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ESSAYS ON ECONOMIC INTEGRATION

by

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Abstract

This thesis presents the findings of three empirical chapters related to economic integration. In the first of these chapters, we run a linear probability model (LPM) on a pooled sample of 106 countries, for the years 1960–2011; and on two sub-samples, one between 1960 and 1996 and the other between 1997 and 2011. This separation helps us determine whether the economic determinants of preferential trade agreements have changed, and our core result is that they have not. Second, for a panel of 180 countries and the years 1995–2012, we run Poisson regressions under three hypotheses, exploring whether integration lowers trade costs. We find that (i) forming trade agreements, (ii) deepening integration, and (iii) staying in trade agreements all significantly lowers trade costs. Our final empirical chapter explores the impact of regional integration on agricultural production in Sub-Saharan Africa using least squares estimates on a panel of 45 countries over the 1961–2014 time horizon. We find no effect of regional integration on agricultural production and, to help us understand why, we again turn to trade costs and Poisson estimation: for 44 SSA countries over the 1995–2012 time horizon, we find that regional integration has not lowered agricultural trade costs in Sub-Saharan Africa, but it has done so for the World.

Acknowledgements

By some (mis)fortune, I stumbled into the world of Economics. The subject fascinates me and, as a career, continues to provide opportunities I never thought possible some years ago. For enabling me to study Economics, and for guiding me along the way, I cannot thank the following people sufficiently. To my mother and dearly departed Oupa, who provided me with an aptitude for Economics, as well as financial and emotional support. To my supervisors, Chris and Markus, I could not have asked for more. Through various exchanges, you provided me with excellent advice and a skillset that will forever serve me.

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CHAPTER 1: INTRODUCTION

1.1 Motivation, structure of thesis and contributions

Economic integration is a formal expression of cooperation between governments to reduce or eliminate trade barriers among only those members within the preferential trade agreement (PTA) (Balassa, 1961; Salvatore, 2007 and Grossman, 2017). By reducing or eliminating trade barriers among members, PTAs can create (displace) trade, known as "trade creation" ("trade diversion"). Trade creation involves new trade that would not exist without the PTA and, in terms of national welfare, is always beneficial for countries. Trade diversion involves the shifting of trade away from one country toward a member's PTA partner and is sometimes detrimental to the countries in terms of national welfare. Trade diversion becomes detrimental when forming a PTA shifts imports from a more-efficient supplier to a less-efficient supplier, and national welfare falls when the benefits of eliminating distortions are smaller than the supplier efficiency loss (Suranovic, 1998).[1]

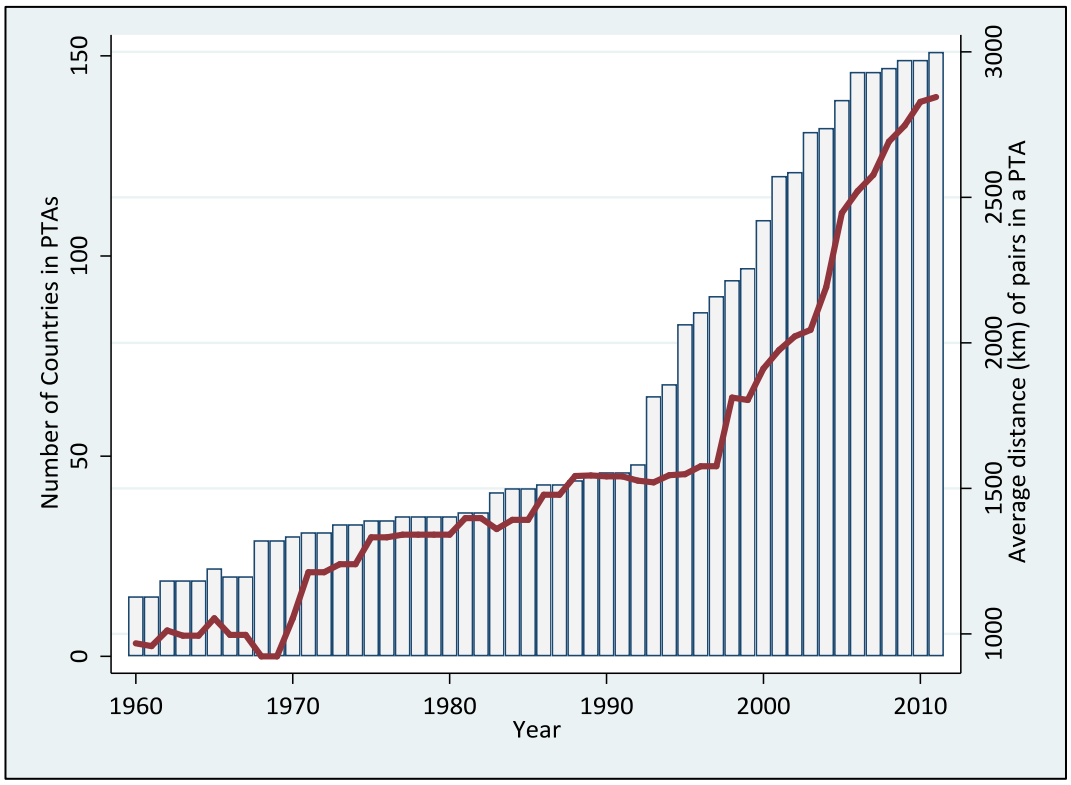
Besides reducing discrimination among members, PTAs can underpin strategic alliances; help lock in domestic policy reform; be used as a strategic device to influence subsequent *multilateral* negotiations (Krugman, 1991a); and can help countries establish themselves as competitive actors in world trade. Furthermore, while integration on its own cannot guarantee faster growth, no country has grown sustainably without growing exports. Since a purpose of PTAs is to facilitate trade between members, the recently signed African Continental Free Trade Agreement (ACFTA) is a step in the right direction for the world's least integrated continent (Berahab & Dadush, 2018 and GATT, 1986).

Beyond Africa, PTAs now regulate approximately one-half of global trade and nearly all continental trade in the Americas (Estevadeordal, Suominen, Harris &

[1] The only way to assure that trade liberalisation will lead to efficiency improvements is if a country removes its trade barriers against all countries (Suranovic, 1998).

Shearer, 2009). In fact, nearly every country in the world is either a member of at least one PTA, or is in the process of negotiating such an agreement (Wu, 2004 and Fugazza & Nicita, 2013), see Figure 1.1. Since PTAs have important economic implications (Baldwin & Venables, 2004), the proliferation in agreements over recent decades has risen economic integration to the forefront of academic and trade policy debates (World Trade Organization, 2012 and Hofmann, Osnago & Ruta, 2017). Further inciting the debate is the rising winds of protectionism (Berahab & Dadush, 2018) in countries like the United States (Trump's administration imposing tariffs on steel and aluminium imports) and the United Kingdom (Brexit).

Figure 1.1: Growth in country participation in, and average distance of, PTAs: 1960–2011



Notes: Although the bars represent the growth in country participation, the pattern of growth in the number of bilateral PTAs is similar. By the end of the period, there were 194 independent countries, 151 of which were members of a bilateral agreement.

Another present example of such a debate concerns South Africa and Nigeria's signing of the ACFTA. Both countries are yet to sign the agreement because of on-going internal consultations. On the one hand, the two countries will gain access to a market of 1.2 billion people and a gross domestic product (GDP) of US$ 2.2 trillion

(Berahab & Dadush, 2018) but, on the other hand, integration in Africa remains contentious because of political insecurity, ambitious agendas and unclear prioritisation, as well as the risk of polarisation (Kritzinger van Niekerk, 2005). Since the successful implementation of the ACFTA hinges (in part) on South Africa and Nigeria signing the agreement, this thesis contributes to the empirical literature on economic integration, thus helping inform the existing debates.

Chapter 2

Alongside the rampant growth in the number of PTAs, has been an increase in the mean distance between country-pairs within agreements, seen in Figure 1.1, and a rise in inter-continental agreements, see Figure 2.1. The mean distance between country-pairs has increased for several reasons, such as: prospects of agreements within a region are already exhausted; priorities have shifted to extra-regional partners; and PTAs are now being employed as tools to overcome regional constraints and open new trade opportunities in the global market space (Fiorentino, Verdeja & Toqueboeuf, 2007). The concurrent increase in mean distance and greater prevalence of inter-continental trade agreements in more recent times, suggests a clear change in the determinants of PTAs (Gonzalez, 2012). For one, this trend suggests that Cairncross (1997) may be correct: Cairncross identified the 'death of distance' in relation to people's ability to communicate but, in the present context, the phrase refers to the possible insignificance of distance in determining the formation of PTAs.

As the first to empirically analyse the economic conditions under which PTAs are more likely to form, Baier and Bergstrand's (2004) benchmark model is frequently used and cited in the trade agreement literature. In light of the recent increase in inter-continental PTAs and a broader geographical scope, we use Baier and Bergstrand's model to revisit in Chapter 2 the economic determinants increasing the probability that two countries will form a PTA, and we explore whether these determinants have evolved over time. Data availability limits us to a sample of 106 countries, which however covers a long time period of 52 years between 1960 and 2011. The time dimension of our panel data enables us to split the pooled sample

into two periods. During the first period, between 1960 and 1996, PTA formation is strongly 'geographically discriminatory' (proximity matters), whereas the period post-1996 is characterised by the rising number of inter-continental PTAs. Dividing the data into the old and new regionalism sub-samples allows us to assess whether the economic determinants of PTAs have changed.

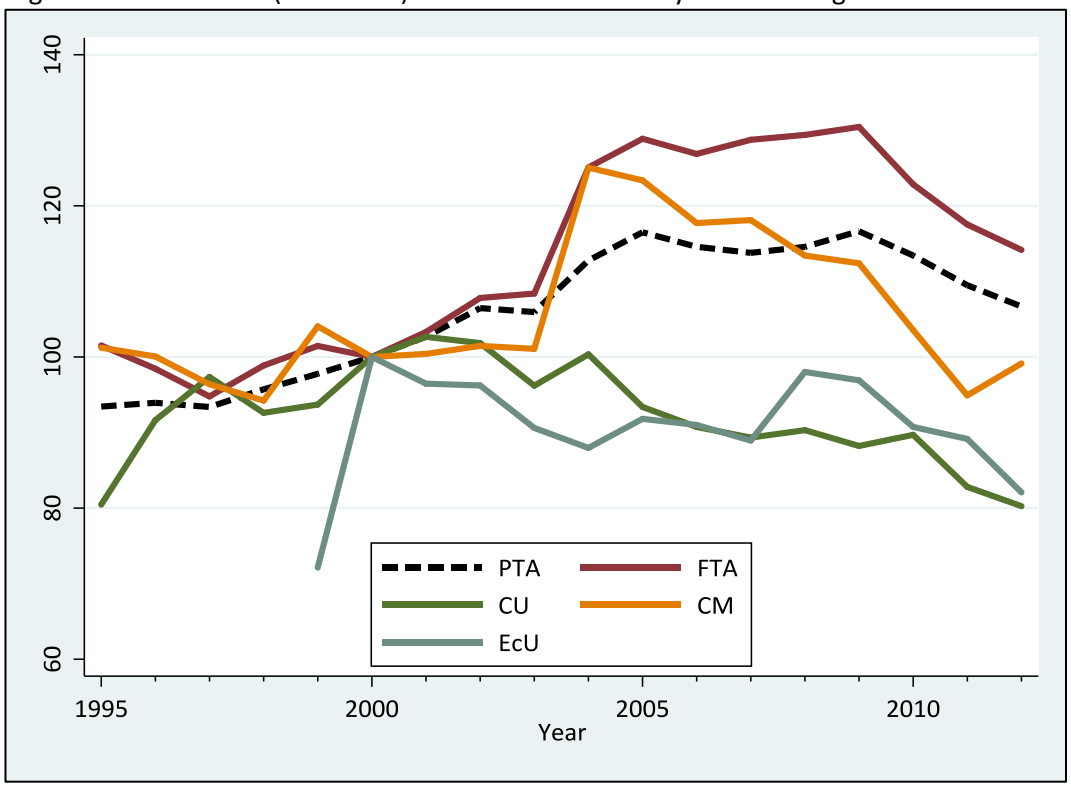
When comparing our regression results for the two periods, our major conclusion however is that both bilateral and multilateral distance still matter for countries seeking bilateral trade integration, even in the post-1996 period. Regarding the relative significance of our determinants, the standardised coefficients show that proximity has the largest impact on the probability of forming a PTA, followed by economic size; however, as more distant pairs integrate, the relative importance of GDP surpasses that of bilateral distance, reflecting the notion of strategic alliances. Therefore, despite much fanfare surrounding the notion of the 'death of distance', our analysis of the data suggests otherwise, proving that distance remains significant in determining the formation of PTAs.

Chapter 3

In order to reduce or eliminate trade barriers among PTA members, governments must cooperate in both trade policy and non-trade policy channels of international trade. For example, countries cooperate to remove tariffs and quotas (trade policy), or to improve customs procedures by simplifying and harmonising documents and automating processes (non-trade policy). Indeed, previous research demonstrates that through reducing barriers to trade, integration lowers trade costs: countries in a trade agreement enjoy cost reductions of around 15% (Arvis, Duval, Shepherd & Utoktham, 2013 and Arvis, Duval, Shepherd, Utoktham & Raj, 2015). Yet despite concerted efforts to reduce barriers to trade, overall trade costs remain persistently high – even between apparently highly integrated economies (Anderson & Van Wincoop, 2004; Snorrason, 2012 and OECD/WTO, 2015).

To quantify the relationship between economic integration and trade costs (the trade costs data captures the ratio of international to domestic trade costs), econometric specifications typically rely on a single PTA dummy variable. By construction however, such a dummy captures a homogenous effect across all country-pairs in the sample. For our panel, this would imply the same effect of entry into a PTA on trade costs across all 180 countries, which is not very convincing given the inherent heterogeneity of countries, and of trade agreements (Vicard, 2008 and Piermartini & Yotov, 2016). Chapter 3 thus contributes to the literature by developing three hypotheses that incorporate different dimensions of economic integration, and by including individual dummy variables for free trade agreements (FTA), customs unions (CU), common markets (CM) and economic unions (EcU), help capture heterogenous effects, see Figure 1.2. For the period under analysis (1995–2012), we thus quantify the effects of (i) forming agreements, (ii) deepening the level of integration, and of (iii) staying in an agreement. Additionally, we do this for different continents, and for different levels of development.

Figure 1.2: Index (2000=100) of mean trade costs by level of integration: 1995–2012



Notes: PTA combines the FTA, CU, CM and EcU information.

Comparable to the results of Arvis et al. (2013) and Arvis et al. (2015), we find that forming a PTA reduces trade costs by 15.35%. Furthermore, we separate the overall reduction in bilateral trade costs associated with the formation of a PTA, into the individual levels of integration constituting PTAs. Therefore, forming an FTA reduces trade costs by 12.14%; and increasing the level of integration from an FTA to a CU, CM and EcU results in additional trade cost reductions of 7.03%, 10.06% and 5.84% respectively. In terms of duration, staying in an FTA, CU, CM, and EcU results in trade cost reductions of 56.28%, 70.24%, 27.44%, and 24.44% respectively. Since the trade costs data captures the ratio of international to domestic trade costs, these percentage reductions reflect the relative change in international versus domestic sales, signalling that once integrated, countries sell relatively more of their production to foreigners than to residents (holding all else constant). Therefore, of all the effects, staying in an FTA and CU results in the most significant decrease in trade costs (and the largest relative change in sales). Thus, while acting strategically to form trade agreements, countries seeking integration to lower trade costs must remain cognisant of the fact that there are variable effects of integration, and that these effects differ by continent and level of development of both the importing and exporting country.

Chapter 4

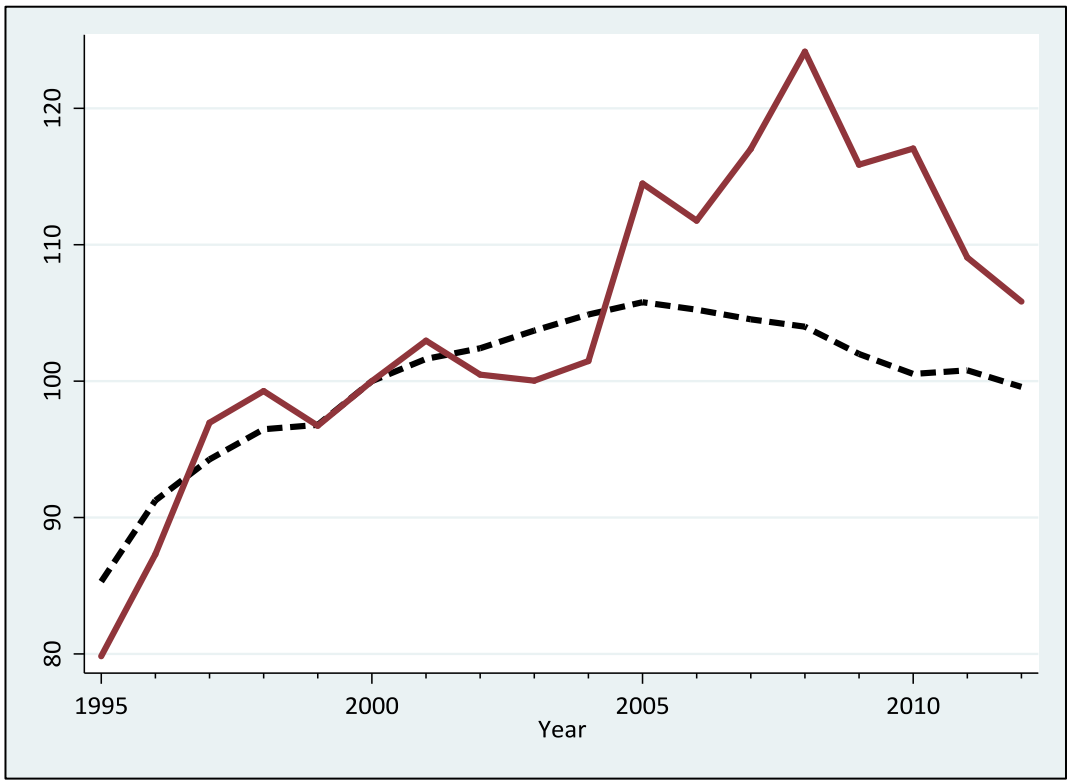
Due to persistently low productivity levels and the resultant food shortages, Sub-Saharan Africa (SSA) is unable to feed itself and thus facing a vast humanitarian catastrophe in the making (Kuhlmann, Sechler & Guinan, 2011). One way to theoretically help increase agricultural production and thwart the catastrophe is via increased economic integration. PTAs help create efficiency gains through shifting production to countries where it can best take place (i.e., integration enables firms to alter their location decisions), and allow for a more efficient sourcing of the inputs to agricultural production. Moreover, PTAs promote competitiveness, liberalise services, promote labour mobility, protect intellectual property, improve governance, and foster transparency and the rule of law (World Bank, 2011).

The persistently low productivity levels also present SSA with an opportunity to produce another 100 million tonnes of grain equivalents each year. Should production increase to this extent, SSA will become a net agricultural exporter (Kuhlmann et al., 2011). Despite the strong theoretical backing, whether increased integration will help is open to debate because empirical studies and analysis on the topic are lacking (Nin-Pratt & Diao, 2014 and World Bank, 2011). Therefore, we investigate in Chapter 4 the impact of economic integration on agricultural production in SSA. This provides, to the best of our knowledge, the first empirical investigation of this relationship. As such, this research is critical for policymakers, particularly those in SSA given the looming catastrophe.

Our analysis of 45 SSA countries over the 1961–2014 period, finds no integration effect on agricultural production. We carry out additional analysis to better understand this result, initially considering whether countries might have specialised away from agriculture, but we find no evidence supporting this. Thereafter, we focus on the relationship between regional integration and agricultural trade costs, see Figure 1.3. Adopting agricultural trade cost data and comparing our SSA sample results to those obtained from a global sample of 176 countries, we find that regional integration has lowered agricultural trade costs in the latter but not in the former, thus failing to provide a significant stimulus to improve agricultural production. Given the widespread enthusiasm for regional integration among policymakers in SSA, these findings provide an important quantification of the effects of regional integration.

By relating our findings to the ACFTA, Chapter 5 summarises and concludes. For South Africa and Nigeria, being the two largest economies in Africa, our research demonstrates that a PTA between the two countries makes sense and that if fully implemented, the agreement will result in lower (agricultural) trade costs. In turn, lower trade costs will encourage participation in world trade, and lower agricultural trade costs will boost agricultural production, both of which will help sustain growth and development on the continent.

Figure 1.3: Index (2000=100) of mean agricultural trade costs for SSA and the World: 1995–2012



Notes: The solid (red) line represents mean trade costs for SSA and the dashed (black) line, mean trade costs for the World. In 1995, mean agricultural trade costs in SSA were 242.91; and for the World, 266.59.

CHAPTER 2: HAVE THE ECONOMIC DETERMINANTS OF PREFERENTIAL TRADE AGREEMENTS CHANGED: 1960–2011?

2.1 Introduction and motivation

The literature is replete with research on the well-developed theory of the effects of preferential trade agreements (PTAs), including of what benefits countries may derive from integration, see Machlup (1977), Whalley (1998), Donaldson (2015) and others.[2] However, only a handful of papers relate to the economic determinants driving the formation of PTAs between countries, and Márquez-Ramos, Martínez-Zarzoso and Suárez-Burguet (2011) state this as a major concern in the traditional literature. Not only is there limited research on the determinants of PTAs, but the determinants of agreements may also be evolving (Gonzalez, 2012).

Historically, PTAs were "geographically discriminatory" and emphasised the importance of natural or continental trading partners, hence were typically intra-continental. However, over the last two decades, there has been substantial growth in the number of inter-continental PTAs, and this trend towards a broader geographical scope of PTAs is even more pronounced for those agreements that are currently under negotiation, or have recently been signed (but are not yet in force). Many recent PTAs also link developing and developed countries and are, therefore, not strictly "regional" (World Trade Organization, 2011c). The concurrent broader geographical scope and increasing trend of inter-continental trade agreements in recent decades, drives the belief that the determinants of PTAs are changing.

Therefore, we revisit Baier and Bergstrand (2004) (henceforth BB), who are the first to empirically analyse the economic determinants affecting the likelihood of pairs of countries to form PTAs. BB's benchmark model explains the variation in PTAs for 1996 by analysing the bilateral trade agreements of 54 countries. The

[2] See Estevadeordal, Suominen, Harris and Shearer (2009); Estevadeordal (2012); TIPS (2011); Afesorgbor and Van Bergeijk (2014) and Chacha (2014).

determinants inform the mutual decision to form a PTA (or stay in one) through their likely trade creation/diversion and economic welfare effects. Using BB's specification, we not only consider the economic factors affecting the probability of country-pairs to form PTAs, but we also consider whether these determinants have changed over time. To do this, we run regressions on a pooled sample of 106 countries for the years 1960 to 2011 and on two sub-samples, 1960–1996 and 1997–2011. We demonstrate that PTAs prior to 1997 were geographically discriminatory, thus we refer to this period as the 'old regionalism'; since 1997, PTAs have increasingly been inter-continental, hence we refer to this period as the 'new regionalism'.[3] BB's research thus explains the formation of PTAs only in the old regionalism, and may fall short in predicting the countries involved in 21st Century Regionalism (Gonzalez, 2012).

The panel structure of our data affords us several advantages over cross-sectional or time-series data. Panel data allows us to include fixed effects to control for omitted variables (such as socio-political factors) and for variables that change over time but not across countries. In other words, we can control for individual country heterogeneity. Furthermore, panel data identifies and estimates effects that are simply not detectable in pure cross-sections or pure time-series data; and because we can rely on the inter-country differences to reduce the collinearity between current and lag variables, panel data helps uncover dynamic relationships. This feature is particularly relevant in the present context because there is a high degree of persistence in the data, with very few instances in which a PTA dissolves.[4] Our model specification allows us to aptly deal with this persistence and to condition on the fact that pairs of countries may have already formed an agreement.

Since integration is progressively involving more distant countries, we expect to find the 'death of distance', a notion first put forward by Cairncross (1997). To the

[3] We motivate for this separation in sub-section 2.3, but note here that the old regionalism ends in 1996 because the 1960-1996 period includes the dissolution of the Soviet Union and the Uruguay Round negotiations; and precedes the second wave of regionalism in 2003. Between 1960 and 1996, PTAs were typically regional and, in contrast, those forming since 1996 are commonly inter-continental, signalling that the 'new regionalism' PTAs are no longer geographically discriminatory.
[4] Discussed in sub-section 2.5.3 - Panel estimations using a LPM.

contrary however, our model (accurately predicting 94% of the PTAs found in 2011) shows that distance plays a significant role in both the old and new regionalism periods. In fact, both bilateral and multilateral distance has a larger marginal effect under the new regionalism. Concerning the remaining determinants, our regression results underpin BB's findings, except for one obvious instance. We find that the probability of a PTA between two countries decreases, the larger is the difference in their capital–labour endowment ratios. One additional observation relates to the impact of economic size, which is negative under the old regionalism and positive under the new regionalism. Furthermore, our standardised coefficients show that proximity has the largest impact on the probability of forming a PTA; followed by economic size; and the formation of PTAs is, therefore, still determined primarily by distance and GDP.

After defining economic integration in sub-section 2.2, and detailing the old and new regionalism perspectives of integration, we review the relevant empirical research.[5] The focus for the literature review is on the determinants of PTAs, which includes an overview of gravity equations and subsequent extensions to BB's research. Following the literature review, we present the data and some descriptive statistics in sub-section 2.3, the estimation methodology in sub-section 2.4 and ultimately in sub-section 2.5, the empirical results before concluding in sub-section 2.6.

2.2 On economic integration and its determinants

Economic integration is a process and a state of affairs reached by that process. *"Regarded as a process, it encompasses measures designed to abolish discrimination between economic units belonging to different national states; viewed as a state of affairs, it can be represented by the absence of various forms of discrimination between national economies."* (Machlup, 1977 and Balassa, 1961, p. 1). Balassa explains the intuition behind this definition: economic integration

[5] See Appendix 2B for a schematic literature review.

comprises measures that entail the suppression of some forms of discrimination, an example being the removal of trade barriers. More simply, economic integration is the commercial policy of discriminatively reducing or eliminating trade barriers among only those members that join together (Salvatore, 2007).

Besides reducing discrimination among members, countries choose to integrate because such agreements underpin strategic alliances and implicitly form part of security arrangements (as in Europe). Smaller countries may see trade agreements as an opportunity; as a way of obtaining more security for their access to larger country markets (as with the Trade, Development and Co-operation Agreement between South Africa and Europe). Other countries try to use regional (and plurilateral) agreements to help lock in domestic policy reform and make it more difficult to subsequently reverse. Finally, some countries use trade agreements as tactical considerations, a component of conscious efforts to use prior regional agreements to influence subsequent multilateral negotiation. For a more detailed discussion on why countries integrate, see Whalley (1998) and the World Trade Organization (2011c).

Before reviewing the literature covering the determinants of PTAs, we explain the difference between the old and new regionalism. This distinction is important because some researchers believe the determinants of PTAs are evolving (Gonzalez, 2012) and understanding the difference is fundamental to the present analysis.

2.2.1 Old and new regionalism perspectives on integration

Several papers use either the type of welfare effects (both static and dynamic), or the degree of integration between countries, to distinguish between the old and new regionalism (De Hanlon, 2011). For example, Burfisher, Robinson and Thierfelder (2004) discuss the integration continuum, that includes “shallow” agreements involving only reducing or eliminating barriers to trade in commodities; and “deep”

agreements, which involve additional elements of harmonising national policies, and allowing or encouraging internal factor mobility.[6]

More than simply considering deeper levels of integration, many recent PTAs link developing and developed countries (Burfisher et al., 2004); and additionally, due to the advent of inter-continental PTAs in the last decade, half of the PTAs currently in force are not strictly "regional" (World Trade Organization, 2011c). This trend towards a broader geographical scope of PTAs is even more pronounced for those agreements that are currently under negotiation, or have recently been signed (but are not yet in force).[7] This development is in marked contrast to just over ten years ago, when activity within a region was dominant and may reflect the fact that several prospects of agreements within a region have already been exhausted. The sharp increase in the number of inter-continental PTAs may also indicate a shift in emphasis from regional priorities to PTAs with extra-regional partners; or, perhaps PTAs are being employed as tools to overcome regional constraints and open new trade opportunities in the global market space (Fiorentino, Verdeja & Toqueboeuf, 2007). The growth in the number of continental and inter-continental PTAs is shown in Figure 2.1.[8]

It is evident from the figure below, that significant growth in the number of inter-continental PTAs occurs in 1997, hence we mark this year as the start of the 'new regionalism'. While we fully motivate for this separation in sub-section 2.3, we note here that the old regionalism ends in 1996 because this period includes the dissolution of the Soviet Union and the Uruguay Round negotiations; and precedes the second wave of regionalism in 2003. Therefore, we identify the years 1960–1996 as 'old regionalism', a "geographically discriminatory" period marked by PTAs that

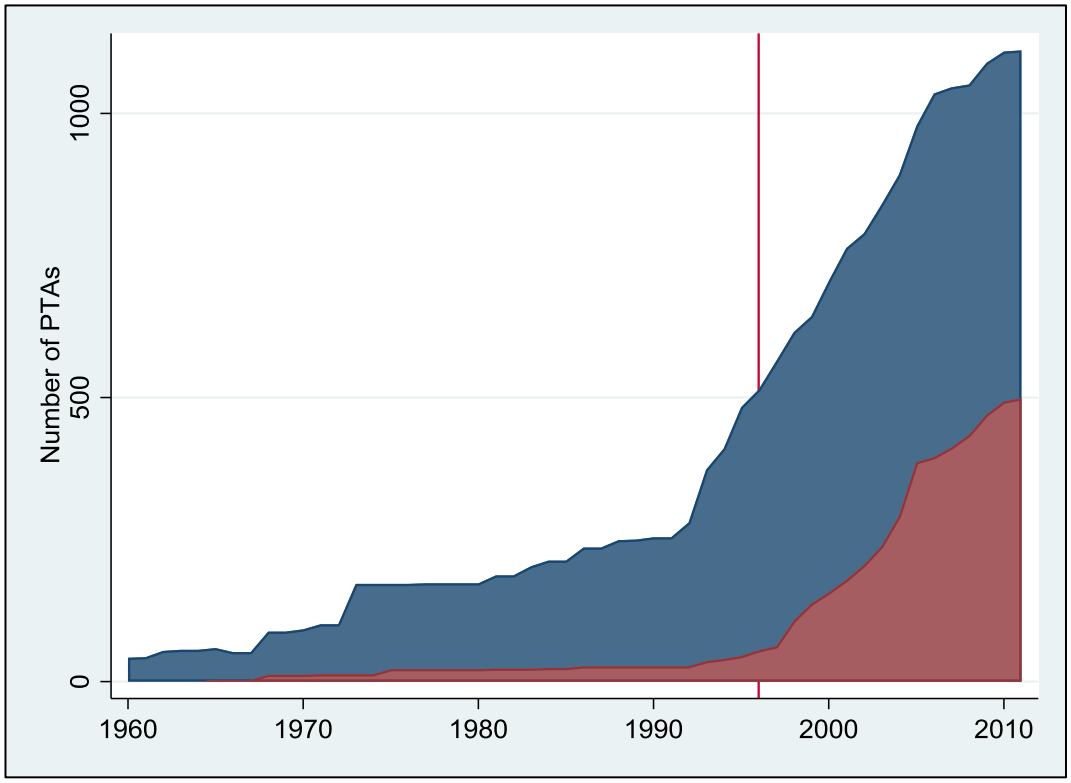
[6] The first 20–30 years after World War II (the 'old regionalism') is a period characterised by shallow integration, whereas following the Uruguay Round of the GATT negotiations (spanning from 1986 to 1994), there were strong elements of deeper integration in PTAs.

[7] These new PTAs (practically all of which are of the inter-continental type) include countries from other geographical areas, according to the regional definitions commonly employed in the WTO context (World Trade Organization, 2011).

[8] A consequence of the trend towards cross-regionalism is an increased fragmentation of trade relations, with countries belonging to multiple, sometimes overlapping PTAs (World Trade Organization, 2011).

were typically regional (Baldwin & Venables, 2004, p. 1). In contrast, the recent increase in the number of inter-continental PTAs signals that the 'new regionalism' PTAs (those formed between 1997 and 2011) are no longer geographically discriminatory, since they have transcended regional boundaries (World Trade Organization, 2011c).

Figure 2.1: Cumulative number of continental (intra-regional) and inter-continental (cross-regional) PTAs, 1960–2011



Notes: The blue area represents the growth in continental PTAs; and the red area, the growth in inter-continental PTAs. The vertical (red) line marks the year 1996.

The static analysis effects of PTAs was pioneered by Viner (1950) by focusing on the trade creating and trade diverting effects of economic integration. When two or more countries enter into a trade agreement, the shifting of imports from a high-cost member country to a low-cost member country in the union is known as trade creation (which is welfare enhancing). Trade diversion, on the other hand, occurs when imports are shifted from a low-cost supplier that is not part of the union (third country) to a high-cost supplier member country that is part of the union and results in welfare losses. Preferential liberalisation occurring from the formation of PTAs therefore, has two main effects – trade creation and trade diversion – and the net

balance between the two determines whether a PTA increases welfare for its members (Bhagwati & Panagariya, 1996b; World Trade Organization, 2011c and Hosny, 2013).

Several studies examine the impact of PTAs and test the theories on trade creation and trade diversion. The first branch of empirical research analyses specific agreements and, using different methodologies, reaches mixed conclusions in terms of the net welfare effects of PTAs. The second branch uses gravity models to infer the trade effects of an agreement, ultimately wondering to what extent PTA partners trade more than would be predicted by standard bilateral trade determinants (e.g. income, geographical proximity, etc.). Within the third branch of empirical literature, researches have tested Krugman's "natural trading partner" hypothesis. Across these three branches, PTAs are largely associated with trade creation and typically facilitate reciprocal liberalisation – particularly in recent years. In fact, PTAs may actually be an important force behind general liberalisation, and when employed after unilateral and multilateral efforts fail, can dismantle trade barriers. Thus, while this literature is not conclusive, it suggests that trade diversion may play a role in some agreements and in some sectors, but it does not emerge as a key effect of PTAs (Freund & Ornelas, 2010a and World Trade Organization, 2011c).

Under the old regionalism, PTAs with geographically proximate countries were considered more likely to be trade creating, lead to a larger improvement in welfare (of the home country) and were thus "natural", whereas distant PTAs were more likely be trade diverting (Krishna, 2003). Thus, Krugman (1991a, b) emphasised economic geography or old regionalism, spurring others to consider continental PTAs and the impact of transport costs on welfare.[9] Krugman (1991b) also considers the impact of PTAs on welfare and finds agreements to be welfare enhancing; however, geographically distant or new regionalism PTAs are welfare decreasing (Baier & Bergstrand, 2004).

[9] The other authors include Frankel (1997) and Frankel, Stein and Wei (1995, 1996, 1998), see BB.

PTAs also have dynamic effects (i.e. effects that change over time). These dynamic effects can be driven by, for instance, economies of scale, effects on the location of production (better utilisation of resources), or stimulation to investment. The likely rise in competition is the greatest dynamic benefit and occurs out of the removal of barriers among the members. When trade barriers are removed, producers in each nation must become more efficient to meet the rising competition within the PTA or they will go out of business. The dynamic gains are presumed to be significant and far greater than the static gains; recent empirical research finding that the dynamic gains are 5 to 6 times larger (Salvatore, 2007).

Two popular areas of research focussing on the dynamic effects of PTAs include the 'accumulation effect' and 'location effect'. The accumulation effect considers how PTAs affect growth through changes in the return on investment in member countries, determined by changes in physical and human capital, or by changes in the technology available to firms. The 'location effect' looks at how the integration of a country into a PTA may alter the distribution of economic activity within the PTA and thereby lead to inequality among member countries. When trade barriers are reduced, firms can alter their location decisions. This decision depends on the balance between production costs and the trade costs that must be incurred to supply different markets. On the one hand, locations where economic activity is more concentrated can be efficient in the presence of external economies of scale that increase firms' productivity. On the other hand, proximity to consumers reduces trade costs, particularly when trade policy restrictions are in place (World Trade Organization, 2011c).

Since static effects can be driven by the same forces as dynamic effects, the ideal usage of the terms 'static' and 'dynamic' is with the use of dated and lagged variables, respectively, in the models or systems of relationships. It is then a contravention to this usage when economists speak of the dynamic effects of the removal of tariffs to separate realisation of economies of scale, increase in competition, and diversion of investment from all other induced changes of resource reallocation. Since all these changes can be explained by means of static or dynamic

analysis, there is no sense in which any particular change can be a described as a dynamic effect (Machlup, 1977). Pursuant to Machlup, our empirical analysis makes use of dated (static) and lagged (dynamic) variables.

2.2.2 Existing empirical work on the determinants of PTAs

As international trade policy agreements, PTAs are governed by the General Agreement on Tariffs and Trade (GATT) (Snorrason, 2012), which came into force on 1 January 1948.[10] Within the founding agreement, the relevant Governments recognised the importance of integration. PART III, Article XXIV, Clause 4 of the GATT states: "*The contracting parties recognize the desirability of increasing freedom of trade by the development, through voluntary agreements, of closer integration between the economies of the countries parties to such agreements. They also recognize that the purpose of a customs union or of a free-trade area should be to facilitate trade between the constituent territories and not to raise barriers to the trade of other contracting parties with such territories.*" (GATT, 1986, p. 41). More broadly, Article XXIV outlines the conditions and measures relating to the formation of customs unions and free trade agreements (FTAs) by members.

The first statistical tests on whether developments at the heart of the GATT/World Trade Organization (WTO) encouraged its members to form PTAs as devices to obtain bargaining leverage within the multilateral regime was conducted by Mansfield and Reinhardt (2003). The two authors consider the growth in GATT/WTO membership; the periodic multilateral trade negotiation rounds; as well as participation and losses in formal GATT/WTO disputes; and find these have led members to seek entrance into PTAs. They also consider all PTAs [that is, partially-liberalising agreements, FTAs, customs unions, and common markets] formally

[10] The GATT was not meant to be a permanent trade body but rather a stopgap agreement to serve until such time that would see the International Trade Organization (ITO) in place (Encyclopedia of the Nations, 2015). Despite the aborted attempt to create the ITO, GATT helped establish a strong and prosperous multilateral trading system that became more and more liberal through rounds of trade negotiations. The system, however, needed a thorough overhaul by the 1980s, and this led to the Uruguay Round and ultimately, to the WTO (World Trade Organization, 2015a).

notified to GATT/WTO, provided they are "reciprocal", meaning that each party grants the other preferential market access.[11] Ultimately, Mansfield and Reinhardt (2003) find that GATT/WTO members joining a PTA routinely violate Article XXIV. Trade barriers within preferential arrangements are almost never completely eliminated and members frequently raise trade barriers on non-members' products. Even preferential groupings where members have not raised their external trade barriers, often inflict some damage on third parties, if for no other reason than this: preferential access granted to members' products degrades (or removes) the competitive edge of non-members' products within the PTA.

For empirical research in international trade, numerous authors rely on the gravity equation because it is one of the most robust empirical findings in economics. The gravity equation extends Newton's universal law of gravitation, and simply considers the bilateral trade interactions between countries as an increasing function of their combined economic size (GDP); and a decreasing function of their geographical distance (Tinbergen, 1962 and Frankel & Rose, 2002). Of course, bilateral distance is not the only thing that matters in the gravity equation. It is thanks to Krugman's (1995) thought experiment of moving two small countries from the middle of Europe to Mars that provides the intuition for why we need the multilateral resistance terms that Anderson (1979) originated and Anderson and Van Wincoop (2003) popularised (Head & Mayer, 2014).[12] Gravity equations can also include variables that relate to either of the two countries and De Groot, Linders, Rietveld and Subramanian (2004), for example, incorporate language, trade policy and common history, so that the model reflects the cost of trade across geographical and cultural distances.

[11] WTO members are bound to notify the PTAs in which they participate. Notifications may also refer to the accession of new parties to an agreement that already exists.

[12] Krugman's (1995) thought experiment goes as follows: consider two small equal-size economies located on Mars and able to trade with each other but separated from all other economies by near-prohibitive transport costs. Half of each country's spending on tradeables, therefore, would consist of imports from the other. However, if the two countries are located in the middle of Europe, close to much larger countries offering competing products, each would then spend only a small fraction of its income on imports from the other. Consequently, the rate of trade between them would be far lower, even if the distance between the two was the same [as on Mars].

Using a gravity model to study the effect of institutions on trade flows, De Groot et al. (2004) find that a similar law or regulatory framework, a better quality of formal institutions, an increase in regulatory quality and lower corruption, all have a significant, positive and substantial impact on trade. Although true for the quality of governance as well, it depends somewhat on the indicator used. In addition, distance may matter more for specific sectors because some goods are prone to search, transport, delay and bureaucratic procedures. Though relevant to the broader topic, these findings relate to institutional determinants of bilateral trade patterns and not to the economic determinants driving the formation of PTAs between countries.

According to Gonzalez (2012), the "traditional" determinants of PTAs fall short in predicting the countries involved in 21st Century Regionalism. He believes that partners are now more distant and exhibit greater differences in their capital–labour ratios than they did in the past, suggesting to him that important changes in the political economy dynamics determining the internal support for further liberalisation may be taking place. His argument is that the changing nature of trade, captured through the rise in vertical specialisation, is driving these changes and introducing new motives for countries to engage in new PTAs. The presence of adequate governance mechanisms, which are conducive to a more efficient allocation of economic activity, as well as the rise in international production linkages, motivate the formation of these new agreements.

To understand the rapid proliferation of PTAs, Baldwin and Jaimovich (2012) research the "domino effect" by generating an empirical index of how "contagious" are PTAs with respect to third nations.[13] They find that contagion is present in the data and is robust to various econometric specifications and samples. Baier,

[13] The "domino effect" is when governments' stances on regional liberalisation are determined by political equilibria, balanced by anti- and pro-membership forces. An event then triggers closer integration within an existing bloc, harming the profits of non-member exporters, in turn stimulating them to boost their pro-membership political activity. The political equilibrium is thus altered (by this activity), leading some countries to join. Consequently, non-member exporters are further harmed by an expanding market that excludes them. More pro-membership political activity stimulates further enlargement of the bloc, creating a second-round effect. The new political equilibrium is marked by larger regional trading blocs (Baldwin, 1993).

Bergstrand and Mariutto (2014) also research the domino effect, and are the first to distinguish empirically between sources of interdependence simultaneously. PTA "interdependence" is simply defined as the effect of other PTAs on the probability of a pair having a PTA. The sources of interdependence include an "own-PTA" effect (the impact on the net welfare gains of a PTA between two countries owing to either already having other PTAs) which probably dwarfs the "cross-PTA" effect [the impact on the net welfare gains of a PTA between the pair owing to other PTAs existing in the rest of the world (RoW)]. Regardless of the term used, the idea is simple: liberalisation begets liberalisation.

Similarly, Egger and Larch (2008) review the domino effect created after the establishment of a new PTA and the incentives of non-members to participate. While this can lead to a domino effect whereby non-members join an existing PTA, it can also lead to a pair of countries to establish a new PTA. The increasingly complex network of PTAs (and crucially the participating countries' existing PTA relationships with third countries) also motivates the decision to enter into a PTA. Accounting for the interdependence of PTAs helps to explain a significant fraction of PTA formations that would not otherwise be predicted by countries' economic characteristics (Chen & Joshi, 2010).

The "juggernaut effect", described by Baldwin and Robert-Nicoud (2015), further demonstrates this concept. Imagine winding back the clock to 1948 when the GATT entered into force and tariffs, which balanced the supply and demand for protection in the political market, stemmed from uncoordinated tariff setting. Introduce a multilateral trade negotiation (MTN) and because of the principle of reciprocity, the cornerstone to this notion, the array of political forces inside each nation participating in the talks, alters. Each nation's exporters are converted from bystanders in the tariff debate to opponents of protection within their own nation and are now able to win the prize of better access to foreign markets *only* if tariffs in their home nation are lowered. Hence, lobbying against domestic tariffs becomes a way of lowering foreign tariffs. In other words, the political objective function facing

all governments is changed through MTN and because the MTN rearranges the political economy forces inside every nation involved in the talks, a new political equilibrium emerges in each nation, generating “political economy momentum”. The novel aspect in all this is the idea that liberalisation is a dynamic process.

Some authors also extend BB’s analysis to capture the degree of integration and Vicard (2009), for one, investigates whether the form and depth of a PTA has an impact on trade. His results show that creating any kind of PTA providing trade preferences to its member countries, significantly increases bilateral trade. Nevertheless, the average treatment effect on bilateral trade does not significantly differ according to the depth of an agreement. Since FTAs, customs unions or common markets have a similar impact on trade among its members, different countries create different kinds of PTAs. The fact that no form of regional integration is superior to another in terms of effective trade creation, suggests that the criteria used to determine the depth of a PTA should not only be based on its potential to foster trade, but also on its potential for political or institutional integration. Vicard’s results support a ‘‘market for regionalism’’ view of PTAs, where different country-pairs choose to create different kinds of PTAs.

