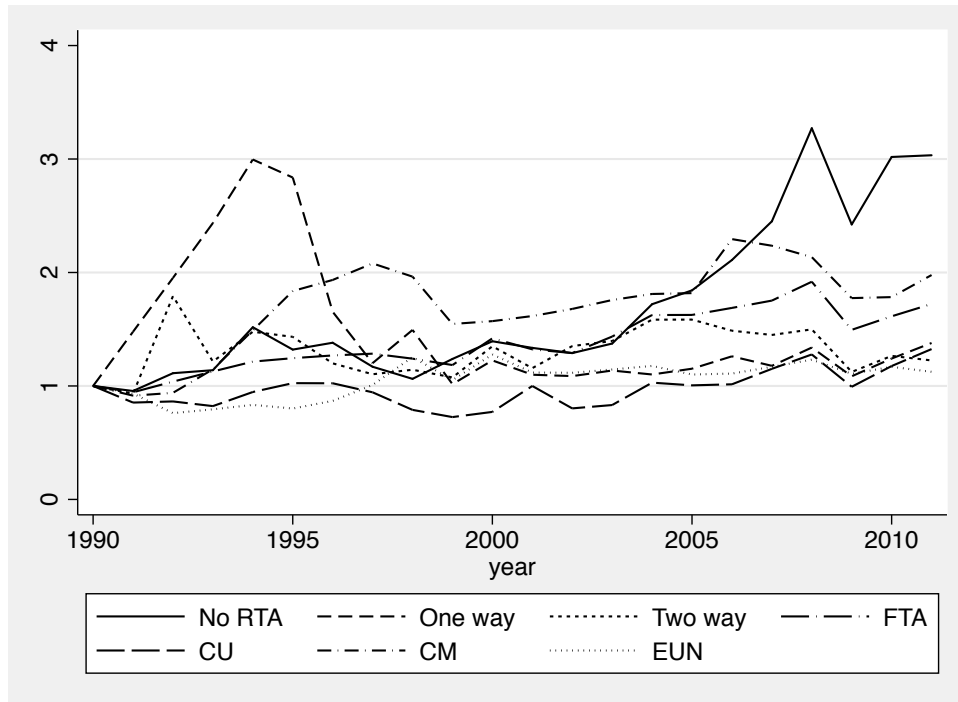


Table 1: Evolution of the type of RTA in bilateral relationships

Year	NR_PTA	PTA	FTA	CU	CM	EUN
1965	113	84	84	12	0	0
1970	129	152	104	12	0	0
1975	1791	371	152	102	0	0
1980	1977	442	153	112	0	0
1985	2253	746	199	173	0	0
1990	2460	764	245	207	0	0
1995	2784	874	444	189	208	0
2000	3132	878	1053	204	138	216
2005	4089	641	1510	252	574	216
2010	3407	2426	1874	285	536	326

Figure 6: Distribution of the bilateral trade imbalances between RTA and non-RTA trading partners

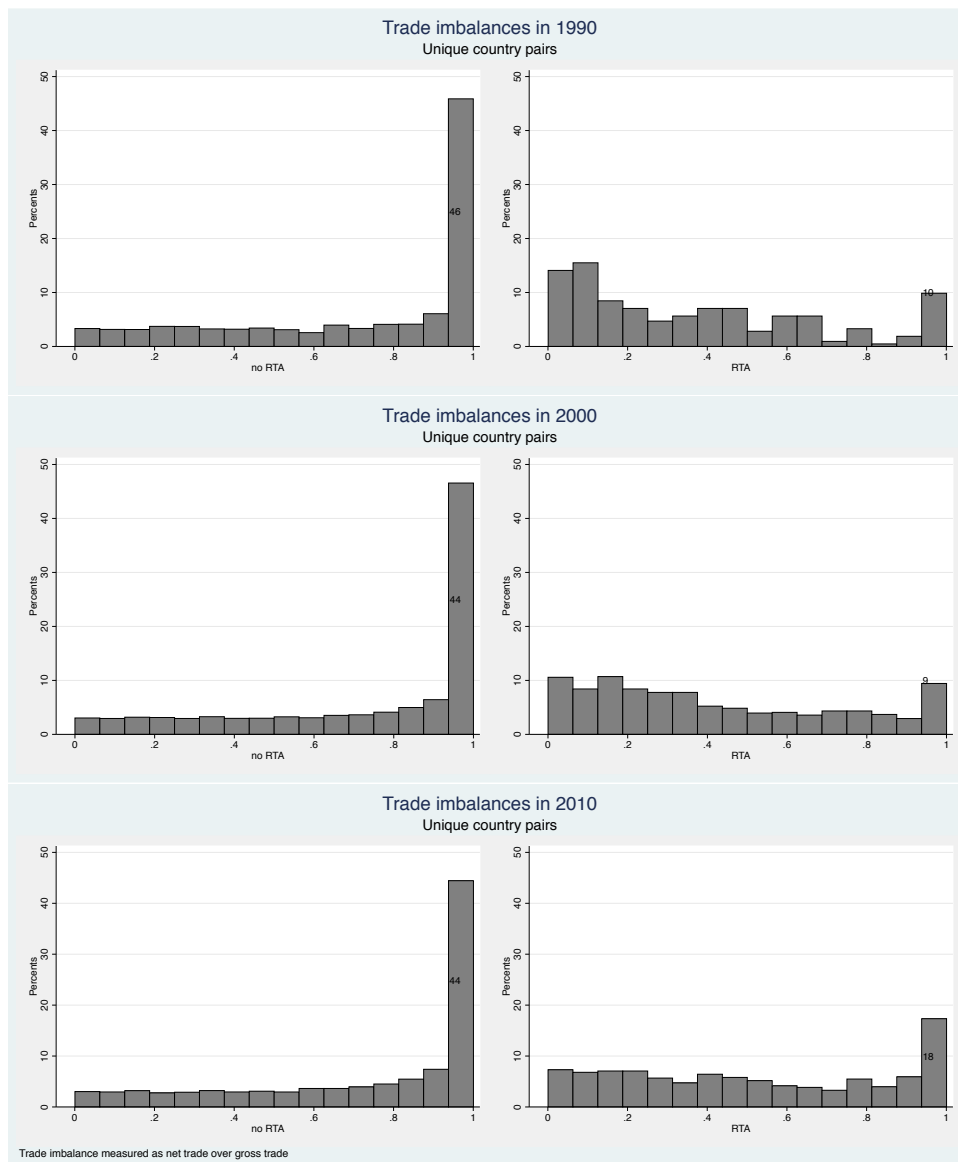


Figure 7: Average competitiveness to RTA and non-RTA trading partners

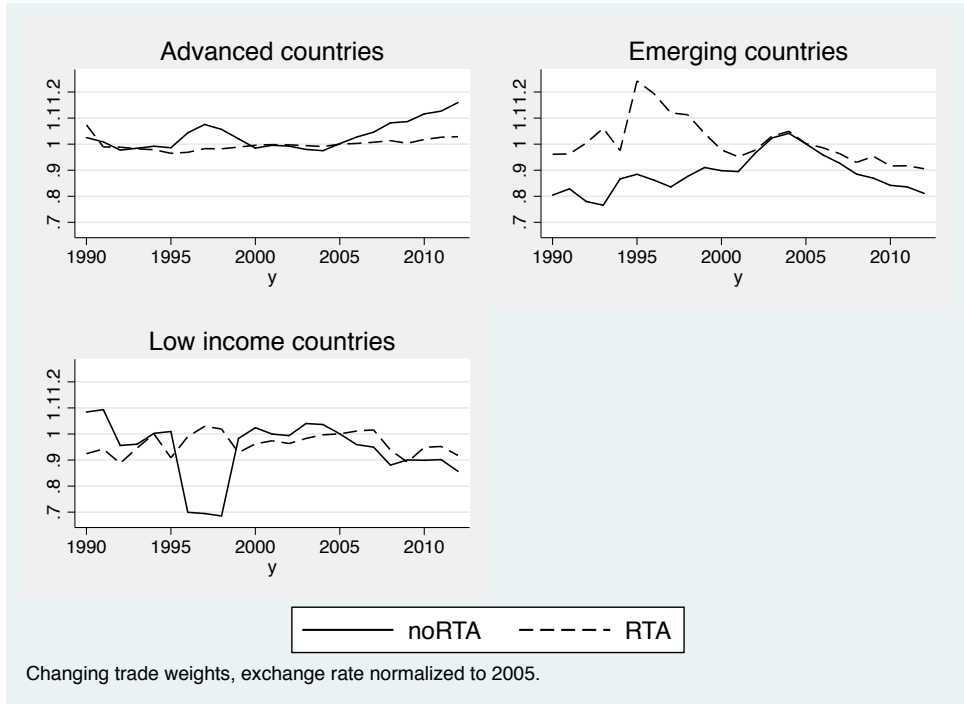


Figure 8: Average competitiveness to RTA and non-RTA trading partners (selected countries)

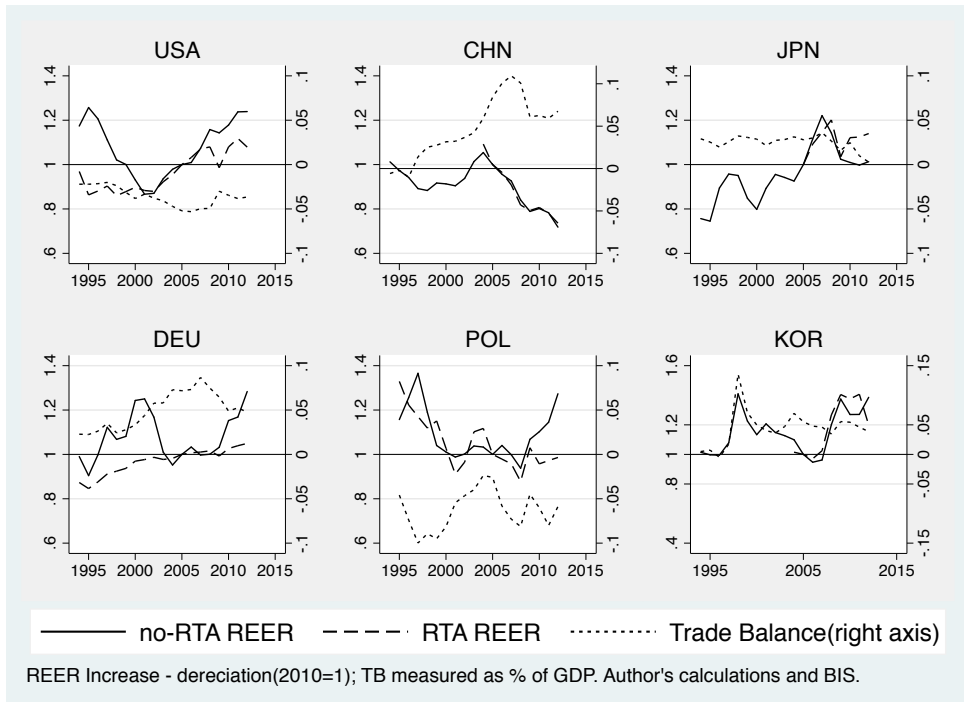


Figure 9: Sample by time

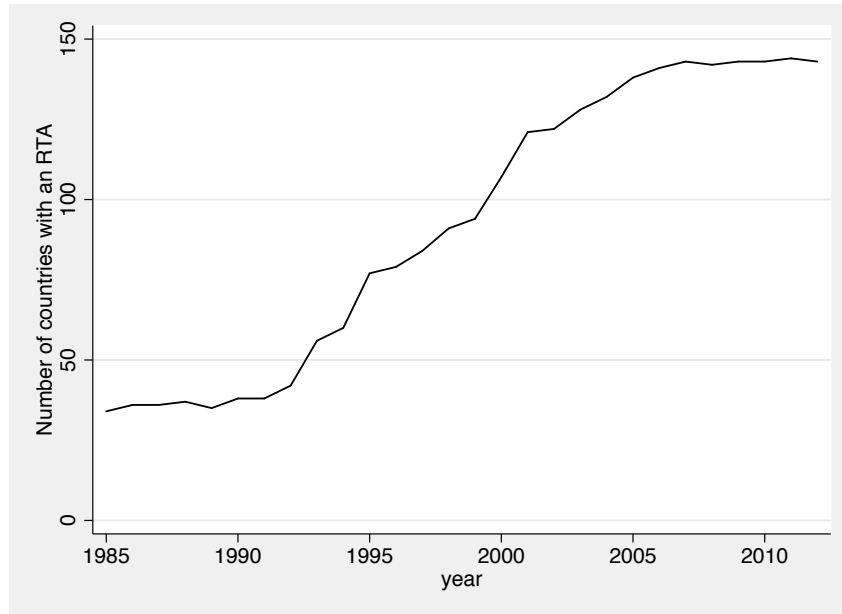


Table 2: Descriptions of types of RTA

Indication		Type of Agreement	Definition
Recorded as "no RTA"	NA	No Agreement	No preferential trade agreement
	NR_PTA	Non Reciprocal Preferential Trade Agreement	Preferential terms and customs concessions given by developed nations to developing countries
	PTA	Preferential Trade Agreement	Preferential terms to members vs. non-members
Recorded as "RTA"	FTA	Free Trade Agreement	Trade barriers eliminated (or substantially so) among members; treat non-members differently
	CU	Customs Union	Same as FTA; but treat non-members the same
	CM	Common Market	Same as CU; but also includes free movemet of labor/capital
	EUN	Economic Union	Same as CM, but also monetary and Fiscal Policy coordination; further harmonization of taxes/regulation/monetary systems

Table 3: Long-term elasticities of trade balance

VARIABLES	(1) TB_1	(2) TB_1	(3) TB_2	(4) TB_2	(5) TB_3	(6) TB_3
$\ln REER^{noRTA}$	0.31** (0.15)	0.44*** (0.15)	0.06 (0.04)	0.13*** (0.04)	0.02 (0.07)	0.11*** (0.05)
$\ln REER^{RTA}$	-0.37*** (0.13)	-0.37*** (0.13)	-0.06 (0.07)	-0.05 (0.07)	-0.01 (0.10)	-0.01 (0.10)
$\ln WorldIncome$		-0.37 (0.24)		0.64** (0.30)		0.85** (0.37)
$\ln DomIncome$		0.08** (0.04)		0.04*** (0.01)		0.05*** (0.01)
Constant	-0.24*** (0.07)	1.06 (1.85)	0.09*** (0.01)	-7.25** (0.01)	0.15*** (0.02)	-9.47*** (3.53)
Observations	781	775	277	277	278	277
R-squared			0.84	0.85		
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Left hand-side are the three different measures of the aggregate trade balance. $TB_1 = \frac{Exp_{it}}{Imp_{it}}$; $TB_2 = \frac{Exp_{it} - Imp_{it}}{GDP_{it}}$; $TB_3 = \frac{Exp_{it} - Imp_{it}}{Exp_{it} + Imp_{it}}$. For TB_1 , TB_3 betafit estimation is used as it is more appropriate for estimating proportions (it fits better the mean and dispersion parameters than a linear estimation). For TB_1 , TB_3 negative trade balances, trade balances equaling zero or over unity are excluded – hence a lower sample. TB_2 is estimated using fixed-effects OLS. Standard errors are clustered at the country level.

Table 4: Change in the long-term elasticities of trade balance

VARIABLES	(1) TB_1	(2) TB_2	(3) TB_3
$\Delta \ln REER^{noRTA}$	0.42** (0.14)	0.12* (0.06)	0.09** (0.03)
$\Delta \ln REER^{RTA}$	-0.15 (0.12)	0.06 (0.05)	0.04 (0.03)
$\Delta \ln WorldIncome$	-0.67* (0.36)	-0.28** (0.11)	-0.29*** (0.09)
$\Delta \ln DomIncome$	0.08 (0.06)	0.07 (0.04)	0.05** (0.02)
lag_TB	-0.03 (0.05)	-0.08*** (0.04)	-0.19*** (0.03)
Constant	0.14 (0.10)	0.14*** (0.03)	0.11*** (0.03)
Year FE	YES	YES	YES
Observations	636	298	291
R-squared	0.04	0.12	0.43
Year FE	YES	YES	YES

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
 Dependent variables – different measures of trade balance. $TB_1 = \frac{Exp_{it}}{Imp_{it}}$; $TB_2 = \frac{Exp_{it}-Imp_{it}}{GDP_{it}}$; $TB_3 = \frac{Exp_{it} - Imp_{it}}{Exp_{it} + Imp_{it}}$

Table 5: GMM estimators

VARIABLES	Two step difference (1) TB_1	Two step system (2) TB_1	Two step difference (3) TB_2	Two step system (4) TB_2	Two step difference (5) TB_3	Two step system (6) TB_3
$\ln REER^{noRTA}$	0.15*** (0.09)	0.19 (0.12)	0.06 (0.04)	0.02 (0.06)	0.08** (0.04)	0.08 (0.05)
$\ln REER^{RTA}$	-0.17** (0.09)	-0.35*** (0.13)	-0.08** (0.04)	-0.21** (0.10)	-0.10** (0.04)	-0.15*** (0.05)
TB_{t-1}	0.89*** (0.03)	0.43*** (0.08)	0.88*** (0.06)	0.27 (0.18)	0.185*** (0.03)	0.33*** (0.06)
$\ln WorlIncome$	-0.04** (0.02)	-0.00 (0.04)	-0.02** (0.01)	-0.01 (0.02)	-0.02** (0.01)	-0.01 (0.02)
$\ln DomIncome$	0.02* (0.01)	-0.04 (0.03)	0.01 (0.01)	-0.04* (0.02)	0.01* (0.01)	-0.01 (0.01)
Constant	-0.22 (0.20)		-0.01 (0.13)		26.18 (0.09)	
Observations	2,472	2,325	2,468	2,322	2,472	2,325
Number of panel.id	139	137	138	137	139	139
P-value Hansen test	1	1	1	1	1	1
AR(2) test p-value	0.94	0.46	0.97	0.59	0.95	0.31

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Left hand-side are the three different measures of the aggregate trade balance. $TB_1 = \frac{Exp_{it}}{Imp_{it}}$; $TB_2 = \frac{Exp_{it} - Imp_{it}}{GDP_{it}}$

$TB_3 = \frac{Exp_{it} - Imp_{it}}{Exp_{it} + Imp_{it}}$; RTA membership defined for all countries that have an FTA, CU, CM or EUN in place (see table 2 for description).