Given that many recent PTAs link developing and developed countries, there is one additional stream of research to consider: the integration of developing countries. Some analysts argue that economic integration theories, for all those of the Viner period, may be irrelevant to the case of developing countries (Hosny, 2013). By investigating what parts of old and new regionalism are applicable to the integration arrangement, Marinov (2014) finds that the rationale behind economic integration among developing countries cannot simply be defined by only the static and dynamic effects that determine integration between developed economies. Moreover, to assess the integration benefits and costs for developing countries, one must consider the specifics of each country, “specifics” referring to: the stage of economic development, structure of the economy, production characteristics, demand preferences, trade regimes and policies, etcetera. In developed countries, the main rationale for economic integration comes from economic groups of

stakeholders but in developing countries, integration processes often are initiated as a political goal and effort.[14]

2.2.3 Theoretical underpinnings of variables and variable descriptions

For a period spanning roughly 70 years, many authors theorised about the determinants of PTA formation but Mansfield and Reinhardt (2003) and BB, were the first to conduct an empirical analysis in terms of socio-politics and economics respectively. BB's cross-sectional (qualitative choice) model provides a systematic empirical analysis of the determinants of the formation of PTAs and of the likelihood of PTAs between pairs of countries.[15] Their specification models a binary PTA variable that reflects the (non-)existence of an agreement. The PTA variable incorporates FTAs, customs unions, common markets and economic unions and we adopt this definition of a PTA in our analysis. Hence, our dependent variable "PTA" is a collective term for the four levels of integration. We use PTA in preference to the misleading phrase *free trade areas* (as well as *customs union*), which falsely equates them in the public mind and discourse, to non-preferential free trade (Bhagwati & Panagariya, 1996a). We construct PTA for 70 countries in the cross-sectional analysis and 106 countries in the panel analysis.[16]

Our dependent variable must reflect the fact that we are exploring the determinants of the formation of PTAs and of the likelihood of PTAs *between* pairs of countries. Therefore, while there are alternative ways of capturing the depth of integration (see Egger & Larch, 2008; Arribas, Perez & Tortosa-Ausina, 2009; and Chapter 4, sub-section 4.3.1), we use FTAs, customs unions, common markets and economic unions because they are *reciprocal* forms of trade agreements reflecting the bilateral decision for a PTA. Moreover, BB include these four levels of integration

[14] There are some additional papers that relate to the determinants of PTAs; a few of which we review in Appendix 2B.
[15] Contextually, qualitative choice models calculate the probability that a country will choose to be in a PTA, given data observed by the country (Train, 1993).
[16] Appendix 2A lists the countries included in the cross-sectional and panel analysis.

in their empirical analysis and therefore our usage of the same levels (and dataset) produces comparable results.

To justify the explanatory variables (i.e., the economic determinants of PTAs) of their model specification, BB develop seven hypotheses and, in the following sub-sections, we review these (the content is sourced from BB). Table 2.1 summarises the economic determinants by providing the variable names, along with a description, the expected sign (based on the theoretical underpinning) and the source of the data.

Hypothesis 1 and 2, the geographic determinants PROXIMITY and REMOTE

Under *Hypothesis 1*, the likelihood of a PTA is larger, the closer are two countries as trading partners. In other words, along the concept of old regionalism, the probability of a PTA is higher as the distance between the countries' economic centres falls, or the more proximate are their economic centres. BB argue that for a given distance between a country-pair (other things equal), the closer are two countries, the lower are their transport costs of international trade and consequently, the higher is their trade volume. The more each country can consume of the other's varieties, the more is trade creation enhanced regionally.

While BB use the term, $NATURAL_{ij}$, to capture the primary factor influencing transport costs, viz., bilateral distance, we prefer to rename the determinant $PROXIMITY_{ij}$ for three reasons. Firstly, because we have two geographic variables in the model, renaming NATURAL as PROXIMITY helps to clearly distinguish between the two. Secondly, countries that trade with each other in larger volume than with other nations, are commonly referred to as "natural" trading partners (Bhagwati, 1996) and we want to distinguish our determinant from this norm. Thirdly, BB and Márquez-Ramos et al. (2011) use natural and "continental" interchangeably but the determinant is defined for all country-pairs, not just continental trade partners.

Theoretically, under *Hypothesis 2*, welfare gains increase when inter-continental transport costs increase in comparison to intra-continental transport

costs. An increase in relative inter-continental transport costs lowers the volume of trade with remote countries (on other continents) and increases trade with near countries (on the same continent). The reduction in trade with remote countries results in a relative tariff distortion with remote countries and in Vinerian terms, there is less 'trade diversion', ultimately making for a more beneficial PTA.

For two continental trading partners, the net welfare gain increases as their remoteness from the RoW increases, captured by $REMOTE_{ij}$. When two countries *ij* are on the same continent, REMOTE measures the simple average of the natural logarithms of the mean distance of country *i* from all its trading partners, except *j*; and the mean distance of country *j* from all its trading partners, except *i*. When two countries *ij* are on different continents, REMOTE has the value 0. This is captured through DCont, a binary variable assuming the value 1 if both countries are on the same continent; and 0 otherwise. REMOTE thus captures inter-continental transport costs for PTAs because it measures how far two countries on the same continent are from other countries but has no value for trading partners on different continents (Baier & Bergstrand, 2004). Thus, we construct REMOTE as:

$$REMOTE_{ij} = DCont_{ij} \times \left\{ \frac{\left[\log\left(\sum_{k=1,k\neq j}^{N} \frac{Distance_{ik}}{N-1} \right) + \log\left(\sum_{k=1,k\neq i}^{N} \frac{Distance_{jk}}{N-1} \right) \right]}{2} \right\} \quad (2.1)$$

Subsequent research by Egger and Larch (2008) recommends including bilateral distance and the continental dummy variables separately, choosing rather to define REMOTE as only the portion in parentheses in specification [2.1]. While this approach defines REMOTE for all trading partners, not just for continental partners, and would be appropriate if our data were sorted or grouped by continent (see Table 2A.1), our objective is not to measure remoteness for all trading partners – only for continental ones. Therefore, since our data is not sorted, the interaction of the continental dummy with multilateral remoteness simply makes identifying the remoteness of continental trading partners (from all trade partners) convenient. Moreover, since the results from Egger and Larch's (2008) specification (presented in Table 2C.7 in Appendix 2C) are qualitatively similar to those generated using BB's

specification, we include REMOTE as specified in [2.1], feeling it best reflects the theoretical relationship between multilateral distance and the likelihood of a PTA.

For example, Australia and New Zealand are distant from the RoW, but are bilaterally proximate. Hence the formation of a trade agreement between these two continental partners not only makes sense, but the PTA is more likely to be trade creating as well. On the other hand, Australia and Argentina are multilaterally remote, but this alone is not sufficient to form a PTA since they are also bilaterally distant from one another. Forming a PTA between two such countries, ones that are both bilaterally distant and multilaterally remote, is more likely to be trade diverting.

Importantly, BB's measure of multilateral remoteness has no explicit theoretical foundation for its formulation (Baier et al., 2014). However, a formulation very close to that of BB surfaces from recent developments in the theoretical foundations for the gravity equation and provides guidance for measuring remoteness using "multilateral resistance" indexes (which control for the trade barriers that each country faces with all its trading partners).[17] These multilateral indexes influence the dependent variable through PTAs formed by each country (*i* and *j* respectively) in terms of own-PTA effects (*i*'s and *j*'s other PTAs), as well as cross-PTA effects (PTAs other than those with *i* or *j*). For empirical purposes and reasons explained in Baier et al. (2014), the appropriate measure of the multilateral PTA index for Country *i*, is simply the count of its PTAs with other (non-*j*) countries. Analogously, the appropriate measure of the multilateral PTA index for *j*, is the count of *j*'s PTAs with other (non-*i*) countries. Subsequently, the appropriate measure of the RoW PTA index for pair *ij*, is simply the count of all PTAs in the world that exclude *i* and *j*. Since Baier et al. find their preferred specification is robust to the GDP-weighted (or GDP-share-weighted) alternative variable, we continue using BB's measure of remoteness

[17] While Anderson and van Wincoop (2003) suggest using country- and partner-time fixed effects as proxies for the multilateral resistance terms to align with gravity theory. This approach is not relevant to the current model specification because the dependent variable is not trade flows (Piermartini & Yotov, 2016).

for consistency with BB's original research, and because it produces theoretically consistent estimates.

Hypothesis 3, 4 and 5, the income determinants RGDP and DRGDP

After accounting for distance and remoteness, *Hypothesis 3* states that the probability of forming a PTA between a pair of countries increases, the larger are their economic sizes (average real GDPs). Here, the gains stem from the exploitation of economies of scale in the presence of differentiated products. $RGDP_{ij}$ thus measures the sum of the logs of real GDPs of countries *i* and *j* in year *t* and introduces asymmetric sizes in terms of absolute factor endowments to determine the effects of scale-economies. Theoretically, a PTA between two large partners increases the volume of trade in more varieties than a PTA between two small partners; and reduces trade in fewer varieties from non-members, than would two small proximate partners. Consequently, the larger increase in trade among two large economies causes a larger net expansion of demand and hence a larger rise in real income.

Hypothesis 4 relates to the net welfare gain from a PTA between a pair of countries, which increases, the more similar are their economic sizes (real GDPs). In other words, countries with smaller differences in real GDPs have a higher probability of forming PTAs, captured by $DRGDP_{ij}$.[18] Intuitively, the more similar are any two countries' market sizes, the larger will be the gains from a PTA. $DRGDP_{ij}$ thus measures the absolute value of the difference between the logs of real GDPs of countries *i* and *j* in year *t*. For RGDP and DRGDP, BB's reasoning applies to continental and inter-continental PTAs.

Although also relating to income, *Hypothesis 5* is difficult to evaluate empirically. The hypothesis states that the net welfare gain from a PTA between a pair of countries decreases, the larger is the economic size of countries outside the PTA.

[18] To substantiate the above, BB conduct two exercises: first, for continental trading partners and second, for inter-continental partners. They find the welfare gains from continental PTAs are monotonically higher the larger the endowments of the countries.

The intuition here is that the previous two hypotheses both relate to income, address the economic sizes of *only* those two countries, whereas it stands to reason, that the economic size of the RoW matters too.

Hypothesis 6 and 7, the endowment determinants DKL, Sq_DKL and DROWKL

In traditional trade models (ignoring transport costs), the benefit of a PTA between a pair of countries increases, the wider their relative factor endowments because traditional comparative advantages (Heckscher-Ohlin trade) are exploited more fully. Consequently, in terms of the endowment variables, *Hypothesis 6* purports that the net welfare gain from a PTA between a pair of countries increases with wider relative factor endowments but possibly only to a point.[19] A continental PTA causes considerable trade diversion of services inter-continentally and with increasing specialisation, the net welfare gains from inter-industry trade are eventually offset by the net trade diversion due to intra-industry trade. Once again, this applies to continental and inter-continental PTAs.

Finally, *Hypothesis 7* purports that the net welfare gain from a PTA between a pair of countries decreases, the wider is the (absolute) difference between the relative factor endowment of the pair and that of the RoW, due to potential trade diversion. DKL_{ij} and $DROWKL_{ij}$ capture the final two hypotheses, with DKL_{ij} measuring the absolute value of the difference between the logs of the capital–labour ratios of countries *i* and *j* in year *t* (Sq_DKL_{ij} measures the square of DKL). $DROWKL_{ij}$ captures the (absolute) difference between the capital-labour ratios of the countries and the RoW's capital-labour ratio due to potential trade diversion and we specify this as in BB:

$$DROWKL_{ij} = \frac{\left\{\left|\log[\frac{\sum_{k=1,k\neq i}^{N} K_k}{\sum_{k=1,k\neq i}^{N} L_k} - \log(\frac{K_i}{L_i})\right| + \left|\log[\frac{\sum_{k=1,k\neq j}^{N} K_k}{\sum_{k=1,k\neq j}^{N} L_k} - \log(\frac{K_j}{L_j})\right|\right\}}{2} \qquad (2.2)$$

[19] BB state that the gains might eventually decline due to increased specialisation (if intercontinental transport costs are low). *Hypothesis 6* concerns only trade between the country pair and the pair's capital–labour ratios but there is an additional loss in welfare from a PTA when the country pair forgoes Heckscher–Ohlin trade with the RoW (up to a point).

Table 2.1: Descriptions of the pure economic determinants, their expected sign and source

Variable (Expected sign)	Description	Source
PTA (Dependent)	1 for a pair of countries, *i* and *j*, where the agreement between the two countries takes the form of an FTA, customs union, common market or economic union; and 0 otherwise.	EIA Database, 31 May 2013[20]
PROXIMITY (Positive)	Inverse of the natural logarithm of the distance between two countries.	Calculated using CEPII data[21]
DCont (Positive)	A dummy variable that takes the value one if two countries are located on the same continent; and 0 otherwise.	
REMOTE (Positive)	Remoteness of a pair of continental trading partners from the RoW. See equation 2.1 above for calculation formula.	
RGDP (Positive)	Sum of the respective logs of GDP: countries *i* and *j*.	Calculated using the TED™ and PWT 8.1[22 & 23]
DRGDP (Negative)	Absolute difference between respective logs of GDP: countries *i* and *j*.	
DKL (Positive)	Absolute difference between the log of the capital–labour ratios: countries *i* and *j*.	Calculated using PWT 8.1 data
Sq_DKL (Negative)	Square of DKL.	
DROWKL (Negative)	Absolute difference between the capital–labour ratios of the member countries and the RoW's capital–labour ratio.	

Notes: We source RGDP and DRGDP from the Total Economy Database (TED) for the replication of the estimation on BB's 54 countries because it generates the most complete dataset. For consistency and barring distance, all other variables are sourced from the PWT 8.1 for further work.

Source: Baier and Bergstrand (2004), Egger and Larch (2008) and Gonzalez (2012).

BB's findings

BB's empirical explanation of the cross-sectional variation in PTAs for 1996 assumes that each country-pair decides in 1996 to form (or not) a PTA, or to enforce (or not), a PTA formed prior to 1996. Their main conclusions are that the potential welfare gains and likelihood of a PTA between a pair of countries are higher when: (i) the two countries are closer in distance ($\hat{\beta}_{PROXIMITY} > 0$); (ii) a pair of continental trading partners is more remote from the RoW ($\hat{\beta}_{REMOTE} > 0$); (iii) the larger and more similar in economic size are two trading partners ($\hat{\beta}_{RGDP} > 0$ and $\hat{\beta}_{DRGDP} < 0$);

[20] Baier and Bergstrand (2015).
[21] Mayer and Zignago (2011).
[22] Total Economy Database; credit to The Conference Board (2015).
[23] Feenstra, Inklaar and Timmer (2015).

(iv) the greater the difference of capital-labour ratios between two partners ($\hat{\beta}_{DKL} > 0$ and $\hat{\beta}_{Sq_{DKL}} < 0$); and (v) the smaller the difference of the members' capital-labour ratios with respect to the RoW's capital-labour ratio ($\hat{\beta}_{DROWKL} < 0$).

Although a valuable contribution, BB deliberately limited their scope to enhance tractability and thus "political economy" determinants of PTAs, such as political lobbies and government distributional preferences, are excluded from their model. The work of Goldberg and Klein (1999) supports this exclusion; finding that the weight of consumer economic welfare in government's objective function is many times larger than the weight of political contributions (98% compared to 2%). The exclusion of political economy determinants is further supported by Márquez-Ramos et al. (2011), who extend BB's work to 66 countries and empirically analyse the determinants of different levels of integration and the importance of additional factors. Their results show that the probability of reaching a higher level of integration increases with income level, economic freedom, cultural affinities and remoteness, whereas it decreases with distance, income differences and factor endowment differences. Moreover, although socio-political variables contribute to explain the formation of PTAs, economic and geographic factors are the most important. The relative importance of socio-political variables in explaining PTA enhancement increases for higher integration levels and for continental partners.

We acknowledge that socio-political factors are of consequence but choose not to delve into this debate because, as Balassa (1961) states, the relationship between the political and economic considerations is not quantifiable, partly because a considerable degree of interdependence exists between these factors. The first step in economic integration may stem from political motives but economic integration also reacts on the political sphere; similarly, if the initial motives are economic, the need for political unity can arise at a later stage. This is not to say that we completely disregard the political determinants, since we take advantage of the panel structure of our data and include fixed effects in our regressions, to absorb any such factors.

Before concluding this section, we briefly relate the above literature on the determinants of PTAs to our empirical specification. As already mentioned, we use the economic determinants identified by BB to explain the formation of PTAs between bilateral country-pairs. While the level of integration is undoubtedly also relevant, most existing arrangements are shallow (viz., non-reciprocal PTAs, PTAs and FTAs) and fewer than 10%, deep (viz., customs unions, common markets and economic unions) (Facchini, Silva & Willmann, 2013). In 2010, for example, there were 6,059 shallow agreements, whereas the deep levels of integration, number only 617, which is roughly 10% (617/6,059) of the shallow levels of integration. Consequently, we do not concern ourselves with the determinants of the different levels. Furthermore, we take advantage of our panel structure and include fixed effects, which indirectly account for any omitted economic, or socio-political determinants, and account for any factors in developing/developed economies that might impact on their willingness to participate in integration agreements.[24] Thanks to our fixed effects controlling for omitted variables, we are not concerned that our "traditional" determinants of PTAs will fall short in predicting the new regionalism agreements of the 21st Century. Our panel data also facilitates a dynamic specification, allowing us to control for the fact that country-pairs may have already formed an agreement.

2.3 The data and descriptive statistics

The evidence presented thus far suggests that integration comes in waves, and this is reiterated below. The first wave of regionalism occurred from the late 1950s through the 1970s (post-colonialism), and the second occurred in the 1990s (post-communism) (Mansfield & Reinhardt, 2003). These waves, particularly the latest one, has seen rampant growth in the number of countries participating in PTAs. This "virtual explosion" in the number of PTAs (Baier & Bergstrand, 2007, p. 73 and Facchini et al., 2013) has transformed the global economic landscape in that today,

[24] While we do not distinguish between developing and developed countries, we standardise our coefficients and then vary income by one standard deviation. This does not result in a significant change in the coefficients and consequently, we do not concern ourselves with differences between the determinants of PTAs in developing and developed countries.

nearly every country in the world is a member of such an agreement (see Figure 1.1), or is in the process of discussing membership (Wu, 2004 and Fugazza & Nicita, 2013). Moreover, PTAs currently regulate approximately one-half of global trade and nearly all continental trade in the Americas (Estevadeordal, Suominen, Harris & Shearer, 2009). The proliferation of PTAs speaks volumes about the importance attached to trade agreements by most governments; and understandably so. In a review of the latest theoretical and empirical research on regionalism, Freund and Ornelas (2010b) find such agreements more of a blessing than a burden. Not surprisingly, economic integration is now considered an item of rising importance in national trade policies (World Trade Organization, 2012) and should be given the utmost consideration (Commonwealth Trade Review, 2015).

Table 2.2 summarises our integration data for: no agreement, non-reciprocal PTA, PTA, FTA, customs union, common market and economic union, in which we observe that the most common levels of integration between 1950 and 2011, are non-reciprocal PTAs and PTAs. Therefore, despite the different waves of integration cited by so many, the waves until the 1990s have generally not seen deepening levels of integration. For each decade between 1950 and 2010, the table shows the number of total agreements (the summation of the different levels of integration), the number of bilateral agreements and the number of bilateral agreements as a percentage of the total number of agreements.

Referring to Table 2.2, the world became more independent between 1950 and 2000, with the number of countries increasing from 116 to 194 and remaining at this mark until 2010, the only decade in which the number of independent countries did not increase. Considering the much-publicised waves of integration since the end of World War II, we are not surprised to find an increase in the number of total agreements from 50 in 1950 to 6,676 in 2010. Notably, there is a rapid increase in the number of 'deeper' levels of integration. Considering customs unions for example, of which there were none in the 1950s and only a handful in 1960 and 1970. In the decade to 1980 however, customs unions increased more than 4-fold; and continued increasing in the decade thereafter. Common markets and economic unions, both of

which did not appear in the data between 1950 and 1990, suddenly appear in 2000 with 69 and 109 bilateral pairings respectively; and by 2010, this has more than doubled for common markets to 287, and to 164 for economic unions. Hence, it appears countries concerned themselves more with forming agreements in the earlier decades whereas in the latter decades, countries concerned themselves not only with forming new agreements, but also with deepening the level of integration within existing agreements. This pattern is consistent with Hofmann, Osnago and Ruta (2017), whose key insight is that PTAs have become deeper over time.

Table 2.2: The number of independent countries; possible and actual bilateral agreements; and the levels of integration constituting the agreed bilateral agreements by decade (1950–2010)

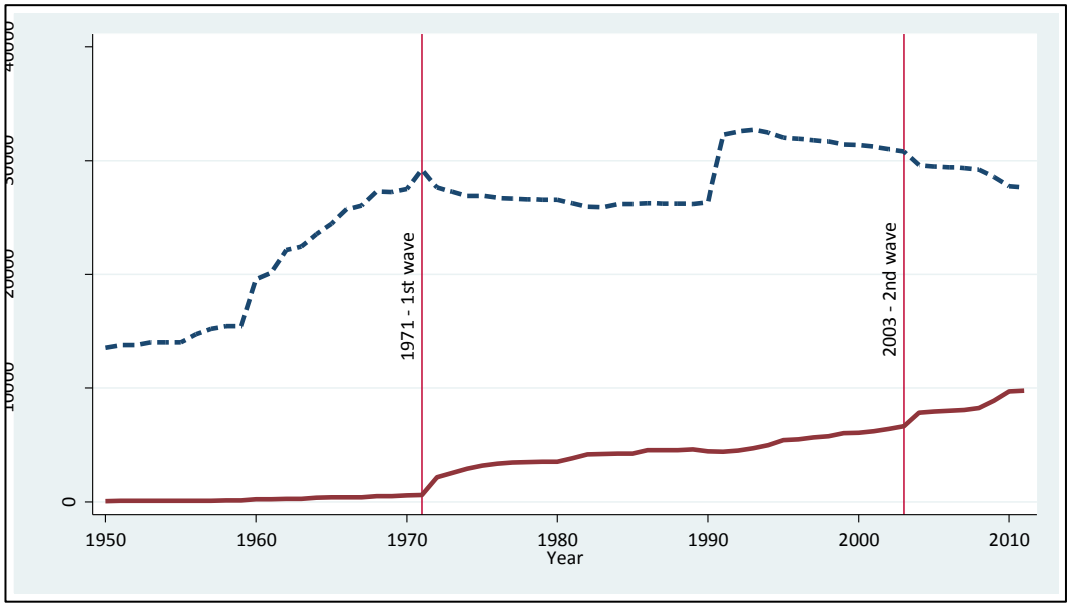
	Decade						
	1950	**1960**	**1970**	**1980**	**1990**	**2000**	**2010**
No. of independent countries	116	140	167	174	176	194	194
No. of agreements (total)	50	126	373	3,031	3,710	4,659	6,676
No. of bilateral agreements	0	42	104	195	281	862	1,602
Bilateral agreements as % of total agreements	0	33.33	27.88	6.43	7.57	18.50	24.00
Level of integration	**Count per level of integration**						
No agreement	13,553	19,568	27,522	26,564	26,347	31,366	27,733
Non-reciprocal PTA	29	34	174	2,532	2,967	3,242	3,643
PTA	21	50	95	304	462	536	1,403
FTA	0	27	83	98	139	572	1,013
Customs Union	0	15	21	97	142	131	166
Common Market	0	0	0	0	0	69	287
Economic Union	0	0	0	0	0	109	164

Notes: The odd numbers found under *No agreement* and *Non-reciprocal PTA*, are due to non-reciprocity. For example, in 1974, Afghanistan (as exporter) had a non-reciprocal trade agreement with Australia. Likewise, for Austria in 1972. *Actual agreements*, excludes *No agreement*.

The information in Table 2.2 is depicted in Figures 2.2 and 2.3. Figure 2.2 shows the total number of no agreements alongside the overall number of agreements (which includes non-reciprocal PTAs through to economic unions). The first wave of integration occurs in 1971, with a visible jump in agreements and a drop in no agreements. From 1971, the upward trend in the number of agreements continues, whereas the number of no agreements stagnates between 1971 and 1990.

The jump in no agreements in 1991 is due to the dissolution of the Soviet Union enacted in December that year. Subsequently, there is an evident tapering off in the number of no agreements.

Figure 2.2: The total number of no agreements alongside the total number of agreements: 1950–2011



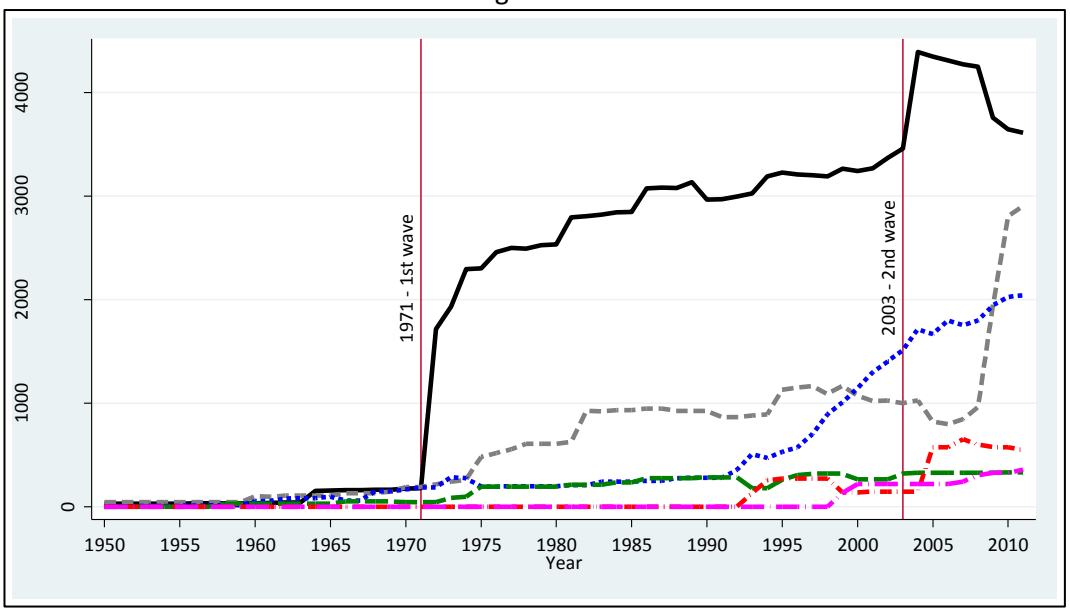
Notes: The dashed (blue) line is the number of no agreements and the solid (red) line the number of agreements. There are two waves of integration, the first in 1971 and the second in 2003. The latter is more evident in Figure 2.3.

Source: EIA Database (31 May 2014) of Baier and Bergstrand (2015).

We provide a decomposition of the solid (red) agreements-series of Figure 2.2 in Figure 2.3 below, which distinguishes among non-reciprocal PTA, PTA, FTA, customs union, common market and economic union. From Figure 2.3, non-reciprocal PTAs constitute the greatest portion of actual agreements, reflecting the information in Table 2.2. The spike in PTAs in 2009 is due to the European Union signing several trade agreements with African countries, whereas the remaining visible increases in FTAs, for example, is due to the evolution and deepening of existing agreements. Two examples of the latter are found between 1992 and 1993, with the transition of the European countries from a customs union to common market and in 1995, amongst Benin, Burkina Faso, Ivory Coast, Mali, Niger, Senegal and Togo. The rise in the number of economic unions is due to the deeper integration of the core European Union countries, beginning in 1999, and due to the formation of the Economic Community of West African States (ECOWAS) in 2000. Shortly thereafter, there is an evident rise

in non-reciprocal PTAs starting in 2003, which demarcates the second wave of integration. During the second wave, there is a large increase in common markets in 2005, due to the addition of the former Soviet bloc to the European Union: Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. Concurrently, there is a drop in PTAs due to the transition to common market.

Figure 2.3: A decomposition of the actual bilateral agreements into the constituent levels of integration: 1950–2011



Notes: The solid (black) line represents non-reciprocal PTAs; the dashed (grey) line represents PTAs; the short-dash (blue) line represents FTAs; the long-dash (green) line represents custom unions; the dash-dot (red) line represents common markets; and the long-dash dot (pink) line represents economic unions. There are two waves of integration, the first in 1971 and the second in 2003.

Source: EIA Database (31 May 2014) of Baier and Bergstrand (2015).

It is clear from Figure 2.1 that the number of inter-continental PTAs starts climbing in 1997. Additionally, we know from Table 2.2 that there was a jump in the number of bilateral agreements between 1990 and 2000; increasing from 281 to 862, or by 206.76%. By providing the simple count of PTAs in 1960, 1996 and 2011 in Table 2.3, we see in 1996, there were only 3 PTAs between members more than 5,000km apart (just 0.74% of all PTAs in 1996) and only 7 that are more than 4,000km apart

(1.72% of all PTAs in 1996).[25] From these statistics, we know there was a jump in PTAs in the decade between 1990 and 2000, and that up to and including 1996, PTAs were typically still geographically discriminatory. To identify where the jump in PTAs occurs, and when the distance between countries starts increasing, we include Figure 2.4.

Table 2.3: Comparing the number of PTAs in 1960, 1996 and 2011, divided into 1,000km bilateral distance bins

	Year (Count of PTA=1)		
Distance in km	**1960**	**1996**	**2011**
>10,000	0	1	54
9,000-10,000	0	0	30
8,000-9,000	0	0	17
7,000-8,000	0	0	12
6,000-7,000	0	0	9
5,000-6,000	0	2	22
4,000-5,000	0	4	40
3,000-4,000	0	32	110
2,000-3,000	4	99	202
1,000-2,000	13	153	255
<1,000	25	116	159
Total	42	407	910

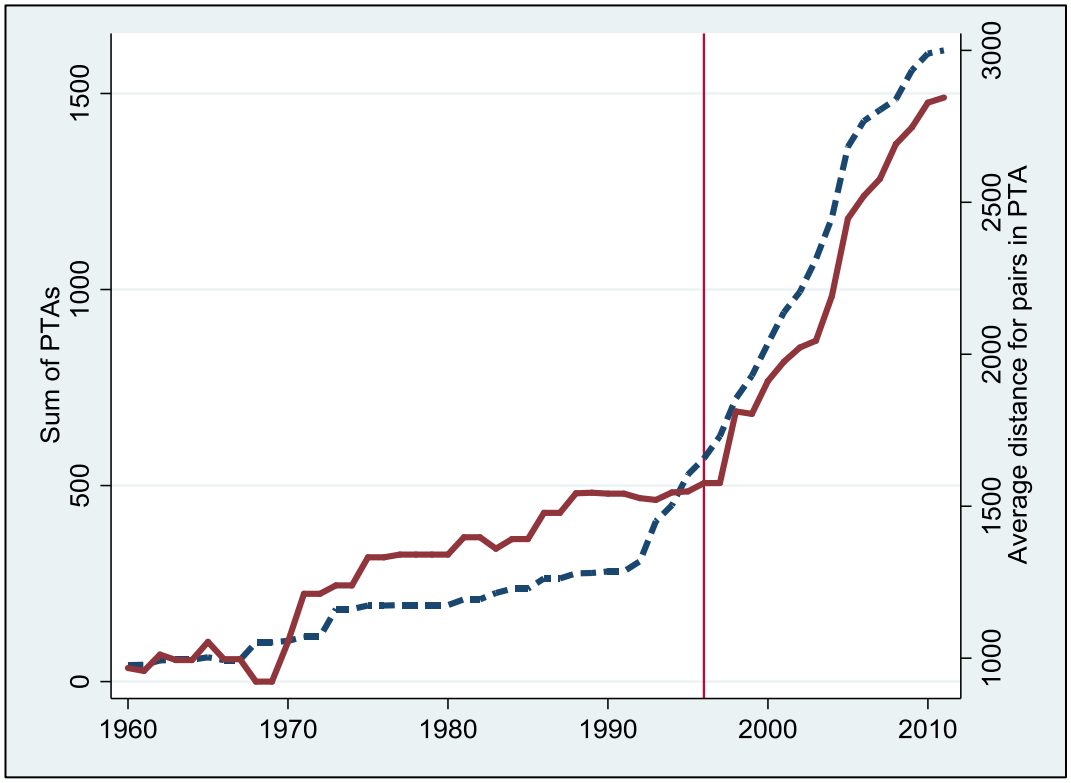
Notes: PTA=1 when country pairs are in an FTA, customs union, common market or economic union. There are fewer PTAs in this table, compared to Tables 2.1 and 2.3, because the data incorporates only those countries included in the model.

The longest bilateral distance between any two countries in a PTA in 1960 is Portugal–Sweden, with the weighted distance between the two equaling 2,821.62km; in 1996 the most distant pairing in a PTA is America–Israel, with a weighted distance of 10,516.26km and lastly, in 2011, the weighted distance between Peru–Singapore is 18,884.5km. In fact, all the country-pairs party to PTAs in 1960 were within 4,000km of one another; nearly 40 years later, this dropped marginally to 98% in 1996, and then quite significantly, to 80% in 2011. From this, it seems quite apparent that PTAs were geographically discriminatory to 1996 and have become more willing to form distant (and extra-regional) agreements over the last 15 years. The increases in the individual *ij* distances between bilateral pairings, means that the average distances

[25] We provide descriptive statistics for 1960, 1996 and 2011 because: (i) the integration data is available from 1950, but this first decade contains too few instances of PTAs to warrant much interest; (ii) 1996 is the year chosen for BB's cross-sectional analysis; and (iii) 2011 marks the end of the period.

for these pairings increased as well. In 1960, the average distance for pairs party to a PTA is 967.70km and by 1996 and 2011, average distances are 1,692.38km and 3,197.31km respectively. For the 36 years between 1960 and 1996, the growth rate in average distance for country pairs was 75%, whereas for the 15 years between 1996 and 2011, the growth rate was 89%.

Figure 2.4: The cumulative growth, and the average distance between countries, in PTAs: 1960–2011



Notes: The dashed (blue) line shows the cumulation of PTAs (left hand side axis). The solid (red) line shows the average distance for pairs in a PTA (right hand side axis). The vertical (red) line represents 1996.

From the dashed (blue) line in Figure 2.4, we see the accumulation of PTAs (read off the left-hand side axis), and the solid (red) line showing the average distance for pairs in a PTA (right-hand side axis). The jump in PTAs occurs in 1992, due to Hungary, Poland and Turkey singing agreements with Europe.[26] The average distance between countries in a PTA increases gradually between 1961 and 1996, but then starts climbing rapidly in 1997. Therefore, we choose 1996 to divide our sample into

[26] Examples of the agreements are: European Communities, Central European Free Trade Agreement (CEFTA) and the European Free Trade Association (EFTA).

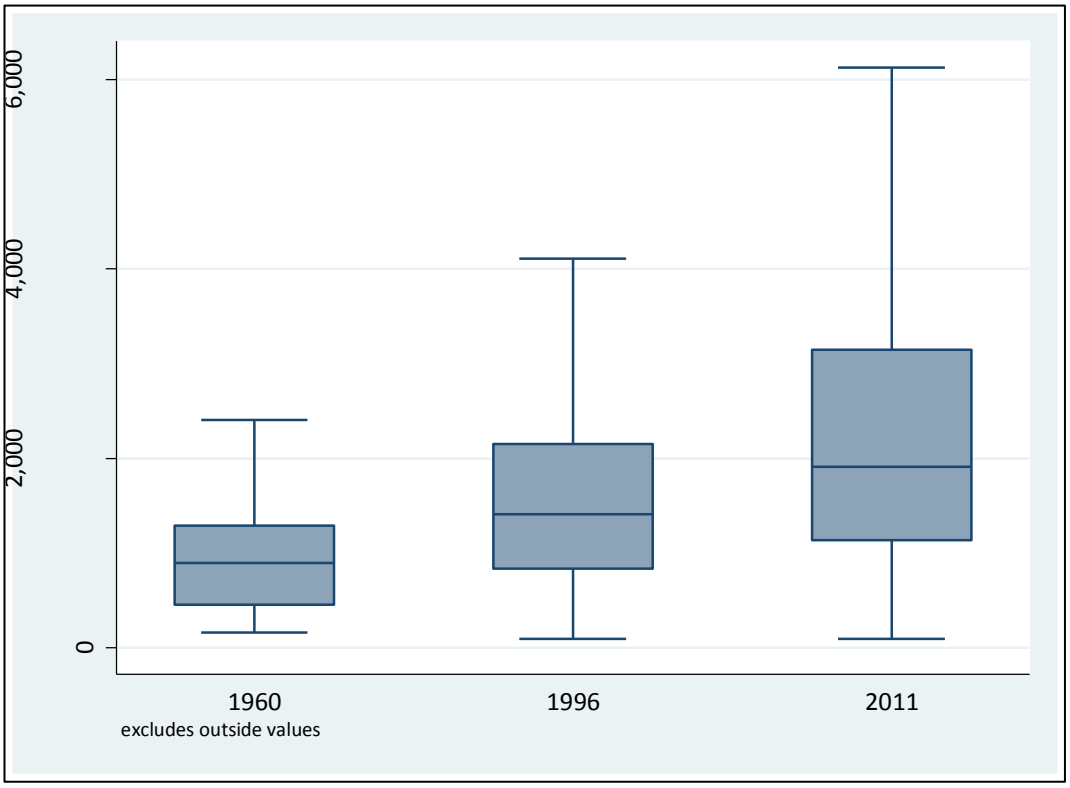
old and new regionalism sub-samples because it precedes the second wave of regionalism in 2003, and follows: the dissolution of the Soviet Union; the establishment of geographically discriminatory agreements incorporating Hungary, Poland and Turkey; the deepening of existing agreements; the Uruguay Round of GATT negotiations (spanning from 1986 to 1994); and occurs before the average distance between country-pairs starts increasing. Consequently, we believe PTAs forming after 1996 are more likely to be inter-continental. This trend is evidenced by reconciling the information in Figures 2.1 and 2.4, with the distances presented in Table 2.3.

One defining characteristic of the latest wave of integration is thus the establishment of inter-continental PTAs. (We explore the idea that integration is occurring among countries that are more distant later in this section.) Using a country like the United States as example, the necessity for this is easily understood. The old regionalism paradigm suggests that the United States will form a PTA with countries in close geographic proximity, hence the North American Free Trade Agreement (NAFTA), which includes Canada and Mexico, America's neighbours. In any year post 1994, the year NAFTA came into effect, the United States can no longer be geographically discriminatory in its efforts to set up additional agreements. Therefore, to create extra prospects and to overcome regional constraints, the United States is obliged to look further afield. The argument is logical and feasible given the on-going negotiations on the Transatlantic Trade and Investment Partnership (TTIP) between America and the European Union; as well as the Trans-Pacific Partnership (TPP) between America and amongst others, Australia, Brunei Darussalam, Japan, Malaysia, New Zealand, Peru, Singapore and Vietnam. The TTIP, TPP and Regional Comprehensive Economic Partnership are unprecedented given the number of partner countries from different continents (Commonwealth Trade Review, 2015) and for many other similarly isolated and/or distant countries, this logic holds.

To further understand the role of distance in determining PTAs, we show box plots of the distances between country-pairs in a PTA for the years for 1960, 1996 and 2011 in Figure 2.5. The figure reflects the averages discussed above and clearly shows

there is greater variance in the distance associated with PTAs in 1996 and 2011. We thus expect to see a fall in the size of the coefficient for the variables related to distance in our empirical estimation.

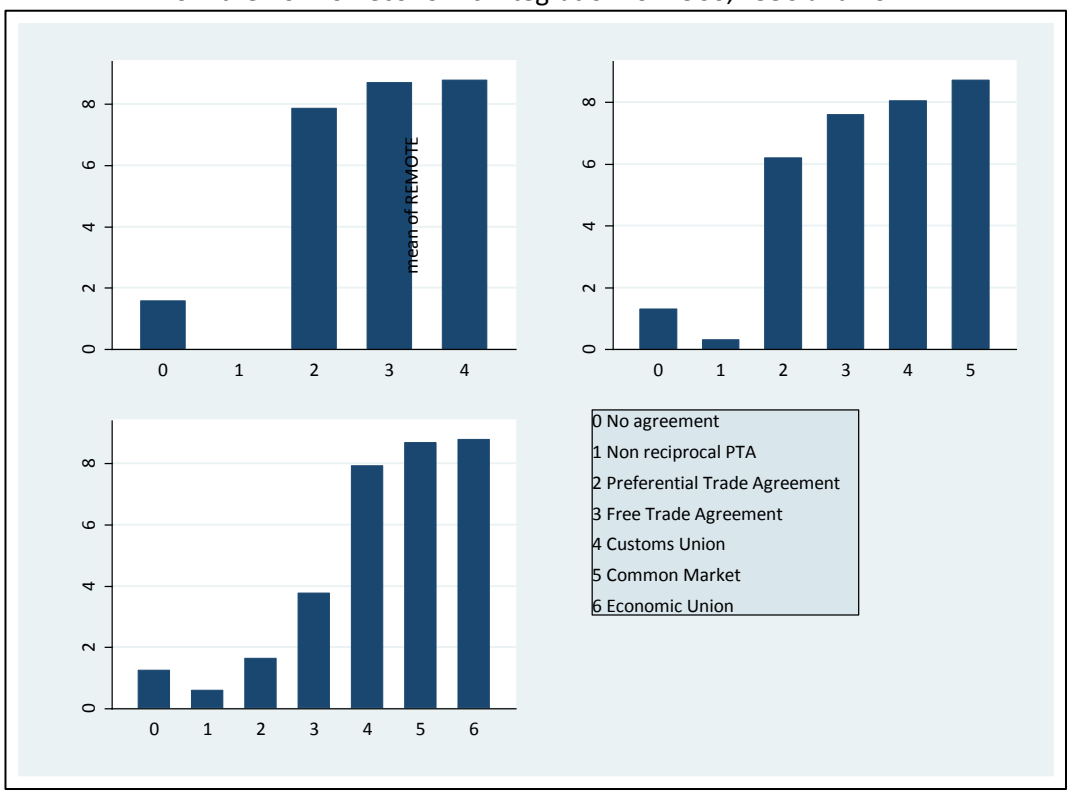
Figure 2.5: Box plot of proximity (bilateral distance) between country-pairs in a PTA for 1960, 1996 and 2011



Notes: Distance weighted by population.

Additionally, in Figure 2.6, we investigate the role remoteness from the RoW plays in determining PTAs. Keeping in mind that REMOTE is only defined for bilateral pairs on the same continent, theory suggests that the more remote pairs are from the RoW, the more likely are they to form a PTA. Additionally, the more remote countries are, the more likely are they to pursue deeper levels of integration: this is seen in the 1996 and 2011 panels of the figure, with common market appearing in 1996 and economic union in 2011. In 1960, no countries had integrated to such a high degree.

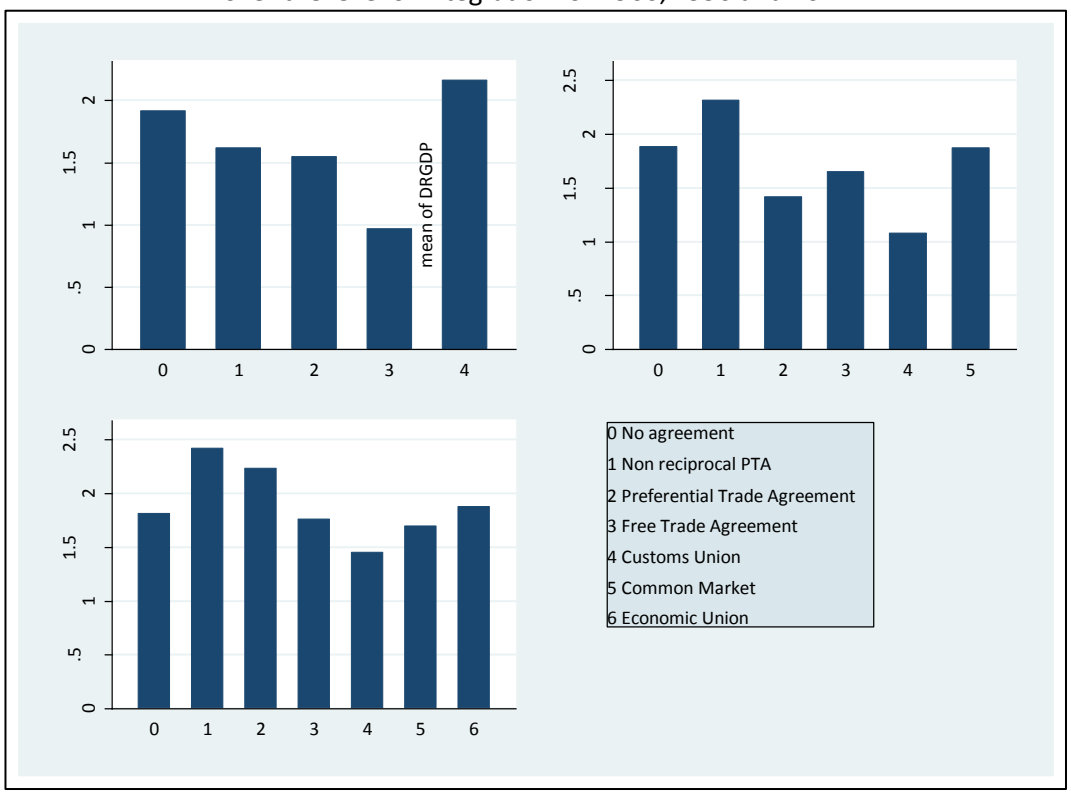
Figure 2.6: Bar plots, displaying the influence of remoteness (multilateral distance) from the RoW on economic integration for 1960, 1996 and 2011



Notes: Horizontal axis shows the level of integration. Panel 1 reflects data for 1960, panel 2 for 1996 and panel 3 for 2011.

While there is no discernible relationship between the sum of each pairing's GDP and the level of integration for the three years 1960, 1996 and 2011, there appears to be some evolution when we consider the absolute difference in each pairing's GDP against the level of integration, seen in Figure 2.7. Theory suggests small differences between countries' GDPs should increase the probability of a PTA and in the first panel of Figure 2.7, this seems to be the case with DRGDP taking on a value of roughly 1 for FTA as opposed to the approximate 2 and 1.5 for no agreement and non-reciprocal PTA and PTA respectively. This distinction appears to decrease in panel 2 for 1996 and more so in panel 3 for 2011, although not substantially. In the empirical analysis, we thus expect to find that the coefficients of differences between countries' GDPs remain relatively constant because even pairs with significant differences in GDP form common markets and economic unions (panel 3).

Figure 2.7: Bar plots, displaying the absolute difference in each bilateral pair's GDP over the level of integration for 1960, 1996 and 2011



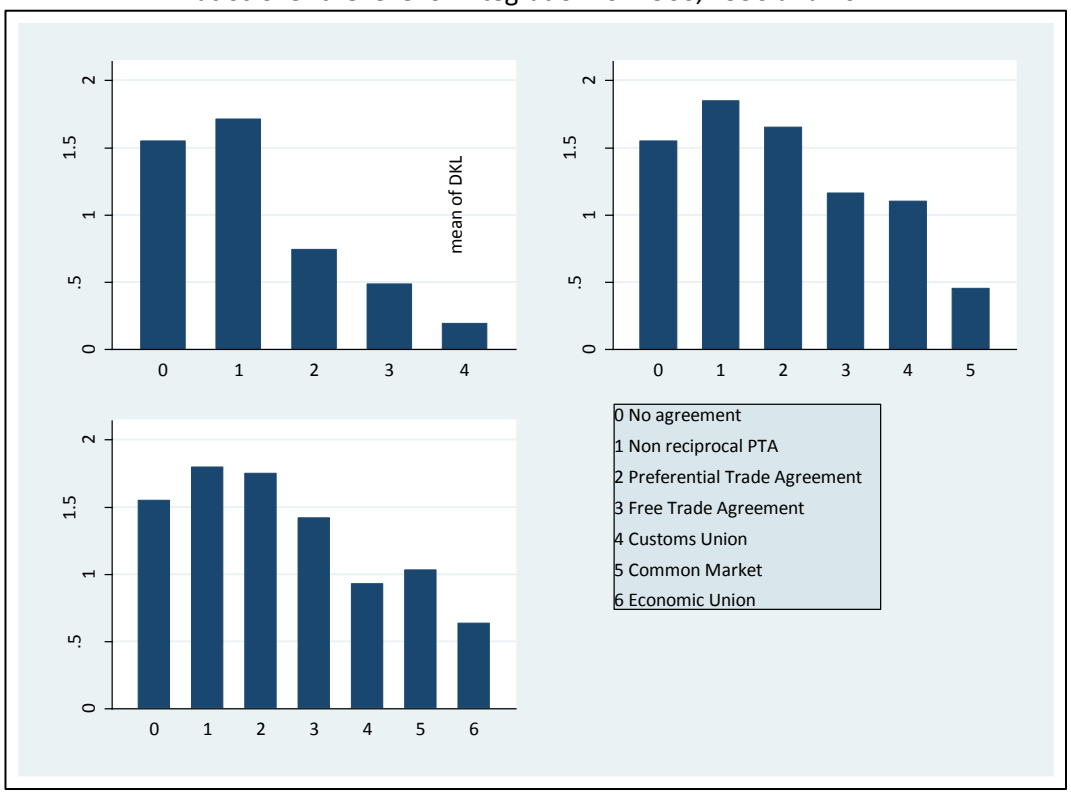
Notes: Horizontal axis shows the level of integration. Panel 1 reflects data for 1960, panel 2 for 1996 and panel 3 for 2011.

Theoretically, the larger the relative factor endowment differences between country-pairs, the greater the probability of a PTA. Figure 2.8, shows plots of the absolute difference in DKL over the different levels of integration in 1960, 1996 and 2011 and in the three panels, the opposite seems true: the more similar countries are in terms of their factor endowments, the more likely are they to be in a PTA.[27] BB note their hypothesis might hold only up to a point, therefore this needs to be explored empirically.

Finally, the probability of a PTA should be lower, the wider is the difference in capital-labour endowment ratios of the member countries relative to that of the RoW. However, plotting DROWKL over the different levels of integration in 1960, 1996 and 2011 respectively, shows no visible patterns and we bear this in mind as we continue our empirical investigation.

[27] Sq_DKL is not plotted because, being the square of DKL, the plot only emphasises the existing differences seen in Figure 2.8.

Figure 2.8: Bar plots of the absolute difference in each bilateral pair's capital-labour ratios over the level of integration for 1960, 1996 and 2011



Notes: Horizontal axis shows the level of integration. Panel 1 reflects data for 1960, panel 2 for 1996 and panel 3 for 2011.

Table 2.4 presents descriptive statistics for 1960, 1996 and 2011, providing the number of PTAs as well as the minimum, maximum and mean for the selected years. PROXIMITY stays constant throughout since geographic distance does not change. The minimum value for REMOTE is theoretically 0, since the variable is defined only for countries on the same continent but in 1996, the Zambia–Zimbabwe pairing has a REMOTE value of -2.979 because the average distance of Zambia from its trading partners is so low that the logarithm transformation results is a negative value. Zambia–Zimbabwe is also responsible for -3.021 minimum value of REMOTE in 2011.[28] For the remaining determinants, there is not much variation in the data and only the number of PTAs clearly rises by a substantial amount.

[28] For continental trading partners, recall that REMOTE measures the simple average of the natural logarithms of the mean distance of country *i* from all its trading partners, except *j*; and the mean distance of country *j* from all its trading partners, except *i*. For Zambia and its African trading partners, the log-transformed distance from the RoW is negative, suggesting most of Zambia's trading partners

Table 2.4: The minimum, maximum and mean of the pure economic determinants identified as in 1960, 1996 and 2011

	1960			1996			2011		
	Min	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**
PROXIMITY	-9.892	-4.286	-8.821	-9.892	-4.286	-8.821	-9.892	-4.286	-8.821
REMOTE	0	14.416	1.801	-2.979	13.342	1.81	-3.021	14.184	1.812
RGDP	10.632	27.68	19.404	13.94	30.557	21.787	14.456	32.296	23.022
DRGDP	0.0004	9.999	1.967	0.0005	9.463	1.946	0.0001	9.619	1.882
DKL	0.0004	5.037	1.451	0.0001	5.362	1.598	0.0002	5.782	1.598
Sq_DKL	0	25.368	3.248	0	28.752	3.889	0	33.428	3.902
DROWKL	0.004	5.877	1.273	0.022	7.028	1.396	0.015	5.307	1.406
No. of PTAs	42			575			1,666		

Notes: DCont is omitted from the table because it is dichotomous.

2.4 Empirical Methodology

The empirical analysis of bilateral trade agreements is typically carried out using one of three qualitative response regression models. The analysis is designed to describe a decision-maker's choice when facing a finite and exhaustive set of mutually exclusive alternatives and, in the context of this paper, calculates the probability that a country will choose to be in a PTA, given data observed by the country. To model this decision, we can use logit, probit or linear probability model (LPM) estimation. These three models differ in the functional form that relates the observed data to the probability: to estimate the binary/dichotomous dependent variable, a LPM uses ordinary least squares (OLS) estimates, whereas the probit and logit models use non-linear estimation. Each model has its advantages, but each also has its weaknesses and these stem from more than the estimation technique alone.

The probit's predicted values are calculated using the cumulative probability distribution function of the standard normal and the logit's predicted values are calculated using the cumulative probability distribution function of the standard logistic.[29] Thus, an advantage to using probit and logit specifications is that the

remain regional, driving down the average distance. For inter-continental trade between Zambia and China, for example, REMOTE is zero because of the DCont dummy variable.

[29] The standard normal and the standard logistic are both symmetric about zero but have different variances.

predicted probabilities are bounded between 0 and 1. To be useful, however, the output from non-linear models must be converted into marginal effects, which are the (average) changes in the conditional expectation function implied by the non-linear model. Since the effect of a change in one variable depends on the initial probability of the event occurring (equivalently, on the values of the other variables), a researcher must identify meaningful values for all of the variables to calculate the impact of changes in a focal variable. Consequently, interpreting logit/probit coefficients is more subtle than interpreting OLS coefficients; and without the marginal effects, it is hard to talk about the impact on observed dependent variables. Furthermore, both the probit and logit models make some rather strong (and convenient) modelling assumptions on the behaviour of the error term in the stipulated underlying structural model (Nagler, 1994; Gujarati, 2004; Friedman, 2012; Giles, 2012a and 2012b; Train, 1993; Angrist & Pischke, 2008; and Hoetker, 2007).

The output from a LPM does not need to be converted into marginal effects, but because P_i equals the probability that PTA = 1 and $1 - P_i$ equals the probability that PTA = 0, the dependent variable follows a Bernoulli distribution. Consequently, the first shortcoming of a LPM is the non-normality of the error term: since PTA only takes two values, so too does the error term.[30] The OLS estimators remain unbiased and asymptotically normal however, rendering this issue less serious (Gujarati, 2004). Two more disadvantages to using a LPM are that OLS estimation imposes heteroskedasticity into the LPM, and that the predicted probabilities are not bounded between 0 and 1 (Friedman, 2012). Of these, the predicted probabilities falling outside the unit interval is the most concerning. Citing the work of Horrace and Oaxaca (2006) and Amemiya (1977), Giles (2012b) and Friedman (2012) note that the greater the proportion of predicted probabilities falling outside the 0 – 1 interval, the more biased and inconsistent the estimates become.

Even though consistent estimation of the LPM may be difficult, this does not imply that either probit or logit is the correct specification of the probability model

[30] For Bernoulli distributions, think of a coin toss, in which there are two possible outcomes, a “success" and "failure".

(Horrace & Oaxaca, 2006). In the typical case of cross-section data and no other complications, probit and logit models are preferred, but with a complex panel dataset or when there are endogenous dummy covariates, a LPM provides the best results. Most of the LPM's flaws can also be addressed, for example using robust standard error estimates to correct for heteroskedasticity, which is the common response. In addition, the LPM is convenient, computationally tractable, easily accommodates the lagged dependent variable and may have less bias than index model alternatives. Thus, while the flaws are well-known and conceded, we prefer the LPM. However, since good practice insists on exploring result robustness to model choice (Giles, 2012b), we check our LPM results against logit estimations, despite the coefficients being difficult to interpret (Friedman, 2012 and Gujarati, 2004).

Moreover, being aware of the incidental parameters problem that arises in non-linear fixed effects models, choosing the LPM saves us from finding a minimal sufficient statistic for μ_i (Baltagi, 2008).[31] We keep in mind the fundamental problem of an LPM, which is the assumption that $P_i = E(PTA = 1|x)$ increases linearly with x. In other words, that the marginal or incremental effect of x remains constant throughout; but since this assumption holds for any linear model, we see this as a far smaller problem than the ones arising when running a logit or probit.

2.4.1 Motivation for estimating with panel data, using a dynamic LPM and fixed effects

Panel data blends inter-individual differences and intra-individual dynamics, thus has several advantages over cross-sectional or time-series data. Panel data allows for the control of variables we cannot observe or measure, such as cultural factors, or variables that change over time but not across countries, such as national

[31] The incidental parameter problem refers to the fact that in non-linear models with a fixed number of observations for each country, the bias in the estimation of the fixed effects contaminates the estimates of the parameters of interest (Charbonneau, 2012).

policies. In other words, panel data accounts for individual country heterogeneity.[32] Pertinently, panel data is better able to identify and estimate effects that are simply not detectable in pure cross-sections or pure time-series data. Panel data thus helps uncover dynamic relationships because we can rely on the inter-individual differences between countries to reduce the collinearity between current and lag variables (Hsiao, 2007 and Baltagi, 1998).

Self-selection into agreements (i.e., endogeneity) remains a concern and to address this, there are three plausible solutions. The "textbook solution" is to use an IV that is highly correlated with PTA, but uncorrelated with the error term. If the IV is uncorrelated with the error term in the regression, then it can be used as an instrument for integration (Cyrus, 2002). However, this method is not straightforward because compelling instruments are hard to find (Chan, Harris, Greene & Kónya, 2014). One alternative approach to addressing endogeneity is a control function (CF) approach (Heckman and Robb, 1985). Dong and Lewbel (2015) explain why the CF approach does not always produce consistent results for binary choices, but given the preceding argument, the most important point is that CF estimators require models of the endogenous regressors as functions of IVs; which Wooldridge (2015) also mentions: "*Constructing a valid CF relies on the availability of one or more instrumental variables*." Even if finding an IV was easy, Baier and Bergstrand (2007) establish that IV, and control-function techniques, do not adjust for endogeneity well, whereas a panel-data approach does. Their 'panel approach' compares (a) fixed and random effects, and (b) fixed effects and first differencing and, for reasons cited in the paper, they prefer fixed effects.

We can control for omitted variables via fixed effects, which are included whenever you are interested in analysing the impact of variables that vary over time and exploring the relationship between predictor and outcome variables within a country. Each country has its own individual characteristics which may, or may not,

[32] For a comprehensive list of advantages and disadvantages of panel data see Baltagi (2008), Chapter 1.

influence the predictor variables and consequently, when using fixed effects, we assume that something within the country may impact or bias the predictor or outcome variables. Fixed effects control for this and, simply put, remove the effect of time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable (Torres-Reyna, 2007). In other words, fixed effects account for the "individuality" of each country by letting the intercept vary for each country and assuming the slope coefficients are constant across countries (Gujarati, 2004).

In terms of our data, the inclusion of fixed effects is apt; firstly, to account for the individuality of each country and secondly, because our macro panel contains most countries of interest, precluding a random sample of countries from a much larger universe. (For example, an OECD panel contains most OECD countries.) Our data presents with a high degree of persistence, and very few instances in which a trade agreement dissolves. Therefore, if no agreement exists between any bilateral pair, it likely remains non-existent in successive years. Additionally, once there is an agreement between two countries, the agreement likely persists till the end of the research period, i.e., 2011. We include a lagged dependent variable on the right hand side to firstly, account for this persistence and secondly, to account for the fact that PTAs have a 'dynamic time-path' dimension (Bhagwati, 1996). The dynamic model specification thus allows us to aptly deal with this persistence and to condition on the fact that pairs of countries may have already formed an agreement. The preliminary findings of Standaert and Rayp (2015) confirm the benefits of studying the behaviour of PTAs dynamically.

The inclusion of fixed effects in a dynamic specification however, can bias the coefficient estimates particularly when *T* is small and *N* is large. Although the 'Nickell bias' arises because the lagged dependent variable becomes correlated with the error term in the fixed effects specification, this bias approaches zero when *T* approaches infinity. In other words, the bias diminishes with increasing *T* (Nickell, 1981). In our specification, the time dimension covers 1960-2011 (52 years) and according to Judson and Owen (1999), a *T* dimension greater than 50 means our dynamic panel specification with fixed effects should not bias the coefficients.

Following the specification, we define the variables and provide in parentheses the expected relationship for each. Our specification thus looks as follows[33]:

$$PTA_{ijt} = \alpha + \beta_0 PTA_{ijt-1} + \beta_1 PROXIMITY_{ij} + \beta_2 REMOTE_{ijt} + \beta_3 RGDP_{ijt} + \beta_4 DRGDP_{ijt} + \beta_5 DKL_{ijt} + \beta_6 Sq_DKL_{ijt} + \beta_7 DROWKL_{ijt} + \in_{ijt} \quad (2.3)$$

where PTA is the dichotomous dependent variable; PROXIMITY is the inverse of the natural logarithm of the distance between two countries ($\hat{\beta}_{PROXIMITY} > 0$); REMOTE is the remoteness of a pair of continental trading partners from the RoW ($\hat{\beta}_{REMOTE} > 0$); RGDP is the sum of the log of the GDP of countries *i* and *j* ($\hat{\beta}_{RGDP} > 0$); DRGDP is the absolute difference in the log of the GDPs of countries *i* and *j* ($\hat{\beta}_{DRGDP} < 0$); DKL is the absolute difference in the log of the capital–labour ratios of countries *i* and *j* ($\hat{\beta}_{DKL} > 0$); Sq_DKL is the square of DKL ($\hat{\beta}_{Sq_DKL} < 0$); DROWKL is the absolute difference between the capital–labour ratios of the member countries and the RoW's capital–labour ratio ($\hat{\beta}_{DROWKL} < 0$); and $\in$ captures both the error term and/or fixed effects - when included.[34] When running regressions with no fixed effects, $\in_{ijt}$ is simply equal to the error ϵ_{ijt}; when we include country and partner fixed effects, $\in_{ijt} = \alpha_i + \beta_j + \epsilon_{ijt}$ and when we also include year fixed effects, $\in_{ijt} = \alpha_i + \beta_j + \varphi_t + \epsilon_{ijt}$; and when we include pairwise fixed effects, $\in_{ijt} = \gamma_{ij} + \epsilon_{ijt}$.[35] Subscript *i*, *j* and *t* represent country, partner and time respectively. Our preferred specification includes country, partner and year fixed effects, omitting pairwise fixed effects because their inclusion means losing PROXIMITY and REMOTE as determinants.

[33] By including DROWKL in our cross-sectional analysis, the observations fall to 531 because of the availability of the capital and labour stock data. When excluding DROWKL from the specification, observations increase to 860; and with DKL (and Sq_DKL) removed, the number of observations increase to 1,430. One observation remains "missing" for Singapore–Germany because in 1996, the data used to identify trade flows between the two countries is missing.

[34] BB exclude Sq_DKL from their preferred specification but we find the determinant significant.

[35] A significant Wald test supports the inclusion of year fixed effects, in addition to country and partner.

2.5 Empirical Results

In this section, we present the empirical results of three modelling exercises. To begin with, as far as possible, we replicate BB's probit regression using their original data, continuing with 1996 for the cross-sectional analysis.[36] In addition, using the same specification, we run the model using new data, estimating the cross-sectional variation in PTAs for 1996 and 2011. Thereafter, our new data allows us to run cross-section regressions on 70 countries (giving 2,415 potential pairings); however, we opt rather for a logit estimation. Like BB, we use 1960 data on incomes, capital and labour stocks for the replication but prefer 1970 for our new data to account for potential endogeneity to increase the number of observations. We later show that lagging the explanatory variables does not resolve the endogeneity problem and that, in fact, the model performs better when using the contemporaneous values, which is what we do in subsequent panel regressions. Finally, we present the output from the LPM regressions run on our panel data.

2.5.1 Replication of BB's cross-section results and extending the cross-section estimation to a larger sample of countries

BB's original data files contain several alternative capital stock variables, which were all used in our attempt to replicate the original results (see column [1] in Table 2C.1 of Appendix 2C), using specification [2.3]. Unfortunately, these attempts could not produce the published results because BB misplaced their DROWKL variable. Despite this obstacle, we run regressions on new data to test the specification, with

[36] Thank you to Professor Jeffrey Bergstrand for providing the original data and the log files for their work. Using the original data and log files, we manage to replicate the original results, to an extent. It was impossible to replicate the results entirely, for many reasons. Firstly, the dependent variable as defined by BB totaled 285 bilateral pairings in 1996, whereas using the same definition, the total for our dependent variable came to 242 bilateral pairings. Secondly, BB are unable to identify their original capital and labour stock data. Moreover, BB somehow misplaced their DROWKL and we thus exclude it from the replication. Thirdly, BB have a complete dataset and lose no observations as variables are added, whereas our dataset is incomplete and thus observations are lost. Finally, while BB provide the formula for REMOTE, the calculation is influenced by the user-defined-groupings of countries by continent.

the results presented in columns [2] – [5]. Column [3] is the same specification as in column [2] except that we conduct the cross-sectional analysis for 2011, meaning the dependent variable (PTA) takes on its 2011 values rather than the former 1996 values; likewise, for column [5] in relation to column [4], in which we include DROWKL. Due to the inclusion of DKL, the dependent variable of 2011 is equivalent to that of 1996, hence the estimation outputs are equivalent for columns [2] and [3], and for columns [4] and [5].

Before discussing the probit results of Table 2C.1, recall that the coefficient signs of probit (and logit) regressions are meaningful but the actual values of the coefficients are not directly interpretable (Baier et al., 2014). Therefore, in the interests of brevity and because the signs are mostly as expected, we provide only a short discussion of these results. In terms of the coefficient's signs, PROXIMITY (positive), REMOTE (positive), RGDP (positive), DRGDP (negative) and DROWKL (negative) have the correct sign throughout. DKL (positive) and Sq_DKL (negative) have their expected signs in columns [1] – [3] but not in columns [4] and [5], where the sign of DKL becomes negative and Sq_DKL positive.

Regarding significance, PROXIMITY, REMOTE and RGDP are significant throughout, as is DROWKL when included. DRGDP is only significant in column [1] and DKL is significant in columns [1] – [3]. Although the quadratic term is found to be statistically insignificant by BB, this is not the case in our estimates. Moreover, since BB provide theoretical reasons for its inclusion, we include Sq_DKL in subsequent estimations. The explanatory power of the model is specification dependent; using the pseudo-R^2 term as a summary measure of explanatory power, specification 2/3 'explains' 67.5% of the variation of PTAs among 860 country-pairings in 1996/2011, whereas specification 3/4 'explains' 72.2% of the variation of PTAs among 531 country-pairings in 1996/2011.

These results show that the probability of a PTA forming between any two countries *ij* is greater when the distance between their economic centres falls, they are on the same continent and distant from the RoW, the larger is the sum of their

GDPs and the smaller is the absolute difference between these GDPs. The probability of a PTA increases, as well, with larger differences in capital–labour endowment ratios but decreases the smaller is the difference between the relative factor endowment of the pair and that of the RoW (Baier & Bergstrand, 2004).[37] The variation observed in the sign of DKL and Sq_DKL is an exception to BB's original results, suggesting perhaps that larger differences in capital-labour endowment ratios, decreases the probability of a PTA.

When extending BB's specification to the larger sample of countries, we opt for a logit specification because we can include standard fixed effects (Baier et al., 2014). Including standard fixed effects is not possible in a probit specification because this is prohibited by the normal distribution underlying probits. Chamberlain (1980) provides a methodology to include time-meaned fixed effects, however to keep things simple and because Baier et al. (2014) find their logit and probit specifications are robust, we prefer the logit. Furthermore, Figures 2.2 and 2.3 demonstrated that the first wave of integration occurred in 1971, with a jump evident in agreements and a drop in no agreements, therefore we adapt BB's approach by drawing our independent variables' data from 1970. We do this to increase the number of countries included in the regression, while still avoiding the potential endogeneity problem. After the adjustment, we estimate the cross-sectional variation in PTAs for 1996 and 2011.

Since our panel dataset is strongly balanced, we experience some loss in observations: from the 138 countries we begin with, we eventually model 70 countries (2,153 observations) in our updated regression. These results are seen in Table 2C.2 and clearly indicate that the 'explanatory' power of the model has fallen substantially, with the pseudo-R^2 dropping to 0.347 in column [1]. Also in column [1], we see that PROXIMITY, REMOTE and RGDP are statistically significant at the 1% level and retain their expected signs (all positive). DRGDP and DROWKL also retain their

[37] This holds true in columns [1] – [3] but not in columns [4] and [5]. Once we introduce DROWKL, the probability of a PTA between two trading partners increases the smaller is the difference in their capital–labour endowment ratios, although the coefficient is insignificant.

expected signs (both negative) but neither is significant. DKL and Sq_DKL have the incorrect sign (negative and positive respectively) and are insignificant, as expected. In column [2], PROXIMITY and REMOTE remain significant but REMOTE takes on a negative sign, opposite to the one expected (positive). This is a surprising result given the coefficient of REMOTE is always positive and significant in Figure 2D.1 and is positive in all subsequent regressions except for in column [6] of Table 2C.3. Following our earlier discussion, this is probably because more isolated country-pairs are already in PTAs by 1996 or have no interest in forming PTAs with countries in their immediate vicinity, otherwise they would already have done so. RGDP is significant at 10% but the remaining variables are all insignificant, despite taking the expected sign.

Lastly, in column [3] of Table 2C.2, PROXIMITY and RGDP are again significant at the 1% level, whereas all other variables are insignificant, despite all variables having the expected sign. In both columns [2] and [3], the pseudo-R^2 falls to 0.079 and 0.158 respectively. Moreover, most determinants become insignificant, the exception being PROXIMITY, which is the only determinant to remain statistically significant at the 1% level across the specifications. RGDP is significant across specifications too, but only at the 10% level in column [2].

Critics commonly argue that trade policy is not an exogenous variable and that countries likely select endogenously into PTAs for reasons not observable but correlated with the level of trade. One way to overcome potential endogeneity is to lag the explanatory variable data, the method used by BB. In the following sub-section, we explore this notion over four steps (the findings from steps 1 and 4 are presented) and we demonstrate that this approach is sensitive to the chosen lag length and that the model performs better when using the contemporaneous values. Alternative solutions to potential endogeneity include instrumental variable (IV) and control-function techniques. While there are alternative solutions, Baier and Bergstrand (2007) establish that IV, and control-function techniques, do not adjust for endogeneity well, whereas a panel-data approach does (see earlier discussion).

2.5.2 Exploring the effect of different lag lengths on the coefficients (4 steps)

Step 1 and findings

First, we loop our regressions so that both the dependent and explanatory variables change over time, estimating 52 different cross-section estimates for the years 1960-2011. Our equation for this first step is:

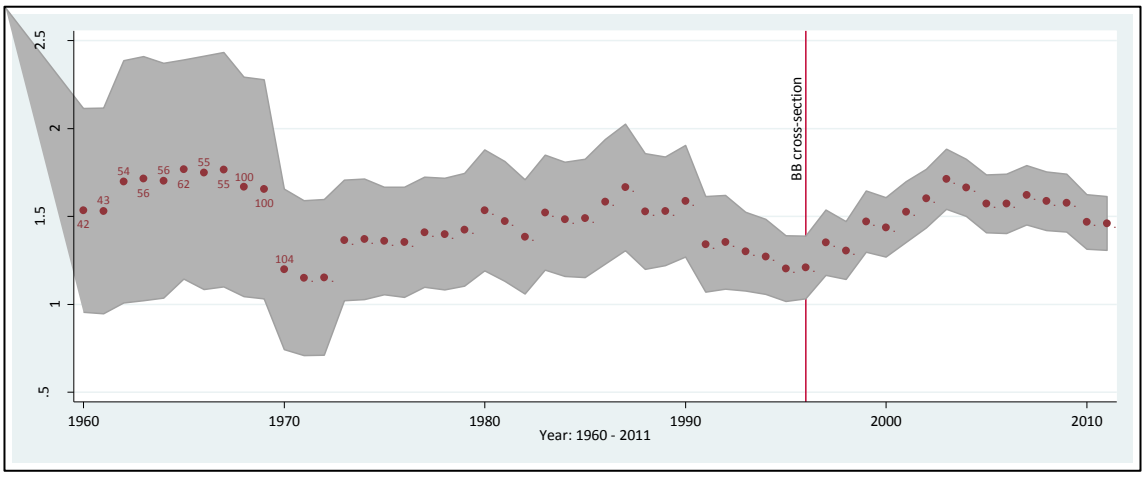
$$PTA_t = \beta_0 + \boldsymbol{x}_t\beta + e \tag{2.4}$$

where x is the vector of determinants and t moves from 1960 to 2011.

Using the coefficient estimates from these regressions, we generate plots for each regressor; the plots display the estimated coefficient from each successive regression of the 52 years. For parsimony, we present two of the determinants that clearly depict the problem arising when lagging the data (the remainder of the figures are in Appendix 2D). In each of the figures, a solid red dot indicates significance at 5% and an open green dot, insignificance. We also include a 95% confidence interval in each figure, which presents as the grey band surrounding points. A vertical red line indicates the year used for BB's cross-sectional analysis: 1996.

Contrary to our expectation that distance plays a less significant role in new regionalism, we find in Figure 2.9 that the coefficient of PROXIMITY deviates around 1.5 and remains significant throughout. Since PROXIMITY captures the geographic distance between any two pairs, which is time-invariant, the consistency in the estimates of the coefficient is not surprising.

Figure 2.9: Rolling coefficient estimates of PROXIMITY for the 1960–2011 period, estimated in cross-section

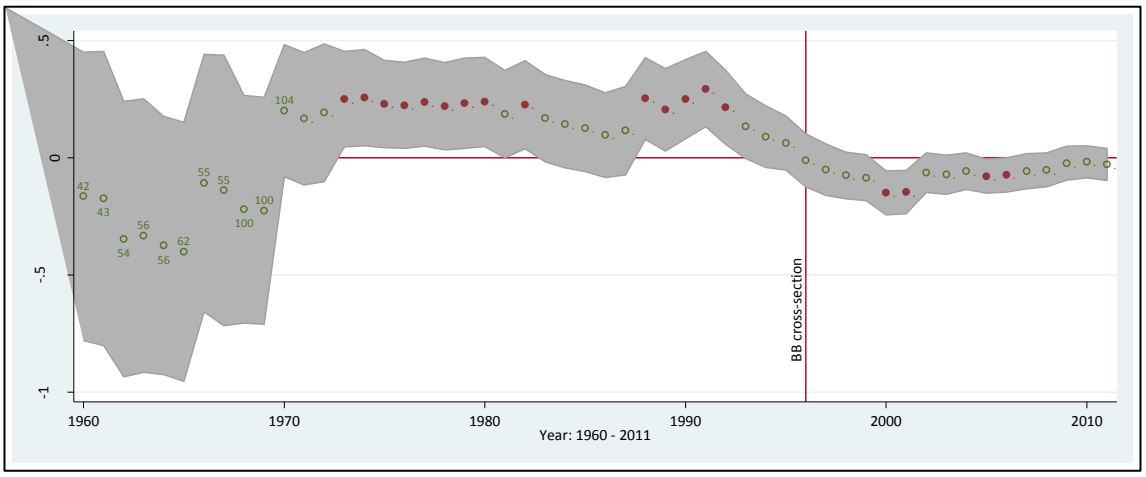


Notes: For the first decade, numbers represent the number of bilateral agreements. The shaded area is a 95% confidence interval; where present, solid red dots indicate significance at the 5% level and open green dots indicate insignificance at the 5% level. 1996, the year chosen for BB's cross-sectional estimate, is indicated by the vertical (red) line. Expected sign is positive.

For multilateral distance, there is a clear downward trend in the size of the coefficient of REMOTE in Figure 2D.1 and all the observations are significant at 5%. The factor driving changes in REMOTE over time is the number of trading partners; and since this tends to increase with time, bearing in mind that REMOTE is essentially the average distance of two continental trading partners from the RoW, this decreasing trend is not surprising. We thus find little variation between the contemporaneous and lagged explanatory variable results of REMOTE, which remains positive throughout and is in line with expectations.

The contemporaneous coefficient values of RGDP (Figure 2D.2) are largely significant and generally maintain the expected sign (positive). Overall, the value of the coefficient deviates between 0 and 0.4, and when tending to zero, the coefficient tends to insignificance. In stark contrast, the coefficient of DRGDP in Figure 2.10 is insignificant between 1960 and 1972 and thereafter, significance fluctuates. Between 1970 and 1995, the sign on the coefficient is positive, whereas we expect a negative. The coefficient of DRGDP takes on the expected negative sign towards the end of the sample but as already mentioned, is seldom significant (significance in only 4 of 16 years).

Figure 2.10: Rolling coefficient estimates of DRGDP for the 1960–2011 period, estimated in cross-section



Notes: See notes for Figure 2.9.

We expect a positive DKL coefficient (Figure 2D.3) but for most years, it is negative. That said, most observations are also insignificant, though tending towards significance from 1989 onwards, even though they remain negative. The plots in the figure appear in line with our earlier expectations that contrary to BB's hypothesis, the probability of a PTA forming between two countries increases with smaller differences in capital–labour endowment ratios. Apart from the period after 1989, the square of DKL (Sq_DKL) is persistently insignificant, seen in Figure 2D.4. Moreover, the coefficient deviates around zero, whereas we expect a negative.

Finally, for DROWKL, we see that the coefficient is predominantly significant in the years post-1977, whereas the coefficient was persistently insignificant prior to 1977. Although recently significant, DROWKL is positive in Figure 2D.5, against expectations.

Step 2 and 3

Second, we calculate the coefficients using the same looped regressions, except this time we use lagged explanatory variables to explain the dependent variable as both evolve over time. Thus, we estimate the following equation:

$$PTA_t = \beta_0 + \boldsymbol{x}_{t-a}\beta + e \qquad (2.5)$$

where a is the lag length and t moves from (1960 + a) to 2011. To determine whether lag length matters, a takes on the value 5, 10 and 20 years. For brevity, the results and figures of steps 2 and 3 are not presented but are available on request. In addition, since PROXIMITY captures the geographic distance between any two pairs, which is time-invariant, no comparison is made with the lagged values.

Third, like our approach in step 1, we investigate whether it is necessary to use data from 1960 for our income, capital and labour stock. We do this once again by looping our regressions and having the dependent variable change over time. We keep the regressors fixed firstly at 1960 and secondly, at 1970, as per BB and our updated analysis. We then investigate the years in which the regressors are significant – if at all. For this, we estimate the following equations:

$$PTA_t = \beta_0 + \boldsymbol{x}_{1960}\beta + e \text{ and } PTA_t = \beta_0 + \boldsymbol{x}_{1970}\beta + e \quad (2.6)$$

where t moves from 1960/1970 to 2011.

Step 4 and findings

Fourthly, we estimate the following equation:

$$PTA_{2011} = \beta_0 + \boldsymbol{x}_t\beta + e \quad (2.7)$$

where t again moves from 1960 to 2011. The results are presented in Table 2.5 below and considering the frequently fluctuating significance of the explanatory variables, regardless of chosen lag length, any cross-sectional analysis depends heavily on the chosen lag length. To demonstrate this fact, consider columns [2] – [7] in contrast to column [1], the latter being BB's specification. Looking at, for example, column [7] and comparing it to column [1], we see that PROXIMITY, REMOTE, RGDP and DKL are of similar magnitude, have the same sign and are significant at the 1% level. DRGDP has the correct sign (negative) in column [7] but is insignificant. DROWKL is also significant at the 1% level in column [7] but takes on the wrong sign (positive). Sq_DKL, on the other hand, is positive and significant in column [1] but takes on the expected negative in column [7] while remaining significant.

Table 2.5: Cross-sectional logit results using dependent variable values from different years to contrast the importance of lag length

Dependent var.	PTA 2011						
Data sourced from	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2011**
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
PROXIMITY (Positive)	1.914***	1.810***	1.889***	1.715***	1.475***	1.494***	1.459***
	(0.161)	(0.126)	(0.123)	(0.099)	(0.077)	(0.081)	(0.078)
REMOTE (Positive)	0.110***	0.123***	0.081***	0.079***	0.083***	0.081***	0.064***
	(0.018)	(0.015)	(0.016)	(0.013)	(0.012)	(0.012)	(0.012)
RGDP (Positive)	0.161***	0.200***	0.247***	0.198***	0.263***	0.231***	0.195***
	(0.036)	(0.028)	(0.028)	(0.024)	(0.022)	(0.022)	(0.023)
DRGDP (Negative)	0.069	-0.012	-0.043	-0.076*	-0.078**	-0.048	-0.028
	(0.053)	(0.046)	(0.045)	(0.040)	(0.035)	(0.035)	(0.035)
DKL (Positive)	-0.467*	-0.108	-0.189	-0.042	-0.322	-0.736***	-0.523***
	(0.239)	(0.201)	(0.211)	(0.195)	(0.207)	(0.184)	(0.189)
Sq_DKL (Negative)	0.110*	-0.045	-0.055	-0.108*	-0.127*	-0.014	-0.122*
	(0.066)	(0.056)	(0.062)	(0.060)	(0.076)	(0.065)	(0.071)
DROWKL (Negative)	-0.326***	-0.125	-0.070	0.018	0.289***	0.388***	0.399***
	(0.092)	(0.087)	(0.077)	(0.067)	(0.059)	(0.063)	(0.067)
Constant	11.853***	9.811***	9.628***	8.733***	5.020***	5.812***	6.190***
	(1.498)	(1.182)	(1.152)	(0.945)	(0.737)	(0.767)	(0.751)
Observations	1,807	2,501	2,606	3,470	4,603	4,648	4,655
Pseudo R-squared	0.358	0.389	0.375	0.365	0.370	0.375	0.363

Notes: Results presented are for cross-sectional logit regressions on PTA 2011, using annual data sourced from 1960, 1970, 1980, 1990, 2000, 2005 and 2011 in columns [1] – [7] respectively. The dependent variable (PTA) is dichotomous, taking the value 1 if country-pair *ij* is in an FTA, customs union, common market or economic union; or 0, otherwise. PROXIMITY is defined as the inverse of the natural logarithm of the distance between two countries; REMOTE as the remoteness of a pair of continental trading partners from the RoW; RGDP as the sum of the log of the GDP of countries *i* and *j* (total GDP, in millions of 1990 US dollars, converted at Geary Khamis PPPs); DRGDP as the absolute difference in the log of the GDPs of countries *i* and *j*; DKL as the absolute difference in the log of the capital-labour ratios of countries *i* and *j*; Sq_DKL as the square of DKL; and DROWKL as the absolute difference between the capital–labour ratios of the member countries and the RoW's capital–labour ratio. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Overall, the specification in column [7] performs marginally better than the specification in column [1]: all the variables, except DRGDP and Sq_DKL, are significant at the 1% level and more variables take their expected signs. Furthermore, the larger pseudo-R^2 suggests that more variation in a larger number of PTAs is

explained by specification [7] (36.3% compared to 35.8%). The pseudo-R^2 of column [2] is higher than that of column [7] but only 3 of the 7 determinants are significant in column [2]. We thus feel confident that the model performs well when using the contemporaneous income, capital and labour stock data.

Therefore, the combined results and above analysis, leads us to conclude that simply lagging the regressors does not sufficiently curb the problem of endogeneity. This conclusion is reached after exploring different lag length alternatives, as seen in the table above and by regressing the contemporaneous dependent variable on static values for the regressors. Our approach allows us to explore a multitude of lag lengths that span from 1 year, to over 50 years. Ultimately, the magnitude of the lag alters the results significantly, so much so, that using the contemporaneous values is preferential. Considering as well, that Baier and Bergstrand (2007) find a panel approach adjusts for endogeneity well, we rely on our panel structure for robust results.

With respect to BB's results and our earlier outputs, we did not control for the persistence in our dependent variable. If a bilateral PTA between *i* and *j* is formed in 1960, the PTA variable takes on the value 1 in 1960 and persists with this value until 2011. Similarly, a bilateral PTA formed between *i* and *j* in 1990, takes on the value 1 in 1990 which persists until 2011. To account for this persistence, we recode the dependent variable to equal 1 in a given year only if the agreement was formed in that year; and if in the preceding year, there was no agreement, i.e., New $PTA_t = 1$ only when $PTA_{t-1} = 0$ and $PTA_t = 1$.[38] In so doing, the dependent variable does not always have sufficient variation to run a regression, hence we focus on those years in which the number of new PTAs is greater than 25.[39] For the 52 year period, the most new PTAs were formed in 2005 (due to the addition of the former Soviet bloc to the European Union), with a total of 199 new agreements for the year.

[38] Our concern with this definition for the dependent variable is that if $PTA_{t+1} = 0$, there is no distinction between a terminated agreement or one that is on-going but coded as 0 because $PTA_t = 1$.
[39] Choosing 25 still leaves us with at least 18 degrees of freedom.

Using 25 new PTAs as our rule of thumb, separating out years in which we have enough variation in the dependent variable to run a regression, we obtain results for 22 years (out of the possible 52). For brevity, however, we present in Table 2C.3 selected years to cover different decades. From these results, we find that removing persistence from the dependent variable generates coefficients that vary in terms of significance, sign and magnitude. Therefore, it is best to continue modelling the cumulative PTA variable, for which the results are more consistent. When running our panel regressions, we again control for the persistence in PTA.

2.5.3 Panel estimations using a LPM

In this section, we present our primary results, those generated by running the LPM model on panel data. Initial estimates are shown with no, country, and pairwise fixed effects but we ultimately prefer to include country and year fixed effects.[40] To establish whether the economic determinants have changed over time, and to explore heterogeneity, we run regressions for the full sample and for the old (1960–1996) and the new regionalism (1997–2011) periods.

Having conceded the well-known problems of the LPM, we run our dynamic model using heteroskedasticity-consistent robust standard errors. We also check what portion of the predicted values fall outside the 0 to 1 range, as deviation outside the unit interval means LPM estimates can be biased and inconsistent.[41] The dynamic LPM results are shown in Table 2.6 (the static LPM results can be found in Table 2C.4 in Appendix 2C).[42] In Tables 2.6 and 2C.4, we provide the dated and lagged (by five years) explanatory variables in columns [2], [4] and [6] to demonstrate that lagging the variables provides no benefit, as was the case in our cross-sectional analysis. Therefore, we proceed using the dated values for our independent variables.

[40] The Wald test demonstrates the significance of year fixed effects.
[41] For our specification with country and year fixed effects, 107,418 of 166,434 (64.5%) observations fall within the unit interval.
[42] For a comparison of the dynamic LPM and logit results, see Table 2C.5 in Appendix 2C.

Table 2.6: Dynamic LPM results, comparing dated and lagged (by 5 years) explanatory variables

Dependent var.	**PTA 1960-2011**					
Lag	**No**	**5 years**	**No**	**5 years**	**No**	**5 years**
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PROXIMITY (Positive)	0.010***	0.014***	0.010***	0.016***	-	-
	(0.000)	(0.001)	(0.001)	(0.001)		
REMOTE (Positive)	0.001***	0.000	0.001***	0.000***	-	-
	(0.000)	(0.000)	(0.000)	(0.000)		
RGDP (Positive)	0.002***	0.000***	0.007***	0.002***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DRGDP (Negative)	-0.001***	0.000	-0.000	0.000	-0.002***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
DKL (Positive)	-0.005***	-0.002***	-0.004***	-0.001	-0.005***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Sq_DKL (Negative)	0.000***	-0.000	0.000	-0.000**	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DROWKL (Negative)	0.001**	-0.000	0.000	0.005***	0.000	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
lag PTA	0.956***	0.938***	0.941***	0.923***	0.927***	0.915***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.063***	0.121***	-0.073***	-0.004	-0.097***	-0.110***
	(0.004)	(0.005)	(0.008)	(0.022)	(0.005)	(0.006)
Fixed Effects	No		Country		Pairwise	
Observations	166,434	158,132	166,434	158,132	177,461	161,401
R-squared	0.918	0.899	0.920	0.902	0.853	0.838

Notes: Results presented are for dynamic LPM regressions on annual data, over the 1960-2011 time horizon. '*Country*' – importer (*i*) and exporter (*j*) ('directional'), and pairwise (*ij*), fixed effects are included but not reported. We exclude REMOTE from columns [5] and [6] because it has minimal within variation: the within sample variation of REMOTE is 0.045, whereas between sample it is 4.030. The variation within sample is therefore 90 times less than the variation between. For additional notes, see Table 2.5.

In Table 2.6, we prefer the specification in column [3] because the specifications in [5] and [6] exclude two key geographical determinants: PROXIMITY and REMOTE; whereas the specifications in [1] and [2] exclude fixed effects. In deciding between the specification of column [3] or [4], we previously noted that there is no benefit to lagging the explanatory variables, and that using the dated values benefits us in terms of the number of observations. Thus, for the significant

determinants in column [3], we find that more geographically proximate countries exhibit a higher probability of PTA membership; as do more remote countries and country-pairs with larger economies; whereas countries having similar capital-labour ratios, lowers the probability of a PTA.

Since our preferred specification is a dynamic model, the coefficients must be adjusted to account for the lagged dependent variable as regressor. Furthermore, we compare the marginal impact of each determinant by standardising our coefficients.[43] The purpose of standardising the coefficients is to determine the relative importance of explanatory variables and/or, to compare the effect of changing different variables (Bring, 1994). The standardised coefficients in Table 2.7 provide the baseline for our subsequent analysis. For the full sample period, we find that more geographically proximate countries exhibit a higher probability of PTA membership ($\hat{\beta}_{PROXIMATE} > 0$); as will more remote countries and country-pairs with larger economies ($\hat{\beta}_{REMOTE} > 0, \hat{\beta}_{RGDP} > 0$). Determinants lowering the probability of a PTA include country-pairs having similarly sized economies ($\hat{\beta}_{DRGDP} < 0$), or countries having similar capital-labour ratios ($\hat{\beta}_{DKL} < 0$) which are also different to the RoW ($\hat{\beta}_{DROWKL} < 0$).[44] That similar capital-labour ratios reduces the probability of a PTA contradicts the theory, but supports our cross-sectional analysis.

[43] To obtain the standardised coefficients, we multiply each variable by its standard deviation, as defined within each sample. In addition, because more distant trading partners are forming PTAs in the new regionalism (and hence the standard deviation is larger than under the old regionalism), we use the full sample standard deviations to standardise both the old and the new regionalism coefficients. The results are qualitatively similar.