Table 6: Long-term elasticity of trade variables

VARIABLES	Dependent variable			
	(1) ln(IMP)	(2) ln(EXP)	(3) ln(DVA_dir)	(4) ln(DVA)
<i>lnREER^{noRTA}</i>	-0.47*** (0.11)	0.22* (0.13)	0.22 (0.17)	0.04 (0.14)
<i>lnREER^{RTA}</i>	0.02 (0.12)	-0.39** (0.15)	-0.44*** (0.14)	-0.34*** (0.12)
<i>lnWorldIncome</i>	0.88** (0.43)		-1.80*** (0.63)	-1.12* (0.56)
<i>lnDomIncome</i>		0.22*** (0.05)	0.25*** (0.09)	0.18** (0.07)
Constant	-0.25 (4.14)	2.05 (1.36)	17.19** (7.90)	12.95* (6.57)
Observations	781	775	261	261
R-squared	0.89	0.80	0.88	0.92
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Errors clustered at the country level. Classification of countries according to IMF 2014.

RTA membership defined for all countries that have an FTA, CU, CM or EUN in place (see table 2 for description).

Table 7: Robustness: By median bilateral trade imbalance

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	TB_1	TB_1	TB_2	TB_2	TB_3	TB_3
$\ln REER^{AboveMed}$	-0.13 (0.21)	-0.42 (0.28)	0.06 (0.08)	0.09 (0.10)	0.29 (0.20)	0.29 (0.29)
$\ln REER^{BelowMed}$	0.42* (0.22)	1.09*** (0.28)	0.08 (0.11)	0.19 (0.14)	0.12 (0.21)	0.63** (0.29)
$\ln WorldIncome$		-10.53*** (2.35)		-2.26 (1.77)		-6.39** (2.74)
$\ln DomIncome$		0.37*** (0.14)		0.17* (0.09)		0.51*** (0.14)
Constant	-1.82*** (0.20)	99.98*** (23.38)	0.07* (0.04)	22.09 (17.44)	-3.29*** (0.24)	57.17** (27.24)
Observations	838	796	2,618	2,495	835	795
R-squared			0.81	0.81		
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Left hand-side are the three different measures of the aggregate trade balance. $TB_1 = \frac{Exp_{it} - Imp_{it}}{Exp_{it} + Imp_{it}}$; $TB_2 = \frac{Exp_{it}}{Imp_{it}}$; $TB_3 = \frac{Exp_{it} - Imp_{it}}{GDP_{it}}$. For TB_1 , TB_3 betafit estimation is used as it is more appropriate for estimating proportions (it fits better the mean and dispersion parameters than a linear estimation). For TB_1 , TB_3 negative trade balances, trade balances equaling zero or over unity are excluded – hence a lower sample. TB_2 is estimated using fixed-effects OLS. Standard errors are clustered at the country level. REERs are split by the size of the median trade balance – $REER^{AboveMed}$ will have the sample of countries the country i has the highest trade balance.

Table 8: Robustness: Contingent countries

VARIABLES	(1) TB_1	(2) TB_1	(3) TB_2	(4) TB_2	(5) TB_3	(6) TB_3
$\ln REER^{noRTA}$	0.61** (0.24)	1.06*** (0.28)	0.24** (0.10)	0.40*** (0.13)	1.05*** (0.26)	1.70*** (0.31)
$\ln REER^{RTA}$	-0.19 (0.20)	-0.34* (0.21)	-0.09 (0.10)	-0.13 (0.11)	-0.58*** (0.22)	-0.72*** (0.22)
$\ln WorldIncome$		-9.04** (3.51)		-2.05 (2.26)		-6.20* (3.27)
$\ln DomIncome$		0.43*** (0.15)		0.19* (0.11)		0.61*** (0.16)
Constant	-1.68*** (0.22)	85.25** (34.81)	0.03 (0.04)	19.92 (22.22)	-3.02*** (0.26)	55.18* (32.39)
Observations	704	702	2,003	1,994	701	701
R-squared			0.79	0.79		
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Left hand-side are the three different measures of the aggregate trade balance. $TB_1 = \frac{Exp_{it} - Imp_{it}}{Exp_{it} + Imp_{it}}$; $TB_2 = \frac{Exp_{it}}{Imp_{it}}$; $TB_3 = \frac{Exp_{it} - Imp_{it}}{GDP_{it}}$. For TB_1 , TB_3 betafit estimation is used as it is more appropriate for estimating proportions (it fits better the mean and dispersion parameters than a linear estimation). For TB_1 , TB_3 negative trade balances, trade balances equaling zero or over unity are excluded – hence a lower sample. TB_2 is estimated using fixed-effects OLS. Standard errors are clustered at the country level. RTA membership defined for all countries that have an FTA, CU, CM or EUN in place (see table 2 for description).

8 Appendix I: Model derivation

Until the laws of thermodynamics are repealed, I shall continue to relate outputs to inputs – i.e. to believe in production functions.

Samuelson (1972) (p. 174)

8.1 Consumption

There are 4 countries, A and B , C and D . A and B has an RTA signed (can be seen as “Northern” countries), C and D have a separate RTA (and can be seen as “Southern” countries). Consumption is a nested CES with regional (if $a > 0$) and domestic (if $\alpha > \frac{1}{2}$) bias.

8.2 Consumption allocation

In country A the consumer maximizes

$$C_A = \left[\begin{aligned} & \left(\frac{1}{4} (1 + \alpha) (1 + a) \right)^{\frac{1}{\lambda}} (C_{AA})^{\frac{\lambda-1}{\lambda}} + \left(\frac{1}{4} (1 - \alpha) (1 + a) \right)^{\frac{1}{\lambda}} (C_{AB})^{\frac{\lambda-1}{\lambda}} \\ & + \left(\frac{1}{4} (1 - a) \right)^{\frac{1}{\lambda}} (C_{AC})^{\frac{\lambda-1}{\lambda}} + \left(\frac{1}{4} (1 - a) \right)^{\frac{1}{\lambda}} (C_{AD})^{\frac{\lambda-1}{\lambda}} \end{aligned} \right]^{\frac{\lambda}{\lambda-1}}$$

α is the split $A - B$ and a the split center-periphery. Both are between 0 and 1 ($\alpha = a = 0$ is an even world, $\alpha = a = 1$ is autarky)

This implies:

$$\begin{aligned} C_{AA} &= \frac{(1 + \alpha)(1 + a)}{4} \left[\frac{P_{AA}}{P_A} \right]^{-\lambda} C_A \\ C_{AB} &= \frac{(1 - \alpha)(1 + a)}{4} \left[\frac{P_{AB}}{P_A} \right]^{-\lambda} C_A \\ C_{AC} &= \frac{1 - a}{4} \left[\frac{P_{AC}}{P_A} \right]^{-\lambda} C_A \\ C_{AD} &= \frac{1 - a}{4} \left[\frac{P_{AD}}{P_A} \right]^{-\lambda} C_A \end{aligned}$$

where :

$$P_A = \left[\frac{(1 + \alpha)(1 + a)}{4} [P_{AA}]^{1-\lambda} + \frac{(1 - \alpha)(1 + a)}{4} [P_{AB}]^{1-\lambda} + \frac{1 - a}{4} [P_{AC}]^{1-\lambda} + \frac{1 - a}{4} [P_{AD}]^{1-\lambda} \right]^{\frac{1}{1-\lambda}}$$

The elasticity across brands is θ . The labor supply is:

$$W_A = P_A C_A$$

8.3 Firms allocation

The output of a representative firm in A is:

$$Y_A = A_A L_A$$

Firms sets prices as a markup over marginal cost:

$$P_{AA} = P_{AB} = P_{AC} = P_{AD} = \rho_A = \frac{\theta}{\theta - 1} \frac{W_A}{A_A}$$