[44] The coefficients for DRGDP and Sq_DKL are, however, not significantly different from zero.

Table 2.7: Results for the dynamic LPM in respect of the following sample periods: full, old regionalism and new regionalism

Dependent var.	**PTA 1960-2011**		**PTA 1960-1996**		**PTA 1997-2011**	
Sample	**Full**		**Old regionalism**		**New regionalism**	
Model adjustment	**Long run**	**Long run - standardised**	**Long run**	**Long run - standardised**	**Long run**	**Long run - standardised**
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PROXIMITY (Positive)	0.175***	0.140***	0.053***	0.041***	0.339***	0.282***
	(0.009)	(0.007)	(0.005)	(0.004)	(0.018)	(0.015)
REMOTE (Positive)	0.016***	0.061***	0.009***	0.036***	0.016***	0.065***
	(0.001)	(0.005)	(0.001)	(0.003)	(0.003)	(0.010)
RGDP (Positive)	0.035***	0.090***	-0.011*	-0.028*	0.119***	0.289***
	(0.010)	(0.026)	(0.006)	(0.016)	(0.033)	(0.080)
DRGDP (Negative)	-0.003	-0.005	-0.002	-0.004	-0.006	-0.008
	(0.003)	(0.004)	(0.002)	(0.002)	(0.006)	(0.009)
DKL (Positive)	-0.068***	-0.075***	-0.047***	-0.053***	-0.048**	-0.052**
	(0.009)	(0.010)	(0.005)	(0.005)	(0.019)	(0.020)
Sq_DKL (Negative)	0.001	0.004	0.002**	0.011**	-0.007	-0.029
	(0.002)	(0.009)	(0.001)	(0.005)	(0.005)	(0.020)
DROWKL (Negative)	-0.018*	-0.015*	0.005	0.005	-0.020	-0.016
	(0.010)	(0.008)	(0.006)	(0.005)	(0.027)	(0.021)
FE (*i*, *j* and *t*)	Yes		Yes		Yes	
Observations	166,434		97,212		69,222	
No. of PTAs	12,274		2,570		9,704	

Notes: Results presented are for dynamic LPM regressions on annual data, over the 1960-2011 time horizon (full sample), and for the 1960-1996 (old regionalism) and 1997-2011 (new regionalism) time horizons respectively. Due to the dynamic specification, the coefficients of columns [1], [3] and [5] are adjusted to reflect the long-run. The coefficients in columns [2], [4] and [6] are standardised so that the variances of the dependent and independent variables equal 1. Standardised coefficients are used to re-express the coefficients as the effect of a one standard deviation change, as opposed to a unit change. '*Country*' – importer (*i*) and exporter (*j*) ('directional'), and year (*t*), fixed effects are included but not reported. For additional notes, see Table 2.5.

Considering the standardised coefficients of the full period, PROXIMITY (0.140) has the largest marginal impact on the probability of forming a PTA, followed by RGDP (0.090); and DKL (-0.075), has the largest marginal impact on reducing the probability of forming a PTA. This further substantiates previous research showing the importance of economic and geographical factors in contributing to the formation of PTAs. Furthermore, PROXIMITY (0.282 versus 0.041) and REMOTE (0.065 versus 0.036) have a larger marginal effect under the new regionalism. RGDP is positive and

significant for the full period (0.090) and under the new regionalism (0.289), but is negative and significant (-0.0.28) under the old regionalism (DRGDP is negative throughout). Moreover, under the new regionalism, RGDP eclipses PROXIMITY as the determinant with the largest marginal effect (0.289 compared to 0.282). In contrast to expectations, DKL is negative and significant throughout and while Sq_DKL is positive and significant under the old regionalism, it becomes negative under the new regionalism. Similarly, DROWKL is positive under the old regionalism, but negative under the new regionalism (and negative and significant for the full period).

To control for the persistence in our data, and to avoid carrying effects from the old regionalism into the new, we remove the persistence in the dependent variable in Table 2.8, so that PTA equals 1 only when PTA_{t-1} is 0 and PTA_t is 1. We, once more present estimations for the full period, and for the old (1960–1996) and new regionalism (1997–2011) periods. Similarly, we present Table 2C.6 in Appendix 2C, in which column [1] provides our baseline results (including all PTAs) but in columns [2] - [4], we exclude PTAs formed prior to 1996; 2000; and 2004 respectively.[45] With the persistence removed in Table 2.8, PROXIMITY and REMOTE remain positive and significant, and RGDP is again positive and significant for the full period and under the new regionalism, but is negative and significant under the old regionalism. DKL behaves as before, maintaining a negative and significant coefficient. The signs and levels of significance of our coefficients in Tables 2.8 and 2C.6 are comparable to those of Table 2.7, suggesting that not only the formation (or onset) of a PTA, but also choosing to stay in a PTA, is driven by the economic determinants included in our specification. Considering the continued importance of these determinants, we next explore the marginal impact of PROXIMITY and RGDP in more detail.

[45] By only considering new PTAs in Table 2.8, we model the 'onset' of PTAs in the different periods, and by excluding PTAs formed prior to (a) 1996, (b) 2000, and (c) 2004 in Table 2C.6, we eliminate any old regionalism PTAs that might bias our new regionalism analysis. In these two tables, the significance and signs of our determinants generally match.

Table 2.8: Dynamic LPM results for new PTAs, checking significance of distance in new regionalism

Dependent var.	**New PTAs: 1960-2011**	**New PTAs: 1960-1996**	**New PTAs: 1997-2011**
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**
PROXIMITY (Positive)	0.006*** (0.000)	0.003*** (0.000)	0.014*** (0.001)
REMOTE (Positive)	0.003*** (0.000)	0.002*** (0.000)	0.003*** (0.001)
RGDP (Positive)	0.005*** (0.001)	-0.002* (0.001)	0.014*** (0.002)
DRGDP (Negative)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.001)
DKL (Positive)	-0.004*** (0.001)	-0.002*** (0.001)	-0.004*** (0.001)
Sq_DKL (Negative)	0.001 (0.000)	-0.000 (0.000)	-0.001 (0.001)
DROWKL (Negative)	-0.001 (0.000)	0.000 (0.000)	-0.001 (0.001)
FE (*i*, *j* and *t*)	Yes	Yes	Yes
Observations	154,690	94,644	60,046
No. of new PTAs	1,595	529	1,066

Notes: PTA is defined only for instances when $PTA_{t-1} = 0$ and $PTA_t = 1$ (therefore, lagPTA is always 0). Subsequent observations for which $PTA_{t+1} = 1$, are changed to missing. Column [1] is for the full sample (1960-2011); column [2] is for old regionalism (1960-1996); and column [3] is for new regionalism (1997-2011). Coefficients are adjusted for the long-run, and standardised. For additional notes, see Table 2.5.

With the standardised coefficients, we explore the effect of (a) dropping the observations falling above the *mean of PROXIMITY plus one standard deviation* and (b) dropping the observations falling below the *mean of PROXIMITY minus one standard deviation*. By dropping the respective observations, we (a) increase the average distance between countries in the sample and (b) decrease the average distance between countries in the sample. We do this for the full sample, results seen in Table 2.9; and we extend the analysis of geographic heterogeneity to both old regionalism and new regionalism, results in Table 2.10 below.

Table 2.9: Results for the dynamic LPM and an exploration of the effect of a one standard deviation change in PROXIMITY

Dependent var.	**PTA 1960-2011**		
Model adjustment	**Long run - standardised**	**More distant**	**More proximate**
		Exclude obs of PROXIMITY:	
		Above *mean + 1SD*	**Below *mean – 1SD***
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**
PROXIMITY (Positive)	0.140***	0.044***	0.142***
	(0.007)	(0.004)	(0.007)
REMOTE (Positive)	0.061***	0.025***	0.063***
	(0.005)	(0.003)	(0.005)
RGDP (Positive)	0.090***	0.098***	0.107***
	(0.026)	(0.019)	(0.029)
DRGDP (Negative)	-0.005	-0.007**	-0.008*
	(0.004)	(0.003)	(0.005)
DKL (Positive)	-0.075***	-0.041***	-0.075***
	(0.010)	(0.007)	(0.011)
Sq_DKL (Negative)	0.004	-0.008	-0.001
	(0.009)	(0.007)	(0.011)
DROWKL (Negative)	-0.015*	0.000	-0.016*
	(0.008)	(0.006)	(0.009)
FE (*i*, *j* and *t*)	Yes	Yes	Yes
Observations	166,434	138,535	146,363
No. of PTAs	12,274	3,332	12,147

Notes: Results presented are for dynamic LPM regressions on annual data, over the 1960-2011 time horizon. To better understand the effect of PROXIMITY, column [2] excludes observations of PROXIMITY which are higher than the mean plus one standard deviation, and column [3] excludes observations of PROXIMITY which are lower than the mean less one standard deviation. Coefficients are adjusted for the long-run, and standardised. For additional notes, see Table 2.5 and Table 2.7.

From Table 2.9, we see that for the full period, dropping the observations that are above the *mean of PROXIMITY plus one standard deviation* results in a significant fall in the number of PTAs included in the sample: 3,332 compared to 12,274. This large drop in the number of PTAs does not occur when we exclude those observations falling below the *mean of PROXIMITY minus one standard deviation* (12,147). From this, it is evident that most PTAs are still between countries in close geographic proximity. We suspect this is largely because of geographic discrimination under old regionalism dominating the existing PTAs. We also note that PROXIMITY has a larger

marginal impact when the average distance between countries decreases (0.142) and a smaller impact when the average distance increases (0.044); likewise for REMOTE, which has a marginal impact of 0.063 and 0.025 respectively.

Under the old regionalism in Table 2.10, the number of PTAs does not change when we exclude the observations falling below the *mean of PROXIMITY minus one standard deviation*. Ipso facto, it must be that the excluded are linked to country-pairs for which there is no PTA. Secondly, in Table 2.10, PROXIMITY has a larger impact under the new regionalism than the old. This contradicts our expectation, that distance would play a less significant role in determining PTAs in the new regionalism and we, therefore, conclude that the death of distance is a fallacy. Furthermore, we find that the greater the distance between countries, the less distance matters to the formation of a PTA and the more RGDP matters. Conversely, the smaller the bilateral distance, the more distance matters.

The results in Table 2.10 suggest that countries are more selective about who they choose as distant PTA partners: selecting those with large GDPs. Moreover, not only has RGDP eclipsed PROXIMITY as the determinant with the largest marginal effect, but it becomes significantly more important under the new regionalism than under the old – particularly for the formation of distant PTAs. Additionally, as distance increases, the marginal impact of the difference in the capital-labour endowment ratio increases, and the absolute difference between GDPs starts negatively affecting the probability of a PTA, suggesting that agreements between developing and developed countries may increase as countries look for comparative advantage benefits; and multilateral distance becomes insignificant.

Table 2.10: Results for the dynamic LPM and an exploration of the effect of a one standard deviation change in PROXIMITY under old and new regionalism

Dependent var.	**PTA 1960-1996**			**PTA 1997-2011**		
Sample	**Old regionalism**			**New regionalism**		
Model adjustment	**Long run - standardised**	**More distant** Exclude obs of PROXIMITY: Above *mean + 1SD*	**More proximate** Exclude obs of PROXIMITY: Below *mean – 1SD*	**Long run - standardised**	**More distant** Exclude obs of PROXIMITY: Above *mean + 1SD*	**More proximate** Exclude obs of PROXIMITY: Below *mean – 1SD*
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PROXIMITY (Positive)	0.041***	0.006***	0.044***	0.282***	0.216***	0.277***
	(0.004)	(0.001)	(0.004)	(0.015)	(0.021)	(0.014)
REMOTE (Positive)	0.036***	0.007***	0.038***	0.065***	0.020	0.066***
	(0.003)	(0.001)	(0.003)	(0.010)	(0.013)	(0.010)
RGDP (Positive)	-0.028*	0.017***	-0.020	0.289***	0.467***	0.268***
	(0.016)	(0.004)	(0.019)	(0.080)	(0.115)	(0.081)
DRGDP (Negative)	-0.004	0.002***	-0.005*	-0.008	-0.042***	-0.010
	(0.002)	(0.001)	(0.003)	(0.009)	(0.014)	(0.009)
DKL (Positive)	-0.053***	-0.018***	-0.057***	-0.052**	-0.084***	-0.038*
	(0.005)	(0.002)	(0.006)	(0.020)	(0.030)	(0.022)
Sq_DKL (Negative)	0.011**	0.004***	0.010	-0.029	-0.017	-0.041*
	(0.005)	(0.001)	(0.006)	(0.020)	(0.029)	(0.022)
DROWKL (Negative)	0.005	0.004***	0.005	-0.016	-0.014	-0.009
	(0.005)	(0.001)	(0.006)	(0.021)	(0.031)	(0.023)
FE (*i*, *j* and *t*)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	97,212	81,638	86,253	69,222	57,626	59,939
No. of PTAs	2,570	415	2,570	9,704	3,626	9,506

Notes: Results presented are for dynamic LPM regressions on annual data, over the 1960-1996 (old regionalism) and 1997-2011 (new regionalism) time horizons respectively. To better understand the effect of PROXIMITY, we exclude observations of PROXIMITY which are higher than the mean plus one standard deviation in columns [2] and [5]; and exclude observations of PROXIMITY which are lower than the mean less one standard deviation in columns [3] and [6]. Coefficients are adjusted for the long-run, and standardised. For additional notes, see Table 2.5 and Table 2.7.

The rising importance of RGDP is not entirely surprising however, given that prospects of agreements within a region may already have been exhausted, making distance an unavoidable obstacle. Therefore, for countries acting strategically, employing PTAs as tools to overcome regional constraints and open new trade opportunities in the global market space, the economic size of your partner matters. Next, we focus on the marginal impact of RGDP. Table 2.11 presents the findings of our investigation into income heterogeneity for the full sample period; and Table 2.12,

for the sub-samples of old and new regionalism. Unsurprisingly, we find, in the full sample that the larger the sum of the two GDPs, the more likely are the two countries to form a PTA (the absolute difference between the GDPs is never significant).

Table 2.11: Results for the dynamic LPM and an exploration of the effect of a one standard deviation change in RGDP

Dependent var.	**PTA 1960-2011**		
Model adjustment	**Long run - standardised**	**Smaller**	**Larger**
		Exclude obs of RGDP:	
		Above *mean + 1SD*	**Below *mean – 1SD***
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**
PROXIMITY (Positive)	0.140***	0.122***	0.151***
	(0.007)	(0.007)	(0.008)
REMOTE (Positive)	0.061***	0.055***	0.065***
	(0.005)	(0.005)	(0.006)
RGDP (Positive)	0.090***	0.050***	0.068***
	(0.026)	(0.018)	(0.026)
DRGDP (Negative)	-0.005	-0.000	0.009
	(0.004)	(0.006)	(0.006)
DKL (Positive)	-0.075***	-0.080***	-0.077***
	(0.010)	(0.010)	(0.011)
Sq_DKL (Negative)	0.004	0.010	-0.001
	(0.009)	(0.009)	(0.011)
DROWKL (Negative)	-0.015*	-0.016*	-0.006
	(0.008)	(0.008)	(0.009)
FE (*i*, *j* and *t*)	Yes	Yes	Yes
Observations	166,434	139,721	140,035
No. of PTAs	12,274	8,458	11,602

Notes: Results presented are for dynamic LPM regressions on annual data, over the 1960-2011 time horizon. To better understand the effect of RGDP, column [2] excludes observations of RGDP which are higher than the mean plus one standard deviation, and column [3] excludes observations of RGDP which are lower than the mean less one standard deviation. Coefficients are adjusted for the long-run, and standardised. For additional notes, see Table 2.5 and Table 2.7.

In Table 2.12, we find that RGDP is negative and significant under the old regionalism (except in column [2]) and becomes positive and significant under the new regionalism. Like the preceding discussion, RGDP matters more when larger and this is particularly true under the new regionalism. Thus, for country-pairs with a large

combined GDP, this is the most significant factor driving the formation of a PTA and proximity becomes less important.

Table 2.12: Results for the dynamic LPM with country fixed effects and an exploration of the effect of a one standard deviation change in RGDP under old and new regionalism

Dependent var.	**PTA 1960-1996**			**PTA 1997-2011**		
Sample	**Old regionalism**			**New regionalism**		
Model adjustment	**Long run - standardised**	**Smaller** Exclude obs of RGDP: Above *mean + 1SD*	**Larger** Exclude obs of RGDP: Below *mean – 1SD*	**Long run - standardised**	**Smaller** Exclude obs of RGDP: Above *mean + 1SD*	**Larger** Exclude obs of RGDP: Below *mean – 1SD*
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PROXIMITY (Positive)	0.041***	0.035***	0.033***	0.282***	0.268***	0.280***
	(0.004)	(0.003)	(0.004)	(0.015)	(0.016)	(0.016)
REMOTE (Positive)	0.036***	0.028***	0.042***	0.065***	0.061***	0.063***
	(0.003)	(0.002)	(0.003)	(0.010)	(0.011)	(0.011)
RGDP (Positive)	-0.028*	-0.005	-0.040***	0.289***	0.118**	0.354***
	(0.016)	(0.010)	(0.015)	(0.080)	(0.059)	(0.075)
DRGDP (Negative)	-0.004	-0.008**	0.006*	-0.008	-0.003	-0.005
	(0.002)	(0.003)	(0.003)	(0.009)	(0.015)	(0.012)
DKL (Positive)	-0.053***	-0.041***	-0.059***	-0.052**	-0.080***	-0.031
	(0.005)	(0.005)	(0.006)	(0.020)	(0.022)	(0.022)
Sq_DKL (Negative)	0.011**	0.006	0.009*	-0.029	-0.020	-0.042*
	(0.005)	(0.005)	(0.006)	(0.020)	(0.022)	(0.022)
DROWKL (Negative)	0.005	0.007	0.004	-0.016	-0.014	-0.014
	(0.005)	(0.005)	(0.005)	(0.021)	(0.025)	(0.022)
FE (*i*, *j* and *t*)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	97,212	81,332	81,917	69,222	58,178	58,454
No. of PTAs	2,570	1,683	2,306	9,704	7,561	8,890

Notes: Results presented are for dynamic LPM regressions on annual data, over the 1960-1996 (old regionalism) and 1997-2011 (new regionalism) time horizons respectively. To better understand the effect of RGDP, we exclude observations of RGDP which are higher than the mean plus one standard deviation in columns [2] and [5]; and exclude observations of RGDP which are lower than the mean less one standard deviation in columns [3] and [6]. Coefficients are adjusted for the long-run, and standardised. For additional notes, see Table 2.5 and Table 2.7.

2.5.4 Model predictions and summary of findings

As a cursory exercise, we conclude this chapter by reviewing our model's predictive prowess. After generating the predicted values from our model, we take

anything less than 0.5 to be a 0 and anything greater or equal to 0.5, as 1. For the full period, the predicted dependent variable correctly identifies 11,534 pairs of PTAs that are both found in the estimation sample, and equivalent to 1 in the data, implying an accuracy rate of 94% (11,534/12,274). Although correctly predicting 11,534 agreements, our model incorrectly predicts 740 PTAs (6.03%) and fails to predict 213 (1.74%) agreements. Similarly, our model predicts 154,687 no agreements, whereas the data consists of 154,160, implying an over-estimation by 527 (or 0.34%).

Of the 213 incorrect PTA predictions, 203 are for the year 1960; 6 for the year 1966; 1 for 1970; 2 for 2006; and 1 for 2008. Three PTA predictions are thus incorrectly predicted under the new regionalism, and these are between: Macedonia–Ukraine and Mexico–Japan in 2006; and Kyrgyzstan–Uzbekistan in 2008. Of these three, Macedonia–Ukraine and Kyrgyzstan–Uzbekistan are continental partners, but for the latter country-pair, this is not surprising because a border dispute has existed for decades between the two countries. For Macedonia–Ukraine, an FTA between the countries was signed in January 2001, ratified in July 2001 and came into effect in September 2001. This agreement exists in the EIA dataset between 2002 and 2005, but is no longer captured from 2006 onwards. This is a mistake in our version of the dataset and has been corrected in newer versions. Lastly, an FTA has existed between Mexico and Japan since April 2005, but in our version of the EIA database, is not coded as a full FTA. Hence, our model specification accurately predicts the new regionalism PTAs.

In summary, economic determinants matters for country-pairs when forming a PTA. Bilateral distance has the largest marginal effect when countries are bilaterally proximate, but when countries are bilaterally distant, economic size matters more. Furthermore, both bilateral and multilateral distance matter more under the new regionalism than under the old regionalism. All the determinants, except for the difference in capital-labour ratios, have a larger marginal effect under the new regionalism.[46] Lastly, the difference in the capital–labour endowment ratios of the

[46] In part, this may be due to the number of PTAs in old and new regionalism. New regionalism has nearly 4 times as many PTAs than old regionalism, making the relationship better identified.

two countries also has a large and significant impact on the formation of a PTA but unlike BB, we find that this difference lowers the probability of a PTA.

One likely reason for the change in the signs of the endowment variables, is due to the appropriateness of the measure, being calculated from capital and labour stock. The two stock variables are both sourced from the PWT and defined as "Capital stock at current PPPs (in mil. 2005 US$)" and the "Number of persons engaged (in millions)", respectively. Capital stock may be inappropriate because of the high degree of mobility capital now experiences, the evidence of which is nicely summarised by Zodrow (2010). Labour stock may be inappropriate because it fails to capture the ratio of skilled to unskilled workers, as in Romalis (2004), who demonstrates that capital-abundance appears to be less important than skill-abundance in determining the pattern of specialisation. This idea is also not new: by incorporating the formation of human capital into a model of international trade, Findlay and Kierzkowski (1983) show that the capital–abundant country will export the skill–intensive good.

Generally, we find the determinants of the new regionalism to be akin to those of the old regionalism. One significant exception to this is RGDP, which was negative and significant under the old regionalism and positive and significant under the new regionalism. (DROWKL also changes sign from positive under the old regionalism to negative under the new regionalism, but is insignificant in both periods.)

2.6 Conclusions

Historically, PTAs formed within regions or continents and were thus considered "geographically discriminatory". However, a defining characteristic of the latest wave of integration has been an increase in the bilateral distance between country-pairs forming PTAs, and a concomitant rise in inter-continental PTAs. This development in recent decades is due to prospects of agreements within regions/continents already being exhausted; and because PTAs are now being employed as tools to overcome regional constraints and open new trade

opportunities. These features suggest that the economic determinants of PTAs are evolving and, believing that this may be the case, we set out to investigate the notion.

We begin by revisiting Baier and Bergstrand (2004), who are the first to empirically analyse the economic determinants of PTAs, and whose theoretical work informs our model's specification. Our panel data consists of 106 countries for the years 1960 to 2011, divided into two sub-samples, 1960–1996 (the old regionalism) and 1997–2011 (the new regionalism). By running our model on the pooled sample (1960–2011), and on the two sub-samples, we find that both bilateral and multilateral distance remain significant determinants affecting the probability of pairs of countries forming PTAs – even though integration is progressively involving more distant countries. In fact, both bilateral and multilateral distance has a larger marginal effect under the new regionalism. Concerning the remaining determinants, our regression results underpin Baier and Bergstrand's (2004) findings, except for one obvious instance. We find that the probability of a PTA between two countries decreases, the larger is the difference in their capital-labour endowment ratios, and we believe this may due to the appropriateness of the measure.

One additional observation relates to the impact of economic size: RGDP is negative under the old regionalism and positive under the new regionalism, suggesting that a large combined economic size initially deterred countries from forming PTAs. Moreover, our standardised coefficients reveal that economic size, bilateral and multilateral distance are the most important economic factors determining new PTAs. For proximate countries, bilateral distance is the most important determinant, but as bilateral distance increases between countries, RGDP becomes the most important determinant. Since prospects of agreements within regions/continents are largely exhausted and that PTAs are now being employed as strategic tools, the rising importance of RGDP is not overly surprising. Additionally, as distance increases, two determinants start strongly acting against the probability of a PTA: the difference in the capital-labour endowment ratio, and the absolute difference between GDPs. Thus, when forming new and distant PTA agreements, the increase in the marginal impact of these two determinants suggests that strategic

actions by countries still consider comparative advantage and that, as this happens, multilateral distance becomes less important.

Although we standardise our coefficients and then vary income by one standard deviation, this approach only indirectly differentiates between developing and developed countries; as does including importer and exporter fixed effects. Therefore, as data becomes available for a wider sample of developing countries, more research should be conducted on the determinants of PTAs within developing nations. For example, from our model and analysis, we cannot directly say that South Africa and Nigeria should form a PTA (or sign the ACFTA) because the data is missing. Logical reasoning and deductions based on our results however, suggest that a PTA between the two largest economies in Africa makes sense given their proximity and size. This is true for any two countries *ij*: the probability of a PTA forming between the two is greater when bilateral distance falls, they are on the same continent and distant from the RoW, and the larger is the sum of their GDPs.

Considering that our model accurately predicts 94% of the PTAs found in 2011, we conclude that the economic determinants have not changed over time and that the determinants remain relevant even for country-pairs engaged in 21st Century Regionalism. Therefore, for countries acting strategically, trying to overcome regional constraints and open new trade opportunities, the 'death of distance' is a fallacy and the economic determinants of the gravity model still matter.

CHAPTER 3: THE INFLUENCE OF ECONOMIC INTEGRATION ON TRADE COSTS: 1995–2012

3.1 Introduction

High trade costs can effectively isolate countries from the rest of the world, and thereby trade costs hold the potential to influence the trajectory of a country's economic development (OECD/WTO, 2015). Isolation from the rest of the world can effectively occur because trade costs are the set of factors (frictions) that drive a wedge between export and import prices, including all expenses incurred in getting a good to a final user (other than the marginal cost of producing the good itself). Trade costs thus include both domestic and international trade costs because it is illogical to exclude trade costs once goods have crossed a border (Anderson & Van Wincoop, 2004 and Arvis et al., 2013). As a set of factors, trade costs incorporate aspects related to both trade policy and non-trade policy. For example, tariff and non-tariff policy barriers, as well as quotas (trade policy), and costs associated with: customs procedures, such as simplifying and harmonising documents or automating processes; shipping; information and contract enforcement; use of foreign currencies; legal and regulatory issues; and local distribution (wholesale and retail) (non-trade policy), constitute the cost of trade.[47]

Being so comprehensive and having the potential to influence economic development, trade costs are a major consideration when formulating trade policy; especially for a country seeking to participate competitively within an expanding international market. Traditionally, this importance was reflected in trade agreements by having the removal of tariffs and quotas as a core feature. However, with growing recognition that the cost of trade is a far broader concept than just tariffs alone, members within preferential trade agreements (PTAs) are increasingly cooperating in several other non-trade policy channels to reduce overall bilateral trade costs.

[47] Anderson and Van Wincoop (2004) refer to the non-trade policy factors as the 'environment'.

Therefore, while agreements initially have a big effect in trade policy channels, the long-term effect of PTAs may be in non-trade policy channels.

Even those believing that trade agreements are as likely to cause harm as they are to cause good, cannot refute that integration lowers trade costs (Moïsé & Sorescu, 2013; World Trade Organization, 2013; Krugman, 1991b and Melitz & Ottaviano, 2008). For example, prior research by Arvis, Duval, Shepherd & Utoktham (2013) and Arvis, Duval, Shepherd, Utoktham & Raj (2015) demonstrates that economic integration lowers trade costs, to such a degree that countries in a trade agreement exhibit costs around 15% lower than those that are not. Despite this 15% reduction however, overall trade costs remain high – even between apparently highly integrated economies (Anderson & Van Wincoop, 2004; Snorrason, 2012 and OECD/WTO, 2015). Since most PTAs have contributed little to reducing trade costs, especially among developing countries (The International Bank for Reconstruction and Development [The IBRD], 2005), we conduct an empirical study of this relationship using trade costs data from the World Bank, as computed by Novy (2013).

Empirical research on the association between PTAs and trade costs generally quantifies the relationship by including a single PTA dummy as an explanatory variable. By construction however, such a dummy captures a homogenous effect across all country-pairs in the sample, which is not very convincing given the inherent heterogeneity of countries, and of trade agreements (Vicard, 2008 and Piermartini & Yotov, 2016). Therefore, we develop three hypotheses that incorporate different dimensions of economic integration to help capture heterogenous effects: for 180 countries over 1995–2012, we thus quantify the effects of (*Hypothesis 1*) forming agreements; (*Hypothesis 2*) deepening the level of integration; and of (*Hypothesis 3*) staying in an agreement. *Hypothesis 1* is analogous to previous research, relying on a single PTA dummy. To help capture the heterogeneity of agreements under *Hypothesis 2*, we go one step further and rather than including a single PTA variable, include individual dummy variables for free trade agreements (FTA), customs unions

(CU), common markets (CM) and economic unions (EcU).[48] Lastly, under *Hypothesis 3*, we capture the long-term effects of PTAs via duration variables for FTAs, CUs, CMs, and EcUs. Additionally, we explore issues of heterogeneity relating to the level of development and geographic location under each hypothesis. We focus on the developing world however, because trade costs are much higher for developing countries than they are for developed (Arvis et al., 2015).

By running our model on (up to) 183,312 observations for 10,184 trade pairs among 180 countries, we find trade cost reductions comparable to those of Arvis et al. (2013) and Arvis et al. (2015). We find under *Hypothesis 1* that forming a PTA lowers trade costs by 15.35%; under *Hypothesis 2*, forming an FTA lowers trade costs by 12.14%, and increasing the level of integration from an FTA to a CU, CM and EcU respectively, results in additional trade cost reductions of 7.03%, 10.06% and 5.84%. Under *Hypothesis 3*, we find that staying in an FTA, CU, CM, and EcU results in trade cost reductions of 56.28%, 70.24%, 27.44%, and 24.44% respectively.[49] Since Novy's (2013) trade costs represent the ratio of international trade costs to domestic trade costs, these percentage reductions imply that once integrated, countries sell relatively more of their production to foreigners than to residents (holding all else constant). Therefore, while we find significant reductions in trade costs under all hypotheses, the most significant reductions (and the largest relative change in international versus domestic sales) arise from staying in an agreement, particularly FTAs and CUs.

The remainder of the paper is structured as follows. Next, we explain how trade costs are derived and why they matter. We also look at the different drivers of trade costs, one of which is economic integration. In sub-section 3.3, we provide analysis of our data and develop our hypotheses. We explain our estimation method

[48] We choose to include and model these four levels of integration because they are reciprocal forms of agreements, reflecting the calculation behind trade costs, and because they align with previous research. Economic Union abbreviated as EcU to distinguish it from the European Union (EU).

[49] To obtain the percentage reductions in trade costs, we calculate the ratio of 'EoT before' to 'EoT after', invert this ratio and then convert to percentages. EoT (ease of trade) is the inverse of trade costs.

in sub-section 3.4, and identify our preferred specifications. Finally, we provide our regression results in sub-section 3.5 and conclude in sub-section 3.6.

3.2 Trade costs and economic integration

Recent work by Grossman (2017), investigates the question: Why might a government be willing to compromise its sovereignty through trade agreements? His answer, quite simply, is: interdependence. Trade agreements are a formal expression of inter-governmental cooperation and through them, governments relinquish their sovereign rights to choose their own trade (and other) policies in exchange for similar concessions by others. Since governments have an interest in the choices made by its trading partners, trade agreements help governments to consider the impact of their actions on interests abroad (internalising the externalities). Countries might also see trade agreements as commitment devices, a means to resist the temptation to give in to local special interests that advocate polices inimical to the general good.[50]

As a formal expression of cooperation, trade agreements have important economic implications for participating and non-participating nations (Baldwin & Venables, 2004). One such implication is the effect on trade costs, which remain high even between apparently highly integrated economies and, consequently, by hindering a country's ability to participate in international trade, have significant welfare implications (Anderson & Van Wincoop, 2004 and Snorrason, 2012).

3.2.1 Why trade costs matter and how they are derived

Additional to the set of factors (frictions) driving a wedge between export and import prices, trade costs include both domestic and international trade costs because it is illogical to exclude trade costs once goods have crossed a border

[50] Pre-commitment is desirable when a policy that the government regards as beneficial before the private sector takes some irreversible (or costly to reverse) action, is no longer so afterwards. There are several examples of economic environments where the trade policy that is optimal *ex ante* is no longer so *ex-post* and this situation creates a "time-inconsistency" problem (Grossman, 2017).

(Anderson & Van Wincoop, 2004 and Arvis et al., 2013). These costs of trade are reported as an index, in *ad valorem* equivalent terms, for each bilateral country-pair. The costs are bilateral in the sense of being an average of trade costs from Country A to Country B; and from Country B to Country A.

The index, computed using Novy's (2013) inverse gravity framework, is expressed as a function of observables (trade and production) and is simply the ratio of international trade costs to domestic trade costs.[51] Novy's methodology captures the idea that, holding all else constant, international trade costs must have increased, relative to domestic trade costs when a country sells relatively more goods to its own residents than to foreigners. Conversely and again holding other factors constant, international trade costs must have decreased, relative to domestic trade costs if a country sells relatively more of its production to foreigners than to residents. Trade costs are thus the price equivalent of the reduction in international trade, compared with the implied potential of domestic production and consumption in the origin and destination markets. Therefore, higher bilateral trade costs result in smaller bilateral trade flows (Arvis et al., 2013 and OECD/WTO, 2015).

A substantial body of research highlights the negative impact of trade costs on economic welfare and development. Consequently, trade costs matter because they "*exert a strong influence on trade flows; on who trades what and with whom; on where products are made and services traded; and on the goods and services available to consumers and the prices they pay for them. Trade costs interact with economic fundamentals like technology and factor endowments (labour and capital) to produce the pattern of trade and production we observe around the world. As such, they have a great potential to influence the trajectory of a country's economic development.*" (OECD/WTO, 2015, p. 36).

The OECD/WTO (2015) provides a great more detail regarding the importance of trade costs, as do Anderson and Van Wincoop (2004), but perhaps the most

[51] Trade is bilateral and production data is the gross national output.

important detail is on the significant welfare implications of trade costs already mentioned, resulting from the interaction of trade costs with comparative advantage. Trade costs affect production and consumption decisions of all economic agents; therefore, when confronted with trade costs that are high, countries can be effectively isolated from the rest of the world. For individuals in such countries, who often live in extreme poverty, high prices disproportionately impact on their consumer welfare. For this reason, lower trade costs are typically associated with net poverty reductions even though the distributional impact of trade costs differs across countries (OECD/WTO, 2015 and Hoekman & Shepherd, 2015).

The most common way of modelling trade flows between countries begins with the basic gravity equation, a simple technique that predicts trade on a bilateral basis between any two countries. The name (gravity equation) derives from the similarity to Newton's universal law of gravity, with the attraction (trade) depending directly on mass (economic size) and inversely on distance (a proxy for trade costs) (Hannan, 2016 and OECD/WTO, 2015). When considering two countries, *i* and *j*, we have four gravity models, expressed in equations [3.1] and [3.2] for intra- and international trade respectively (see Arvis et al., 2015).

$$X_{ii} = \frac{Y_i E_i}{Y}\left(\frac{\tau_{ii}}{\Pi_i P_i}\right)^{1-\sigma} \quad (3.1a) \qquad \text{and} \qquad X_{jj} = \frac{Y_j E_j}{Y}\left(\frac{\tau_{jj}}{\Pi_j P_j}\right)^{1-\sigma} \quad (3.1b)$$

$$X_{ij} = \frac{Y_i E_j}{Y}\left(\frac{\tau_{ij}}{\Pi_i P_j}\right)^{1-\sigma} \quad (3.2a) \qquad \text{and} \qquad X_{ji} = \frac{Y_j E_i}{Y}\left(\frac{\tau_{ji}}{\Pi_j P_i}\right)^{1-\sigma} \quad (3.2b)$$

where X represents trade between two countries (*i* to *j* or *j* to *i*) or within countries (goods produced and sold in *i* or in *j*); within a country, Y and E represent total production and total expenditure respectively; τ represents "iceberg" trade costs; σ is the intra-sectoral elasticity of substitution (among varieties within a sector) and Π and P represent multilateral resistance (Arvis et al., 2015).

By eliminating the multilateral resistance terms through multiplying [3.1a] by [3.1b], and [3.2a] by [3.2b], we get:

$$X_{ii}X_{jj} = \frac{Y_i E_i}{Y}\frac{Y_j E_j}{Y}\left(\frac{\tau_{ii}\tau_{jj}}{\Pi_i P_i \Pi_j P_j}\right)^{1-\sigma} \quad (3.3)$$

and

$$X_{ij}X_{ji} = \frac{Y_i E_j}{Y}\frac{Y_j E_i}{Y}\left(\frac{\tau_{ij}\tau_{ji}}{\Pi_i P_j \Pi_j P_i}\right)^{1-\sigma} \quad (3.4)$$

Finally, by dividing [3.4] by [3.3], taking the geometric average of trade costs in both directions and converting to an *ad valorem* equivalent by subtracting unity, we get:

$$t_{ij} = t_{ji} = \left(\frac{\tau_{ij}\tau_{ji}}{\tau_{ii}\tau_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}\right)^{\frac{1}{2(\sigma-1)}} - 1 \quad (3.5)$$

This measure of trade costs represents the geometric average of trade costs in both directions, i.e. those facing exports from country *i* to *j* and those facing exports from country *j* to *i*. Between countries *i* and *j*, t_{ij} thus captures international relative to domestic trade costs within each country. Intuitively, trade costs are higher when countries tend to trade domestically, rather than internationally, i.e., as $\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}$ increases. When this ratio falls and countries trade more internationally than domestically, international trade costs must be falling relative to domestic trade costs. Country-pairs that do not trade at all record infinite trade costs, since these are derived from a ratio that includes trade flows in the denominator. Furthermore, t_{ij} is a useful summary indicator of the overall level of trade costs between *i* and *j*; and since its derivation follows a "top down" approach, it includes all factors (observable and unobservable) that contribute to the standard definition of iceberg trade costs in trade models (Arvis et al., 2015).

For reasons discussed in Arvis et al. (2015), the one caveat about the structure of t_{ij} means we must cautiously interpret the measure. t_{ij} is not immune from price (unit value) effects because of the approach taken to calculate trade costs and net out price changes, i.e., the procedure that removes the two multilateral resistance terms from the model. The price indices represent the appropriate "deflators" for GDP and trade values and therefore, in practice, trade values may change at a different rate from output values, particularly if only relatively high-quality goods are traded. Changes in t_{ij} may thus conflate unit price and volume effects.

Ultimately, the data captures costs that make it harder to trade goods between countries (rather than inside). With symmetrical trade costs, moving a product from Japan to the United States equals exactly the cost of moving the product from the United States to Japan, and so forth, and because of this, every pair of countries' bilateral trade will be balanced. Thus, while the assumption of symmetric trade costs is not realistic, the World Bank's trade cost data derived using Novy's (2013) inverse gravity framework is the most comprehensive data source. Moreover, this comprehensive measure of trade costs captures not only international transport costs and tariffs, but also a wider range of frictions that can be difficult to observe such as language barriers, informational-costs and bureaucratic red tape. Furthermore, Novy's approach has a strong theoretical foundation, with the indirectly inferred trade costs shown to be consistent with a large variety of international trade models.[52] Novy's measure, moreover, is not subject to the usual problems that plague econometric estimates, such as omitted variable bias or endogeneity bias, because it is based on mathematical operations (Moïsé & Sorescu, 2013; Novy, 2013; Arvis et al., 2013 and Arvis et al., 2015).

3.2.2 The evolution of trade costs and integration defined

To provide context to the above, we next provide some summary statistics for trade costs, explore how trade costs have changed over time and finally, review the differences in trade costs for developed and developing countries. Before we discuss the data however, we define integration and the different forms of trade agreements.

As explained in Chapter 2, economic integration is a process and a state of affairs. When regarded as a process, it encompasses measures designed to abolish discrimination between economic units belonging to different national states and when regarded as a state of affairs, it can be represented by the absence of various forms of discrimination between national economies. Quintessentially, the process of

[52] Novy specifically mentions Anderson and Van Wincoop (2003), Eaton and Kortum (2002), Chaney (2008) and Melitz and Ottaviano (2008).

economic integration comprises measures that entail the suppression of some forms of discrimination between the members of the integration agreement. Therefore, international agreements on trade policies belong to the area of international cooperation, while the removal of trade barriers is an act of economic integration (Balassa, 1961).

Trade agreements can take different forms; the data represents these as: No agreement; FTA; CU; CM; and EcU. We choose to analyse and model these four reciprocal levels of integration because they reflect the bilateral average of trade costs, and because they align with previous research.[53] We define the reciprocal levels of agreements in Table 3.1, below.

Table 3.1: Descriptions of the reciprocal levels of integration

Level of integration	Definition
FTA	Trade barriers (substantially) eliminated among members; treat non-members differently.
CU	Same as FTA; but treat non-members the same.
CM	Same as CU; but also includes free movement of labour/capital.
EcU	Same as CM, but with monetary and Fiscal Policy coordination; further harmonisation of taxes, regulations and the monetary system.

Source: Baier and Bergstrand (2015).

An FTA (substantially) eliminates all trade barriers among members and non-members are treated differently. The implication is that all tariffs and quotas on all products, among all members, are eliminated. The most common example of an FTA is that of the North American FTA (NAFTA), in which all tariffs among America, Canada and Mexico have been removed. When first implemented in 1994, the agreement immediately lifted tariffs on most goods produced by the three countries and over the next 15 years, eliminated the remaining barriers to cross-border investment and to the movement of goods and services between the members (the last remaining

[53] Data is also available for non-reciprocal Preferential Trade Agreements and Preferential Trade Agreements.

tariffs were removed on 1 January 2008) (Bergstrand & Baier, 2015 and NAFTA Now, 2012).

A CU is the same as an FTA in the sense that all trade barriers are eliminated among members and non-members are treated the same, in that they face a common external tariff (CET) for their exports to enter the union. That is, members enter an FTA and apply a CET schedule to imports from non-members (Bergstrand & Baier, 2015 and Andriamananjara, 2011). The Southern African Customs Union was established in 1910 and is the oldest example of a CU. A CM is the same as a CU but also includes the free movement of labour and/or capital, allowing goods, labour and capital to move around as freely among the members, as within a single country. The East Africa Community (EAC), comprised of Burundi, Kenya, Rwanda, Tanzania and Uganda, serves as an example of a Common Market within which all factors of production can move freely (East African Community, 2016). The EAC also highlights a problem with many African trade agreements: goods, labour and capital do not commonly move around as freely among the members, as within a single country because while these provisions are included in the agreements, the agreements are poorly implemented.

The final and highest degree of integration is an EcU, which is the same as a CM but includes monetary and fiscal policy coordination, as well as further harmonisation of taxes, regulations and the monetary system. The best example of this level of integration is the European Union (EU), consisting of 28 European countries (Baier & Bergstrand, 2015).[54]

To get an idea of the degree of movement between levels of integration, Table 3.2 presents a transition matrix of the changes from lower (higher) levels of integration to higher (lower) levels (read from the vertical to the horizontal). For example, movements from no agreement to FTA constitute the bulk of all upward

[54] Since the data terminates in 2012, we still consider the UK as part of the EU.

transitions (972); and from CU to no agreement, the bulk of all downward transitions (10).

Table 3.2: Transition matrix for pairs of countries moving between levels of integration

		To:				
		No agreement	**FTA**	**CU**	**CM**	**EcU**
From:	**No agreement**		972	127	22	12
	FTA	5		111	301	3
	CU	10	0		67	28
	CM	0	0	0		136
	EcU	0	0	0	0	

Notes: Read from the vertical to the horizontal, the matrix shows the changes in the levels of integration. For example, moving from 'no agreement' to FTA constitute the bulk of all upward transitions (972); and from CU to 'no agreement', the bulk of all downward transitions (10).

Next, we turn our attentions to the relationship between integration and trade costs. Trade costs can be substantial (Arvis et al., 2015 and Anderson & Van Wincoop, 2004), shown below in Table 3.3, which provides minimum, mean and maximum trade costs across the different levels of integration. Even at the highest levels of integration (CU, CM and EcU), mean trade costs are over 100%, despite tariffs in many countries falling to historical lows (Arvis et al., 2015). For the final user, the implication is that – on average – the cost of any imported good (the price in the foreign market) is essentially double the price of the good in the domestic market. Perhaps more concerning, is the maximum trade cost of the different levels of integration, at over 1,000 for FTAs. Even at higher levels of integration, maximum trade costs still surpass 400%.

Table 3.3: Summary statistics for trade costs across the different levels of integration (1995–2012)

Level of integration	**N**	**Min**	**Mean**	**Max**	**Std dev**
No agreement	77,092	3.84	304.74	1,746.57	152.80
FTA	10,214	3.34	161.24	1,003.57	91.92
CU	1,654	11.83	128.42	496.07	70.29
CM	2,986	2.95	102.14	401.37	46.33
EcU	1,411	0.83	105.91	603.45	62.22
Total	120,869	0.83	272.57	2,299.30	150.86

Notes: FTA – Free Trade Agreement; CU – Customs Union; CM – Common Market; and EcU – Economic Union.

Next, we review how trade costs have evolved over time. In addition to simply reviewing trade costs over the years, we review how trade costs change with duration. (*Duration* simply refers to the number of years spent within a specific level of integration.) Table 3.4 provides summary statistics for 1995, 2000, 2005, 2010 and 2012.