The demand for goods produced in country A is:

$$\begin{aligned} Y_A = & \frac{(1 + \alpha)(1 + a)}{4} \left[\frac{\rho_A}{P_A} \right]^{-\lambda} C_A + \frac{(1 - \alpha)(1 + a)}{4} \left[\frac{\rho_A}{P_B} \right]^{-\lambda} C_B \\ & + \frac{1 - a}{4} \left[\frac{\rho_A}{P_C} \right]^{-\lambda} C_C + \frac{1 - a}{4} \left[\frac{\rho_A}{P_D} \right]^{-\lambda} C_D \end{aligned}$$

8.4 Exports and imports

The volume and value of exports from country A is:

$$\begin{aligned} X_A^R &= X_{AB}^R + X_{AC}^R + X_{AD}^R \\ &= \frac{(1 - \alpha)(1 + a)}{4} \left[\frac{\rho_A}{P_B} \right]^{-\lambda} C_B + \frac{1 - a}{4} \left[\frac{\rho_A}{P_C} \right]^{-\lambda} C_C + \frac{1 - a}{4} \left[\frac{\rho_A}{P_D} \right]^{-\lambda} C_D \\ X_A^{Val} &= \rho_A \frac{(1 - \alpha)(1 + a)}{4} \left[\frac{\rho_A}{P_B} \right]^{-\lambda} C_B + \rho_A \frac{1 - a}{4} \left[\frac{\rho_A}{P_C} \right]^{-\lambda} C_C + \rho_A \frac{1 - a}{4} \left[\frac{\rho_A}{P_D} \right]^{-\lambda} C_D \end{aligned}$$

The volume and value of imports is:

$$\begin{aligned} M_A^R &= M_{AB}^R + M_{AC}^R + M_{AD}^R \\ &= \frac{(1 - \alpha)(1 + a)}{4} \left[\frac{\rho_B}{P_A} \right]^{-\lambda} C_A + \frac{1 - a}{4} \left[\frac{\rho_C}{P_A} \right]^{-\lambda} C_A + \frac{1 - a}{4} \left[\frac{\rho_D}{P_A} \right]^{-\lambda} C_A \\ M_A^{Val} &= \rho_B \frac{(1 - \alpha)(1 + a)}{4} \left[\frac{\rho_B}{P_A} \right]^{-\lambda} C_A + \rho_C \frac{1 - a}{4} \left[\frac{\rho_C}{P_A} \right]^{-\lambda} C_A + \rho_D \frac{1 - a}{4} \left[\frac{\rho_D}{P_A} \right]^{-\lambda} C_A \end{aligned}$$

8.5 Steady state

Because of symmetry all outputs are equal, all prices are equal, and all consumption are equal.

The key equations are:

$$\begin{aligned} W_0 &= P_0 C_0 \\ P_0 &= \frac{\theta}{\theta - 1} \frac{W_0}{A_0} \\ Y_0 &= C_0 \end{aligned}$$

which implies:

$$\frac{W_0}{P_0} = C_0 = Y_0 = A_0 \frac{\theta - 1}{\theta}$$

Exports and imports are (trade is balanced bilaterally):

$$\begin{aligned} X_{A,0}^R &= X_{AB,0}^R + X_{AC,0}^R + X_{AD,0}^R = \frac{(1-\alpha)(1+a)}{4}C_0 + \frac{1-a}{4}C_0 + \frac{1-a}{4}C_0 \\ M_{A,0}^R &= M_{AB,0}^R + M_{AC,0}^R + M_{AD,0}^R = \frac{(1-\alpha)(1+a)}{4}C_0 + \frac{1-a}{4}C_0 + \frac{1-a}{4}C_0 \end{aligned}$$

8.6 Linear approximation

The price index is approximated as:

$$\begin{aligned} \hat{P}_A &= \frac{(1+\alpha)(1+a)}{4}\hat{\rho}_A + \frac{(1-\alpha)(1+a)}{4}\hat{\rho}_B + \frac{1-a}{4}\hat{\rho}_C + \frac{1-a}{4}\hat{\rho}_D \\ \hat{P}_B &= \frac{(1+\alpha)(1+a)}{4}\hat{\rho}_B + \frac{(1-\alpha)(1+a)}{4}\hat{\rho}_A + \frac{1-a}{4}\hat{\rho}_C + \frac{1-a}{4}\hat{\rho}_D \\ \hat{P}_C &= \frac{(1+\alpha)(1+a)}{4}\hat{\rho}_C + \frac{(1-\alpha)(1+a)}{4}\hat{\rho}_D + \frac{1-a}{4}\hat{\rho}_A + \frac{1-a}{4}\hat{\rho}_B \\ \hat{P}_D &= \frac{(1+\alpha)(1+a)}{4}\hat{\rho}_D + \frac{(1-\alpha)(1+a)}{4}\hat{\rho}_C + \frac{1-a}{4}\hat{\rho}_A + \frac{1-a}{4}\hat{\rho}_B \end{aligned}$$

The expansion of country A's exports are (written in terms of trade):

$$\begin{aligned} \hat{X}_{AB}^R &= \frac{X_{AB}^R - X_{AB,0}^R}{X_{AB,0}^R} = -\lambda_C (\hat{\rho}_A - \hat{P}_B) + \hat{C}_B \\ \hat{X}_{AC}^R &= -\lambda (\hat{\rho}_A - \hat{P}_C) + \hat{C}_C \\ \hat{X}_{AD}^R &= -\lambda (\hat{\rho}_A - \hat{P}_D) + \hat{C}_D \\ \hat{X}_A^R &= \frac{X_A^R - X_{A,0}^R}{X_{A,0}^R} = s_0 \hat{X}_{AB}^R + (1-s_0) (\hat{X}_{AC}^R + \hat{X}_{AD}^R) \end{aligned}$$

where:

$$s_0 = \frac{(1-\alpha)(1+a)}{(1-\alpha)(1+a) + 2(1-a)}$$

This implies that when the price of the good A rises – meaning you (holding sizes of the countries unchanged), the price elasticity of export volume to B is:

When the price of A rises in terms of trade- meaning you need more of good B to acquire the goods of country A, the effect on the exports from A to B is lower

$$\hat{X}_{AB}^R = -\lambda (\hat{\rho}_A - \hat{P}_B) = -\lambda \left(\hat{\rho}_A - \frac{(a+1)(1-\alpha)}{4} \hat{\rho}_A \right)$$

Thus, the pass-through of the change in prices in A will be reduced more the higher is the a . Alike the pass-through to C will be higher (reduced lower) the higher is a :

$$\hat{X}_{AC}^R = -\lambda (\hat{\rho}_A - \hat{P}_C) = -\lambda \left(\hat{\rho}_A - \frac{1-a}{4} \hat{\rho}_A \right)$$

If $\alpha = 0$ and country A reduces prices of its good by 10%, the pass through to the terms of trade with B will be $2\frac{1+a}{4}$ lower than to the terms of trade of C. This implies that the deeper regional bias – deeper regionalisation will make the exports to the regional partners less elastic.

Similar procedure is applied to the expansion of country A's imports (as measured by the terms of trade):

$$\begin{aligned}\hat{M}_{AB}^R &= \frac{M_{AB}^R - M_{AB,0}^R}{M_{AB,0}^R} = -\lambda_C (\hat{\rho}_B - \hat{P}_A) + \hat{C}_A \\ \hat{M}_{AC}^R &= -\lambda (\hat{\rho}_C - \hat{P}_A) + \hat{C}_A \\ \hat{M}_{AD}^R &= -\lambda (\hat{\rho}_D - \hat{P}_A) + \hat{C}_A \\ \hat{M}_A^R &= s_0 \hat{M}_{AB}^R + (1 - s_0) (\hat{M}_{AC}^R + \hat{M}_{AD}^R)\end{aligned}$$

The main concern of the paper is the trade balances. The trade balance of A will consist of The bilateral trade balances are:

$$\begin{aligned}TB_{AB} &= \frac{(1-\alpha)(1+a)}{4} P_0 C_0 \left[(1-\lambda) (\hat{\rho}_A - \hat{\rho}_B) - \lambda (\hat{P}_A - \hat{P}_B) - (\hat{C}_A - \hat{C}_B) \right] \\ &= \frac{(1-\alpha)(1+a)}{4} P_0 C_0 \left[\left(1 - \lambda \left[1 + \frac{\alpha(1+a)}{2} \right] \right) (\hat{\rho}_A - \hat{\rho}_B) - (\hat{C}_A - \hat{C}_B) \right] \\ TB_{AC} &= \frac{1-a}{4} P_0 C_0 \left[(1-\lambda) (\hat{\rho}_A - \hat{\rho}_C) - \lambda (\hat{P}_A - \hat{P}_C) - (\hat{C}_A - \hat{C}_C) \right] \\ &= \frac{1-a}{4} P_0 C_0 \left[\lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_B) + \left(1 - \lambda_C \left[1 + \frac{(1+\alpha)(1+a)-(1-a)}{4} \right] \right) (\hat{\rho}_A - \hat{\rho}_C) \right. \\ &\quad \left. - \lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_D) - (\hat{C}_A - \hat{C}_C) \right] \\ TB_{AD} &= \frac{1-a}{4} P_0 C_0 \left[(1-\lambda) (\hat{\rho}_A - \hat{\rho}_D) - \lambda (\hat{P}_A - \hat{P}_D) - (\hat{C}_A - \hat{C}_D) \right] \\ &= \frac{1-a}{4} P_0 C_0 \left[\lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_B) + \left(1 - \lambda_C \left[1 + \frac{(1+\alpha)(1+a)-(1-a)}{4} \right] \right) (\hat{\rho}_A - \hat{\rho}_D) \right. \\ &\quad \left. - \lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_C) - (\hat{C}_A - \hat{C}_D) \right]\end{aligned}$$

The higher are the regional preferences, the greater will be the increase in trade with non-regionals (since the first term increases on a,b), and the lower will be the change in the trade with the regional trading partner. Equations ?? and ?? link the terms of trade and the exchange rate in the presence of regionalism and domestic bias. The depreciation of A will improve the terms of trade with all trading partners, but much more so with the non-regional (see equation ??).

Therefore when production integration between the regional trading agreement members is more intensive, upon depreciation trade balance improves more on the account of the non-RTA trading partners.

Focus on the impact of prices. If $\alpha = 0$ (no bias A vs B):

$$\begin{aligned}
TB_{AB} &= \frac{1+a}{4} P_0 C_0 (1-\lambda) (\hat{\rho}_A - \hat{\rho}_B) \\
TB_{AC} &= \frac{1-a}{4} P_0 C_0 \left[\lambda \frac{a}{2} (\hat{\rho}_A - \hat{\rho}_B) + \left(1 - \lambda \left[1 + \frac{a}{2}\right]\right) (\hat{\rho}_A - \hat{\rho}_C) - \lambda \frac{a}{2} (\hat{\rho}_A - \hat{\rho}_D) \right] \\
TB_{AD} &= \frac{1-a}{4} P_0 C_0 \left[\lambda \frac{a}{2} (\hat{\rho}_A - \hat{\rho}_B) + \left(1 - \lambda \left[1 + \frac{a}{2}\right]\right) (\hat{\rho}_A - \hat{\rho}_D) - \lambda \frac{a}{2} (\hat{\rho}_A - \hat{\rho}_C) \right] \\
TB_{AB} + TB_{AC} + TB_{AD} &= P_0 C_0 \left[\frac{1+a}{4} (1-\lambda_C) + \frac{a(1-a)}{4} \lambda \right] (\hat{\rho}_A - \hat{\rho}_B) \\
&\quad + P_0 C_0 \frac{1-a}{4} [1 - \lambda(1+a)] (\hat{\rho}_A - \hat{\rho}_C) \\
&\quad + P_0 C_0 \frac{1-a}{4} [1 - \lambda(1+a)] (\hat{\rho}_A - \hat{\rho}_D) \\
TB_{AC} + TB_{AD} &= \frac{1-a}{4} P_0 C_0 \left[\begin{aligned} &\lambda a (\hat{\rho}_A - \hat{\rho}_B) + (1 - \lambda_C (1+a)) (\hat{\rho}_A - \hat{\rho}_C) \\ &\quad + (1 - \lambda(1+a)) (\hat{\rho}_A - \hat{\rho}_D) \end{aligned} \right]
\end{aligned}$$

$$\begin{aligned}
X_{A,0}^R &= X_{AB,0}^R + X_{AC,0}^R + X_{AD,0}^R = \frac{1+a}{4} C_0 + \frac{1-a}{4} C_0 + \frac{1-a}{4} C_0 \\
M_{A,0}^R &= M_{AB,0}^R + M_{AC,0}^R + M_{AD,0}^R = \frac{1+a}{4} C_0 + \frac{1-a}{4} C_0 + \frac{1-a}{4} C_0
\end{aligned}$$

This is the most reasonable case. If we scale the trade balance by the corresponding steady state gross flows ($(1+a)/4$ and $2 * (1-a)/4$), the terms-of-trade A vs B impact both TB_{AB} and $TB_{AC} + TB_{AD}$. The impact of $\hat{\rho}_A - \hat{\rho}_B$ on TB_{AB} is smaller (in absolute magnitude, i.e. less negative) than the impact of $\hat{\rho}_A - \hat{\rho}_C = \hat{\rho}_A - \hat{\rho}$ on $TB_{AC} + TB_{AD}$:

$$\begin{aligned}
1 - \lambda &< 0 \\
1 - \lambda(1+a) &< 0 \\
1 - \lambda &> 1 - \lambda(1+a)
\end{aligned}$$

If $a = 0$ (no bias center-periphery):

$$\begin{aligned}
TB_{AB} &= \frac{1-\alpha}{4} P_0 C_0 \left(1 - \lambda \left[1 + \frac{\alpha}{2}\right]\right) (\hat{\rho}_A - \hat{\rho}_B) \\
TB_{AC} &= \frac{1}{4} P_0 C_0 \left[-\lambda \frac{\alpha}{4} (\hat{\rho}_A - \hat{\rho}_B) + \left(1 - \lambda \left[1 + \frac{\alpha}{4}\right]\right) (\hat{\rho}_A - \hat{\rho}_C) + \lambda \frac{\alpha}{4} (\hat{\rho}_A - \hat{\rho}_D)\right] \\
TB_{AD} &= \frac{1}{4} P_0 C_0 \left[-\lambda \frac{\alpha}{4} (\hat{\rho}_A - \hat{\rho}_B) + \left(1 - \lambda \left[1 + \frac{\alpha}{4}\right]\right) (\hat{\rho}_A - \hat{\rho}_D) + \lambda \frac{\alpha}{4} (\hat{\rho}_A - \hat{\rho}_C)\right] \\
TB_{AB} + TB_{AC} + TB_{AD} &= \frac{1}{4} P_0 C_0 \left[(1-\alpha) \left(1 - \lambda \left[1 + \frac{\alpha}{2}\right]\right) - \lambda \frac{\alpha}{2}\right] (\hat{\rho}_A - \hat{\rho}_B) \\
&\quad + \frac{1}{4} P_0 C_0 (1-\lambda) (\hat{\rho}_A - \hat{\rho}_C) \\
&\quad + \frac{1}{4} P_0 C_0 (1-\lambda) (\hat{\rho}_A - \hat{\rho}_D)
\end{aligned}$$

8.7 Empirical Estimation Trade Balance Measures

Recall the steady state real exports and imports (nominal are the same times P_0)

$$\begin{aligned} X_{A,0}^R &= X_{AB,0}^R + X_{AC,0}^R + X_{AD,0}^R = \frac{(1-\alpha)(1+a)}{4}C_0 + \frac{1-a}{4}C_0 + \frac{1-a}{4}C_0 \\ M_{A,0}^R &= M_{AB,0}^R + M_{AC,0}^R + M_{AD,0}^R = \frac{(1-\alpha)(1+a)}{4}C_0 + \frac{1-a}{4}C_0 + \frac{1-a}{4}C_0 \end{aligned}$$

The steady state value of A exports (and imports) is:

$$(X + M)_0 = 2 * \left(\frac{(1-\alpha)(1+a)}{4} + \frac{1-a}{2} \right) P_0 C_0$$

Recall the trade balances:

$$\begin{aligned} TB_{AB} &= \frac{(1-\alpha)(1+a)}{4}P_0C_0 \left[\left(1 - \lambda \left[1 + \frac{\alpha(1+a)}{2} \right] \right) (\hat{\rho}_A - \hat{\rho}_B) - (\hat{C}_A - \hat{C}_B) \right] \\ TB_{AC} &= \frac{1-a}{4}P_0C_0 \left[\begin{aligned} &\lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_B) + \left(1 - \lambda_C \left[1 + \frac{(1+\alpha)(1+a)-(1-a)}{4} \right] \right) (\hat{\rho}_A - \hat{\rho}_C) \\ &- \lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_D) - (\hat{C}_A - \hat{C}_C) \end{aligned} \right] \\ TB_{AD} &= \frac{1-a}{4}P_0C_0 \left[\begin{aligned} &\lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_B) + \left(1 - \lambda_C \left[1 + \frac{(1+\alpha)(1+a)-(1-a)}{4} \right] \right) (\hat{\rho}_A - \hat{\rho}_D) \\ &- \lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_C) - (\hat{C}_A - \hat{C}_D) \end{aligned} \right] \end{aligned}$$

Assuming that $\hat{\rho}_D = \hat{\rho}_C$ to abstract from intra-periphery stuff. The trade balance measures as according are then as follows. Taking Φ equal to the share of trade between A and B in A 's total trade:

$$\Phi = \frac{\frac{(1-\alpha)(1+a)}{4}}{\frac{(1-\alpha)(1+a)}{4} + \frac{1-a}{2}}$$

I formulate the three measures used in the empirical research of the trade balance as approximations around their steady-state values. In all three measures the presence of a makes the reaction to the change in terms-of-trade with the regional partner B less (negative) than with the non-regional trade agreement partners.