Table 3.4: Summary statistics for trade costs in 1995, 2000, 2005, 2010 and 2012

Year	N	Min	Mean	Max	Std dev
1995	3,125	29.03	230.87	719.12	112.06
2000	6,889	21.45	268.01	1367.03	138.99
2005	8,288	10.76	282.22	1505.48	156.32
2010	7,209	5.05	282.55	2299.30	166.67
2012	5,461	17.08	264.38	1509.90	158.26

We find that mean trade costs have typically increased over the years, starting at 231% in 1995 and rising to 282% in 2005/10. In contrast, Table 3.5 shows the behaviour of mean trade costs when the duration of being in an agreement (in years) increases. While our trade cost data is available from 1995 onwards, our integration data is available from 1950 onwards. Therefore, we calculate the duration measures commencing from 1950. This implies that, for long-standing agreements such as the EU, by the time we get to 1995, duration can already equal 40 years or more.

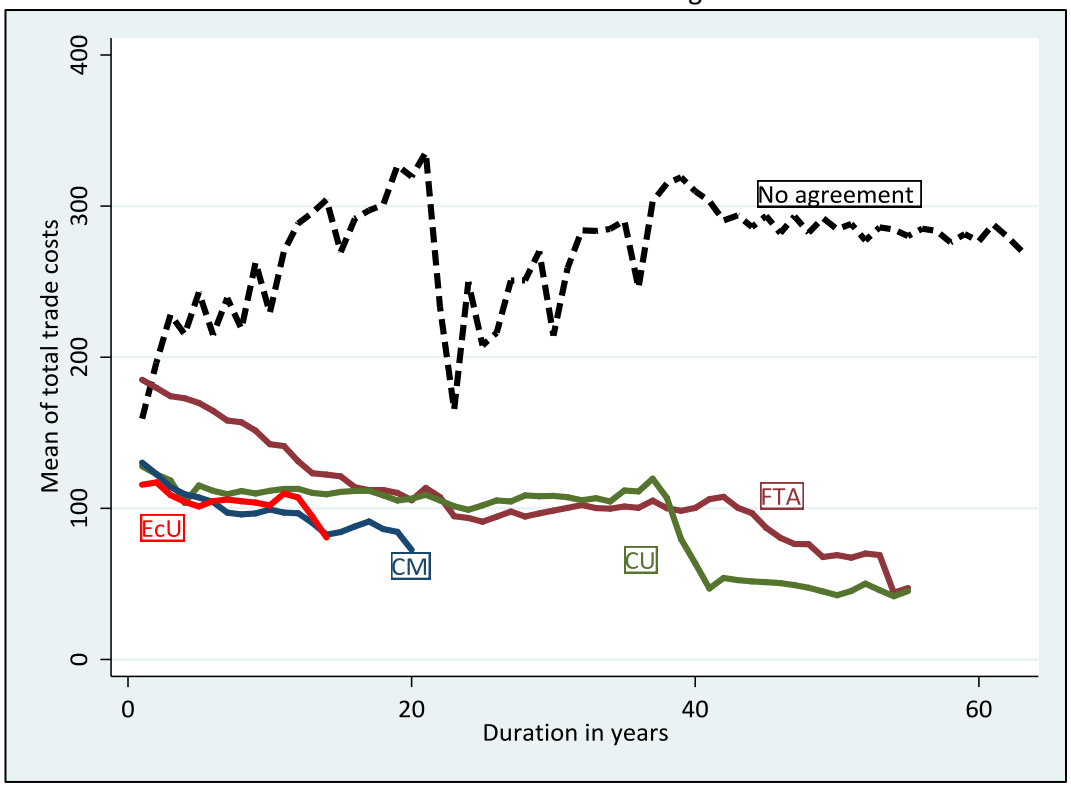
Table 3.5: Mean total trade costs over duration of being in a trade agreement, across the different levels of integration

	Duration (in years) of being in an agreement	1	5	10	14	20	30	40	50
No agreement	**Mean of total trade cost**	159.3	243.0	229.4	304.3	319.5	214.3	309.8	284.7
	Index (Year 1 = 100)	100	152	144	191	201	134	194	179
FTA	**Mean of total trade cost**	185.1	169.7	142.5	122.3	105.4	98.5	100.3	69.1
	Index (Year 1 = 100)	100	92	77	66	57	53	54	37
CU	**Mean of total trade cost**	127.8	115.1	111.6	109.3	106.4	108.2	63.7	42.5
	Index (Year 1 = 100)	100	90	87	86	83	85	50	33
CM	**Mean of total trade cost**	130.2	107.2	99.3	82.6	72.6			
	Index (Year 1 = 100)	100	82	76	63	56			
EcU	**Mean of total trade cost**	115.7	101.3	101.9	80.8				
	Index (Year 1 = 100)	100	88	88	70				

Notes: FTA – Free Trade Agreement; CU – Customs Union; CM – Common Market; and EcU – Economic Union. A duration of 14 years is presented, rather than 15 years, because the EcU duration data is only available for 14 years. The mean is unweighted.

In Table 3.5 (shown graphically in Figure 3.1), we clearly see that trade costs fall with duration/time – apart from when no agreement is in place. Furthermore, trade costs are at their highest one year into an agreement and lower at every point thereafter.[55] Across the different levels of integration, Figure 3.1 shows the mean total trade costs over duration of belonging to an agreement, and makes it clear that trade costs are generally lower for country-pairs with higher degrees of integration.

Figure 3.1: Mean total trade costs over duration of belonging to a trade agreement, across the different levels of integration



Notes: Integration data is available for 1950-2012, hence the duration of being in an agreement is calculated for this period, despite the trade cost data only being available for 1995-2012. The mean is unweighted.

From Figure 3.1, we note that trade costs for country-pairs without an agreement are not only erratic but they tend to increase for a period spanning approximately 20 years: while there is a sharp fall in costs after approximately 20 years, the tendency is for them to increase again for the next 20 years; but then to remain relatively constant between a duration of 40 and 60 years. For all the country-

[55] One year is used as the baseline because the move from 0 to 1 year does not account for the initial level of integration.

pairs with some form of agreement, trade costs are lower as the duration of an agreement increases.

We confirm in Table 3.6 and Figure 3.2 that trade costs in the developing world are significantly higher than for developed economies (Arvis et al., 2013). Table 3.6 provides summary statistics for trade costs by the level of development. Developed countries are those with a GDP per capita of $12,476 or above and we consider all others as developing. We use GDP per capita to make the distinction between developed and developing countries (rather than GNI per capita as in World Bank, 2017) because the GDP data is more complete and the two series are highly correlated.

Table 3.6: Summary statistics for trade costs by level of development for the period: 1995–2012

Trade costs by level of development	N	Min	Mean	Max	Std dev
Developed (*i* and *j*)	11,903	0.83	172.09	1,420.19	115.50
Developing (*i* and *j*)	50,825	2.95	312.07	2,299.30	161.54
Developed (*i*)-Developing (*j*)	29,600	7.57	261.74	1,509.90	136.85
Developing (*i*)-Developed (*j*)	28,541	3.34	255.38	1,505.48	132.36

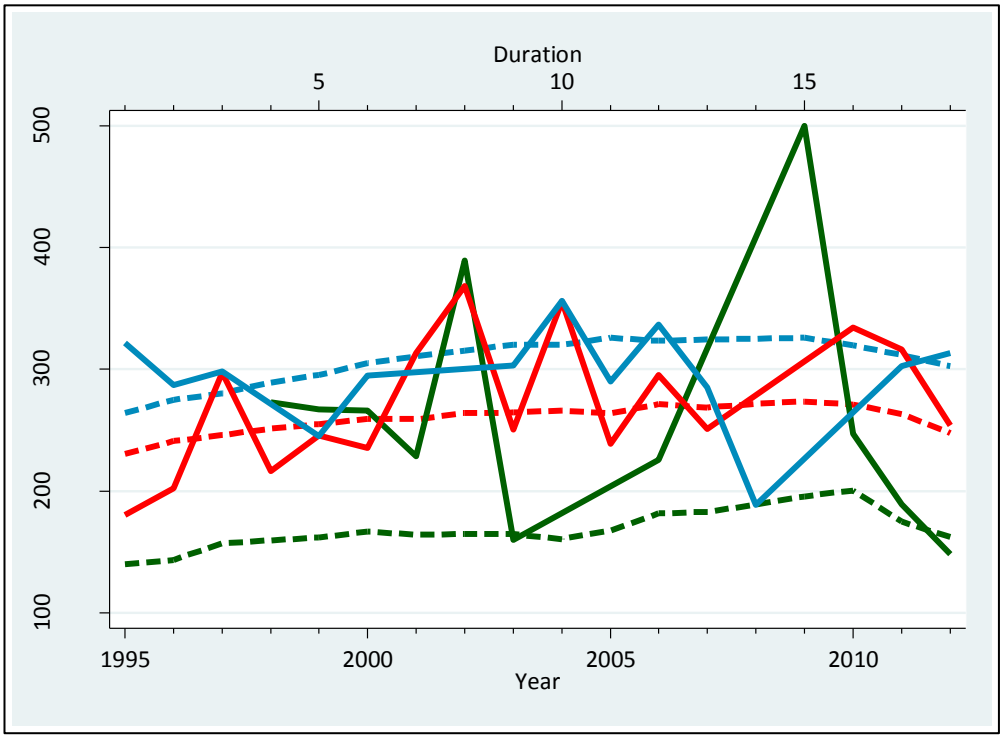
Notes: Developed countries are those with a GDP per capita of $12,476 or above; and we consider all others as developing. The difference between the number of country-pairs for Developed-Developing (29,600) and Developing-Developed (28,541) is because, using symmetrical trade cost data, we drop duplicate pairs of countries so that *ij* does not appear again as *ji*.

When both *i* and *j* are developed countries, the mean trade cost is 172%, which is substantially lower than the 262% faced by developing-developed country-pairs, or the 255% faced by developed-developing country-pairs. As in Arvis et al. (2013), mean trade costs among developing countries are higher still, at 312% – approximately 81% higher than among developed economies and 19% higher than when trade involves a developed country partner. The statistics for developed-developing and developing-developed country-pairs are similar because of the way trade costs are derived. Bear in mind that trade costs (t_{ij}) is the geometric average of trade costs in both directions, i.e. those facing exports from country *i* to *j* and those facing exports from country *j* to *i*, which further explains the similarity between the costs for developing-developed and developed-developing country-pairs. The

difference between the two series stems from the sample size: 29,600 for developed-developing country-pairs and 28,541 for developing-developed country-pairs is because, using symmetrical trade cost data, we drop duplicate pairs of countries so that *ij* does not appear again as *ji*.

Figure 3.2 demonstrates why we consider the changes in trade costs by duration, rather than over time. The dashed lines represent mean trade costs between developed (green), developing (blue) and developing-developed (red) country-pairs for 1995-2012 and, reflecting the data in Table 3.6, there is an evident increasing trend with little variation. Due to this increasing trend over time, we include the second set of solid lines, which show changes in trade costs as duration within-an-agreement increases. These solid lines present with significantly more variation.[56]

Figure 3.2: Mean trade costs by level of development over time (1995–2012) and duration

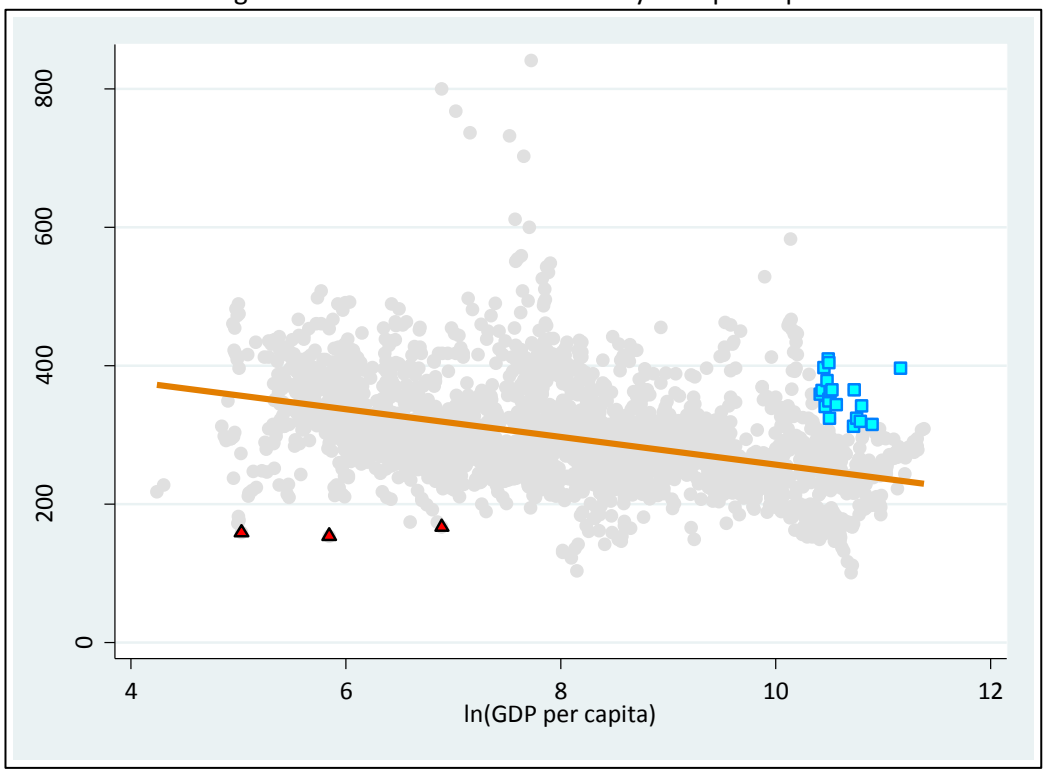


Notes: Blue = Developing; Red = Developed-Developing; Green = Developed. Dashed lines are mean trade costs by year; and solid lines, mean trade costs by duration. Due to the reciprocal calculation of trade costs, developing-developed is equivalent to developed-developing. The mean is unweighted.

[56] Duration is calculated within the sample so that we have the same number of observations on the "Duration" and "Year" axes.

Lastly, we present Figure 3.3, which shows mean trade costs against GDP per capita. While there are several factors contributing to trade costs, see Table 3.8, there is a clear inverse dependence between trade costs and per capita income: poorer countries tend to have much higher levels of trade costs than do richer countries (Arvis et al., 2013). There are, however, a few exceptions, highlighted in Figure 3.3 as red triangles for developing countries with mean trade costs lower than the mean for developed economies, and blue squares for developed countries with mean trade costs higher than the mean for developing economies. Developing countries with mean trade costs lower than the mean for developed economies include Burundi, Central African Republic, Zambia and Vietnam (these examples demonstrate that measurement error is highly probable in Africa). Developed countries with mean trade costs higher than the mean for developing economies include Australia, Iceland, Macao, Luxembourg and Singapore. The inclusion of Singapore on this list, although surprising, can be attributed to exports to Syria (2008-2010) and imports from several African and Central American countries.

Figure 3.3: Mean trade costs by GDP per capita



Notes: Triangles denote developing countries with mean trade costs lower than the mean for developed economies. Squares denote developed countries with mean trade costs higher than the mean for developing economies. The mean is unweighted.

To aid our subsequent regression analysis, we invert trade costs to form the Ease of Trade (EoT), or what Novy (2013, p. 3) calls the "freeness measure". The EoT captures the inverse of trade costs so that a high value corresponds to low trade barriers, and zero values correspond to infinitely high trade barriers. Table 3.7 presents a Top-10 list of the highest and lowest average EoTs for the period, 1995–2012. Keeping in mind Figure 3.3, we expect to find the EoT for developed countries higher, and for developing economies, lower; barring a few exceptions, this is indeed what we find. The mean EoT for our data is 0.004. Under sub-section 3.5, we discuss and motivate for the transformation of trade costs to the EoT but for the time being, continue analysing trade costs.

Table 3.7: Top 10 highest and lowest average EoTs (1995–2012)

	Highest average EoT			Lowest average EoT		
Rank	**Importer**	**Exporter**	**Mean EoT**	**Importer**	**Exporter**	**Mean EoT**
1	Netherlands	Germany	0.13268	Zimbabwe	Paraguay	0.00077
2	Netherlands	Belgium	0.08339	Romania	Myanmar (Burma)	0.00069
3	Hong Kong	China	0.06204	Norway	Myanmar (Burma)	0.00070
4	Lithuania	Estonia	0.04629	Tunisia	Armenia	0.00072
5	Russia	Estonia	0.04401	Sudan	Barbados	0.00073
6	Finland	Estonia	0.04100	Venezuela	Armenia	0.00077
7	Russia	Netherlands	0.03505	Tanzania	Dominican Republic	0.00077
8	UK	Ireland	0.03497	Kenya	Cuba	0.00080
9	UK	Netherlands	0.03448	Kyrgyzstan	Colombia	0.00080
10	USA	Canada	0.03392	Venezuela	Kuwait	0.00085

Notes: Mean EoT for our data is 0.004.

3.2.3 Economic integration as a driver of trade costs

No two countries face identical challenges (OECD/WTO, 2015) and trade costs are no exception, clearly varying by country, distance and level of development. Consequently, we review the work of Arvis et al. (2013) and Arvis et al. (2015), two papers focussing on the drivers of trade costs. Endogenous and exogenous factors, categorised into (a) 'bilateral factors of separation', and (b) 'factors specific to the origin or destination' drive trade costs, see Table 3.8. Between the exporter and importer, the bilateral factors of separation are those that are more dependent on

exogenous factors than policy choices; whereas the factors specific to the country of origin or destination, represent the “thickness” of their borders.

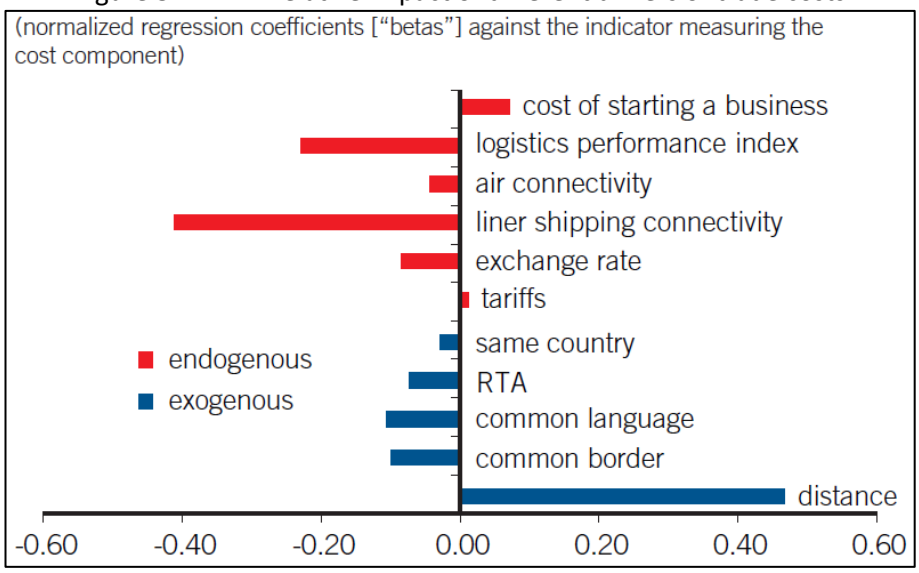
Table 3.8: Drivers of trade costs

Bilateral factors of separation	Factors specific to the origin or destination
• Geographical distance. • Transportation costs or the lead time associated with transportation. • Common language or history; sharing a border; or participation in the same economic community.	• Logistics performance and trade facilitation bottlenecks. • International connectivity, such as the existence of regular maritime, air or terrestrial services. • Tariffs. • Non-tariff measures.

Source: Arvis et al. (2013).

Trade costs from the bilateral factors of separation stem from the environment (transportation, insurance against various hazards and time costs, for example), whereas costs from the factors specific to the origin or destination stem from policy (usually tariffs and quotas) (Anderson & Van Wincoop, 2004). In Figure 3.4, we show the relative impact of different drivers on trade costs. Distance has the largest positive impact on trade costs, while shipping connectivity has the largest negative impact. Several papers explore the relationship between distance and trade costs by means of gravity models and find that trade volume declines steeply as distance increases, since distance induces transportation costs. Moreover, distance creates barriers to information and reduces the probability that a trade connection between two countries will take place. Unsurprisingly, physical separation has a major trade-reducing effect and so economic interactions remain local (Redding & Venables, 2002; Arvis et al., 2013 and Arvis et al., 2015).

Figure 3.4: Relative impact of different drivers of trade costs



Source: Arvis et al. (2013).

Among the environmental (or non-trade policy) factors, public investment in roads, ports and other transport infrastructure; and while facilitating the creation of business relationships, international migration networks relating to information, language and institutional barriers all reduce trade costs. Technology, too, is a major factor in explaining trade because it shapes comparative advantage and reduces trade costs (World Trade Organization, 2013). The policy areas that seem to have the greatest impact on trade costs are: the availability of trade-related information, the simplification and harmonisation of documents, the streamlining of procedures and the use of automated processes (Moïsé & Sorescu, 2013).

Integration affects trade costs via the environment and policy. Fundamentally, the formation of a trade agreement means that member countries apply lower tariffs; but they also cooperate on several other policy areas that reduce overall bilateral trade costs among members, beyond the removal of explicit trade barriers (Piermartini & Yotov, 2016). Even for those who listen to the trade creation/diversion arguments, and who believe that trade agreements are as likely to cause harm as they are to cause good, Krugman (1991b) highlights some often-missed potential gains, including ones that are mostly trade-diverting and that could affect the cost of trade. The first of these, is the reduction of consumption distortions that occur even while diverting trade; and the second, that due to the increase in size, both productive

efficiency and competitiveness of oligopolistic markets are subject to economies of scale.[57] The third and final gain, is found in the fact that integration characteristically improves the terms of trade for a region, at the expense of the rest of the world.

The negative impact of PTA (RTA in the figure) on trade costs is evident in Figure 3.4. However, not only does the PTA dummy variable fail to account for the different levels of integration and the inherent heterogeneity of such agreements (Vicard, 2008 and Hofmann, Osnago & Ruta, 2017)[58]; it cannot control for the fact that countries are themselves inherently heterogeneous, differing over time, levels of integration and levels of development. Further evidence of heterogeneity is highlighted in research released by the World Bank, showing that most trade agreements have contributed little to reducing the associated costs of trade, especially among developing countries (The IBRD, 2005). Even for fully integrated members, i.e., countries in an EcU, freight charges, time in transit and information costs (shipping costs) cannot be avoided (Redding & Venables, 2002) and this is probably why overall trade costs remain high (Arvis et al., 2015).

Given the inherent heterogeneity, previous research relies on a PTA dummy variable to its detriment: by construction, PTA captures a homogenous effect across all country-pairs in the sample. Such an indicator variable is informative but it cannot capture the fact that trade agreements differ throughout the world (Vicard, 2008 and Piermartini & Yotov, 2016). Therefore, rather than a single PTA indicator variable, our model distinguishes between different types of agreements: country-pairs thus have the choice to be in an FTA, CU, CM or EcU – rather than just a PTA.

Whether by means of policy and/or the environment, our data analysis has thus far demonstrated that not only does integration lower trade costs but that more highly integrated country-pairs face lower trade costs. We also demonstrated that

[57] Melitz and Ottaviano (2008) also demonstrate that larger, more integrated markets exhibit higher productivity and lower mark-ups.

[58] Not least because they differ in terms of what specific provisions they cover (Piermartini & Yotov, 2016). Only last year did Hofmann et al. (2017) release a database on the content of PTAs. The database covers all PTAs notified to the WTO and in force as of December 2015.

lower trade costs are expected for pairs that stay in the same level of integration for longer periods of time (cf. Table 3.5 and Figure 3.1 in both instances). Since there are different trade policy and non-trade policy channels through which integration lowers trade costs, we put forth three hypotheses related to the existence, depth and duration of agreements. The hypotheses are developed below and contextually discussed in the subsequent sections in which we note elements of the policy and non-trade policy (or environmental) factors.

3.3 Data analysis and development of hypotheses

In this section, we extend our data analysis to develop three separate hypotheses around trade agreements. We argue that (1) where trade agreements exist, there is a concomitant reduction in trade costs; and that such costs are influenced by (2) the depth of an agreement, as well as (3) the duration of an agreement.

3.3.1 Hypotheses 1 and 2: The existence and depth of a trade agreement lowers trade costs

Among the several reasons already discussed, we believe the signing of a trade agreement will reduce trade costs simply because the lowering of tariffs and quotas is a central feature. Moreover, such agreements can generate a mutual understanding of each other's problems and difficulties, which can thereby engender the sharing of best practice and positive experiences among members. While this exchange may be more relevant and better accepted among developing countries, when membership includes both developed and developing countries, there is scope for financial support and technical assistance for the less developed countries. Examples include the assistance provided to the African, Caribbean and Pacific (ACP) countries by the Euro-Mediterranean Initiative of the EU, where provisions are included for technical assistance in matters relating to customs. Similarly, Japan provides funding for

capacity-building initiatives in the Asia-Pacific Economic Cooperation member countries (The IBRD, 2005).

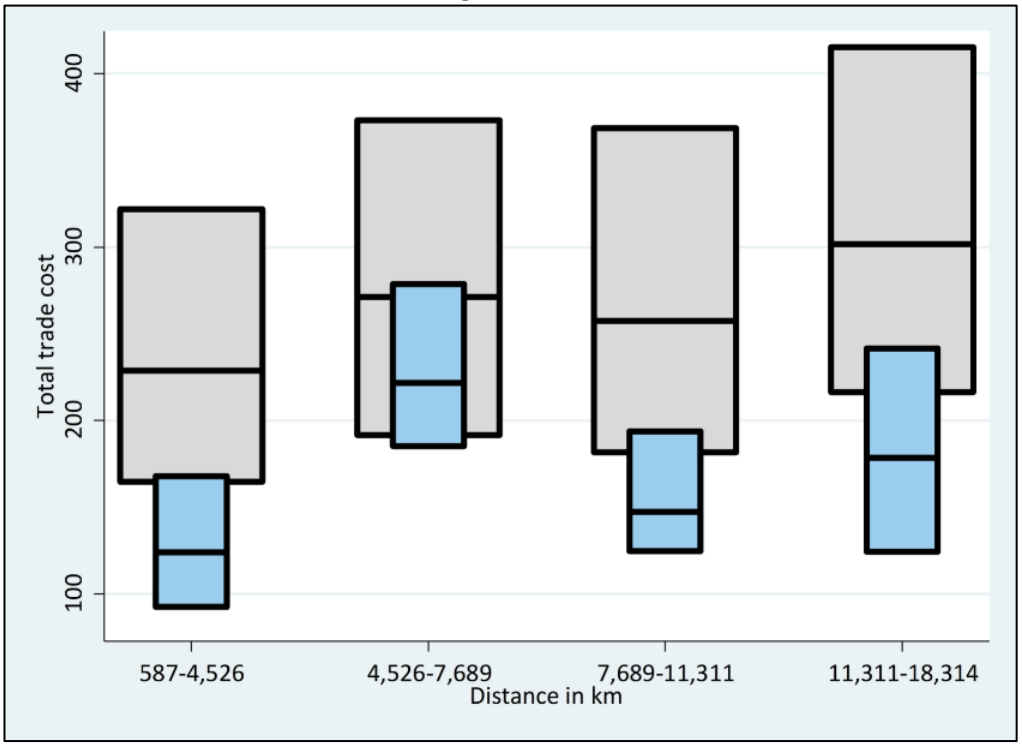
Furthermore, trade agreements can precipitate cooperation in lowering trade costs, since such agreements: raise the level of policy salience; spread information about members and international markets; improve the institutional efficiency of countries; provide "institutional homes" for joint initiatives; and may facilitate dispute resolution across multiple areas. Trade agreements can thus address institutional gaps and reinforce the corridor approaches that are common in agreements between developing countries. At the same time, agreements can provide a forum for the discussion and definition of norms and harmonised rules that are often necessary for effective implementation. Finally, negotiating transport issues in a regional forum, can help de-politicise issues; and the inherent cooperation with trading partners may, therefore, create the necessary momentum to overcome reluctance and opposition from domestic policymakers, customs officials and traders. Thereby, trade agreements create opportunities to lower trade costs in areas other than tariffs and non-tariff barriers (Schiff & Winters, 2002 and The IBRD, 2005).

Consequently, negotiating and concluding trade agreements may be an effective way of inducing reductions in bilateral trade costs among partners, and this is particularly true for country-pairs that have not formed an agreement. This is exactly what we see in Figure 3.5, which illustrates total trade costs by existence of a trade agreement, over four distance categories (chosen according to percentile ranges: 1-25; 25-50; 50-75 and 75-99). We find further support for this notion by Arvis et al. (2015); the existence of a trade agreement is equivalent to reducing bilateral distance by around 50%. Therefore, regardless of distance, the signing of a trade agreement between country-pair *ij* will lower trade costs for both parties. This brings us to Hypothesis 1.

Hypothesis 1: As compared to no agreement, trade costs will be lower for a pair of countries, *ij*, after the formation of a trade agreement between the two countries, ceteris paribus. In other words, the signing of an agreement between *i* and *j*, regardless of the degree of integration, will result in lower trade costs between *i* and *j*.

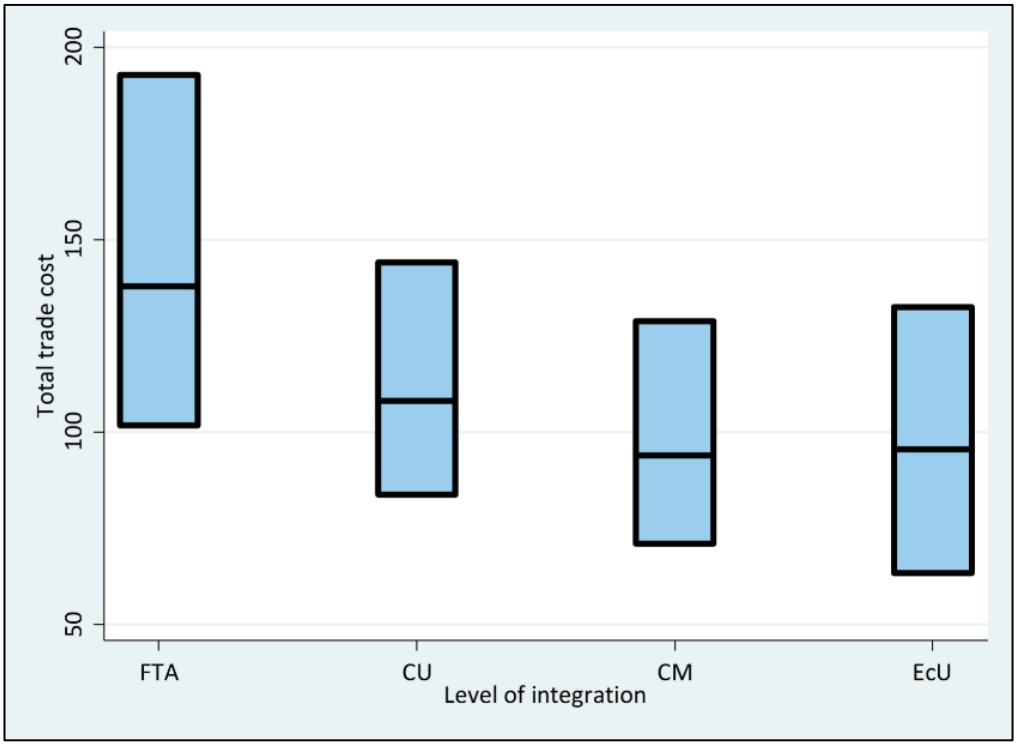
Country-pair *ij* should experience a (further) reduction in trade costs when the pair moves from an FTA to CU, CM and/or EcU because of the (additional) elimination of all trade barriers among members or the free movement of labour and/or capital. Therefore, while trade costs will be lowered through the obvious reductions in tariffs and quotas, additional reductions are as likely to accrue through the myriad of policy and environmental channels. Figure 3.6 thus decomposes the agreements series of Figure 3.5 into the constituent levels of integration: FTA, CU, CM and EcU. The figure clearly shows a downward trend in trade costs as we move from an FTA through to an EcU.

Figure 3.5: Box plot of total trade costs (1995–2012) by distance and existence of an agreement



Notes: Grey = 0 and blue = 1. Following previous work, 0 represents no agreements, and 1 represents FTAs, CUs, CMs and EcUs. The four distance categories represent the following percentile ranges: 1-25; 25-50; 50-75 and 75-99.

Figure 3.6: Box plot of trade costs (1995–2012) by reciprocal trade agreements



Notes: We decompose the "1" in Figure 3.5 into FTA, CU, CM and EcU.

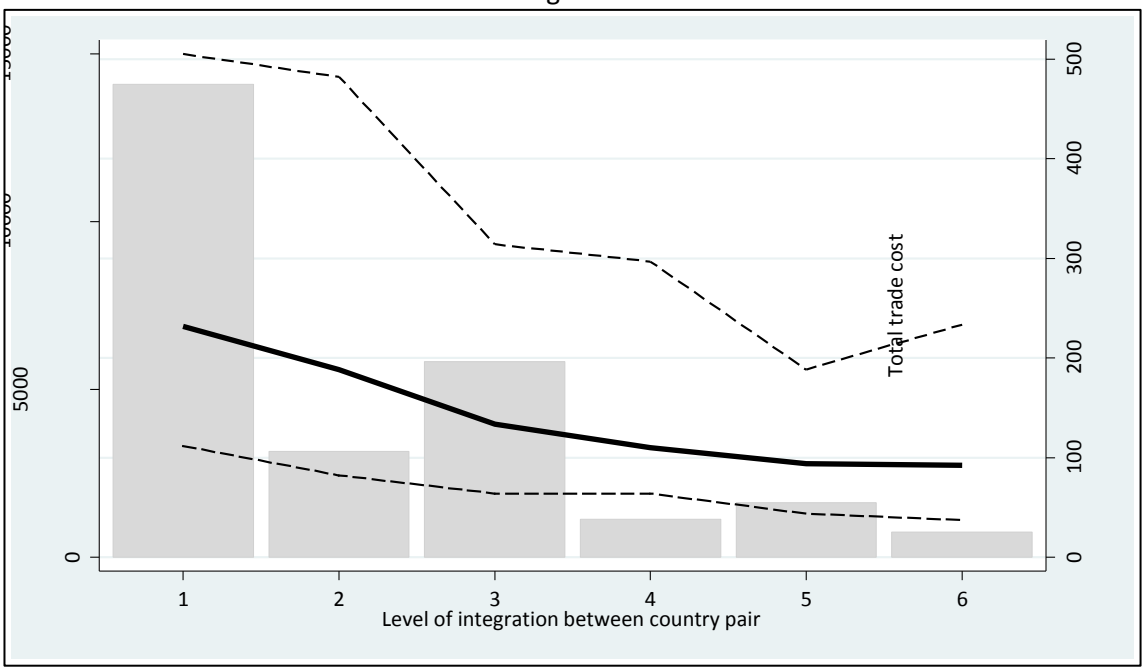
Trade costs might not always decrease as integration increases, owing to the assorted disciplines embedded in trade agreements. Policy frictions can be introduced and thereby increase the costs of trading. Each additional rule in a trade agreement represents a new policy for firms to consider in their export, outsourcing, and investment decisions; each also has legal, administrative and economic implications. Consequently, if countries operate on two or more agreement fronts simultaneously, differences in rules across trade agreements often translate into transaction costs. With nearly all World Trade Organization (WTO) members being party to at least one trade agreement, this is a growing concern. In some regions, such as Latin America for example, the average number of trade agreement memberships per country rises to more than half a dozen (Estevadoreal, Shearer & Suominen, 2009).

In Figure 3.7, we show declining total trade costs over all forms of trade agreements (here we include the non-reciprocal forms of integration as well). The grey bars represent the number of trade agreements by level of integration where: (1) is non-reciprocal preferential trade agreements (PTAs), which dominate the data;

(2) is preferential trade agreements; (3) is FTAs; (4) is CUs; (5) is CMs; and (6) is EcUs. The solid black line shows total trade costs (the dashed black line shows the 5th and 95th percentiles) and we clearly see a decreasing trend as we move from a non-reciprocal PTA to an EcU, leading us to Hypothesis 2.

Hypothesis 2: The higher the degree of integration between a pair of countries, *ij*, the lower will be their trade costs, ceteris paribus. Therefore, a vertical increase in the degree of integration, say from an FTA to a CU or from a CM to an EcU, will result in lower trade costs between *i* and *j*.

Figure 3.7: Total trade cost (1995–2012) alongside the number of observations by level of integration



Notes: The bars represent the number of observations (left hand side axis) and the lines represent the mean total trade costs (dashed lines are the 5th and 95th percentiles). The numbers represent: (1) non-reciprocal PTA, (2) PTA, (3) FTA, (4) CU (5) CM (6) EcU.

Owing to the varied disciplines in trade agreements, there is heterogeneity in terms of the tariff reduction trajectories for different agreements. For example, some agreements may use a linear trajectory whereas others employ a non-linear trajectory that often involves some back-loading, with larger reductions left to the latter part of the transition period (Estevadoreal et al., 2009). This implies that over and above the inherent heterogeneity of trade agreements, Hypothesis 1 might not

always hold and may, to some extent, be dependent on the number of agreements. Moreover, if a transition to a higher degree of integration introduces new rules and implications, Hypothesis 2 may not hold. Despite these caveats, Table 3.5 together with Figures 3.1, 3.5, 3.6 and 3.7, clearly show lower trade costs are associated with (1) the existence of an agreement, and (2) more highly integrated country-pairs.

3.3.2 Hypothesis 3: The duration of a trade agreement lowers trade costs

The ambiguities mentioned by Estevadoreal et al. (2009) aside, the General Agreement on Tariffs and Trade (GATT) Article XXIV, stipulates that the elimination of tariffs on "substantially all trade" must occur within a "reasonable length of time".[59] The general interpretation of Article XXIV, is liberalisation of 90% of tariff lines by year 10 into the agreement, with exceptions tolerated only in exceptional cases. That said, trade agreements do tend to converge in their extent of tariff liberalisation by the end of the first decade of operation, regardless of the measurement that is employed.

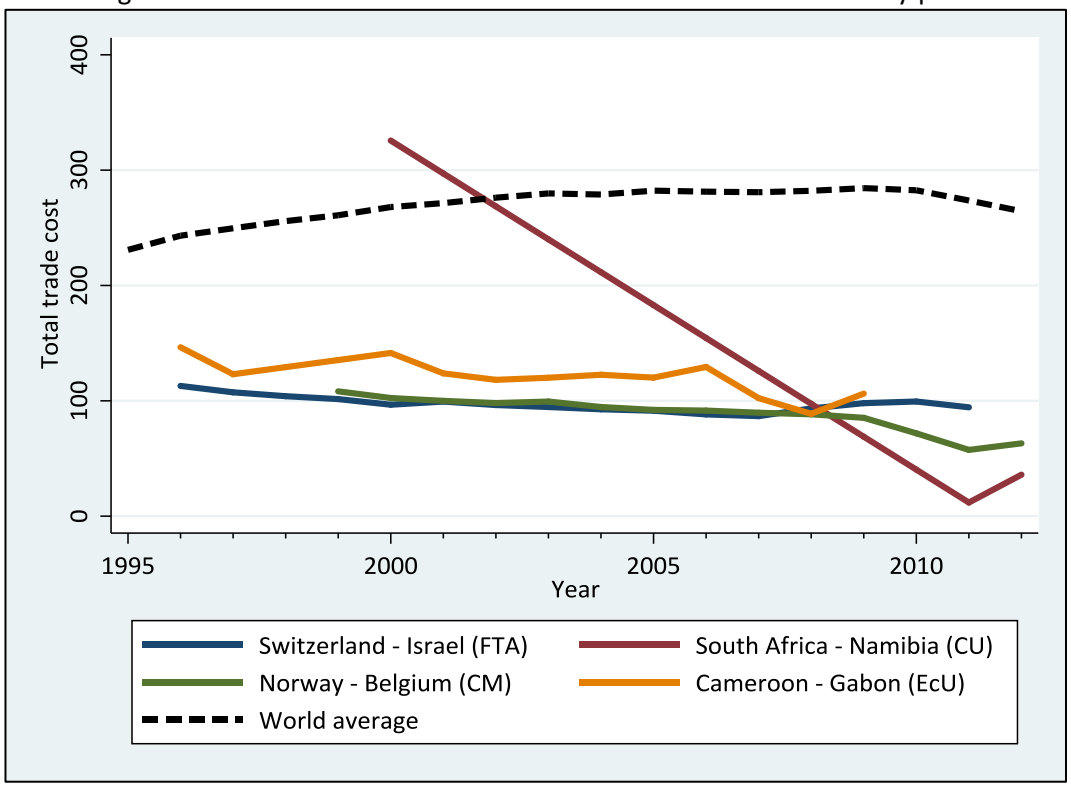
In Figure 3.8, we thus present examples of country-pairs that have been in a trade agreement for at least 10 years. The world average of total trade costs is provided as a reference point and is represented by the dashed line in the figure. Each country-pair represented in Figure 3.8 experienced a gradual decrease in trade costs for the period under review, the exception being our CU example of South Africa and Namibia. For this pair, there is clearly a linear downward trend between 2000 and 2011; and despite the slight increase in 2012, trade costs are still lower than in 2000.

For the SACU, further analysis reveals missing trade cost data between South Africa-Lesotho and between South Africa-Swaziland. The data for South Africa-Botswana is available but offers minimal insight into why there is such a sharp drop-off for South Africa-Namibia. Thus, without the data for Lesotho and Swaziland, it is hard to say with certainty that the substantial decrease in trade costs for South Africa-

[59] The 1979 Enabling Clause imposes less stringent requirements on trade agreements involving only developing countries; while such agreements are expected to carry out some lowering of barriers between the parties, they can stop short of complete tariff elimination (Estevadoreal et al., 2009).

Namibia is due to the CU. That said, trade costs between South Africa and several other trade partners (among them China, Brazil, Singapore, Australia, Germany, Rwanda, Nigeria, and Kenya) do not decrease linearly, and in the cases of Rwanda and Australia, trade costs have not substantially decreased at all. Therefore, while South Africa has experienced declining trade costs with several other partners, the linear decrease in trade costs with Namibia must be due to the two countries being members of the SACU.

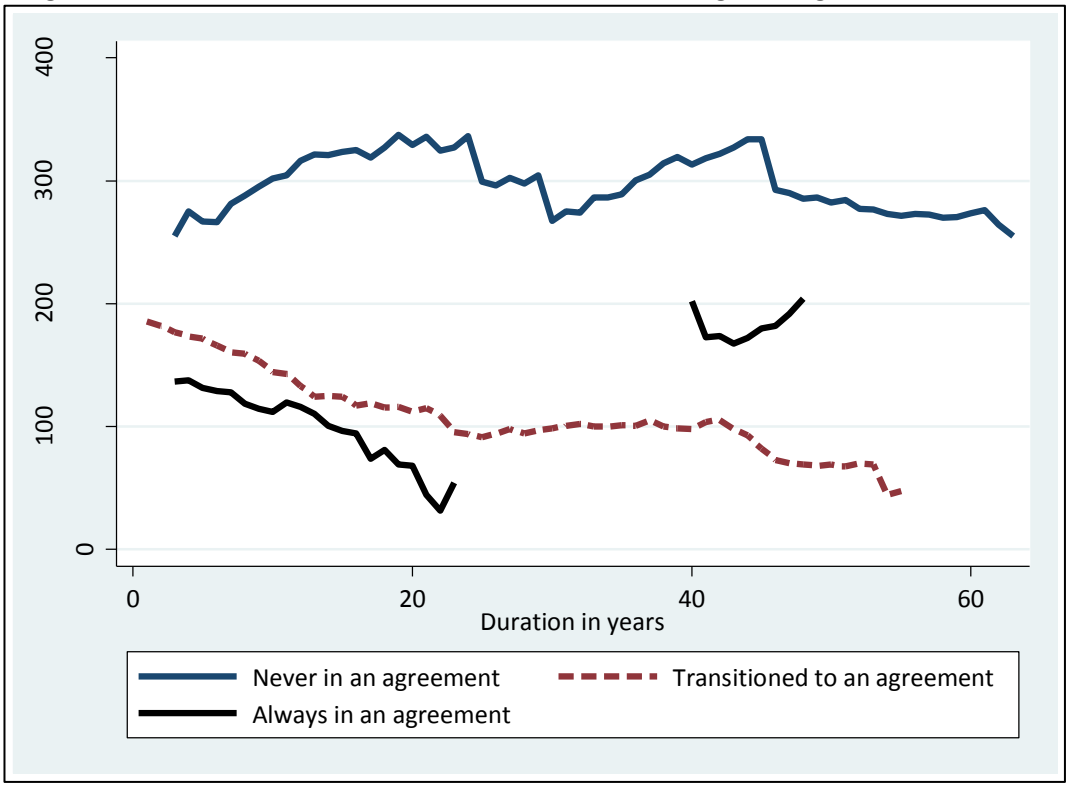
Figure 3.8: Total trade costs for 1995–2012 for selected country-pairs



In Figure 3.9, we show the behaviour of mean trade costs as the duration of (not) being in an agreement increases. The figure clearly shows that pairs without any trade agreement face higher trade costs and that these do not generally fall with time, reflecting what we saw in Figure 3.1. On the other hand, for country-pairs 'always in an agreement', there is a noticeable decline in trade costs between 3 and 23 years. Interestingly, for pairs that have been members to an agreement for 40 years or more, trade costs are remarkably high and do not fall with time. This U-shape in trade costs between a duration 40 and 48 years, reflects the costs of Egypt, Iraq and Syria with Yemen. While there are several other countries that have been in an agreement for

40+ years (Austria and Denmark, for example), the exclusion criteria mean these countries are dropped from the "Always in an agreement" series.

Figure 3.9: Mean total trade costs as duration of being in an agreement increases



Notes: As before, an agreement incorporates FTAs, CUs, CMs and EcUs. The mean is unweighted.

On the other hand, for country-pairs that formed an agreement, there is a clear and continuous downward trend in trade costs. This suggests that the duration of a trade agreement negatively affects trade costs, especially for those pairs that previously had no agreement (further supporting Hypothesis 1). Hypothesis 3 thus follows.

Hypothesis 3: For any two countries, *ij*, the longer the duration of being in a trade agreement, the lower will be their trade costs, ceteris paribus. Therefore, keeping the degree of integration constant, trade costs between *i* and *j* after 2 years will be higher than trade costs between *i* and *j* after 10 years.

Further supporting our notion that duration negatively affects trade costs, is the recent progress towards the implementation of the Trade Facilitation Agreement

(TFA). This was facilitated when WTO members adopted the Protocol of Amendment to insert the text into the WTO legal framework; and countries started to ratify the TFA. This is of relevance for developing countries and least developed countries who, on an individual basis, can group commitments into three categories to be notified to the Trade Facilitation Committee at the WTO. First, commitments to be implemented upon entry into force of the agreement; second, commitments to be implemented after a transitional period and third, commitments that can (or will) only occur after a transitional period and require the acquisition of implementation capacity through the provision of assistance and support for capacity building (Valensisi, Lisinge & Karingi, 2016).

The trade facilitation literature is appropriate within context, since most of the trade agreements notified to the WTO include commitments in such matters (United Nations, 2011) and trade facilitation is a policy factor now affecting the pattern of trade and production in the developing world (Arvis et al, 2015). Moreover, the OECD (2015a) finds that the implementation of the TFA could reduce worldwide trade costs by between 12.5% and 17.5%; and that countries implementing the TFA in full, will reduce their trade costs by between 1.4 and 3.9 percentage points more than those that do only the minimum that the TFA requires.

Hypothesis 3, therefore, seems more definitive. No matter what the tariff reduction trajectory, liberalisation of 90% of tariff lines by year 10 into the agreement seems to be the norm. Adding further support to this argument, the TFA commitments are now part and parcel of trade agreements and clearly time based. Therefore, trade costs should be noticeably lower 10 years after an agreement was first signed.

To summarise the three hypotheses and to put them into context, we use NAFTA to support our logic. We believe that (1) the implementation of NAFTA in 1994 meant a reduction in trade costs between America, Mexico and Canada; (2) should NAFTA's three members choose to form a CM, the three countries will again experience a reduction in trade costs; and (3) even if NAFTA does not transition to a

CM, the longer the three members stay in the agreement, the lower will be their trade costs.

3.4 Estimation method and preferred specifications

Being one of the most popular and successful frameworks in economics, the gravity model is often referred to as the workhorse in international trade with hundreds of papers using the model to study and quantify the effects of various determinants of international trade (Yotov, Piermartini, Monteiro & Larch, 2016). As international trade's workhorse, Piermartini and Yotov (2016) feel it pertinent to integrate the latest developments in the empirical gravity literature and to offer six recommendations to obtain reliable partial equilibrium estimates (their recommendations applying equally to analyses with aggregate and disaggregated data).

In order to obtain reliable estimates, we abide by Piermartini and Yotov's (2016) six best-practices, hence: (i) use panel data; (ii) allow for changes in trade costs by using interval data instead of consecutive years; (iii) use directional (exporter and importer) time-varying fixed effects; (iv) employ pair fixed effects; and (v) estimate gravity in multiplicative form, i.e., with the Poisson estimator. Piermartini and Yotov also recommend including intra-national trade flows as an explanatory variable, but this is not necessary in the present context because the trade costs data incorporates internal trade.

The basis for recommendation (ii) is that for econometric specifications with fixed effects, the dependent and independent variables cannot fully adjust in a single year's time when data are pooled over consecutive years (Cheng & Wall, 2005). To address this problem, we use 4-year interval data to allow for changes in bilateral trade costs in response to trade policy or other changes affecting trade costs (Piermartini & Yotov, 2016), hence, $EoT \in \{1996; 2000; 2004; 2008; 2012\}$.

However, this approach causes a substantial reduction in observations of changes within the levels of integration; and a concomitant loss in variation.

Consequently, we choose to run our regressions using consecutive annual data, and include results from the interval data as a robustness check in Appendix 3C. Under Hypothesis 1, the results obtained from using the annual data yields a smaller coefficient estimate for PTA than the estimate for PTA obtained by using the interval data. Therefore, we believe our approach of using consecutive annual data may underestimate the magnitude of the effect of trade agreements on trade costs.

3.4.1 Motivation for panel data, fixed effects and the Poisson estimator

Using panel data provides a few advantages over standard cross-section techniques. For example, by looking at the average treatment effect of an FTA between country-pairs, Baier and Bergstrand (2007) find that panel data estimates are five to six times larger than those obtained using ordinary least squares (OLS). Moreover, a panel data approach adjusts well for endogeneity and is consequently preferred by Head and Mayer (2014) and Anderson and Yotov (2016). Using panel data with origin and destination countries, however, necessitates using country-year dummies (Head & Mayer, 2014). Therefore, we include exporter-year, importer-year and pairwise fixed effects as part of our preferred specifications, as recommended by Head and Mayer (2014) and Piermartini and Yotov's (2016), who themselves, recommend using panel data.

Fixed effects control for any unobservable that contributes to shifting the overall level of trade costs (Head & Mayer, 2014). Fixed effects are also the easiest way of controlling for "multilateral resistance" and obtaining unbiased coefficient estimates (Moïsé & Sorescu, 2013).[60] The introduction of fixed effects, however, introduces a major restriction on the model: variables that vary only in the same

[60] Fixed effects models only estimate within effects, thus cannot suffer from heterogeneity bias (Bell & Jones, 2015).

dimension as the fixed effects cannot be included in the model, because they would be perfectly collinear with the fixed effects. For example, if we use fixed effects by importer, it is impossible to separately identify the impact of a variable like the importer's regulation in energy, transport and communications (ETCR) score, which is constant across all exporters for a given importer; it is subsumed into the fixed effects. It is only possible, therefore, to identify the effect of variables that vary bilaterally (Shepherd, 2013).

Furthermore, in the presence of country fixed effects, we can no longer identify a variety of potentially interesting trade determinants. These include anything that affects the propensity of an exporter to export to all destinations (such as being an island); variables that affect imports without regard to origin, such as average country-level applied tariffs; and sums, averages and differences in country-specific variables. If any one of these variables is added to a trade equation estimated with country-fixed effects, programs such as Stata will report meaningless estimates, since they are identified by dropping one or more of the country dummies. This is the case for size variables and country-level institutional variables (e.g. rule of law). Consequently, cross-section or pooled panel estimates are not reliable — even if they have country or country-year fixed effects. Thus, the best approach is to include pairwise fixed effects (Head & Mayer, 2014).

The inclusion of pairwise fixed effects is further supported by Cheng and Wall (2005) and Piermartini and Yotov (2016). Cheng and Wall test several approaches to specifying the fixed effects and they demonstrate that using a two-way fixed-effects model (including country-pair and period dummies) eliminates estimation bias and is preferred statistically to all other specifications. Piermartini and Yotov go a step further by recommending that pairwise fixed effects be added on top of the theoretically-motivated importer- and exporter-year fixed effects, which is the approach we adopt.

When studying static linear models, there are generally no problems when including fixed effects, since they can easily be differenced out to allow consistent

estimation of the relevant parameters. However, in the context of panel data, fixed effect models remove the higher-level variance and, by removing this higher-level variance, fixed effect models lose a large amount of important information: no inferences can be made about the higher-level variance, including whether it is significant, or not. As a result, it becomes impossible to measure the effects of time-invariant variables at all, because all degrees of freedom at the higher level have been consumed (Bell & Jones, 2015).

Furthermore, any parameter estimates for time-varying variables deal with only a small subsection of the variance in that variable. Consider time-invariant processes, which can have effects on time-varying variables and which are lost in the fixed effects model. Countries that do not change their political regime, or do not change their state of peace (which is most countries) are effectively removed from the sample (Bell & Jones, 2015). Therefore, despite Hornok (2011) warning that such a specification leaves too little variation in the data, fixed effects models are the "gold standard" (Bell & Jones, 2015, p. 139) and supported by numerous authors.

Several country-pairs do not trade, and hence no trade costs are recorded. These "zeros" are difficult to explain within the traditional gravity framework because, using a log-normal specification, the logarithm of the zero-valued trade flows is undefined. While exponential-regression models have no technical difficulty in dealing with zeros, the discrepancy between stylised facts and theory suggests the gravity model is incorrectly specified. Alternatively, zero trade could be a measurement issue, in that small, non-zero flows of trade show up as exact zeros in the data. Even if so, the assumption that such trade flows are missing at random is very difficult to support (Jochmans, 2015 and Burger, Van Oort & Linders, 2009).

According to Head and Mayer (2014), the high frequency of zeros calls for two things. First, models must be adjusted to accommodate zeros since they are an important feature of the data. Second, estimation methods must be revised to allow for consistent estimates in the presence of a dependent variable that takes on zeros frequently. A major drawback of OLS, therefore, is that it cannot consider the

information contained in the zero trade flows; owing to which, these observations are dropped from the estimation sample (Piermartini & Yotov, 2016). Although OLS cannot consider the information contained in the zero trade flows, which potentially leads to sample selection bias, the key concern is heteroskedasticity.

Trade data is plagued by heteroskedasticity and if the error term is heteroskedastic, which is highly probable in practice, then the expected value of the error term depends on the explanatory variable since it includes the variance term. This violates the first assumption of OLS and consequently, the estimates of the effects of trade costs are not only biased but also inconsistent when gravity is estimated in log-linear form with the OLS estimator (or any other estimator that requires non-linear transformation). The violation of the first assumption of OLS suggests the estimator may be biased and inconsistent. The presence of heteroskedasticity under the assumption of a multiplicative error term, and a means to comprehensively address it, requires the adoption of a completely different estimation methodology (Piermartini & Yotov, 2016 and Shepherd, 2013), which leads us to Poisson, our preferred estimation methodology.[61]

Poisson estimation overcomes the problems of dropping zero values and heteroskedasticity, and is consistent in the presence of fixed effects that are entered into the regression as dummy variables (like in OLS).[62] The latter is particularly important for gravity modelling because most theory consistent models require the inclusion of fixed effects by both exporter and importer. Furthermore, interpretation of the coefficients from the Poisson model is straightforward, and follows the same pattern as under OLS. Although the dependent variable for the Poisson regression is specified in levels, rather than in logarithms, the coefficients of any independent variables entered in levels are interpreted as semi-elasticities. If the independent

[61] Shepherd (2013) highlights that this kind of heteroskedasticity cannot be dealt with by simply applying a robust covariance matrix estimator, since it affects the parameter estimates in addition to the standard errors.
[62] Demonstrated by Santos Silva and Tenreyro in 2011 and 2006 respectively.

variables are entered in logarithms, these are interpreted as elasticities, as under OLS (Piermartini & Yotov, 2016 and Shepherd, 2013).

These desirable properties aside, using the Poisson estimator has an unintended consequence: it leads to a perfect fit between the fixed effects and their structural gravity counterparts (the multilateral resistance terms) (Fally, 2015). There is an additional issue, in that a fit that comes merely from size effects, cannot be interpreted as support for the theory. Trade must go somewhere; thus larger countries must export and import more as a matter of accounting identities, not theory (Head & Mayer, 2014). Despite this consequence, the Poisson estimator is a very attractive choice for empirical gravity analysis (Piermartini & Yotov, 2016) and considering it offers several advantages over OLS, such as handling the zero trade flows and heteroskedasticity, it is our preferred estimation method. OLS results are included as a robustness check.

3.4.2 Specifications to test Hypotheses 1, 2 and 3

A natural starting point for our analysis is the specification of Arvis et al. (2015). However, rather than considering several drivers of trade costs, we use a parsimonious specification which allows us to focus on the effects of trade agreements and avoids the imprecise measurement of many variables entering gravity-model specification (Egger & Pruša, 2016).[63] We take advantage of our panel structure and fixed effects to absorb the omitted drivers of trade costs.

To test Hypothesis 1 (Existence), our preferred specification is:

$$EoT_{ij,t} = b_0 + b_1 PTA_{ij,t} + u_{ij,t}, \text{ where } EoT_{ij,t} = \frac{1}{Trade\ costs_{ij,t}} \qquad (3.6)$$

[63] Distances between countries pertain to some arbitrary points in space which may coincide with origins and destinations of exports and imports or not; adjacency probably matters differently for country-pairs with longer or shorter borders; common official language could misrepresent the importance of the actual overlap of (native or non-native) speakers between two countries; and domestic as opposed to foreign trade costs might be mismeasured.

where EoT is the "Ease of Trade"/inverse of trade costs (we motivate for converting trade costs to the EoT in sub-section 3.5); PTA is a dummy variable equal to 1 if there is a regional trade agreement in force between the two countries; and u incorporates both the error term and/or fixed effects - when included. When running regressions with no fixed effects, $u_{ij,t}$ is simply equal to the error term $\epsilon_{ij,t}$; when we include country fixed effects, $u_{ij,t} = \alpha_i + \beta_j + u_{ij,t}$ and when we include pairwise fixed effects, $u_{ij,t} = \gamma_{ij} + u_{ij,t}$. When running our preferred specification, which includes importer-year, exporter-year and pairwise fixed effects, $u_{ij,t} = \gamma_{it} + \epsilon_{jt} + \omega_{ij} + \mu_{ij,t}$. Subscript *i*, *j* and *t* represent the exporter, importer and time respectively.

To test Hypothesis 2 (Depth), we replace the PTA dummy of equation [3.6] with "Integration" to help us control for the fact that not all trade agreements are equal. We test Hypothesis 2 using:

$$EoT_{ij,t} = b_0 + b_1 \boldsymbol{Integration}_{ij,t} + u_{ij,t} \quad (3.7a)$$

where the variables are as before except we now include Integration, which is a vector incorporating dummy variables for FTA, CU, CM and EcU respectively.

Equation (3.7b) differs to (3.7a) in that Integration becomes a categorical variable, in which 1 represents country-pairs in an FTA; 2 pairs in a CU; 3 pairs in a CM; and 4, pairs in an EcU. Since a non-monotonic relationship is likely (cf. Piermartini & Yotov, 2016) due to strong phasing-in effects of PTAs, we also add a quadratic Integration term to equation (7b):

$$EoT_{ij,t} = b_0 + b_1 Integration_{ij,t} + b_1 Integration^2_{ij,t} + u_{ij,t} \quad (3.7b)$$

We also consider "depth" with respect to membership in agreements, separating purely bilateral agreements from plurilateral agreements.[64] Our specification remains the same as for Hypothesis 1, except we run the specification on a bilateral and plurilateral sample.

[64] Pure bilateral agreements are those that constitute only two countries. Agreements such as those between the EU and any number of partner countries are considered plurilateral.

To test Hypothesis 3 (Duration), we add "Duration" to equation [3.6]. We test Hypothesis 3 using:

$$EoT_{ij,t} = b_0 + b_1 PTA_{ij,t} + b_2 \boldsymbol{Duration}_{ij,t} + u_{ij,t} \quad (3.8)$$

where the variables are as before except, alongside the PTA dummy, we include Duration, which is a vector capturing the duration (number of years) a country-pair spends in an FTA, CU, CM or EcU.

3.5 The dataset used in our regressions and the results

While we have integration data for 193 countries and for the 1950–2012 time horizon, our trade cost data is only available for 191 countries and for 1995–2012 (18 years) (World Bank, 2016a).[65] Using our integration data as the country base and the trade cost data to establish the period under review, we have a total of 667,008 observations $[(193 \times 192) \times 18 = 667{,}008]$. However, since the method of calculation of trade costs means costs from *i* to *j* are equivalent to those from *j* to *i*, we include only one measure for each country-pair and end up with 333,504 observations. Our panel is also not balanced, with 212,635 missing observations for trade costs because (a) the trade between bilateral pairs was not recorded (i.e., the data is missing), or (b) no trade occurred between bilateral pairs. Even when there is no trade occurring, trade costs remain relevant because they may be the very reason for countries not trading. Thus, with no changes to the data, least squares regression would drop the 212,635 missing observations and would consequently use a total of 120,869 observations for estimations.

To help alleviate this problem, we invert trade costs to form the EoT, which captures the inverse of trade costs. High EoT values thus correspond to low trade costs (Novy, 2013), and zero values correspond to infinitely high trade costs. This inversion enables us to replace some of the 212,635 missing observations with estimations, generated from one of three methods. Our first method replaces all missing EoT data with zeros, essentially assuming infinitely high trade costs. Without the inversion of

[65] The database has since been extended to include 208 countries, and cover the period to 2015.

trade costs, assigning infinite costs requires assigning an arbitrarily high number to the missing observations, and this is theoretically inconsistent.

The second method assumes trade costs are prohibitively high. To test this assumption, we replace EoT in the missing years with a cut-off assumed (time-invariantly) 5% lower than the lowest EoT observed within each individual country-pair.[66] Our final method follows Anderson and Yotov (2016), whereby we use estimated pair fixed effects to construct EoT. This method provides us with a balanced panel, but it also means our regressions are predominantly based on guesses: 212,635 EoT observations are predicted via fixed effects, whereas 120,869 are observed.

In contrast, the first two methods fill in fewer gaps with 'estimations', adding 30,672 and 62,443 observations respectively. The first method adds fewer observations because it replaces all missing values with zero, and a large portion of these are subsequently dropped from the regressions because they belong to groups with all zeros or missing values. This method also falsely assumes that trade costs are infinitely high, whereas they are simply prohibitively high. By adding non-zero values, our second method avoids creating all-zero groups and aligns better with our data: for some country-pairs within the 18-year time frame, we have missing values for only some of the years. If trade costs were infinitely high, trade would never occur. The more feasible assumption to make, and the one that more truly reflects the high trade barriers between countries, is to assume that trade costs are prohibitively high, as we do when employing the second method.

Since employing the second method also means most of our values remain observed (and not predicted), this is our preferred approach. Under the second method, we run regressions on 183,312 observations (120,869 + 62,443 = 183,312). Henceforth, we refer to the sample consisting of 120,869 observations as the 'raw data' and to the sample consisting of 183,312 observations as the 'modified data'.

[66] We explore a range of different cut-off points as well, from 1% through to 99%, see Appendix 3C.

Although we focus on the second technique in the text, we consider the robustness of our results using the other two methods in Appendix 3C.

3.5.1 Regression results: Testing Hypothesis 1 (Existence)

In Table 3.9, we provide the baseline Poisson regression results (implemented via the *ppml_panel_sg* command) for Hypothesis 1, in which EoT is regressed on PTA as in specification [3.6].[67] PTA is a dummy variable equal to unity if two countries are members of the same trade agreement, an agreement consisting of FTA, CU, CM and EcU, as previously explained. We present the results generated using both the raw data (column [1]), and the data modified to assume that the EoT is respectively (time-invariantly) 5%, 10% and 20% lower than the lowest EoT observed within the individual country-pair. Thus, the coefficient on PTA in column [1] differs noticeably from PTA in columns [2] – [4] but despite the different magnitudes, PTA remains positive and statistically significant. Throughout, we include *it* and *jt* – directional-time fixed effects, as well as *ij* – pairwise fixed effects.

Since the raw and modified data have different means and variances, we cannot directly compare the estimated coefficients.[68] Therefore, to establish whether the estimated coefficients of PTA differ significantly between the raw and modified data samples, we conduct a z-test, specified as in Clogg, Petkova, and Haritou (1995):

$$z = \frac{\beta_1 - \beta_2}{\sqrt{(se\ \beta_1)^2 + (se\ \beta_2)^2}} = \frac{0.046\text{-}0.033}{\sqrt{(0.006)^2 + (0.005)^2}} = 1.664$$

and probability, 0.048. Thus, we conclude that the two coefficients are significantly different. Since including the additional observations is significant, we continue using

[67] For OLS results, see Appendix 3C. Self-selection into agreements remains a concern for all if driven by a time variant factor not captured by our fixed effects. Since empirical models of trade are usually estimated with the gravity equation, specification [3.6] suggests that integration increases the EoT, but perhaps a higher EoT promotes integration. Alternatively, it is also possible that another factor, such as development, encourages integration and increases the EoT. If this is the case, the equation is misspecified, for integration will be correlated with the error term in the regression and OLS will, therefore, not provide consistent estimates. Instead, the OLS estimates will overstate the importance of integration and this bias may also bias the other coefficients in the equation (Cyrus, 2002).

[68] One also cannot directly compare the OLS and Poisson estimates. Using the z-test, with $b_1 = 0.00047$ for the OLS, and $b_1 = 0.033$ for the Poisson estimates, we find a significant difference ($z = 6.505$ with p-value of 0.000). This result further supports using Poisson estimation.

the modified data sample because (a) we believe it better captures the high trade barriers between countries, (b) provides us with additional observations and variation, and (c) the results appear robust to different cut-offs/trade-cost premiums, see Table 3C.3 in Appendix 3C.

Table 3.9: Fixed Effects Poisson regression results: Effect of PTA on Ease of Trade (1995–2012)

Dependent var.	**Ease of Trade (1995-2012)**			
Data manipulation	**None**	**Bilateral minimum less:**		
		5%	**10%**	**20%**
	(1)	**(2)**	**(3)**	**(4)**
PTA	0.046***	0.033***	0.030***	0.026***
	(0.006)	(0.005)	(0.005)	(0.005)
Observations	120,869	183,312	183,312	183,312
Country-pairs	5,461	10,184	10,184	10,184
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes
R-squared	0.813	0.798	0.799	0.801

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) and the PTA dummy, defined as the inverse of trade costs, and which is equal to unity if two countries are members of the same trade agreement respectively. An agreement consists of FTA, CU, CM and EcU. The data are annual, comprising up to 183,312 observations for 10,184 trade pairs among 180 countries and 19,100 PTAs over the 1995-2012 time horizon. The samples in columns [2] – [4] include an additional 4,723 pairs and 62,443 more observations compared with the raw data sample in [1]. Exporter-year (*ij*), importer-year (*jt*) and pairwise fixed effects (*ij*) are included but not reported. In this analysis, we account for the missing trade costs data for many country-pair years: column [1] presents the benchmark results for the unadjusted inverse trade costs ('Ease of Trade') variable. In columns [2] – [4], we assume that Ease of Trade is (time-invariantly) 5%, 10% and 20%, respectively, lower than the lowest EoT/inverse trade costs observed within the individual country-pair. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

The 5% cut-off/trade cost premium is sufficient because larger reductions make no significant changes to the sign or significance of the coefficient. The coefficient of PTA remains positive and significant to the point where we replace EoT in the missing years with a 48% cut-off. Although at 90% we see a negative and significant coefficient for PTA, this does not make economic sense. If the formation of a trade agreement leads to a lower EoT, then international trade between members should, consequently, decline. If this happens, it contrasts the "convincing empirical evidence" from Baier and Bergstrand (2007, p. 92) who find that a PTA will, on average, increase two member countries' trade by approximately 100% after 10 years.

This also substantiates our assertion that infinitely high trade costs are an unrealistic assumption. Thus, our results in column [2] constitute our core result under Hypothesis 1. Using our preferred specification with fixed effects and the modified data sample, we find that the formation of a trade agreement leads to a 0.033 increase in EoT. With an average EoT for the sample of 0.004, the formation of a PTA, therefore, means EoT increases to 0.037. When following Piermartini and Yotov's (2016) recommendation to use interval data, the effect of forming a PTA is even larger and increases between 0.037 and 0.052; therefore, we consider the 0.033 estimation as conservative. The homogenous PTA effect is not convincing considering our prior arguments, even less so since such regressions pool all countries together and fail to account for the specificity of different types of trade relations, such as those between countries at different levels of development. When considering these differences, Arvis et al. (2015) find that North-North and South-South agreements tend to reduce trade costs more than do North-South PTAs.

Consequently, following the example of Arvis et al. (2015), we investigate whether a country's level of development influences the results.[69] Table 3.10 thus presents regression results of EoT (1995–2012) on PTA for split samples, combining developed and developing country-pairs. Developed countries are those for which GDP per capita is greater or equal to $12,476 (we use GDP per capita to make the distinction between developed and developing countries, rather than GNI per capita as in World Bank (2017) because the GDP data is more complete and the two series are highly correlated). In column [1], both the exporter and importer are developed countries and in column [2], both are developing countries. In column [3], the exporter is developed and the importer developing, and we invert this for column [4] so that the exporter is developing and the importer, developed.

[69] Heterogeneity is also evident when considering when an agreement was formed, in so far as the coefficient on RTA differs when considering country-pairs that have always been in an agreement to those that formed an agreement within the sample period (see Appendix 3B).

Table 3.10: Poisson regression results for Ease of Trade (1995–2012) for developed and developing countries

Dependent var.	**Ease of Trade (1995-2012)**			
Exporter	**Developed**	**Developing**	**Developed**	**Developing**
Importer	**Developed**	**Developing**	**Developing**	**Developed**
	(1)	**(2)**	**(3)**	**(4)**
PTA	0.017*	0.043***	0.019***	0.051***
	(0.009)	(0.004)	(0.006)	(0.015)
Observations	16,437	86,670	40,646	39,559
Country-pairs	1,747	5,892	3,260	3,272
No. of PTAs	5,460	6,052	4,251	3,337
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes
R-squared	0.896	0.908	0.934	0.933

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) and the PTA dummy for different levels of *i* and *j*'s development. In column [1], both the exporter and importer is developed. In column [2], both the exporter and importer is developing. In column [3], the exporter is developed and the importer is developing. In column [4], the exporter is developing and the importer is developed. The mean Ease of Trade for each column is as follows: 0.008 for column [1] and 0.004 for columns [2] – [4]. For additional notes, see Table 3.9.

The PTA dummy has a positive and statistically significant coefficient in all four regressions of Table 3.10, but with noticeable differences in magnitude. The results suggest that integration has a larger effect on trade costs when the exporter is a developing country, as in columns [2] and [4]. After accounting for the different sample sizes by conducting z-tests, these results are confirmed: the coefficient on PTA in column [2] (0.043) is significantly different to the coefficient in column [1] (0.017); similarly, the coefficient on PTA in column [4] (0.051) is significantly different to the coefficient in column [3] (0.019); however, while the coefficient in column [3] does not differ significantly from the coefficient in [1], the coefficient in Column [4], does differ to column [1].

These results demonstrate that the formation of a PTA between developed countries leads to a 0.017 increase in the EoT, but when the exporter is developed and the importer developing, EoT increases by 0.019. For developing country-pairs, the formation of a PTA leads to a 0.043 increase in the EoT, and when the exporter is a developing country and the importer developed, the formation of a PTA leads to a 0.051 increase in EoT. At the mean, these changes imply EoT increases to 0.025 (a 32%

increase) in column [1] and to 0.047, 0.023 and 0.055 in columns [2] – [4] respectively (or by 8.51%, 17.39% and 7.27%).

To some extent, these results contrast those of Arvis et al. (2015), who find that North-North and South-South agreements are more likely to reduce trade costs than North-South PTAs. Our results show that the largest reduction in trade costs, occur where the exporter is a developing country. The justification behind the different magnitudes, however, remains the same. There may be a lack of ambition or coverage in North-South PTAs, or the effective liberalisation undertaken by pairs is sometimes unbalanced, in the sense that the Southern partner may benefit from very long phase-in periods. Additionally, there is simply more scope for a reduction in trade costs for developing countries – see Table 3.6.

Since we find a large and significant coefficient for developing country-pairs in Table 3.10, and surmising that there is more scope for reduction, we focus our analysis on South-South agreements in Table 3.11, by exploring the effect of trade agreements on EoT for developing countries in different continents.[70]

Table 3.11: Poisson regression results for Ease of Trade (1995–2012) for developing countries – Hypothesis 1

Dependent var.	**Ease of Trade (1995-2012)**				
Continent	**Africa**	**Asia**	**C. America**	**Europe**	**S. America**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
PTA	0.007	-0.005	0.071***	0.048***	0.010
	(0.015)	(0.009)	(0.019)	(0.008)	(0.012)
Observations	12,548	6,671	1,577	3,171	1,449
Country-pairs	710	469	119	274	87
No. of PTAs	145	92	82	127	50
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes	Yes
R-squared	0.904	0.962	0.979	0.981	0.975

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) and the PTA dummy on different continents. Australasia omitted because of collinearity between PTA and the fixed effects; North America omitted due to insufficient observations. The mean Ease of Trade for each column is as follows: 0.004 for column [1]; 0.005 for column [2]; 0.007 for columns [3], [4] and [5] respectively. For additional notes, see Table 3.9.

[70] With limited quality of local/internal production data in the developing countries, the trade costs data likely contains measurement error (which could be severe in specific areas like Sub-Saharan Africa).

By continent, we find positive and significant coefficients for Central America and Europe; positive and insignificant coefficients for Africa and South America; and a negative and insignificant coefficient for Asia. Australasia is omitted because of collinearity between PTA and the fixed effects, and North America due to insufficient observations. The continental results suggest the 0.043 coefficient on PTA for the pooled sample in column [2] of Table 3.10 is driven by trade agreements in Central America and Europe.

To address any potential endogeneity concerns, the "textbook solution" is to use instrumental variables (IVs) that are highly correlated with trade costs, but uncorrelated with the error term. If the IVs are uncorrelated with the error term in the regression, then they can be used as instruments for integration (Cyrus, 2002). Using cross-sectional analysis, Egger, Larch, Staub and Winkelmann (2011) use IVs in a two-part Poisson pseudo-maximum likelihood estimator and control for general equilibrium effects, zero-trade flows and endogeneity. This method is, however, not straightforward because compelling instruments are hard to find (Chan, Harris, Greene & Kónya, 2014). One alternative approach to addressing endogeneity is a control function (CF) approach (Heckman and Robb, 1985). Dong and Lewbel (2015) explain why the CF approach does not always produce consistent results for binary choices, but given the preceding argument, the most important point is that CF estimators require models of the endogenous regressors as functions of IVs; which Wooldridge (2015) also mentions: "*Constructing a valid CF relies on the availability of one or more instrumental variables*."

Most variables that plausibly cause PTAs also "belong" in the trade equation on their own (e.g. distance and colonial history). Even if finding an IV was easy, Baier and Bergstrand (2007) establish that IV, and control-function techniques, do not adjust for endogeneity well, whereas a panel-data approach does. Their 'panel approach' compares (a) fixed and random effects, and (b) fixed effects and first differencing and, for reasons cited in the paper, they prefer fixed effects. Baier and Bergstrand also confirm that there are no "feedback effects" when moving from trade changes to PTA changes.

Therefore, lacking plausible IVs, the most promising approach is to include country-pair (pairwise) fixed effects, which forces identification to come from the within-dimension of the data. Studies that introduce pairwise fixed effects often obtain dramatically different coefficient estimates (Head & Mayer, 2014) and this approach has consequently been adopted by Anderson and Yotov (2016). To keep things succinct, our endogeneity checks are presented in Tables 3C.5 and Table 3C.6 and are only provided for Hypothesis 1, in which endogeneity is not a problem: the coefficient on PTA is positive and significant when lagging the variable by 1, 2, 5 and 10 years respectively. Table 3C.6 checks for potential feedback between $u_{ij,t}$ and $RTA_{ij,t+1}$, as in Wooldridge (2002). Future PTAs could depend on $u_{ij,t}$ if countries choose to base future participation on domestic shocks in the past; or if policymakers choose PTA members at time $t+1$ who had a low $u_{ij,t}$. Since our preferred specifications include pairwise fixed effects and our lag and lead PTA variables are insignificant, we anticipate no problems of endogeneity.

3.5.2 Regression results: Testing Hypothesis 2 (Depth)

If Hypothesis 2 holds true, we will see an increase in the EoT as the depth of an integration agreement increases. In other words, we expect to see concomitant increases in the EoT as we transition through to higher levels of integration. To test this, we use specification [3.7a], in which we amend specification [3.6] from Hypothesis 1 by replacing the PTA dummy with "Integration". For robustness, we initially define **Integration** as a vector of dummy variables, so that where we previously had only PTA, we now have one dummy each for FTA, CU, CM and EcU; thereby controlling for the depth of trade agreements. We remind the reader that we focus on these forms of integration because they are reciprocal, reflecting the bilateral average of trade costs, and because it is in line with previous work. Furthermore, we test Hypothesis 2 with specification [3.7b], in which Integration is a categorical variable capturing the individual levels of integration: 1 reflects country-pairs in an FTA; 2 reflects pairs in a CU; 3 reflects pairs in a CM; 4 reflects pairs in an EcU; and is 0 otherwise.

In columns [1a] and [1b] of Table 3.12, we show the results generated by running equation [3.7a]. In column [1a], the dummy variables remain 'switched on' once a specific level of integration is reached (analogous to educational attainment), whereas the dummy variables in column [1b] are only 'switched on' when the agreement between a country-pair is at that specific level of integration. Therefore, the coefficients in column [1a] sum to form the coefficients in column [1b]: the coefficient of FTA in column [1a] added to the coefficient of CU, equals the coefficient of CU in column [1b]; and so on and so forth. The coefficients in column [1a], therefore, represent the additional easing of trade that country-pairs realise when moving to higher degrees of integration. Since our data captures the declared nature of the agreements – rather than the actual level of integration – we choose to use the dummy variables as specified in column [1b] for subsequent analysis.

As specified in column [1b], our dummy variables capture the changing nature of trade agreements, and capture the cumulative effect of integration. We think the latter is important because, referring to Table 3.1, a CU is the same as an FTA but treats non-members the same; a CM is the same as a CU, but also includes the free movement of labour and/or capital; and an EcU is the same as CM, but with monetary and fiscal policy coordination; further harmonisation of taxes, regulation and the monetary system (Baier & Bergstrand, 2015). The higher levels of integration thus encapsulate lower levels, and therefore there is a cumulative dimension. Columns [2] and [3] show the results of running specification [3.7b]. Although Integration and Integration-squared are significant, we do not include either in subsequent regressions because the variables are a black box and cannot identify what is happening at each specific level of integration.

Table 3.12: Poisson regression results for Ease of Trade (1995–2012) on Integration

Dependent var.	**Ease of Trade (1995-2012)**			
Specification	**[3.7a]**		**[3.7b]**	
	(1a)	**(1b)**	**(2)**	**(3)**
FTA	0.027***	0.027***	-	-
	(0.005)	(0.005)		
CU	0.053***	0.080***	-	-
	(0.016)	(0.016)		
CM	0.036*	0.116***	-	-
	(0.020)	(0.013)		
EcU	0.068***	0.184***	-	-
	(0.025)	(0.020)		
Integration	-	-	0.041***	0.021**
			(0.003)	(0.008)
Integration^2	-	-	-	0.006**
				(0.002)
R-squared	0.798	0.798	0.798	0.798

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) regressed on Integration, using equation [3.7a] in columns [1a] and [1b] and equation [3.7b] in columns [2] and [3]. Thus, in columns [1a] and [1b], **Integration** is a vector of dummy variables, one each for FTA, CU, CM and EcU. In columns [2] and [3], Integration is categorical and captures the individual levels of integration, so that 1 reflects country-pairs in an FTA; 2 reflects pairs in a CU; 3 reflects pairs in a CM; 4 reflects pairs in an EcU; and is 0 otherwise. The data are annual, comprising 183,312 observations for 10,184 trade pairs among 180 countries and 19,100 PTAs over the 1995-2012 time horizon. The mean Ease of Trade for each column is 0.004. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Our preferred specifications are the ones in columns [1a] and [1b], clearly showing that the level of integration matters. More specifically, we find that the formation of an FTA leads to a 0.027 increase in the EoT. As a country-pair forms a CU, CM and EcU, there is an additional increase in the EoT equal to 0.053, 0.036 and 0.068 respectively. Starting with a mean EoT of 0.004, the cumulative effect in column [1b] shows that the EoT increases to 0.031 when pairs form an FTA, to 0.084 when pairs form a CU, to 0.120 when pairs form a CM, and to 0.188 when pairs form an EcU.

Under Hypothesis 2, we also consider the depth of membership in agreements, such that we separate purely bilateral agreements and plurilateral agreements. Pure bilateral agreements are those that constitute only two countries,

whereas agreements such as those between the EU and any number of partner countries are considered plurilateral. For Hypothesis 1, we generate results using the full sample (183,312 observations), the purely bilateral sample (2,104 observations) and the plurilateral sample (181,208 observations); but for Hypothesis 2, we use only the full and plurilateral samples because most observations fall within the plurilateral sample. These results are presented in Table 3C.9 but despite the sample adjustments, the z-test shows that the coefficients are not statistically different and so we do not interpret the findings.

We again extend our testing of Hypothesis 2 to developing and developed country-pairs. Using specification [3.7a], we generate the results in Table 3.13 and find that the depth of integration plays a significant part in driving trade costs, particularly so when the exporter is a developing country. For developed countries (those with a GDP per capita of $12,476 or above), the results of Table 3.13 suggest integration decreases the EoT at the CU and CM levels, but we must be careful when interpreting the coefficients because of the way the dummy variables are defined/coded. Since the dummies are equal to unity only when country-pairs are in a specific level of integration, these coefficients reflect the cumulative effect of integration.

Distinguishing the level of development by GDP per capita can be misleading. For example, the Caribbean Community and Common Market (CARICOM) countries are generally considered developed by the GDP per capita metric, however, the Revised treaty of Chaguaramas[71] lists CARICOM member countries as either less developed countries (Antigua and Barbuda, Belize, Dominica and Grenada, for example) or as more developed countries (Bahamas, Barbados, Guyana and Jamaica, for example). Therefore, the CARICOM countries may be considered as developed only by the GDP per capita metric, and as developing countries by many others.

[71] Which establishes the Caribbean community including the CARICOM single market and economy.

Table 3.13: Poisson regression results for Ease of Trade (1995–2012) by level of development – Hypothesis 2

Dependent var.	**Ease of Trade (1995-2012)**			
Exporter	**Developed**	**Developing**	**Developed**	**Developing**
Importer	**Developed**	**Developing**	**Developing**	**Developed**
	(1)	**(2)**	**(3)**	**(4)**
FTA	0.014	0.037***	0.020***	0.051***
	(0.009)	(0.004)	(0.006)	(0.015)
CU	-0.095**	0.073***	0.020	0.157***
	(0.039)	(0.020)	(0.033)	(0.053)
CM	-0.053**	0.187***	0.066***	0.113***
	(0.022)	(0.020)	(0.015)	(0.020)
EcU	0.038	0.072***	0.042	0.220***
	(0.024)	(0.023)	(0.026)	(0.025)
Observations	16,437	86,670	40,646	39,559
Country-pairs	1,747	5,892	3,260	3,272
No. of PTAs	5,460	6,052	4,251	3,337
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes
R-squared	0.897	0.909	0.934	0.934

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) regressed on **Integration**, using Equation [3.7a]. In column [1], there are a total of 1,604 FTAs, 196 CUs, 2,475 CMs and 1,185 EcUs: CUs thus account for just 3.59% of all PTAs. In column [2], there are a total of 4,177 FTAs, 1,315 CUs, 128 CMs and 432 EcUs: CMs thus account for just 2.12% of all PTAs. In column [3], there are a total of 3,150 FTAs, 566 CUs, 493 CMs and 42 EcUs: EcUs thus account for just 0.99% of all PTAs. In column [4], there are a total of 2,769 FTAs, 125 CUs, 419 CMs and 24 EcUs: CUs thus account for just 3.75% of all PTAs, and EcUs just 0.72%. The mean Ease of Trade for each column is: 0.008 for column [1], 0.004 for columns [2] – [4]. For additional notes, see Table 3.12.

The caveat concerning distinguishing the level of development by GDP per capita aside, the negative coefficient for CU in column [1] stems from 27 country-pairs, and these 27 countries are members in one of three agreements: the CARICOM, the Gulf Co-operation Council Customs Union (GCCCU) and MERCOSUR.[72] In Table 3C.10, we reproduce column [1] of Table 3.13 and sequentially exclude the GCCCU, CARICOM and MERCOSUR from the sample. These results suggest that the GCCCU is the primary driver of the negative CU coefficient and, therefore, for the negative CM coefficient.

[72] Members of the respective agreements can be found in Appendix 3A.

While it seems the GCCCU is the primary driver, Uruguay, Argentina and Brazil (part of MERCOSUR), help explain the anomaly and highlights a problem with our modelling approach: "*MERCOSUR is not really a free trade agreement, let alone a customs union.*" (Brown & Tovar, 2016).[73] Brazil and Argentina have continuously failed to coordinate changes in important trade policies applied toward non-members, and for numerous products, they also frequently do not engage in bilateral free trade because they apply anti-dumping against one another. Furthermore, despite bilaterally applied tariffs falling and remaining low, and the average MFN tariff applied to imports from the rest of the world being mostly unchanged since the mid-1990s, Argentina and Brazil frequently impose temporary trade barrier policies of antidumping, safeguards, and countervailing duties. In practice, these policies commonly take the form of specific duties, price undertakings, and even quantitative restrictions (Brown & Tovar, 2016). This problem extends to most African PTAs, which do not implement the provisions included in the trade agreements. Therefore, we exercise caution in interpreting these results.

The negative coefficient of CM in column [1] is also due to the CU-effect of the GCCCU[74], and hides that the individual effect of CM is positive but insufficient to offset the negative CU-effect. Similarly, with respect to the decrease in the EcU coefficient in column [2], there are 432 instances of an EcU in the sample of 86,670 observations, dominated by 36 country-pairs. All but one of these pairs are African, coming from either the West African Economic and Monetary Union (WAEMU/UEMOA) or the Economic and Monetary Community of Central Africa (CEMAC).[75] These EcUs have an individual effect which is negative, but one insufficient to drive a negative cumulative effect of integration.

[73] Our data takes the declared classification of an agreement to be the true classification, whereas by contrast, the reality may be starkly different, as in the case of MERCOSUR; ideally, we need a variable that captures the actual degree of integration. At present, however, this is not possible.
[74] See Table 3C.8 in Appendix 3C: The large negative coefficient on CU (-0.109) causes the negative cumulative effects of CU and CM in Table 3.13 because CM is individually insufficient to offset this.
[75] The exception is Portugal–Greece.

Barring the few exceptions, our results demonstrate that the level of integration affects the extent to which EoT changes when pairs form a trade agreement. More specifically, for country-pairs seeking to integrate, the associated change in the EoT depends on the specific level of integration and on the level of development. When both trading partners are developed, the largest increase in the EoT is realised only once pairs integrate to form an EcU (0.038), whereas for developing trade partners, integration to such a high level means a fall in the EoT, from the high reached in a CM (0.187). When the exporter is developed and the importer developing, the largest cumulative increase in the EoT is reached at the CM level (0.066). When an exporter is developing and the importer developed, the largest increase in the EoT is realised at the EcU level (0.220).

To test Hypothesis 2 on the different continents, we need to redefine our explanatory variables: since several levels of integration have very few observations, we model the EoT on FTA and 'FTA Plus' agreements. FTA Plus agreements incorporate the higher levels of integration: CU, CM and EcU. This combination creates more observations for the higher levels of integration, and therefore better identifies the relationship with the EoT. We focus our analysis on the Developing-Developing country-pairs, with the results presented in Table 3.14.

Table 3.14: Poisson regression results for Ease of Trade (1995–2012) for developing countries – Hypothesis 2

Dependent var.	**Ease of Trade (1995-2012)**				
Continent	**Africa**	**Asia**	**C. America**	**Europe**	**S. America**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
FTA	0.004	-0.005	0.071***	0.041***	0.017
	(0.017)	(0.009)	(0.019)	(0.008)	(0.011)
FTA plus	0.024	-0.232*	-	0.131***	-0.375***
	(0.027)	(0.098)		(0.018)	(0.058)
Observations	12,548	6,671	1,577	3,171	1,449
Country-pairs	710	469	119	274	87
No. of PTAs	145	92	82	127	50
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes	Yes
R-squared	0.904	0.962	0.979	0.982	0.975

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) modelled on the FTA dummy, and an FTA plus dummy, which combines CU, CM and EcU. Australasia omitted because of collinearity and North America due to insufficient observations. The mean Ease of

Trade for each column is as follows: 0.004 for column [1], 0.005 for column [2], 0.007 for columns [3], [4] and [5]. For additional notes, see Table 3.12.

Trade agreements in Central America and Europe again drive the positive and significant results for FTA, and Europe is the only continent to have a positive and significant coefficient on FTA Plus. Concerning the negative coefficients for FTA Plus, we refer the reader back to our discussion about MERCOSUR. Furthermore, we note that South East Asian countries do not seem to be involved in very deep agreements (Hofmann et al., 2017) and thus the relationship between FTA Plus and the EoT may be poorly defined. Evidently, the effect of integration on the EoT differs among continents, in so far as there is a positive and insignificant effect in Africa, a positive and significant effect in Central America and Europe, and negative effects in Asia and South America.