Net exports over total steady-state trade: $TB_1 = \frac{EXP-IMP}{EXP+IMP}$:

$$\begin{aligned}
\frac{T\hat{B}_A}{(X+M)_0} &= \frac{T\hat{B}_{AB} + T\hat{B}_{AC} + T\hat{B}_{AD}}{2P_0C_0 * \left(\frac{(1-\alpha)(1+a)}{4} + \frac{(1-a)}{2} \right)} \\
&= \left\langle \Phi \left(1 - \lambda \left[1 + \frac{\alpha(1+a)}{2} \right] \right) (\hat{\rho}_A - \hat{\rho}_B) \right. \\
&\quad \left. + (1 - \Phi) \left[\frac{\lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_B)}{+ \left(1 - \lambda \left[1 + \frac{(1+\alpha)(1+a)-(1-a)}{2} \right] \right)} (\hat{\rho}_A - \hat{\rho}_C) \right] \right. \\
&\quad \left. + \left[\Phi \hat{C}_B + \frac{1-\Phi}{2} (\hat{C}_C + \hat{C}_D) \right] - \hat{C}_A \right\rangle 2\Phi \left(\frac{(1-\alpha)(1+a)}{4} \right)^{-1} \\
&= \left\langle \left(\Phi - \lambda \left[\Phi \left(1 + \frac{(1+\alpha)(1+a)-(1-a)}{4} \right) - \frac{(1-\alpha)(1+a)-(1-a)}{4} \right] \right) (\hat{\rho}_A - \hat{\rho}_B) \right. \\
&\quad \left. + (1 - \Phi) \left(1 - \lambda \left[1 + \frac{(1+\alpha)(1+a)-(1-a)}{2} \right] \right) (\hat{\rho}_A - \hat{\rho}_C) \right. \\
&\quad \left. + \left[\Phi \hat{C}_B + \frac{1-\Phi}{2} (\hat{C}_C + \hat{C}_D) \right] - \hat{C}_A \right\rangle 2\Phi \left(\frac{(1-\alpha)(1+a)}{4} \right)^{-1}
\end{aligned}$$

Log of total exports over total imports: $TB_2 = \ln \left(\frac{EXP}{IMP} \right)$

$$\begin{aligned}
\frac{\hat{X}_{AB}}{\hat{M}_{AB}} &= s_0(-\lambda)(\hat{\rho}_A - \hat{P}_B) + (1 - s_0)(-\lambda)(2\hat{\rho}_A - \hat{P}_C - \hat{P}_D) - \\
&\quad - s_0(-\lambda)(\hat{\rho}_B - \hat{P}_A) + (1 - s_0)(-\lambda)(\hat{\rho}_C + \hat{\rho}_D - \hat{P}_A) = \\
&= -\lambda \left(s_0 [\hat{\rho}_A - \hat{\rho}_B - (\hat{P}_B - \hat{P}_A)] - (1 - s_0) [\hat{\rho}_A - \hat{\rho}_C + \hat{\rho}_A - \hat{\rho}_D - (\hat{P}_C - \hat{P}_A) - (\hat{P}_D - \hat{P}_A)] \right) \\
&= \lambda \left(1 + \frac{\alpha(1+a)}{2} \right) (s_0(\hat{\rho}_A - \hat{\rho}_B) - (1 - s_0)((\hat{\rho}_A - \hat{\rho}_C) + (\hat{\rho}_A - \hat{\rho}_D)))
\end{aligned} \tag{7}$$

Net exports the scaled by steady state GDP $TB_3 = \frac{EXP-IMP}{P_0C_0}$:

$$\begin{aligned}
\frac{TB_A}{P_0C_0} &= \frac{TB_{AB} + TB_{AC} + TB_{AD}}{P_0C_0} \\
&= \Phi \left(1 - \lambda \left[1 + \frac{\alpha(1+a)}{2} \right] \right) (\hat{\rho}_A - \hat{\rho}_B) \\
&\quad + (1 - \Phi) \left[\frac{\lambda \frac{(1-\alpha)(1+a)-(1-a)}{4} (\hat{\rho}_A - \hat{\rho}_B)}{+ \left(1 - \lambda \left[1 + \frac{(1+\alpha)(1+a)-(1-a)}{2} \right] \right)} (\hat{\rho}_A - \hat{\rho}_C) \right] \\
&\quad + \left[\Phi \hat{C}_B + \frac{1-\Phi}{2} (\hat{C}_C + \hat{C}_D) \right] - \hat{C}_A \\
&= \left(\Phi - \lambda \left[\Phi \left(1 + \frac{(1+\alpha)(1+a)-(1-a)}{4} \right) - \frac{(1-\alpha)(1+a)-(1-a)}{4} \right] \right) (\hat{\rho}_A - \hat{\rho}_B) \\
&\quad + (1 - \Phi) \left(1 - \lambda \left[1 + \frac{(1+\alpha)(1+a)-(1-a)}{2} \right] \right) (\hat{\rho}_A - \hat{\rho}_C) \\
&\quad + \left[\Phi \hat{C}_B + \frac{1-\Phi}{2} (\hat{C}_C + \hat{C}_D) \right] - \hat{C}_A
\end{aligned}$$

9 Appendix II: REER construction

For the construction of the aggregate REER we use the common system of CPI-based REER construction, that goes back to Armington (1969) theoretical foundations. This construction technic is used by BIS, IMF, OECD and other institutions.

The CPI-based REER of country i is then give by the geometric average of the real exchange rates across the j trading partners:

$$REER_{i,t} = \prod_{j=1}^{j=n} \left(\frac{cpi_i ner_i}{cpi_j ner_j} \right)^{\omega_{ij}}$$

Nominal exchange rate $ner_{i,j}$ and consumer price indices $cpi_{i,j}$ are taken from the IFS database and aggregated to yearly values (simple average) across the available data.

Competitiveness weight ω_{ij} is calculated in accordance to what is called “third market effect” as opposed to simple trade weights.

Therefore, assume that country i and j can compete in k markets (including their own).

Define T_l^k as the sales of country l in country k 's market. Then s_j^k is country's j market share in country k and w_i^k share of country i 's output sold in country k . s_i^i is the domestic supply of country i to country i . We proxy for domestic supply on the basis of the original Turner & dack (1993) methodology and the WEO data.

$$s_j^k = \frac{T_j^k}{\sum_l T_l^k}$$

$$w_i^k = \frac{T_i^k}{\sum_n T_l^n}$$

Then the weight attached to country j by country i is:

$$\omega_{ij} = \frac{\sum_k w_i^k s_j^k}{\sum_k w_i^k (1 - s_i^k)}$$

This weight could be understood as the sum over all possible markets of the magnitude of the degrees of competition between producers of the ij country pair over the magnitude of competition of the producers of the country i over all possible markets.

This construction of the competitiveness weight is a convex combination of the bilateral import weight and a double export weights, and can be represented in a following way:

$$\omega_{ij} = \lambda_i^{IMP} \omega_{ij}^{IMP} + \lambda_i^{EXP} \omega_{ij}^{EXP}$$

Where:

$$\omega_{ij}^{IMP} = \frac{s_i^j}{\sum_{l \neq i} s_l^i} - \text{simple import weight};$$

$$\omega_{ij}^{EXP} = \frac{\sum_{k \neq i} w_i^k s_j^k}{\sum_{k \neq i} w_i^k (1 - s_i^k)} - \text{ratio of the intensity of competition between the producers of } i \text{ and } j \text{ markets, taking into account the competition of the other possible markets};$$

$\lambda_i^{IMP} = \frac{w_i^k(1-s_i^i)}{\sum_k w_i^k(1-s_i^k)}$ - is the measure of relative importance of competition of the domestic producers of country i and all other producers;

$\lambda_i^{EXP} = \frac{\sum_{k \neq i} w_i^k(1-s_i^k)}{\sum_k w_i^k(1-s_i^k)}$ - the measure of relative importance of competition of the exporters of country i and other producers in all export markets.