3.5.3 Regression results: Testing Hypothesis 3 (Duration)

Persisting with our modified data sample, we test Hypothesis 3 with specification [3.8] and present the results in Table 3.15. In column [1], we regress the EoT on a PTA dummy and the duration of membership in a PTA; in column [2], we keep the PTA dummy, but we separate duration into FTA and FTA Plus (which includes the duration for CU, CM and EcU). In column [3], we again keep the PTA dummy but further unpack duration to include each level of integration. As expected, the duration of membership in an agreement increases the EoT. Furthermore, it is evident that the duration effect is not as large in magnitude as transitioning to higher degrees of integration.

Under Hypothesis 1, we found a coefficient estimate of PTA equal to 0.033. Adding a duration aspect reduces the coefficient of PTA to 0.011 in column [1]. Here, we add PTA duration to control for the tendency to form CUs, CMs and EcUs after forming an FTA, so the possible time spent in these forms are limited by this fact. In columns [2] and [3], the effect of PTA (0.022) is still diminished (compared to our results under Hypothesis 1) but is larger than in column [1].

Table 3.15: Poisson regression results for Ease of Trade (1995–2012) on Integration and Duration

Dependent var.	**Ease of Trade (1995-2012)**		
	(1)	**(2)**	**(3)**
PTA	0.011*	0.022***	0.022***
	(0.006)	(0.006)	(0.006)
Duration in PTA	0.006***	-	-
	(0.001)		
Duration in FTA	-	0.003***	0.003***
		(0.001)	(0.001)
Duration in FTA plus	-	0.009***	-
		(0.001)	
Duration in CU	-	-	0.002
			(0.001)
Duration in CM	-	-	0.011***
			(0.001)
Duration in EcU	-	-	0.013***
			(0.003)
FE (*it, jt, ij*)	Yes	Yes	Yes
R-squared	0.799	0.800	0.801

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) regressed on PTA and the duration of being in a PTA in column [1]. In columns [2] and [3], we unpack the duration coefficient, first to FTA and FTA Plus agreements; then to FTA, CU, CM and EcU. The data are annual, comprising 183,312 observations for 10,184 trade pairs among 180 countries and 19,100 PTAs over the 1995-2012 time horizon. The mean Ease of Trade for each column is 0.004. For additional notes, see Table 3.9.

Since our integration data begins in 1950, we initially start counting the duration (in years) of being in an agreement from this point forward. However, calculating duration from 1950 might distort the true effect of duration because the benefits of an agreement are likely to occur within the first 10-15 years after formation, see Piermartini and Yotov (2016), who find evidence of strong phasing-in effects. Given the GATT Article XXIV interpretation of liberalisation of 90% of tariff lines by year 10 into the agreement, this is not surprising, but it means our duration variable probably does not reflect the true effect because of long-standing agreements such as the EU. Therefore, we re-specify our duration variable in Table 3.16, dropping FTA, CU, CM and EcU agreements that formed [1] 10 or more years before our sample period begins, [2] 5 or more years before and [3] any number of

years before our sample period. These exclusions allow us to focus on agreements for which the phasing-in period of the agreement may still be relevant.

Table 3.16: Truncated results for Hypothesis 3

Dependent var.	**Ease of Trade (1995-2012)**		
Exclusion criteria:	**Number of years in agreement before sample period:**		
	10 (or more) years	**5 (or more) years**	**1 (or more) years**
	(1)	**(2)**	**(3)**
PTA	0.023***	0.022***	0.032***
	(0.006)	(0.007)	(0.007)
Duration in FTA	0.003***	0.003***	0.001*
	(0.001)	(0.001)	(0.001)
Duration in CU	0.006**	0.007***	0.003**
	(0.002)	(0.002)	(0.001)
Duration in CM	0.017***	0.019***	0.022***
	(0.001)	(0.002)	(0.002)
Duration in EcU	0.003***	0.003***	0.002
	(0.001)	(0.001)	(0.001)
Observations	180,107	179,254	176,838
R-squared	0.893	0.888	0.889

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) regressed on PTA and the duration of being in an FTA, CU, CM and EcU. Duration starts counting in 1950, but in columns [1] – [3], we drop FTA, CU, CM and EcU agreements formed [1] 10 or more years before; [2] 5 or more years before; and [3] any number of years before our sample period. The mean Ease of Trade for all columns is 0.004. For additional notes, see Table 3.9 and 3.15.

The results in Table 3.16 suggest that significant increases in the EoT do not occur only in the first 5-10 years after the formation of an agreement, with two exceptions. First, the duration of being in a CM climbs quite significantly from its original 0.011 value in Table 3.15, to 0.022 in column [3]. Second, the duration of being in an EcU has fallen noticeably from 0.013 in Table 3.15 to 0.003 in columns [1] and [2] of Table 3.16, and 0.002 in column [3], but insignificantly so.

Table 3.17: Poisson regression results for Ease of Trade (1995–2012) for developed and developing countries – Hypothesis 3

Dependent var.	**Ease of Trade (1995-2012)**			
Exporter	**Developed**	**Developing**	**Developed**	**Developing**
Importer	**Developed**	**Developing**	**Developing**	**Developed**
	(1)	**(2)**	**(3)**	**(4)**
PTA	0.007	0.031***	-0.003	0.061***
	(0.009)	(0.005)	(0.007)	(0.019)
Duration in FTA	-0.003**	0.003***	0.006***	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)
Duration in CU	-0.021***	0.004	0.008***	0.004
	(0.004)	(0.003)	(0.001)	(0.003)
Duration in CM	0.001	0.013**	0.001	0.017***
	(0.001)	(0.005)	(0.005)	(0.004)
Duration in EcU	0.012***	0.000	0.001	-0.059**
	(0.002)	(0.002)	(0.009)	(0.025)
Observations	16,437	86,670	40,646	39,559
Country-pairs	1,747	5,892	3,260	3,272
No. of PTAs	5,460	6,052	4,251	3,337
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes
R-squared	0.897	0.908	0.934	0.934

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) regressed on PTA and **Duration**, which includes a count (in number of years) variable for each level of integration: FTA, CU, CM and EcU. The mean Ease of Trade for each column is: 0.008 for column [1], 0.004 for columns [2] – [4]. For additional notes, see Table 3.9 and 3.15.

In contrast to the findings in Table 3.16, where the duration of being in an agreement generally had a positive effect on EoT, the results in Table 3.17 are mixed when distinguishing differing levels of development. In column [1], for developed country-pairs, we find the duration of being in an FTA (-0.003) and CU (-0.021) to have negative and significant effects on the EoT, whereas the duration of being in an EcU (0.012) has a positive and significant effect. For developing country-pairs in column [2], the coefficients are all positive but insignificant for the duration in a CM and EcU. Between Developed-Developing, or Developing-Developed country pairs, PTA (-0.003) is negative in column [3] but positive and significant in column [4]. Similar contrasts are seen for the duration in an FTA and EcU.

To explore heterogeneity by continent, we again use FTA Plus to group together the duration of being in a CU, CM and EcU.[76] From the results in Table 3.18, there is evidence again of differences among the continents. PTA is typically positive and significant, see Asia (0.023), Central America (0.064) and Europe (0.023); as is the coefficient for duration in an FTA, see Africa (0.004) and Europe (0.012). However, the coefficient for duration in an FTA in Asia (-0.006) has a negative and significant coefficient. For duration in FTA Plus, Africa (0.006) has a positive and significant coefficient, and Asia (-0.170) has a negative and significant coefficient once more.

Table 3.18: Poisson regression results for Hypothesis 3 (Duration) for developing countries by continent

Dependent var.	**Ease of Trade (1995-2012)**				
Continent	**Africa**	**Asia**	**C. America**	**Europe**	**S. America**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
PTA	-0.010	0.023*	0.064***	0.023***	0.006
	(0.017)	(0.012)	(0.019)	(0.009)	(0.013)
Duration in FTA	0.004*	-0.006***	0.001	0.012***	0.003
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Duration in FTA plus	0.006*	-0.170***	-0.006	0.000	-0.000
	(0.003)	(0.051)	(0.004)	(0.005)	(0.002)
Observations	12,548	6,671	1,577	3,171	1,449
Country-pairs	710	469	119	274	87
No. of PTAs	145	92	82	127	50
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes	Yes
R-squared	0.906	0.962	0.979	0.982	0.975

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) modelled on the PTA dummy, as well as the duration of being in an FTA and the duration of being in FTA plus (consisting of CUs, CMs and EcUs). Australasia omitted because of collinearity and North America due to insufficient observations. The mean Ease of Trade for each column is as follows: 0.004 for column [1], 0.005 for column [2], 0.007 for columns [3], [4] and [5]. For additional notes, see Table 3.9 and 3.15.

3.5.4 Regression results for combined hypotheses

Finally, we combine our three hypotheses in Table 3.19. In columns [1] – [3], we provide each hypothesis individually, and in column [4], the combination. We have eight coefficient estimates in column [4], with CU being omitted due to collinearity. Of the eight coefficients, four are positive and significant: PTA (0.073), Duration in FTA

[76] Several coefficients are missing when rather using CU, CM and EcU.

(0.002), Duration in CM (0.007) and Duration in EcU (0.013); and one is negative and significant: FTA (-0.051).

Table 3.19: Poisson regression results for Hypothesis 1, 2 and 3 and a combination of all three

Dependent var.	**Ease of Trade (1995-2012)**			
Hypothesis:	**One**	**Two**	**Three**	**3 combined**
	(1)	**(2)**	**(3)**	**(4)**
PTA	0.033***	-	0.022***	0.073***
	(0.005)		(0.006)	(0.018)
FTA	-	0.027***	-	-0.051***
		(0.005)		(0.017)
CU	-	0.080***	-	-
		(0.016)		
CM	-	0.116***	-	0.020
		(0.013)		(0.021)
EcU	-	0.184***	-	0.020
		(0.020)		(0.025)
Duration in FTA	-	-	0.003***	0.002***
			(0.001)	(0.001)
Duration in CU	-	-	0.002	0.001
			(0.001)	(0.002)
Duration in CM	-	-	0.011***	0.007***
			(0.001)	(0.002)
Duration in EcU	-	-	0.013***	0.013***
			(0.003)	(0.004)
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes
R-squared	0.798	0.798	0.801	0.801

Notes: Results presented are for Fixed Effects Poisson model for Hypothesis 1 in column [1], Hypothesis 2 in column [2], and Hypothesis 3 in column [3]. These specifications are combined in column [4]. The mean Ease of Trade for each column is 0.004. For additional notes, see Table 3.9, 3.12 and 3.15.

Seeing that there is one negative and significant coefficient, the combined results support our initial hypotheses and demonstrate that for country-pairs: (1) the formation of a PTA increases the EoT; (2) the higher the degree of integration, the higher the EoT; and (3) the longer the duration of being in a trade agreement, the higher the EoT.

3.5.5 Summary of approach and findings

We include individual dummy variables for FTAs, CUs, CMs and EcUs to help capture heterogenous effects of integration. The dummy variables are imperfect however, because they cannot distinguish between the effects of different trade agreements at the same level of integration, for example. Therefore, for country-pairs with multiple (and often overlapping) agreements in place, instances of which are commonly found in Africa and South America, we cannot isolate the effects of individual agreements. Consequently, for such instances, we are unable to disentangle which agreement (if not all) causes the increase in the EoT.

Nevertheless, the existence of a trade agreement increases the EoT between countries because the formation of a trade agreement means that member countries cooperate on trade policy and non-trade policy areas to reduce overall bilateral trade costs among members (Piermartini & Yotov, 2016). Like prior research, we find significant increases in the EoT occur when country-pairs form a PTA. Under our modified data sample, the EoT averages 0.004 and the formation of an agreement increases this by 0.033. When considering the level of development of both the exporting and importing country, the magnitude of this effect differs. For developed countries, the coefficient on PTA is 0.017 and for developing countries, the coefficient for PTA is 0.043. When the exporter is developed and the importer developing, the coefficient for PTA is 0.019 and when the exporter is developing and the importer developed, the coefficient for PTA is 0.051. Heterogeneity is also prevalent within developing country-pairs, but we refer the reader back to Table 3.11 for these results.

Deepening the level of integration results in further increases in the EoT because of (a) the elimination of all trade barriers, in the case of FTAs and CUs, and (b) the free movement of labour and/or capital, in the case of CMs and EcUs. Our results suggest higher degrees of integration cause increases in the EoT. More specifically, the formation of an FTA, CU, CM and EcU increases the EoT by 0.027, 0.053, 0.036 and 0.068 respectively. The cumulative/overall effect of integrating is

that an FTA increases EoT by 0.027, a CU increases EoT by 0.080, a CM increases EoT by 0.116 and an EcU increases EoT by 0.184. Our heterogeneity analysis demonstrates that when both trading partners are developed, the largest increase in the EoT occurs once pairs form an EcU (0.038), whereas for developing trade partners, integration to such a high level means a fall in the EoT, from the high reached when in a CM (0.187). When the exporter is developed and the importer developing, the largest cumulative increase in EoT is reached at the CM level (0.066). When an exporter is developing and the importer developed, the largest increase in EoT is realised at the EcU level (0.220).

Finally, we find that the longer the duration (in years) of belonging to a trade agreement, the easier is trade. The longer the duration of an FTA, CU, CM and EcU, the higher the EoT is by 0.003, 0.002, 0.011 and 0.013 respectively. Our heterogeneity analysis found that for developed country-pairs, the duration of belonging to an FTA (-0.003) and CU (-0.021) is negative and significant, and for developing-developed country-pairs, the duration of being in an EcU (-0.059) is negative and significant. We suspect the sample period of 1995–2012 may be responsible for some of these idiosyncrasies because, for the period under review: most developed countries have been integrated for a long time; and with the rise of China as a global trade partner, trade between the OECD and Asian countries has boomed – without agreements being in place. Therefore, the reference group does not fully capture the importance of the agreements, or the importance of duration.

3.6 Conclusion

For countries seeking to participate competitively within an expanding international market, trade costs are a major consideration when formulating trade policy. With the potential to influence economic development, to reduce net poverty and improve welfare, countries now cooperate not only on trade policy channels of trade costs but also on non-trade policy channels. Previous research has not fully

considered these aspects, generally focussing on just the PTA effect of integration via a dummy variable.

While informative, such a dummy captures a homogenous effect across all country-pairs in the sample. For our panel, this would imply the same effect of entry into a PTA on trade costs across all 180 countries (10,184 trade pairs), and totally ignores the 'dynamic time-path' dimension of PTAs (Bhagwati, 1996). In this chapter, our major contribution is thus the inclusion of different integration effects through FTA, CU, CM and EcU dummy, and duration variables. For the period under analysis (1995–2012), we thus quantify the effects of (i) forming agreements, (ii) deepening the level of integration, and of (iii) staying in an agreement. We test each hypothesis under a pooled sample, and additionally under different levels of development for the exporting and importing country, and by continent. Running our regressions under the different developmental and geographic samples further helps identify heterogenous effects.

To facilitate our regression analysis, we inverted trade costs to obtain the 'ease of trade', the results presented in the previous section. In terms of trade costs, our results are comparable to those of Arvis et al. (2013) and Arvis et al. (2015). The aggregate PTA effect reduces trade costs by 15.35%; whereas forming an FTA reduces trade costs by 12.14%. Subsequently increasing the level of integration from an FTA to a CU, CM and EcU results in additional trade cost reductions of 7.03%, 10.06% and 5.84% respectively. In terms of duration, staying in an FTA, CU, CM, and EcU results in trade cost reductions of 56.28%, 70.24%, 27.44%, and 24.44% respectively. Since our trade costs data captures the ratio of international trade costs to domestic trade costs, these percentage reductions imply that once integrated, countries sell relatively more of their production to foreigners than to residents (holding all else constant).

While we find significant trade cost reductions under each hypothesis (and hence significant relative changes in international versus domestic sales), the effect of staying in an FTA and CU results in the most significant decrease. This could also be

a feature of the data, since CMs and EcU form after FTAs and CUs, there are naturally fewer identifying observations. Nonetheless, that duration has such a large significant effect on trade costs is understandable considering the dynamic time-path dimension of PTAs. In the short-term, reductions in trade costs vary because of the assorted disciplines embedded in trade agreements. Each additional rule represents a new policy for firms to consider in their trading decisions; each also has legal, administrative and economic implications, and thus increases the costs of trading (Estevadoreal et al., 2009). In the long-run however, PTAs improve trade-related information; documents are simplified and harmonised; procedures are streamlined and automated; the level of policy salience increases, as does the institutional efficiency of countries; and trade agreements facilitate dispute resolution across multiple areas (Schiff & Winters, 2002; The IBRD, 2005 and Moïsé & Sorescu, 2013).

Ultimately, our results demonstrate that the existence of a trade agreement decreases trade costs, as does deepening the level of integration, and increasing the duration of being in a trade agreement. Moreover, for countries seeking to participate more fully in the global trading network by decreasing trade costs via PTAs, our results provide food for thought to policymakers. Members within PTAs must consider the numerous effects of integration stemming from trade and non-trade policy channels. Aside from the channels already mentioned, policymakers must consider (1) the level of development of the exporting and of importing country, (2) continental geography; (3) the depth of integration; as well as (4) committing to an agreement for some time.

CHAPTER 4: THE IMPACT OF REGIONAL INTEGRATION ON AGRICULTURAL PRODUCTION IN SUB-SAHARAN AFRICA: 1961–2014

4.1 Introduction: Sub-Saharan Africa's food problem

"*Sub-Saharan Africa [SSA] is at a crossroads of tremendous opportunity and significant challenge. With half of the world's uncultivated arable land, the region is both the last great agricultural frontier and a locus of vast humanitarian catastrophe in the making, a building crisis of hunger and food insecurity that will only be exacerbated by climate change.*" (Kuhlmann, Sechler & Guinan, 2011, p. 3).

Despite enormous resource endowments, SSA cannot feed itself: due to persistently low productivity levels (productivity and yields are lower in some places than they were during the Roman Empire) and the resultant food shortages, SSA is a net importing region for food staples with a food and agricultural trade deficit that continues to widen (Hazell, 2013; Plaat & Aftoni, 2015; Luan, Cui & Ferrat, 2013; Mkandawire, Nyantakyi-Frimpong, Armah & Arku, 2014; and Guinan, Kuhlmann, Searchinger, Contini & Martha, 2012).[77]

However, the persistently low productivity levels also present SSA with an opportunity: SSA has the capacity to easily produce another 100 million tonnes of grain equivalents each year if more intensively farmed. Should production increase to this extent, the region will become a net agricultural exporter.[78] However, the

[77] Our data analysis finds that imports of agricultural products and food (excluding fish) have been increasing since the 1960s, and far outweigh their exports – see Appendix 4B. According to Chauvin et al. (2012), SSA is trading less and less food within the continent (or example, in 1995 SSA imported and exported 46% and 31% of its food from and to other SSA countries. In 2010, it decreased to 17% and 19% respectively) because as income levels increase, the demand for processed agricultural food also increases. Unfortunately, most processed food is produced outside of SSA, leading SSA countries to import more and more food from outside of SSA.

[78] This potential is evidenced by experimental trials, best farmer practices, and the low yields SSA currently achieves compared to similar agro-ecological zones. Moreover, there is considerable untapped irrigation potential and remaining uncultivated land that could be brought into production (Hazell, 2013).

opportunity to put SSA's tremendous agricultural production potential to use to feed its people and spur economic growth is closing quickly, because of rapid population growth and climate change; and failing to address these two major obstacles means SSA will remain underdeveloped and food insecure (Kuhlmann et al., 2011 and Hazell, 2013). According to the United Nations (2015), Africa's population growth will account for more than half of the world's population growth between 2015 and 2050. During this period, the populations of 28 African countries are projected to more than double, and by 2100, ten countries (nine of which are in SSA) are projected to have increased by at least a factor of five.[79] Climate change too, is taking an increasing and unexpectedly rapid toll, threatening to cut rain-fed farm yields by half. Left unchecked, the deterioration of SSA's productive capacity will not only continue to wreak havoc in the region but will be felt acutely worldwide (Kuhlmann et al., 2011).

To take advantage of the opportunity and improve agricultural production, several authors and international organisations advocate increasing regional economic integration. Theoretically, trade agreements create efficiency gains through shifting production to countries where it can best take place (i.e., integration enables firms to alter their location decisions), and allow for a more efficient sourcing of the inputs to agricultural production. Furthermore, PTAs promote competitiveness, liberalise services, promote labour mobility, protect intellectual property, improve governance, and foster transparency and the rule of law. Therefore, integration should 'on balance' increase agricultural production (World Bank, 2011). Despite the strong theoretical backing, whether increased integration will help is open to debate because the dearth of empirical studies makes for a lack of clear guidance for policymakers (Nin-Pratt & Diao, 2014 and World Bank, 2011). Consequently, this chapter focuses on a simple question: has regional integration in SSA increased agricultural production?

[79] The ten countries are: Angola, Burundi, Democratic Republic of Congo, Malawi, Mali, Niger, Somalia (the only non-SSA country), Uganda, Tanzania and Zambia.

To answer this question, we analyse 45 SSA countries over the 1961–2014 period, but find no integration effect on agricultural production.[80] To better understand this result, we carry out additional analysis that considers whether countries might have benefitted from specialising away from agriculture. We find no evidence supporting this, and subsequently focus on the relationship between regional integration and agricultural trade costs. Adopting agricultural trade cost data and comparing our SSA sample results to those obtained for the World, we find that regional integration has lowered agricultural trade costs for the global sample of 176 countries, but has not done so in SSA. Without the lowering of agricultural trade costs, integration has failed to provide the necessary stimulus to improve agricultural production. Given the widespread enthusiasm for regional integration among policymakers in SSA, these findings provide an important quantification of the effects of regional integration.

The remainder of the paper is structured as follows: in sub-section 4.2, we review the theoretical relationship between regional integration and agricultural production. In sub-section 4.3, we discuss the data, provide some descriptive statistics, and provide the empirical model specification. We present our regression results and their interpretation in sub-section 4.4, and conclude in sub-section 4.5.

4.2 Regional integration and agricultural production

Lacking empirical studies and analysis about the impact of integration on agriculture in SSA (Nin-Pratt & Diao, 2014 and World Bank, 2011), policymakers are left with economic theory to guide their decisions. In the following sub-sections, we thus explore the theory, which leads directly to a discussion concerning the sectoral value added as a percentage of GDP; and review a selection of the support for regional integration as a means to increasing agricultural production. Before we come to this,

[80] Although there are 46 countries in SSA, Sao Tome and Principe drops out of our preferred regressions.

however, we define regional integration and discuss the importance of agriculture to SSA.

4.2.1 Defining regional integration

The process of integration comprises measures that entail the suppression of some forms of discrimination between the members of the integration agreement (Balassa, 1961). Trade agreements include a spectrum of levels of economic integration, and Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008), includes all multilateral and bilateral regional trade agreements (RTAs) as notified to the WTO for 1950 to 2015 (66 years), covering 280 countries.[81] Due to the extensive coverage of the data, we are able to explore the effects of specific RTAs (and of excluding specific agreements) in our regressions. There are four distinct (but not mutually exclusive) types of RTAs: Free Trade Agreements (FTA), Customs Unions (CU), Economic Integration Agreements (EIA), and Partial Scope (PS) Agreements. Definitions for these levels of integration are in Table 4.1.

Table 4.1: Definitions of the levels of integration

Level of integration	Definition
FTA	Trade barriers (substantially) eliminated among members; treat non-members differently.
CU	Same as FTA; but treat non-members the same.
EIA	Substantial liberalisation of the trade in services
PS	The agreement covers only certain products.

Source: Baier and Bergstrand (2015), Egger and Larch (2008), and World Trade Organization (2018a). In the present context, we prefer Egger and Larch's dataset to Baier and Bergstrand's because the former includes all multilateral and bilateral RTAs notified to the WTO. This extensive dataset allows us to focus on the effects of specific RTAs, or to exclude specific agreements from regressions.

Within SSA, there are seven plurilateral trade agreements among the 46 countries (see Appendix 4A for a list of the countries) and because each RTA is

[81] WTO members are bound to notify the RTAs in which they participate. Notifications may also refer to the accession of new parties to an agreement that already exists.

included in the database, we can investigate their individual effects within SSA. The seven agreements are: 1) Southern African Development Community (SADC), 2) East African Community (EAC), 3) Common Market for Eastern and Southern Africa (COMESA) 4) Southern African Customs Union (SACU) 5) Central African Economic and Monetary Community (CEMAC) 6) Economic Community of West African States (ECOWAS) and 7) West African Economic and Monetary Union (WAEMU).[82] In Larch's Database, these RTAs are coded according to their WTO notification date, specifically using their "entry into force" dates. Therefore, several agreements occur in the data several years after their initial establishment. For example, the SADC formed in 1992 but is only coded in the data from 2000.

The SADC Declaration and Treaty of 1992 states in Article 21 that: "[1] *Member States shall cooperate in all areas necessary to foster regional development and integration on the basis of balance, equity and mutual benefit.* [2] *Member States shall, through appropriate institutions of SADC, coordinate, rationalise and harmonise their overall macro-economic and sectoral policies and strategies, programmes and projects in the areas of co-operation*." The specific areas of cooperation include food security, land and agriculture; infrastructure and services; industry, trade, investment and finance; and natural resources and environment, amongst others (SADC, 2018). Consequently, the coding of agreements according to their entry into force dates will cause (some) downward bias. For the years 1992–1999, our SADC dummy variable should be 1 but is coded as 0 because the RTA was not notified to the WTO.[83] Through biasing coefficients downward, our estimates of RTA are a conservative estimate of its effect on agricultural productivity.

More than differences in coverage, RTA heterogeneity exists in terms of their "provisions". The WTO Agreements contain provisions giving developing countries special rights, and giving developed countries the possibility to treat developing

[82] CEMAC is also known as the Economic and Monetary Community of Central Africa, and WAEMU is also known by its French acronym, UEMOA (*l'Union Economique et Monétaire Ouest Africaine*).
[83] This could also be due to pure error/oversight of the signatory parties to notify the RTA to the WTO. In this case, it is akin to classical measurement error in the RTA dummy, again biasing estimates downward.

countries more favourably than other WTO Members. Provisions confirming countries' existing multilateral obligations, and that may also deepen such commitments, are categorised as "WTO+" provisions, examples being measures on anti-dumping, restrictions on state aid and the liberalisation of trade in services. "WTOX" provisions involve policy areas not covered by the WTO's current mandate and may compromise the WTO's ability to expand into these legal territories with binding, non-discriminatory policy. Examples of WTOX provisions include anti-terrorism, environmental and labour market regulations. Lastly, there are provisions on institutional quality (IQ) (WTO, 2018b and Kohl, 2013).

Differences in these provisions are captured by Kohl, Brakman and Garretsen (2015) and by the Design of Trade Agreements (DESTA). Kohl et al. identify the number of provisions covered by different RTAs: there are a possible 13 provisions under the WTO+, 4 under WTOX and 9 under IQ (26 provisions in total – see Appendix 4C). While their data is available by agreement, it is time invariant. DESTA collects systematic data on the design of preferential trade agreements, and they provide information on general features and specific commitments in such agreements, including provisions. However, DESTA's dyadic RTA database on provisions is problematic because the dyadic nature requires aggregation for incorporation in our model and, once again, is time invariant. Consequently, we cannot easily incorporate provision heterogeneity in our model.[84]

4.2.2 The importance of agriculture, trade and regional integration to SSA

Agriculture is an important driver of growth. According to Chauvin, Mulangu and Porto (2012), the literature is replete with examples of productivity-led agricultural transformation playing an active role in economic transformation, with

[84] Covering different years, Hofmann, Osnago & Ruta (2017) provide time-variant data on the provisions covered by trade agreements notified to the WTO. Unfortunately, we discovered the data only in mid-2018, and were thus unable to incorporate it in our analysis. Therefore, this leaves scope for future research.

several studies finding agriculture was the engine of growth in most developing countries. With causality typically running from agricultural growth to economy-wide growth, even small variations in agricultural productivity has strong implications for the rate and pattern of economy-wide growth. Consequently, agriculture is not only an engine for growth, but it is also an important force for poverty reduction particularly considering that agriculture constitutes a significant portion of all African economies. Agriculture thus contributes towards major continental priorities, despite subsistence farming remaining the sector's cornerstone. SSA's agricultural sector thus spans two vastly different worlds, a small commercial sector and a vast, largely subsistence small farm sector that operates outside of systems for getting capital or selling goods. Between the two lies the region's "missing middle", referring to the underdeveloped link in value chains that could build productive systems and tie smallholders into the stream of commerce. Moreover, the majority of SSA's untapped human resources engaged in agriculture, typically exist outside mainstream market systems, lacking capacity and technical knowledge, and are cut off from the established commercial enterprises that could provide a link to larger, more profitable markets (Kuhlmann et al., 2011).[85]

Within SSA, small farms that are dependent on family labour, with very little machinery and several activities, dominate agriculture. As a result, a significant portion of production is sold through informal channels (NEPAD, 2013).[86] Although there is progress towards formalising trade, a common scene of Africa's cross-border trade is the sight of women crossing the borders with their heads and backs laden and arms overloaded with goods for sale, whereas male traders transport heavy loads on bicycles, trucks, buses and pushcarts. The men and women carry goods that include agricultural commodities (amongst other items) such as cereals, fruits and vegetables, and generally, this form of trade today averages half of intra-African trade (FAO, 2017). It is, therefore, difficult to capture fully the extent of informal cross-

[85] For Africa, this is estimated at 600 million small producers.

[86] This kind of cross-border trade is usually called informal because it involves small entrepreneurs; traders who do not access preferential tariff agreements; traders who may buy, or more often sell, in informal sector markets; and traders who do not always pass through the formal import and export channels for all or part of their goods (FAO, 2017).

border trade in SSA – despite its significance – and is consequently omitted from formal statistics. Similarly, pervasive issues extend to the measurement and estimations of agricultural production.[87]

Agricultural trade reform is therefore, particularly important in its potential for increasing incomes. While agriculture accounts for just 10% of world trade, the potential income gains from agricultural trade reform make up approximately 70% of total potential gains (Laborde & Martin, 2012). Incomes increase for three main reasons: first, some countries have more land and other agricultural resources per person than others. Hence, trade allows such countries to supply those whose resources are much more limited – raising real incomes in both countries. Second, if differences in the agricultural productivity are high enough relative to productivity in other sectors, even countries with relatively limited land can become exporters. Third, with trade, consumers can diversify their diets to incorporate products not available locally. Beyond simply raising incomes, however, the gains from international trade have important implications in that higher incomes make food a smaller share of total consumption expenditures, providing a buffer against threats to food insecurity, if incomes should fall (Martin, 2017).

Estimates suggest that every 10% increase in trade costs reduces trade by 20% and because trade costs are relatively higher for many farm products, this problem is most acutely felt in agriculture. In fact, SSA faces some of the highest international trade costs in the world, at well over twice the level of other developing regions. Furthermore, for poor, landlocked countries in the region, trade costs are up to four times as high as those in developed countries.[88] These high transport costs limit SSA's ability to trade globally, let alone regionally or even locally; and delays and uncertainty in transportation can lead to spoilage, additional warehousing or port payments, along with the need to maintain extra inventory. Better infrastructure and policies will

[87] Research often consists of one-off studies and use diverse monitoring techniques, for example. Due to the limited quality of local/internal production data, measurement error is a concern.
[88] Weak storage and distribution infrastructure further add to the costs of agricultural trade.

reduce transportation times and other trade costs and stimulate investment and trade (Kuhlmann et al., 2011).

The Alliance for a Green Revolution in Africa (AGRA) is an alliance led by Africans with roots in farming communities across the continent. In 2016, they published a book on the status of African agriculture that highlights the importance of promoting regional integration in a manner that reduces the costs of doing business and migration of skills. Since 16 African countries are entirely land-locked and most economies are small, these features offer an opportunity for regional integration and trade, especially from product specialisation and cross-border trade (AGRA, 2016).

Relating to the migration of skills, the Brookings Institution (2016) states that regional integration should bolster agriculture production because tariffs and inflexible border policies are currently a major obstacle to trade. For example, only 13 countries (of 55) offer visa-free or visa-on-arrival entry to all Africans, driving up the cost of skills migration. Therefore, landlocked businesses that shift produce across frontiers to ports often incur huge losses in the process (Schwartzstein, 2016). Labour mobility is critical because food must physically be able to move from areas of surplus to areas of deficit. The legacy of arbitrary colonial boundaries and past power struggles, however, means that moving food from areas of surplus to areas of deficit is often prevented. These fragmented and arbitrary market designations, accompanied by incredibly burdensome policy and regulatory environments, have left many of Africa's poor and landlocked countries at the mercy of their neighbours' infrastructure and policy environments. Not surprisingly, regional trade in both agriculture and food has increased only moderately over the last two decades (Kuhlmann et al., 2011).

International institutions and national governments are therefore, increasingly paying attention to the role regional trade and integration can play in

fostering agricultural growth and mitigating the effect of the food crisis in SSA.[89] This awareness piqued following the 2007/8 food crisis, when the G-8 leaders expressed their commitment to free humankind from hunger through improving food security, nutrition and sustainable agriculture. The communiqué of the G-8 leaders placed a strong focus on the development of agricultural markets, trade and rural economic growth as the cornerstones of food security (L'Aquila Joint Statement on Global Food Security, July 2009).[90]

Since food security exists when all people have access to sufficient and nutritious food (FAO, 2015a), nations must either produce this themselves, or import it. Therefore, Mkandawire et al. (2014) recommend enhancing regional integration as a national and household food security strategy. They argue (qualitatively) that while self-reliance presents a more efficient and effective strategy for food security, regional integration should proceed based on comparative advantage in terms of careful choices of which food items are cheaper to import and which ones should be produced domestically. This idea is supported by the FAO: SSA's success in achieving food and nutrition goals depends, inter alia, on the degree of economic integration or interconnectedness. Enhancing intra-SSA trade through strengthened regional integration arrangements that transcend national and subnational borders will play a key role in overcoming SSA's food import dependency and food insecurity problems (FAO, 2015b and FAO, 2016).[91]

The support for regional integration as a means to increasing agricultural production begins with the threat of competition. Theoretically, competition from suppliers outside the region and the elimination of intra-regional barriers will encourage the intra-regional agricultural sector to focus on competitiveness and

[89] Integration is at the centre of the stated priories of African leaders (Hoekman, Senbet & Simbanegavi, 2017).

[90] Found online at: http://www.g8.utoronto.ca/summit/2009laquila/2009-food.pdf. Accessed: 29 May 2018.

[91] Other than the FAO, the United Nations supports regional integration via UNCTAD and UNECA. UNCTAD's (2009) Multi-year Expert Meeting on International Cooperation was devoted to South–South and triangular cooperation for sustainable agriculture development and food security in developing countries; UNECA's annual Economic Report on Africa 2009 focused on developing African agriculture through regional value chains.

release resources away from inefficient sub-sectors. A vibrant regional agricultural sector will raise and keep employment and value-added within the region and it will improve access to food via productivity improvements. In turn, the regional savings from the increased income and more efficient allocation of resources, will lead to regional investments that will enlarge capacity in areas like infrastructure or research and extension, and enhance competitiveness further (Rakotoarisoa, 2011). We elaborate on these points next.

Integration creates efficiency gains by enabling firms to alter their location decisions, thereby shifting production to countries where it can best take place. This decision rests on the balance between the production and trade costs that must be incurred to supply different markets. On the one hand, locations where economic activity is more concentrated can be efficient in the presence of external economies of scale that increase firms' productivity. On the other hand, proximity to consumers reduces trade costs, particularly when trade policy restrictions are in place (World Trade Organization, 2011b). Moreover, integration allows for a more efficient sourcing of the inputs to agricultural production.[92] Therefore, the primary motive for RTAs is no longer preferential market access because increasingly important is the use of RTAs to promote competitiveness, liberalise services, promote labour mobility, protect intellectual property, improve governance, and foster transparency and the rule of law, amongst others (World Bank, 2011).[93]

RTAs generate both static and dynamic effects, but the dynamic growth effect alters the economic benefits of integration and is, therefore, important for RTA members. The static effects generate a one-time reallocation of resources, stemming firstly, from improved market access. Second, countries left outside the RTA may lose out because their trade with RTA members is displaced by trade between members,

[92] Pascal Lamy's opening address to the XIIIth Congress of the European Association of Agricultural Economists in Zurich in August 2011 (World Trade Organization, 2011b).

[93] Many of these benefits are only available to nations because they coordinate their economic policies during integration. One such example is a trade war between large countries: if the two countries cooperate and set zero tariffs against each other, then both will benefit relative to the case when both countries attempt to secure short-term advantages by setting optimal tariffs (Suranovic, 1998).

but any potential negative effect of RTAs on third countries can be addressed by lowering RTA external tariffs to leave the third countries' trade levels unchanged. Third, RTAs may divert trade and enable producers from within the RTA to displace other, more efficient producers. These diversion concerns, however, can be addressed through lump-sum transfers within the RTA to ensure welfare gains for all (World Bank, 2011).

The dynamic RTA effects are more complex because they operate by changing the rate at which new factors of production, mainly capital, are accumulated. For example, in the presence of imperfect competition and economies of scale, the size of the market matters. Therefore, uniting small economies makes regional firms more efficient and more competitive, by allowing them access to a bigger market. Moreover, preferential liberalisation and defragmentation of national markets lead immediately to more competition because more firms are present in the market. In turn, this results in industrial restructuring and upgrading because firms need to grow to cover their costs in the more competitive environment, and the least efficient firms exit the market. Ultimately, the region is left with a more efficient industrial structure, with fewer, bigger, more efficient firms competing more effectively with each other (World Bank, 2011).

An additional dynamic effect stems from the location decisions of firms in the RTA, potentially having a distributional impact within the preference zone. Firms may benefit from the existence of positive externalities (or agglomeration forces) associated with being located close to markets and other producers. However, there are also negative externalities (or dispersion forces) linked with geographic concentration, such as higher cost for land or labour. RTAs alter the balance of agglomeration and dispersion forces in a complex way: in theory, lowering trade costs reduces dispersion forces and diminishes agglomeration forces but the extent to which this occurs is indeterminate in theory and case-specific. Therefore, RTA members are likely to benefit unequally from these complex dynamic gains (World Bank, 2011).

More than the numerous traditional benefits of trade gains, the opportunity to tap into foreign markets, increased returns and increased competition, and the potential to attract foreign direct investment, regional integration provides some non-traditional benefits. These include the locking-in of domestic reforms; improved signalling (which partly relates to attracting foreign direct investment); enhanced insurance against instability, shocks and the resurgence of protectionism in developed countries; improved coordination and bargaining power; and improved security through building trust, raising the opportunity cost of war, and hence, reducing the risk of conflicts between countries (Kritzinger van Niekerk, 2005).

Despite the arguments for trade agreements, some authors oppose integration because opening to foreign markets exposes smaller and poor producers to increased price volatility and competition (Edelman et al., 2014).[94] However, these fears are unfounded: in autarky, price shocks can have particularly severe effects on a country's economy and on poor populations' food security because food output in any one region is typically highly volatile, thus bad harvests result in severe food shortages, high prices and vulnerable people becoming food insecure. Since a drought in one country is unlikely to be associated with drought in other major suppliers around the world, international trade allows consumers to obtain their food from a much more diversified and stable set of suppliers. Quite simply, diversification of sources of supply reduces volatility and if trade does cause volatility, this can be managed. If trade is cut off absolutely, or restricted using unpredictable trade policies, the outcome is likely to be much more volatility than with open trade (Martin, 2017).

Causing continual debate and making regional integration even more contentious (Nin-Pratt & Diao, 2014), is that increased competition drives efficiency in RTAs. This is the primary concern for the agricultural sector because domestic agricultural firms may face lower-cost producers from within the RTA and these firms may have significantly better marketing and trade infrastructure. The dilemma, therefore, is whether to subject domestic agriculture to further competition in the

[94] Several more issues hamper regional integration in SSA, see Kritzinger van Niekerk (2005), and Bailey and Wellesley (2017).

hope that the farm sector will respond by undertaking structural and technological change and becoming competitive regionally and, eventually, globally (World Bank, 2011).

With adequate safeguards in place, countries can develop a competitive agricultural sector. Firms have realised the potential of closer market integration through collective action on research, market development, the harmonisation of health and safety regulations, cooperation on trade policy and on approaches to development agencies and donors. The treatment of these issues determines the extent to which market expansion leads to scale economies and the rationalisation of production and investment and where these arrangements have worked well, RTAs have been successful at establishing regional markets and developing trade through investment (World Bank, 2011).

4.2.3 Sector comparisons: value added as a percentage of GDP (1981–2016)

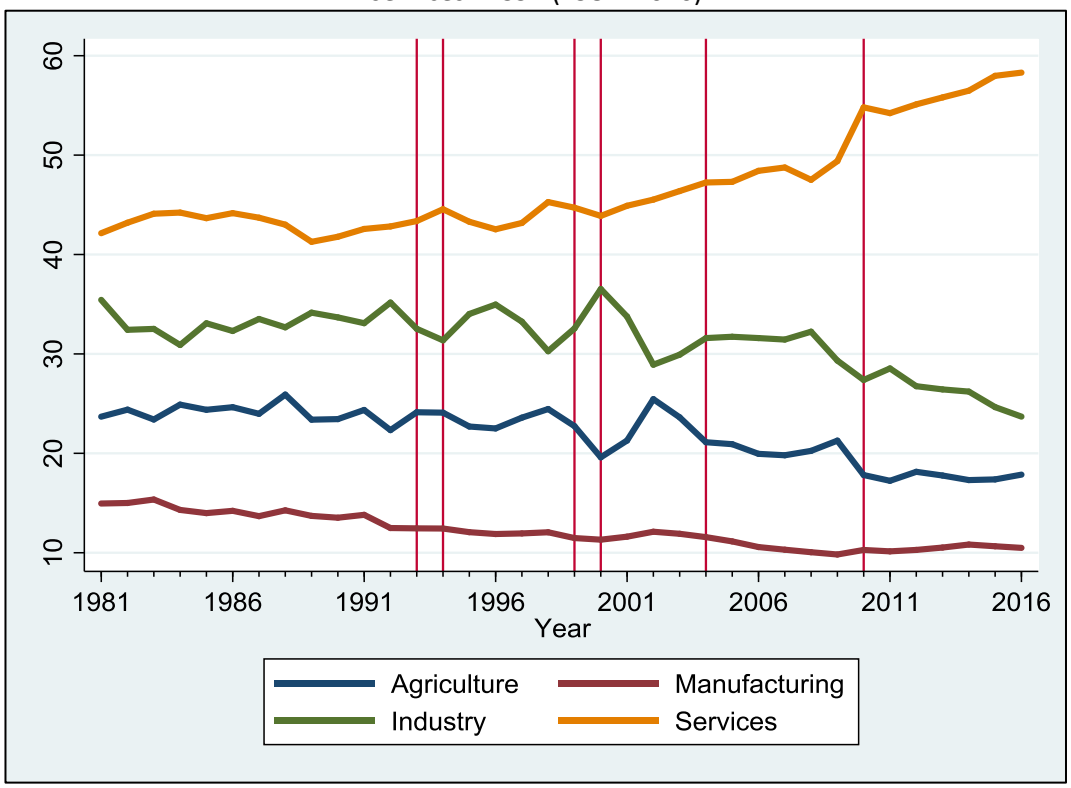
A pivotal insight from the economic development literature is that development entails structural change. Structural change refers to the evolution of sectoral specialisation at the country level and is accompanied by geographic clustering. Geographic clustering increases the structural differences between regions by allowing countries to diversify and specialise in different activities according to regional comparative advantage; resulting in heterogeneous regions. Those countries diversifying away from agriculture and other traditional products are the ones able to pull themselves out of poverty and get richer. Regional integration can cause structural change to the economies of SSA, but a curious feature of SSA over the last decade is that rapid growth has been accompanied by little structural change towards non-traditional tradables (such as manufactures) (McMillan & Rodrik, 2011; Rodrik, 2016 and Imbs, Montenegro & Wacziarg, 2012).[95]

[95] The African experience is particularly intriguing to Diao, McMillan and Rodrik (2017) because growth-enhancing structural change appears to have come typically at the expense of declining labour productivity growth in the more modern sectors of the economy.

Regional units specialise in goods of first necessity, such as agricultural staples, when there are distinct regions that are closed to each other. Consequently, a poor country is concentrated in a small number of sectors, since its constituent regions produce a small range of similar goods. As regions gradually integrate, each regional unit gains access to a larger market, indivisibilities become less binding and regional clustering occurs because of standard comparative advantage forces. While its regions cluster, the country diversifies, because its overall sectoral composition aggregates that of regions specialised in different activities. While activity diversifies in the aggregate, clustering takes place locally. Integrated regions become increasingly dissimilar in terms of their production structure; but become increasingly similar in terms of their income and productivity levels, thanks to the efficiency-enhancing effects of trade, factor movements and the accelerated diffusion of technologies across regions (Imbs, Montenegro & Wacziarg, 2012).

Therefore, we review SSA's value added (as percentage of GDP) by agriculture, and compare this contribution to that of manufacturing, industry and services. Agriculture's value added has been declining since 1981, see Figure 4.1 below; and from our analysis of the data, we find a decline in value added of 24.63% for the period under review. This declining trend extends to agricultural value added per worker, cereal yields and total factor productivity, all of which are much lower than in Asia and Latin America (AGRA, 2016). Of the four sectors in Figure 4.1, only services has increased; however, we believe that this increasing trend in services is not due to RTAs because, of the seven plurilateral agreements, only the EAC includes services and it has done so only since 2010.