For calculating the RTA and no-RTA REERs, we represent all countries outside the sample as a single competing country. For example, when we are calculating the competitiveness weights attached to the Germany-France trade flows in 2005 as they have an RTA signed, we treat Russia and People's Republic of China (PRC) as a part of a joint non-RTA market where both of the countries compete. This allows us to estimate the competitiveness weights with respect to the RTA (or non-RTA) trading partners without isolating them from the existence of the non-RTA (RTA) markets. Then $REER^{RTA}$ and $REER^{noRTA}$ become the representative measure of price competitiveness with respect to the given group.

This technic has a long history of being demanding on restricting the elasticity of substitution between final and intermediate goods to the same level. This has been recently challenged by the developments on new, better, indices relax this assumption Bems & Johnson (2012). These indices use different weight structures, or even industry-level underpinned construction, allowing to better capture the competitiveness of the economy. We use as the alternative index the VAREER developed by Bems & Johnson (2012). The section below describes in general its construction.

10 Appendix III: Lists of Regional Trade Agreements (replicated from Bergstrand dataset)

Economic Unions

Euro Area (1999): Austria, Belgium, Cyprus (2008), Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta (2008), Netherlands, Portugal, Slovak Republic (2008), Slovenia (2008), Spain

West African Economic and Monetary Union (UEMOA/WAEMU) (2000): Benin, Burkina Faso, Guinea-Bissau, Ivory Coast, Mali, Niger, Senegal, Togo

Economic and Monetary Community of Central Africa (CEMAC) (2000): Cameroon, Central African Republic, Chad, Equatorial Guinea, Gabon

Common Markets

European Economic Area (EEA) (1993): Austria (1994), Belgium, Bulgaria (2007), Cyprus (2005), Czech Republic (2005), Denmark, Estonia (2005), Finland (1994), France, Germany, Greece, Hungary (2005), Iceland (1994), Ireland, Italy, Latvia (2005), Lithuania (2005), Luxembourg, Malta (2005), Netherlands, Norway (1994), Poland (2005), Portugal, Romania (2007), Slovak Republic (2005), Slovenia (2005), Spain, Sweden (1994), UK

East African Community (EAC) (2001): Burundi (2008), Kenya, Rwanda (2008), Tanzania, Uganda

Customs Union

Andean Community 1 (1995): Bolivia, Colombia, Ecuador, Peru, Venezuela

Caribbean Community and Common Market (CARICOM) (1975): Antigua And Barbuda, Bahamas (1984), Barbados, Belize, Dominica, Grenada, Guyana, Haiti (2003), Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname (1996), Trinidad and Tobago

Central American Common Market (CACM1) (1966-1969): Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua

Eurasian Economic Community (EURASIAN) (2010): Belarus, Kazakhstan, Russia

European Economic Community (EEC) (1962-1992): Belgium, Denmark (1973), France, Germany, Greece (1981), Ireland (1973), Italy, Luxembourg, Netherlands, Portugal (1986), Spain (1986), UK (1973)

European Union Customs Union (EUCU): EU-San Marino (1993), EU-Cyprus (1993)

Gulf Cooperation Council Customs Union (GCCCU) (2003): Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates

Mercado Comn del Sur (MERCOSUR) (1995): Argentina, Brazil, Paraguay, Uruguay

Southern African Customs Union (SACU) (1970): Botswana, Lesotho, Namibia (1990), South Africa, Swaziland

West African Economic and Monetary Union (WAEMU) (1995-1999): Benin, Burkina Faso, Guinea-Bissau (1997), Ivory Coast, Mali, Niger, Senegal, Togo

Czech Republic-Slovak Republic (1993-2004)

Free Trade Agreements

1. Plurilateral Agreements

Andean Community 2 (1993-1994): Bolivia, Colombia, Ecuador, Venezuela

Arab Common Market (ACM) (1965): Egypt, Iraq, Syria, Yemen

ASEAN-ANZERTA (2010): Australia, New Zealand and ASEAN members

Association of Southeast Asian Nations (ASEAN) (2000): Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar (Burma), Philippines, Singapore, Thailand, Vietnam

Baltic FTA (BAFTA 1999-2004): Estonia, Latvia, Lithuania

Caribbean Free Trade Agreement (CARIFTA) (1968-1974): Antigua and Barbuda, Barbados, Belize (1971), Dominica, Grenada, Guyana, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago

Central American Common Market (CACM2) (1951-1965): Costa Rica (1963), El Salvador, Guatemala (1955), Honduras (1957), Nicaragua

Central American Common Market (CACM3) (1993): Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua

Central European Free Trade Area (CEFTA) (1993): Albania (2007), Bosnia and Herzegovina (2007), Bulgaria (1999-2006), Croatia (2003), Czech Republic (until 2004), Hungary (1993-2004), Macedonia (2006), Moldova (2007), Poland (until 2004), Romania (1997-2006), Slovak Republic (1993-2004), Slovenia (1996-2004)

Colombia -Northern Triangle FTA: Colombia, Mexico, El Salvador, Guatemala, Honduras

Common Market for Eastern and Southern Africa (COMESA) (2001): Burundi (2005), Comoros (2006), Congo D.R., Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya (2006), Madagascar, Malawi, Mauritius, Rwanda (2005), Seychelles, Swaziland, Uganda, Sudan

Dominican Republic-Central America-United States FTA (2006) (CAFTA-DR): Costa Rica (2009), Dominican Republic (2007), El Salvador, Guatemala (2007), Honduras, Nicaragua, United States

European Free Trade Association (EFTA 1960): Austria (until 1995), Denmark (until 1973), Finland (1986-1995), Iceland (1970), Norway, Portugal (until 1986), Sweden (until 1995), Switzerland, United Kingdom (until 1973)

European Union (EU) (1958): Austria (1995), Belgium, Bulgaria (2007), Cyprus (2004), Czech Republic (2004), Denmark (1973), Estonia (2004), Finland (1995), France, Germany, Greece (1981), Hungary (2004), Ireland (1973), Italy, Latvia (2004), Lithuania (2004), Luxembourg, Malta (2004), Netherlands, Poland (2004), Portugal (1986), Slovak Republic (2004), Slovenia (2004), Spain (1986), Sweden (1995), United Kingdom (1973)

Gulf Cooperation Council (GCCFTA)(1983-2002): Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates

NAFTA (North American Free Trade Agreement 1994): Canada, Mexico, US

Pan-Arab Free Trade Area (1998) (PAFTA/GAFTA): Algeria (2009), Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon (1999), Libya (1999), Morocco, Oman, Palestine (2005), Qatar, Saudi Arabia, Sudan (2005), Syria, Tunisia, United Arab Emirates, Yemen (2005)

Pacific Island Countries Trade Agreements (2003) (PICTA): Fiji, Kiribati, Papua New Guinea, Solomon Islands, Tonga, Samoa

South Asian Free Trade Area (SAFTA)(2006): Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka

Southern African Development Community (SADC) (2001): Botswana, Congo D.R., Lesotho, Madagascar, Malawi (2009), Mauritius, Mozambique (2009), Namibia, South Africa, Swaziland, Tanzania (2009), Zambia, Zimbabwe

Trans-Pacific Partnership (TPP) (2006): Brunei, Chile, New Zealand, Singapore

West African Monetary Union (WAMU) (1962-1965): Burkina Faso, Mali, Mauritania, Niger, Senegal

2. Bilateral Agreements

Albania-Bosnia and Herzegovina (2004-2006)
Albania-Croatia (2004-2006)
Albania-Macedonia (2003-2006)
Albania-Macedonia (2003-2006)
Albania-Romania (2004)
Andean Community 1-Chile (2005)
Andean Community 1-MERCOSUR (2005)
Angola-Egypt (2001)
Armenia-Georgia (1999)
Armenia-Kazakhstan (2002)
Armenia-Kyrgyz Republic (1996)
Armenia-Moldova (1996)
Armenia-Russia (1993)
Armenia-Turkmenistan (1997)
Armenia-Ukraine (1997)
ASEAN-PR China (2006)
ASEAN-India (2010)
ASEAN-Japan (2008)
ASEAN-South Korea (2007)
Australia-Chile (2009)
Australia-New Zealand (1983-2009)
Australia-Papua New Guinea (1977)
Australia-Singapore (2003-2009)
Australia-Thailand (2005-2009)
Australia-USA (2005)
Azerbaijan-Georgia (1997)
Azerbaijan-Russia (1993)
Azerbaijan-Ukraine (1997)
Bahrain-USA (2007)
Belarus-Russia (1993-2009)
Belarus-Ukraine (2007)
Bolivia-Chile (1996-2004)
Bolivia-Mexico (1995)
Bosnia and Herzegovina-Bulgaria (2005)
Bosnia and Herzegovina-Croatia (2001-2006)
Bosnia and Herzegovina-Macedonia, (2003-2005)
Bosnia and Herzegovina-Moldova (2005-2006)
Bosnia and Herzegovina-Romania (2004-2006)
Bosnia and Herzegovina-Slovenia (2002-2003)
Bulgaria-Israel (2002-2006)
Bulgaria-Macedonia (2000-2006)
Bulgaria-Moldova (2004)
CACM3-Dominican Republic (1998)
CACM3-Mexico (2001)
Cameroon-Gabon (1966-1999)
Canada-Chile (1997)
Canada-Israel (1997)
Canada-Peru (2010)

Canada-USA (1989-1993)
CARICOM-Costa Rica (2004)
CARICOM-Dominican Republic (1998)
CEFTA-Bulgaria (1993-1998)
Chile-PR China (2007)
Chile-Costa Rica (2002)
Chile-El Salvador (2003)
Chile-Japan (2008)
Chile-Korea (2004)
Chile-Mexico (2000)
Chile-Panama (2008)
Chile-USA (2004)
PR China-Costa Rica (2010)
PR China-Hong Kong (2004)
PR China-Macao (2004)
PR China-New Zealand (2009)
PR China-Nicaragua (2007)
PR China-Pakistan (2008)
PR China-Peru (2010)
Colombia-Mexico (1995-2009)
COMESA-SADC (2006)
Congo, Republic of-Gabon (1966)
Costa Rica-Mexico (1995-2000)
Croatia-Macedonia (2004)
Czech Republic-Estonia (1997)
Czech Republic-Israel (1997-2004)
Czech Republic-Latvia (1997-2004)
Czech Republic-Lithuania (1997-2004)
Czech Republic-Romania (1997-2006)
EEC-Israel (1975-1992)
EEA-Israel (1993)
EFTA-Albania (2010)
EFTA-Bulgaria (1994-2006)
EFTA-Canada (2010)
EFTA-Chile (2005)
EFTA-Croatia (2002)
EFTA-Czech Republic (1994-2004)
EFTA-Egypt (2007)
EFTA-Estonia (1997-2004)
EFTA-GCCCU (2009)
EFTA-Hungary (1994-2004)
EFTA-Israel (1993)
EFTA-Jordan (2002)
EFTA-Latvia (1996-2004)
EFTA-Lebanon (2007)
EFTA-Lithuania (1997-2004)
EFTA-Macedonia (2001)
EFTA-Mexico (2002)
EFTA-Morocco (2000)

EFTA-Poland (1994)
EFTA-Romania (1994-2006)
EFTA-SACU (2008)
EFTA-Singapore (2003)
EFTA-Slovak Republic (1993-2004)
EFTA-Slovenia (1995-2004)
EFTA-South Korea (2007)
EFTA-Tunisia (2005)
Egypt-Jordan (1999)
El Salvador-Panama (2003)
Estonia-Hungary (1999-2004)
Estonia-Slovak Republic (1997-2004)
Estonia-Slovenia (1997-2004)
EU-Algeria (2005)
EU-Bulgaria (1994-2006)
EU-Chile (2005)
EU-Croatia (2003)
EU-Cyprus (1988-2004)
EU-Czech Republic (1992-2004)
EU-EFTA (Agreement/European Economic Area 1973/1994)
EU-Egypt (2005)
EU-Estonia (1998-2004)
EU-Faroe Islands (1997)
EU-Hungary (1992-2004)
EU-Israel (2000)
EU-Jordan (2002)
EU-Latvia (1995-2004)
EU-Lebanon (2003)
EU-Lithuania (1995-2004)
EU-Macedonia (2002)
EU-Mexico (1998)
EU-Morocco (2001)
EU-Poland (1992-2004)
EU-Romania (1993-2006)
EU-Slovak Republic (1993-2004)
EU-Slovenia (1997-2004)
EU-South Africa (2000)
EU-Tunisia (1999)
Faroe Islands-Iceland (1994)
Faroe Islands-Norway (1994)
Faroe Islands-Poland (2000-2004)
Faroe Islands-Switzerland (1996)
Georgia-Kazakhstan (2000)
Georgia-Russia (1993)
Georgia-Turkmenistan (2000)
Georgia-Ukraine (1997)
Hungary-Israel (1998-2004)
Hungary-Latvia (2000-2004)
Hungary-Lithuania (2000-2004)

India-Sri Lanka (1999-2005)
India-Singapore (2006)
India-South Korea (2010)
Ireland-Latvia (1995)
Ireland-Lithuania (1995)
Israel-Mexico (2001)
Israel-Poland (1998-2004)
Israel-Romania (2002-2006)
Israel-Slovak Republic (1997-2004)
Israel-Slovenia (1999-2004)
Israel-USA (1986)
Japan-Switzerland (2010)
Jordan-Singapore (2006)
Jordan-USA (2002)
Kazakhstan-Kyrgyz Republic (1996)
Kazakhstan-Russia (1993-2009)
Kyrgyz Republic-Moldova (1997)
Kyrgyz Republic-Russia (1993)
Kyrgyz Republic-Ukraine (1998)
Kyrgyz Republic-Uzbekistan (1999-2007)
Latvia-Slovak Republic (1997-2004)
Lithuania-Poland (1997-2004)
Lithuania-Slovak Republic (1997-2004)
Lithuania-Slovenia (1997-2003)
Macedonia-Moldova (2005-2006)
Macedonia-Romania (2004-2006)
Macedonia-Slovenia (1997-2003)
Macedonia-Ukraine (2002-2005)
MERCOSUR-Bolivia (1996-2004)
MERCOSUR-Chile (1996)
MERCOSUR-Israel (2008)
Mexico-Colombia (1995)
Mexico-Japan (2005)
Mexico-Nicaragua (1999)
Mexico-Uruguay (2005)
Mexico-Venezuela (1995)
Moldova-Ukraine (2005)
Morocco-USA (2006)
New Zealand-Singapore (2001-2009)
New Zealand-Thailand (2006-2009)
Oman-USA (2009)
Pakistan-Sri Lanka (2005)
Panama-Singapore (2007)
Peru-Singapore (2010)
Peru-USA (2009)
Poland-Latvia (1999-2004)
Romania-Moldova (1995-2006)
Russia-Tajikistan (1993)
Russia-Turkmenistan (1993)

Russia-Ukraine (1994)
Russia-Uzbekistan (1993)
SADC-SACU (2009)
Slovak Republic-Estonia (1997)
Slovenia-Israel (1999)
Slovenia-Latvia (1997)
Tajikistan-Ukraine (1995)
Turkmenistan-Ukraine (1995)
TPP-PR China (2007)
Ukraine-Estonia (1997)
Ukraine-Uzbekistan (1996)
USA-Singapore (2004)

Table 9: Country List

Afghanistan	Egypt, Arab Rep.	Lithuania	South Africa
Albania	El Salvador	Luxembourg	Spain
Algeria	Estonia	Macedonia, FYR	Sri Lanka
Argentina	Ethiopia	Madagascar	St. Kitts and Nevis
Armenia	Fiji	Malawi	St. Lucia
Australia	Finland	Malaysia	St. Vincent and the Grenadines
Austria	France	Maldives	Sudan
Bahamas	Gabon	Mali	Sweden
Bahrain	Georgia	Malta	Suriname
Bangladesh	Germany	Mauritius	Switzerland
Barbados	Greece	Mexico	Syrian Arab Republic
Belgium	Grenada	Morocco	Tanzania
Belize	Guatemala	Mozambique	Thailand
Benin	Guyana	Nepal	Togo
Bosnia and Herzegovina	Honduras	Netherlands	Tonga
Brazil	Hong Kong	New Zealand	Trinidad And Tobago
Brunei Darussalam	Hungary	Nicaragua	Tunisia
Bulgaria	Iceland	Niger	Turkey
Burkina Faso	India	Nigeria	Uganda
Burundi	Indonesia	Norway	Ukraine
Cambodia	Ireland	Oman	United Kingdom
Cameroon	Israel	Pakistan	United States
Canada	Italy	Panama	Uruguay
Central African Republic	Ivory Coast	Paraguay	Venezuela
Chile	Jamaica	Philippines	Vietnam
PR China	Japan	Poland	Yemen
Colombia	Jordan	Portugal	Zambia
Congo, Dem. Rep.	Kazakhstan	Qatar	
Costa Rica	Kenya	Russian Federation	
Croatia	Korea, Rep.	Rwanda	
Cyprus	Kuwait	Saudi Arabia	
Czech Republic	Kyrgyz Republic	Senegal	
Denmark	Latvia	Singapore	
Dominica	Lebanon	Slovak Republic	
Dominican Republic	Libya	Slovenia	