0Figure 4.1: Value added (as % of GDP) for agriculture, manufacturing, industry and services in SSA (1981–2016)



Notes: The red, vertical lines denote the "entry into force" dates of the seven different regional trade agreements: 1993 – ECOWAS, 1994 – COMESA, 1999 – CEMAC, 2000 – SADC, EAC (goods) and WAEMU, 2004 – SACU and 2010 – EAC (services).
(i) *Agriculture* corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. (ii) *Industry* corresponds to ISIC divisions 10-45 and includes (iii) *manufacturing* (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. (iv) *Services* correspond to ISIC divisions 50-99 and they include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling.[96]
Sources: World Bank (2016b) and World Trade Organization.[97]

For SSA, farmers have moved out of rural areas, but these urban migrants are being absorbed largely into informal activities and into services that are not particularly productive. This is a concern because the economy grows when labour

[96] Sectoral definitions are verbatim, and each is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Moreover, value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.
[97] Accessed via the Regional Trade Agreements Information System [Online]. Available at: http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx. This is also the primary source of data for Egger and Larch (2008).

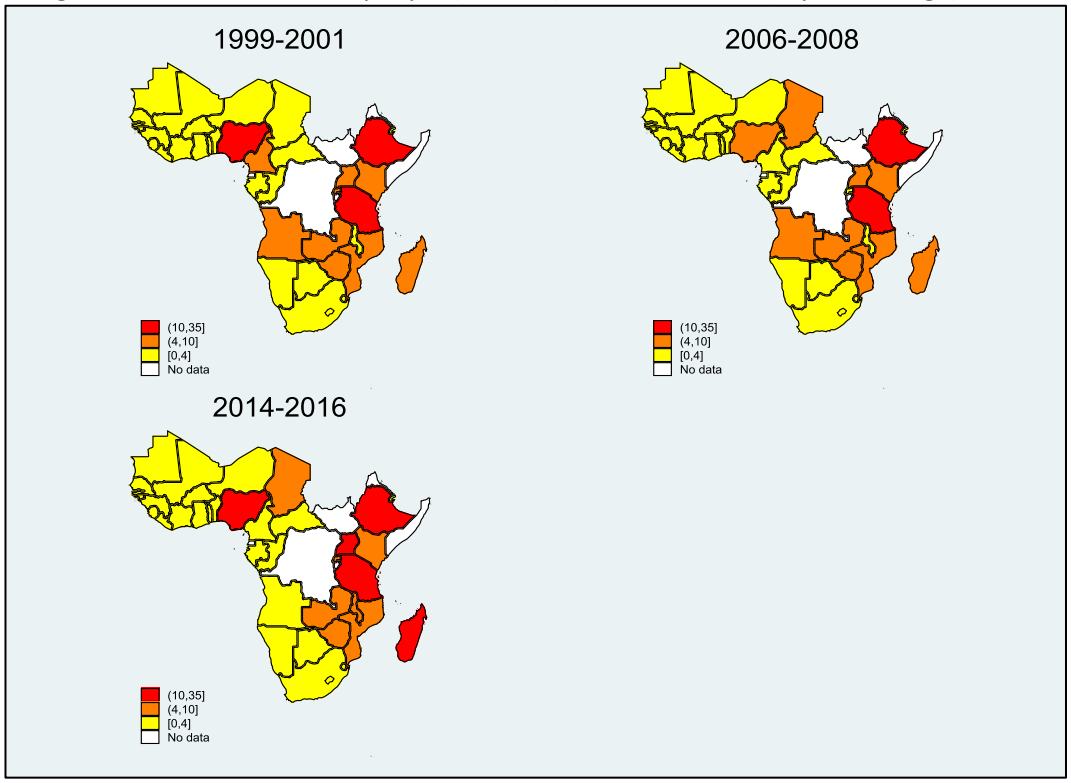
moves from less productive to more productive activities.[98] Additionally, the share of agriculture in value added has dropped significantly since the 1960s, but the primary beneficiary of this reduction has been urban services rather than manufactures. In fact, industrialisation lost ground in the mid-1970s, and has not made much of a recovery in recent decades. Manufacturing industries' share of employment stands below 8%, and its share in GDP is approximately 10%, down from almost 15% in 1975. Most SSA countries are too poor to be experiencing de-industrialisation, but that is precisely what seems to be taking place. Therefore, the SSA pattern of structural change is very different from the classic pattern that has produced high growth in Asia, and before that, the European industrialisers (McMillan & Rodrik, 2011 and Rodrik, 2016).

Structural change is typically a signal of growth and development but in SSA, structural change has served to hinder economic growth in many countries (McMillan & Rodrik, 2011). This may be because a large percentage of the population is employed in agriculture (65% of the region's employment relates to agriculture, agri-trade and agro-industry); traditional cash crops account for half of total agricultural exports; and agricultural raw materials and food represent three quarters of domestic trade.[99] Moreover, the declining share of agriculture's value to GDP (and the movement to services that are not particularly productive) is exacerbating poverty and driving hunger: globally, SSA is the only place where the number of malnourished children is higher now than in the mid-1960s. Related research on undernourishment in the region, shows that over the two decades from 1990–92 to 2010–12, the number of undernourished increased by 52 million people; whereas in the rest of the world, undernourishment fell (Figure 4.2 provides three snapshots of undernourishment in SSA) (World Economic Forum et al., 2011; World Economic

[98] McMillan, Rodrik and Verduzco-Gallo (2014) emphasize the importance that labour flows from low-productivity to high productivity activities as a key driver of development.
[99] Staple food crops account for about half of the employment in SSA, with 47% of these workers being women.

Forum et al., 2015; GIZ, 2012; World Bank, 2016b; Guinan, Kuhlmann, Searchinger, Contini & Martha, 2012 and Warr, 2014).[100]

Figure 4.2: Number of people (millions) undernourished (3-year average) in SSA



Notes: Per country, the average number of people undernourished in the region is approximately 4 million.

Source: Created using FAOSTAT data.

4.3 Our data, variables and methodology

In the following sub-sections, we provide information on our dependent variable (agricultural production), as well as our explanatory variables. We include both ex-ante ("forward looking") and ex-post ("backward looking") measures of integration on the right hand side because the ex-ante measures represent the declared – rather than actual – level of integration; and including dummy variables for the levels of integration means all agreements are treated identically. Ex-post measures reflect the fact that integration is a phased process (De Lombaerde & Van

[100] More research shows that roughly 26% of people aged 15 years or more in SSA, representing 153 million people, suffered from severe food insecurity in 2014/15 - the highest prevalence of severe food insecurity in the world (FAO, 2015b).

Langenhove, 2004), one affected by many additional factors for which we cannot control.

4.3.1 Agricultural production and explanatory variables

In sub-section 4.2.2, we touched upon the importance of agriculture as a driver of growth, and as an important force for poverty reduction. Consequently, and because even small variations in agricultural productivity has strong implications for the rate and pattern of economy-wide growth, we choose agricultural production as the dependent variable, sourced from the FAO's FAOSTAT database. Our dependent variable and explanatory variables are outlined in Table 4.2 below. While there are no completely reliable series with wide country, crop and time coverage, the FAO's agricultural production data is the most comprehensive for SSA. Furthermore, assuming that measurement errors for production are random, or that the bias changes little over time, the index values are as good an indicator of relative trends as are available.

Table 4.2: Proposed variables, their descriptions and potential sources for the data

Variable	Description	Source
Agricultural production (Dependent)	Net production index number (2004-2006 = 100) Net = Gross – feed – seed	FAOSTAT
Integration	See Table 4.1	Larch RTA database
GDP	Gross Domestic Product in current USD	World Bank (World Development Indicators)
Exports	Exports of goods and services in current USD	
Imports	Imports of goods and services in current USD	
Population	Population in millions of people	

Notes: The FAOSTAT indices of agricultural production show the relative level of the aggregate volume of agricultural production for each year in comparison with the base period 2004-2006. They are based on the sum of price-weighted quantities of different agricultural commodities produced after deductions of quantities used as seed and feed weighted in a similar manner. The resulting aggregate represents, therefore, disposable production for any use except as seed and feed. All the indices are calculated by the Laspeyres formula. Production quantities of each commodity are weighted by 2004-2006 average international commodity prices and summed for each year. The "international commodity prices" are used to avoid the use of exchange rates for obtaining continental and world aggregates, and to improve and facilitate international comparative analysis of productivity at the national level. These "international prices", expressed in so-called "international dollars", are derived using a Geary-Khamis formula for the agricultural sector. OECD crop production data (wheat, maize, rice and soybean) is available for 1990 – 2026, but country coverage is not as extensive as FAOSTAT.

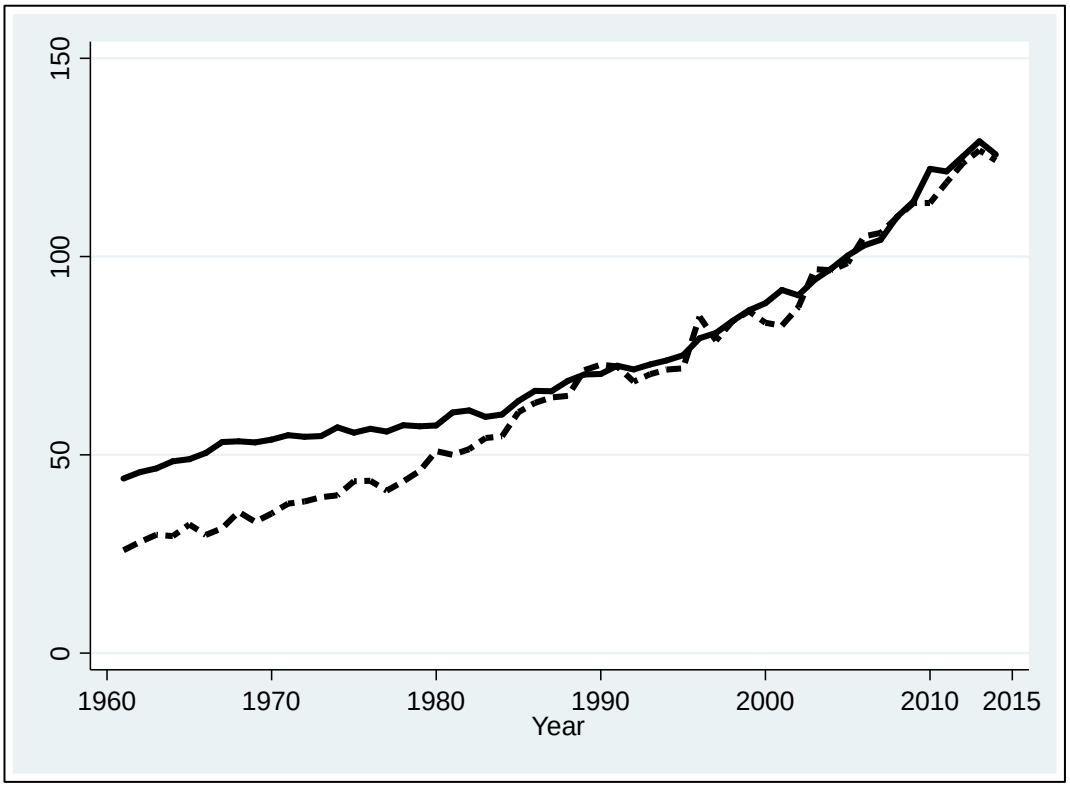
There is extreme heterogeneity of African nations in terms of food producing systems and their socio-political drivers (Luan et al., 2013 and NEPAD, 2013). Northern Africa, for example, (a) has mainly an arid farming system with a low level of agricultural productivity (Dixon, Gulliver & Gibbon, 2001), and (b) is the largest grain importing region in the world, with severe constraints on arable land and water (Sadler & Magnan, 2011). Thus, in Table 4.3, we contrast a few summary statistics for our production data in Africa, with production in SSA. In Figure 4.3, we plot the aggregate net agricultural production for SSA and North Africa over 1961 to 2014. In Table 4.3, we notice that the mean net agricultural production in Africa and SSA is similar, but SSA's production varies significantly less. With a minimum of 44 and a maximum of 129, SSA's deviation is approximately 24; but for Africa, the deviation is 32, with a minimum of 13 and a maximum of 206. In Figure 4.3, we clearly see that between 1961 and the mid-1980s, North Africa's production was below that of SSA's; however, since the mid-1980s the two series have converged.

Table 4.3: Summary descriptive statistics for Africa and SSA's net agricultural production

Variable	Mean	Std. Dev.	Min	Max
Net agricultural production	73.73	31.53	13.36	206.16
Net agricultural production in SSA	74.78	23.84	44.03	129.09

Notes: Total number of observations is 2,795 per variable, except for SSA, where there are 2,417 observations.

Figure 4.3: The aggregated (by year) net agricultural production in SSA and North Africa: 1961–2014



Notes: 2004-2006 = 100. Solid line = SSA and dashed line = North Africa, consisting of Algeria, Djibouti, Egypt, Libya, Morocco, Somalia, Sudan and Tunisia.

Since our production data is available by country, this means aggregating the bilateral integration data. Therefore, Table 4.4 provides some aggregated descriptive statistics for the integration data by year. This table shows the number of RTAs, categorised into PS, FTA, CU and EIA. These four categories (which are not mutually exclusive) do not sum to the total number of RTAs because RTA, being dichotomous, simply captures whether an agreement exists. The number of bilateral pairs refers to the sum of country pairs party to a RTA, so with 4 countries in an agreement, there are 6 [(4 x 3) / 2] bilateral pairs.

According to Egger and Larch's (2008) data, there were no SSA FTAs in 1990, however Table 4.4 is slightly misleading because we present the data by decade, it does not tell us that countries like Burkina Faso, Ghana, Cameroon, Chad and Gabon were in an FTA between 1962 and 1966, or that Kenya, Uganda and Tanzania were in an FTA between 1967 and 1977. Further, there are a few cases where the data notified to the WTO do not correspond to the actual existence of a RTA (see previously

discussed SADC example). These instances notwithstanding, integration in SSA took off in the 1980s and today, consists largely of CUs and FTAs. Since the 2000s, each SSA country has had an average of between 14 and 15 RTA partners, climbing significantly from the 5-6 average of the previous two decades.

Table 4.4: Aggregated descriptive statistics of SSA integration by year: 1950–2015

	Count of the number of bilateral pairs in[2]:					
Year	**RTAs**	**PSs**	**FTAs**	**CUs**	**EIAs**	**Ave. number of RTA partners per country[1]**
1950	1	0	0	1	0	0.043
1960	0	0	0	0	0	0
1970	1	0	0	1	0	0.043
1980	120	0	0	120	0	5.217
1990	135	21	0	120	0	5.870
2000	338	28	91	256	0	14.696
2010	333	28	91	244	10	14.478
2015	340	28	105	244	10	14.783

Notes: [1] Calculations performed with duplicate pairs deleted, except for the calculation of average partners.

[2] RTA – Regional Trade Agreement, PS – Partial Scope, FTA – Free Trade Agreement, CU – Customs Union, and EIA – Economic Integration Agreement. These four categories do not sum to the total number of RTAs because RTA, being a dummy, captures whether there is one or more agreements in a given year.

According to the data, there is a CU between South Africa and Zimbabwe in 1950.

The number of bilateral pairs refers to the sum of country pairs party to a RTA, so with 4 countries in an agreement, there are 6 [(4 x 3) / 2] bilateral pairs.

While Larch's data includes no SSA FTAs up to 1990, the table is slightly misleading because we present the data by decade, thus cannot capture agreements forming and collapsing within the decadal bins.

For the levels of integration in our model, we include dummy variables, but these ex-ante measures are problematic because the dummies treat agreements identically. Furthermore, because agreements often have long transition/phasing-in periods, the entry into force data coded in the data does not reflect the true level of integration. For example, Hinkle, Hoppe and Newfarmer (2006)[101] highlight that despite the proliferation of regional agreements, significant barriers to trade remain, mostly because of imperfect implementation of agreements, high border costs, restrictive rules of origin and poor infrastructure. None of the four free trade agreements (COMESA, SADC, ECOWAS and CEMAC) involved in the trade negotiations

[101] More recently, Piermartini and Yotov (2016) find evidence of strong phasing-in effects.

has unimpeded commerce among its members. The issues persist within customs unions; all, save the SACU, still collect tariffs on internal trade and maintain other barriers to intra-regional trade. Therefore, we must consider ex-post measures of integration as well.

Ex-post measures of regional integration

A few papers define ex-post measures of integration, such as Cheong (2010), who defines the "coverage rate" as the proportion of dutiable imports from FTA members that are eligible for preferential treatment. Dutiable imports being those imports on which the MFN tariffs are more than zero (imports that have a zero MFN duty are disregarded because preferences would be irrelevant for them). The coverage rate shows the official scope of the FTA, with higher ratios reflecting a wider scope. The coverage rate does not show the actual utilisation of preferences because some imports that were eligible for preferential treatment may have entered under the MFN regime for various reasons. Therefore, the coverage rate is an upper bound to the share of dutiable imports that entered with preferences.

Similarly, Cheong (2010) equates the "utilisation rate" to the attractiveness of a preferential regime relative to MFN treatment. Hence, the rate shows the degree to which preference-eligible dutiable imports enter under preferential – rather than MFN – tariffs. The utilisation rate considers only dutiable imports that are eligible for preferences. The higher the utilisation rate, the more preference-eligible imports enter under preferential rather than MFN tariffs. A higher utilisation rate also implies that the compliance costs of rules of origin are less of a constraint.

Arribas, Pérez and Tortosa-Ausina (2011) base their ex-post measures on the geographical neutrality concept of Krugman (1996), and the Standard of Perfect International Integration by Frankel (2000). Like previous authors, they define "trade openness" as:

$$Trade\ openness = \frac{(X + M)}{GDP} \tag{4.1}$$

Arribas et al. (2011) extend this measure to include the structure of the current trade relations between countries, what some authors have labelled the "architecture" of trade flows (Kali & Reyes, 2007), or the World Trade Web (WTW). Relevant aspects of this architecture would include the number of trade partners, the proportionality of trade flows to the size of the partners, and the role of barriers – particularly distance.

Considering the possible measures and given our data, we create two ex-post variables: "Depth" and "Extent", specified in equation [4.2] and [4.3] respectively. Both variables are defined individually for seven multilateral trade agreements and as an aggregate across the seven agreements. The seven plurilateral agreements are: the (1) SADC, (2) EAC, (3) COMESA, (4) SACU, (5) CEMAC, (6) ECOWAS and (7) WAEMU. Trade data ("goods, value of exports, free on board, US dollars" and "goods, value of imports, free on board, US dollars") comes from the IMF Direction Of Trade Statistics (IMF, 2018).

$$Depth_j = \frac{\sum X^j_{RTA\ partners} + \sum M^j_{RTA\ partners}}{GDP_j} \tag{4.2}$$

$$Extent_j = \frac{\sum GDP_{RTA\ partners,\ \ excluding\ j}}{GDP_j} \tag{4.3}$$

Hence, for *j* as a member of the SADC, Depth is defined as:

$$Depth_j = \frac{\sum X^j_{SADC} + \sum M^j_{SADC}}{GDP_j}$$

where $\sum X^j_{SADC}$ is the sum of *j*'s exports to the SADC members, and $\sum M^j_{SADC}$ is the sum of *j*'s imports from the SADC members. Furthermore, for each agreement, the calculation is limited to the specific years in which *j* was member to the relevant agreement(s). For example, Madagascar was suspended from the SADC between 2009 and 2014, and hence is excluded from the calculation of Depth for this period.

Similarly, for Extent, we divide the trade agreements' total GDP (excluding *j*) by the GDP of *j*. Once these calculations are finalised, we aggregate across the seven agreements to obtain an overall 'Depth' and 'Extent' measure. While our ex-ante measures of integration fail to differentiate between agreements and do not reflect the true level of integration because of phasing-in periods; and because our ex-post measures are influenced by other factors beyond our control, the best approach to balancing out the respective flaws is to include both ex-ante and ex-post measures.

4.3.2 Empirical model

The empirical model of this chapter includes variations of our three hypotheses from Chapter 3. We believe three aspects of regional integration cause an increase in agricultural production; firstly, the existence of a regional agreement; second, the depth of a regional agreement; thirdly, the duration (in years) of being in a regional agreement. These three hypotheses are initially captured by (1) an RTA dummy variable; (2) the number of RTA partners, and the total number of RTAs; and (3) the average duration of membership in RTAs. However, since agriculture in SSA is largely subsistence, production depends primarily on public policies and farmer's behaviour, which are not addressed in RTAs. Therefore, our null hypothesis is that we will not find support for any of the hypotheses. Nonetheless, each hypothesis is stated below.

Hypothesis 1 (Existence): As compared to no agreement, agricultural production will be higher for country *i* after joining a regional trade agreement, ceteris paribus. In other words, the signing of a regional agreement by *i*, regardless of the degree of integration, will result in higher agricultural production for *i*.

Hypothesis 2 (Depth): The more highly integrated is country *I*, the higher will be its agricultural production, ceteris paribus. Therefore, a vertical increase in the degree of integration, say from a PS to an FTA, or from an FTA to a CU, will result in higher agricultural production for *i*.

Hypothesis 3 (Duration): For country *i*, the longer the duration of being in a trade agreement, the higher will be its agricultural production, ceteris paribus. Therefore, keeping the degree of integration constant, agricultural production for *i* after 10 years in a regional agreement will be higher than agricultural production for *i* after 2 years in the agreement.

4.4 Least squares regression results and discussion

Our base model adapted from Chapter 3 is:

$$\begin{aligned} Agricultural\ production_{it} \\ &= \alpha + \beta_1 RTA_{it} + \beta_2 No.of\ RTA\ partners_{it} + \beta_3 Total\ RTAs_{it} \\ &+ \beta_4 Ave.Duration_{it} + \beta_5 Population_{it} + \eta_i + u_t + \varepsilon_{it} \end{aligned} \quad (4.4)$$

where *Agricultural production* is the net agricultural production[102], *RTA* is a dummy variable equal to 1 for years in which country *i* was in at least one SSA-based RTA, *No. of RTA partners* is the aggregated total number of trade agreement partners for country *i*, across all RTAs and *Total RTAs* is the aggregated total number of agreements country *i* is involved in. *Ave. Duration* is the average number of years for which country *i* has been in RTA(s) and *Population* is the population in millions.[103] We also include country (η_i) and year (u_t) fixed effects.

Tables 4D.1 and 4D.2 present our initial results of running specification [4.4] on our panel of 46 SSA countries, over the 1961-2014 time horizon. Since we do not have agricultural data for Eritrea and Ethiopia prior to 1993, or for South Sudan in

[102] We also run regressions on 'agricultural production per capita' as the dependent variable (see Appendix 4D) but notice a substantial fall in explanatory power of our specification.
[103] At most, a country has membership within three of the seven SSA RTAs. *Ave. Duration* is, thus, an average across these three agreements.

2012–2014, we lose a few observations and run our specifications on the remaining 2,417 observations. Two major insights come from these results. First, our model explains more of the variation in net agricultural production than it does in net agricultural production per capita, which is why we prefer the former for subsequent regressions. Second, our Depth variables are insignificant and thus excluded.[104]

4.4.1 Preferred least squares results

After re-specifying our model to include measures of extent (market access) (equation [4.3]) and global trade openness (equation [4.1]), our preferred specification is (all data is aggregated by country and year):

$$\begin{aligned} Agricultural\ production_{it} \\ &= \alpha + \beta_1 RTA_{it} + \beta_2 Extent_{it} + \beta_3 Trade\ Openness_{it} \\ &+ \beta_4 Ave.Duration_{it} + \beta_5 Population_{it} + \eta_i + u_t + \varepsilon_{it} \end{aligned} \quad (4.5)$$

where the variables are as before, but *Extent* captures market access, and *Trade Openness* captures global openness to trade.[105] These changes result in significant β_2 and β_3 estimates (results in Table 4.5) and these two variables are, consequently, kept as explanatory variables for our preferred specification. Due to the possible divergence away from the agriculture sector, we include estimations on three disaggregated sectors of agriculture: cereals, crops and livestock in columns [2] – [4] respectively.

Clearly, these results are not sensitive to the level of aggregation and while we expect to find positive coefficients for $\hat{\beta}_1$ to $\hat{\beta}_4$, we find that $\hat{\beta}_{RTA}$ and $\hat{\beta}_{Trade\ Openness}$ are typically negative and significant. Consistent with the negative coefficient on

[104] Several alternatives created using equation [4.2] were insignificant and thus we exclude the measure of Depth. Apart from the results presented in Tables 4D.1 and 4D.2, we also tested additional measures created from FAOSTAT and IMF data. Since these are also insignificant, we do not provide the results.

[105] Aside from global trade openness, we tested whether (i) agricultural trade openness, or (ii) RTA openness might be significant, but neither was. Given the dependence of SSA (extra-regional) exports on primary commodities, an increase in cash crop production will be directly associated with an increase in total exports. In the case of mineral exporters, changes in domestic production and changes in total exports (commodity booms and busts) may be associated directly with food imports. The composition of trade may thus be a confounding variable, making it more difficult to interpret the results.

openness, fewer barriers between countries stemming from the formation of an RTA may well increase informal trade, particularly for cereals and livestock; hence, recorded intra-regional trade in agriculture may decline. From these results, we find no integration effect on agricultural production. The extent (access to the size of the market) has a positive effect, which is significant in columns [1] and [3], but insignificant in columns [2] and [4]. Similarly, trade openness is significant in columns [1] and [3] but with a negative effect on agricultural production, and is insignificant in columns [2] and [4]. Lastly, the duration of being in RTA(s) has a positively significant effect in columns [1] and [4], but is insignificant in columns [2] and [3]. Population is insignificant throughout.

Table 4.5: Least squares regression results of total and sectoral agricultural production: preferred specification

Dependent variable:	**Net agricultural production (1961 – 2014)**			
Agricultural sector:	**Base**	**Cereal**	**Crops**	**Livestock**
	(1)	**(2)**	**(3)**	**(4)**
RTA	-8.758***	-23.652	-13.168***	-5.302**
	(3.091)	(15.238)	(4.235)	(2.666)
Extent (market access)	0.001**	0.003	0.004*	-0.000
	(0.001)	(0.002)	(0.002)	(0.001)
Trade Openness	-8.472**	-4.493	-10.127**	-1.853
	(3.938)	(11.239)	(4.874)	(3.832)
Ave. duration in RTA(s)	1.156*	1.147	1.107	1.211***
	(0.600)	(1.209)	(0.779)	(0.432)
Population (millions)	0.281	0.469	0.268	0.157
	(0.180)	(0.444)	(0.199)	(0.158)
Constant	44.170***	32.550*	42.943***	47.332***
	(5.431)	(18.247)	(7.282)	(4.400)
FE (*i* and *t*)	Yes	Yes	Yes	Yes
Observations	1,998	1,904	1,994	1,994
Number of Countries	45	42	44	44
Within R-squared	0.740	0.153	0.646	0.742
Overall R-squared	0.790	0.435	0.715	0.797

Notes: The table shows the results of regressing net agricultural production on variables representing existence, depth and duration aspects of integration. *Agricultural production* is (i) the net agricultural production, as well as the net production of (ii) cereals, (iii) crops and (iv) livestock. The *RTA* dummy equals 1 for years in which country *i* was in at least one SSA-based RTA. *Extent* captures market access, *Trade Openness* captures global openness to trade, *Ave. Duration* is the average number of years for which country *i* has been in RTA(s) and, *Population*

is the population of each member country (in millions). The data are annual, comprising up to 1,998 observations for a maximum of 45 countries over the 1961-2014 time horizon. By the end of the sample period, countries are members in an average of 1.6 agreements, and have an average of 15.5 trade partners within each agreement. The Stata command *xtreg* is used for the models. Fixed effects are included as indicated but not reported: *i* – country fixed effects and *t* – time fixed effects. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Further, we standardise our coefficients so that the variances of the dependent variables equal 1. Standardised coefficients are used to re-express the coefficients as the effect of a one standard deviation change, as opposed to a unit change. The purpose of standardising the coefficients is to determine the relative importance of explanatory variables and/or, to compare the effect of changing different variables (Bring, 1994). We present these coefficients in Table 4.6 below.

Table 4.6: Preferred specification: original and standardised coefficients

Dependent variable: Net agricultural production (1961 – 2014)		
Variable	**Original**	**Standardised**
RTA	-8.758***	-8.758***
	(3.091)	(3.091)
Extent (market access)	0.001**	2.116**
	(0.001)	(0.935)
Trade Openness	-8.472**	-3.761**
	(3.938)	(1.748)
Ave. duration in RTA(s)	1.156*	5.454*
	(0.600)	(2.832)
Population (millions)	0.281	5.362
	(0.180)	(3.424)

Notes: The table compares the results of column [1] in Table 4.5, repeated under "Original", to the standardised coefficients. We obtain the standardised coefficients by first standardising the variables using z-scores, then running the regression again.[106] RTA is not standardised because it is a dummy variable.

The standardised coefficients reveal that forming an RTA has the largest negative impact on the agricultural production index, leading to a reduction in the index by 8.758. Furthermore, a one standard deviation increase in trade openness,

[106] z-scores calculated using: $x_{it} = \frac{x_{it} - \bar{x}}{\sigma(x)}$.

causes a reduction in the index by 3.761. In contrast, a one standard deviation increase in extent (market access), causes an increase in the index by 2.116, and a one standard deviation increase in duration, causes an increase in the index by 5.454.[107] These increases are however, insufficient to offset the net reduction in agricultural productivity caused by integration.

While our results are not sensitive to the level of aggregation, we also need to check whether the results are sensitive to (a) RTA's specification, and (b) the sample of countries. Since the RTA dummy equals 1 when country *i* is in a SSA-based bilateral or plurilateral trade agreement, we recode the dummy to only equal 1 when country *i* is in one of the seven plurilateral agreements. The coefficients resulting from (a) were statistically similar to before re-specifying the RTA dummy, hence we do not present these results.

To check (b), we exclude from the sample South Africa, Kenya and Nigeria in columns [2], [3] and [4] of Table 4.7 respectively. In terms of global GDP, these three countries rank 39th, 69th and 27th respectively, and in terms of agricultural production value, these countries rank 3rd, 9th and 1st respectively in Africa.[108] These statistics merely warrant the exclusion of South Africa, Kenya and Nigeria from the regression, since they may be catalysts within their geographic regions (Kritzinger van Niekerk, 2005). Therefore, being large economies with large agricultural sectors, we exclude South Africa, Kenya and Nigeria because their size might bias the results through acting as catalysts. With the same concerns in mind, we exclude the SADC, EAC and COMESA countries in columns [5], [6] and [7] respectively, believing these large plurilateral agreements may act as catalysts within SSA. When excluding the members of these agreements, the number of countries included in the regression does not change significantly because trade agreements in the region formed no earlier than 1993, yet the agricultural production data is available from 1961. Thus, excluding

[107] The standard deviations are: 1,506.638 (Extent); 0.444 (Trade Openness); 4.720 (Average duration in RTA); and 19.062 (Population).
[108] GDP ranking sourced from the World Bank (2017) [Online]. Found at: https://datacatalog.worldbank.org/dataset/gdp-ranking. Agricultural production values sourced from FAOSTAT [Online]. Found at: http://www.fao.org/faostat/en/#data/QV.

country *i* when party to an agreement does not necessarily result in country *i*'s exclusion from the regression.

Table 4.7: Least squares regression results: sensitivity to country and RTA sample

Dependent variable:	**Net agricultural production (1961 – 2014)**						
Exclusions from sample:	**None**	**South Africa**	**Kenya**	**Nigeria**	**SADC**	**EAC**	**COMESA**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
RTA	-8.758***	-8.869***	-8.939***	-8.645***	-5.290**	-8.768***	-5.294*
	(3.091)	(3.219)	(3.255)	(3.083)	(2.201)	(3.142)	(2.794)
Extent (market access)	0.001**	0.001**	0.001**	0.001**	0.000	0.001**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
Trade Openness	-8.472**	-8.552**	-8.304**	-8.567**	-4.169	-8.320**	-4.436
	(3.938)	(3.939)	(3.981)	(3.841)	(4.166)	(3.974)	(3.666)
Ave. duration in RTA(s)	1.156*	1.118*	1.178*	1.157*	1.260**	1.155*	1.147*
	(0.600)	(0.617)	(0.605)	(0.596)	(0.586)	(0.603)	(0.598)
Population (millions)	0.281	0.293	0.263	0.623	0.251	0.267	0.347
	(0.180)	(0.191)	(0.173)	(0.601)	(0.164)	(0.175)	(0.234)
Constant	44.170***	43.775***	44.430***	40.465***	11.827**	44.300***	39.371***
	(5.431)	(5.603)	(5.453)	(8.070)	(4.755)	(5.457)	(6.264)
FE (*i* and *t*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,998	1,944	1,944	1,944	1,680	1,940	1,736
Number of Countries	45	44	44	44	43	45	44
Within R2	0.740	0.737	0.732	0.735	0.820	0.728	0.785
Overall R2	0.790	0.788	0.784	0.785	0.849	0.789	0.834

Notes: The table shows the results of regressing net agricultural production on variables representing existence, depth and duration aspects of integration. Since the trade agreements formed no earlier than 1993, yet the agricultural production data is available to 1961, excluding country *i* when party to an agreement does not necessarily result in country *i*'s exclusion from the regression. The data are annual, comprising up to 1,998 observations for a maximum of 45 countries over the 1961-2014 time horizon. The Stata command *xtreg* is used for the models. Fixed effects are included as indicated but not reported: *i* – country fixed effects and *t* – time fixed effects. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

4.4.2 Explaining the absent RTA effect

SSA's small commercial sector is kept distant from the vast subsistence sector, creating a "missing middle". The divide is greatest in agriculture because trade costs are relatively higher for many farm products and these high trade costs limit SSA's ability to trade (Kuhlmann et al., 2011). Therefore, we believe trade costs are

influencing our results and so to help us understand the absent RTA effect (i.e., the negative relationship between integration and agricultural production), we also model the agricultural Ease of Trade (EoT), which is simply the inversion of agricultural trade costs. Therefore, high EoT values correspond to low agricultural trade barriers, and zero values correspond to infinitely high trade barriers. We define EoT as:

$$Agricultural\ EoT_{ij,t} = \frac{1}{Agricultural\ trade\ costs_{ij,t}} \quad (4.4)$$

Using our model and data from Chapter 3, we explore the effect of integration on agricultural EoT in SSA, and in the World. Typically, we expect regional integration to lower trade costs but since we invert agricultural trade costs to create the agricultural EoT, we expect integration will increase the agricultural EoT. The three hypotheses forming the basis of our model from Chapter 3 are paraphrased below.

Hypothesis 1: As compared to no agreement, agricultural EoT will be higher for a pair of countries, *ij*, after the formation of a trade agreement between the two countries, ceteris paribus. In other words, the signing of an agreement between *i* and *j*, regardless of the degree of integration, will result in a higher agricultural EoT between *i* and *j*.

Hypothesis 2: The higher the degree of integration between a pair of countries, *ij*, the higher will be their agricultural EoT, ceteris paribus. Therefore, a vertical increase in the degree of integration, say from a PS to an FTA or from an FTA to a CU, will result in a higher agricultural EoT between *i* and *j*.

Hypothesis 3: For any two countries, *ij*, the longer the duration of being in a trade agreement, the higher will be their agricultural EoT, ceteris paribus. Therefore, keeping the degree of integration constant, agricultural EoT between *i* and *j* after 10 years will be higher than agricultural EoT between *i* and *j* after 2 years.

We test the three hypotheses and present the results in Table 4D.4: for the 44 countries (2,341 observations) in SSA, there is only one positive and significant effect

on the agricultural EoT in, that of duration in an FTA (0.026). The remaining coefficients generally have large standard errors, pointing to the imprecision of our estimates for our limited sample. In contrast, the 65,633 observations among the 176 countries for the World generate more precise estimates. Our results in column [8] show that regional integration causes the agricultural EoT to: increase by 0.113 when forming an RTA; decrease by 0.107 when forming an FTA; increase by 0.042 when forming a CM; decrease by 0.012 when forming an EcU (insignificant); increase by 0.004 when staying in an FTA; increase by 0.002 when staying in a CU (insignificant); increase by 0.022 when staying in a CM; and increase by 0.016 when staying in an EcU.

We standardise the coefficients from Table 4D.4 in Table 4.8. Like before, we calculate the standardised variables (excluding RTA, FTA, CU, CM and EcU, our dummy variables), and run the regression again. From these results, the duration in an FTA causes the only positive and significant increase (0.072) in the agricultural EoT for SSA. In contrast, RTA (0.113), CM (0.042), the duration in an FTA (0.012), the duration in a CM (0.020), and the duration in an EcU (0.009) all have a positive and significant impact on the agricultural EoT for the World. Additionally, FTA has a negative and significant impact (-0.107) on the agricultural EoT.[109]

Hence, regional integration does not result in an easing of trade in agricultural products in SSA, whereas it does ease trade for the World. The ineffectiveness of regional agreements to ease trade (or lower trade costs) may be due to policies in the region typically contributing to the status quo. To a large extent, policies in the region cause price instability and the deterioration of food security. Policies such as ad hoc import and export bans, and bureaucratic procedures usually raise smuggling costs, costs for consumers, and create disincentives for the private sector. These barriers inhibit farmers' access to more lucrative markets (AGRA, 2016) and is maintaining the "missing middle".

[109] For SSA, the standard deviations are: 3.334 (Duration in FTA); 2.667 (Duration in CU); 0.966 (Duration in CM); and 2.599 (Duration in EcU). For the World, the standard deviations are: 5.326 (Duration in FTA); 3.654 (Duration in CU); 1.855 (Duration in CM); and 1.102 (Duration in EcU).

Table 4.8: Poisson regression results for combined Hypotheses: SSA countries compared to the World (original and standardised coefficients)

Dependent variable: Agricultural EoT (1995 – 2012)				
	Sub-Saharan Africa		World	
Variable	**Original**	**Standardised**	**Original**	**Standardised**
RTA	0.086	0.086	0.113***	0.113***
	(0.069)	(0.069)	(0.020)	(0.020)
FTA	-0.099	-0.099	-0.107***	-0.107***
	(0.073)	(0.073)	(0.020)	(0.020)
CU	-	-	-	-
CM	-	-	0.042**	0.042**
			(0.021)	(0.021)
EcU	-0.105	-0.105	-0.012	-0.012
	(0.082)	(0.082)	(0.024)	(0.024)
Duration in FTA	0.026***	0.088***	0.004***	0.024***
	(0.005)	(0.018)	(0.001)	(0.003)
Duration in CU	0.025	0.066	0.002	0.007
	(0.015)	(0.041)	(0.001)	(0.005)
Duration in CM	-0.006	-0.005	0.022***	0.041***
	(0.008)	(0.008)	(0.001)	(0.002)
Duration in EcU	-0.007	-0.017	0.016***	0.018***
	(0.008)	(0.022)	(0.002)	(0.003)

Notes: The table compares the results of columns [4] and [8] in Table 4D.4 (repeated under "Original"), to the standardised coefficients for SSA, and the World. We obtain the standardised coefficients by first standardising the variables, then running the regression again. RTA, FTA, CU, CM and EcU are not standardised because each is a dummy variable.

4.5 Discussion of regression results and conclusions

SSA is the last great agricultural frontier, with more than 70% of the population engaged in agriculture and enormous resource endowments. However, thanks to persistently low productivity levels, the region is unable to feed itself and has become a net importing region for food staples, with an agricultural trade deficit that continues to widen. Moreover, low productivity in the agricultural sector means most

locals continue to face economic stagnation, poverty, and hunger. At the same time, the persistently low productivity levels present SSA with an opportunity: SSA has the capacity to easily produce another 100 million tonnes of grain equivalents each year. Should production reach its potential, SSA will become a net agricultural exporter. Several authors and international organisations advocate regional economic integration as one way of taking advantage of the opportunity, despite there being limited information and analysis about integration's impact on agricultural production, and the dearth of empirical studies (World Bank, 2011 and Nin-Pratt & Diao, 2014).

By analysing the effects of regional integration across national borders on agricultural production, we contribute to the limited pool of empirical studies and analysis on the subject. Given the widespread enthusiasm for regional integration among policymakers in SSA, these findings provide an important quantification of the effects of regional integration. Initially, we run regressions on a panel of 45 SSA countries, covering the period 1961–2014 and find no integration effect on agricultural production, demonstrating that regional integration has been an ineffective strategy to boosting agricultural productivity.

To help us understand why there is no effect, we carry out additional analysis considering whether countries might have benefitted from specialising away from agriculture. With no definitive evidence supporting this, we subsequently focus on the relationship between regional integration and agricultural trade costs. Adopting agricultural trade cost data and comparing our SSA sample results to those obtained from a global sample of 176 countries, we find that regional integration has lowered agricultural trade costs for the World but not in the former, thus failing to stimulate agricultural production. Thus, because regional integration has not resulted in the easing of intra-continental trade, subsistence farmers still face significant trade costs.[110] Research by Balat, Brambilla and Porto (2009) underpins this finding: not

[110] In part, trade costs remain high because of tariffs and inflexible border policies (Schwartzstein, 2016), limiting SSA's potential to export. Moreover, policy distortions, weak institutions and poor infrastructure are the main reasons why SSA has become a net food importer (Rakotoarisoa, Iafrate &

only do trade costs prevent the full realisation of the gains from trade, but they also wither the poverty alleviation role of export opportunities. Overcoming these costs and having access to markets for agricultural export crops means households can enter export cash cropping, in turn, this reduces poverty because major export crops have higher returns than food crops. Finally, we believe the SSA RTAs have failed to lower agricultural trade costs because the 'shallow' agreements are poorly implemented.

Since integration remains contentious in Africa because of political insecurity, ambitious agendas and unclear prioritisation, as well as the risk of polarisation (Kritzinger van Niekerk, 2005), increasing regional integration across national borders is difficult. However, this is precisely what the continent needs: deeper trade agreements. Deeper trade agreements that are fully implemented will bring about lower (agricultural) trade costs, thus providing the necessary stimulus to productivity and growth. As a first step however, national coalitions that link businesses to the agricultural sector and pool resources, should help drive specialisation and economies of scale. Furthermore, unity amongst the numerous subsistence farmers within agriculture, and between the agricultural and non-agricultural sectors, will promote efficiency and competition, build capacity and improve technical knowledge. By pooling resources, coalitions will also limit individual exposure to significant transport costs while the agreements gradually bring about lower (agricultural) trade costs.

If regional integration has not worked, how can SSA improve its agricultural productivity and become a net agricultural exporter? We agree that linking the agricultural and non-agricultural sectors (Diao, Hazell, Resnick and Thurlow, 2006)[111], as well as uniting not only small economies (World Bank, 2011), but also the numerous subsistence farmers is vital. In the presence of imperfect competition and

Paschali, 2011), which is exacerbated by the increased demand for processed agricultural food from outside the region.

[111] Evidenced by the Green Revolution and the "induced innovation model": the "induced innovation model" emphasised the importance of technical change for agricultural growth, but also stressed that technical change is often endogenous to a country's economic system.

economies of scale, the size of the market matters. Uniting the vast subsistence sector, and providing them with systems for getting capital and selling goods, will promote efficiency and competition. Moreover, collaborations will build capacity and improve technical knowledge; and by pooling resources, limit individuals having to face significant transport costs alone. In turn, this results in restructuring and upgrading because farms need to grow to cover their costs in the more competitive environment, and the least efficient farms exit the market. Ultimately, by tying the smallholders into the stream of commerce, SSA will be left with a more efficient structure, with fewer, bigger, more efficient farms competing more effectively with each other (World Bank, 2011 and Kuhlmann et al., 2011).[112]

The challenge for SSA policymakers, therefore, is to find the right balance between a food security and a business agenda, and to ensure that the business agenda engages with large numbers of small farms (Hazell, 2013). Consequently, policymakers must focus on internal integration, i.e., linking businesses to the agricultural sector, and on the national development of institutions and infrastructure. Further research should therefore, focus on integration into national markets, and on the effects of different agreement provisions. In other words, research should focus on internal integration, i.e., linking businesses to the agricultural sector, and on finding the right balance between the food security and business agenda, ensuring that the business agenda engages with large numbers of small farms (Hazell, 2013).

[112] From Melitz and Ottaviano (2008), we know the exposure to larger markets results in higher aggregate productivity, and recent research finds being open to trade increases productivity in the agriculture sector (Martin, 2017).

CHAPTER 5: CONCLUSIONS AND POLICY IMPLICATIONS

By influencing how countries interact in global markets, economic integration is undeniably important to everyone, from poor Sub-Saharan African countries characterised by small-scale subsistence farming to global powerhouses such as the United States and China. Opposing this assertion, recent actions in the global landscape suggest a retreat from globalisation, for example, the Trump administration imposing tariffs on steel and aluminium imports or the decision of the UK electorate to leave the EU. Similar sentiments in the build-up to such actions were the initial motivation behind this doctoral thesis, driving the belief that higher levels of economic integration may not be sustainable.[113]

Although integration on its own cannot guarantee faster growth, no country has grown sustainably without growing exports and since PTAs facilitate trade, the African Continental Free Trade Agreement (ACFTA) is a step in the right direction for the world's least integrated continent. If the agreement is to succeed within the rising winds of protectionism however, South Africa and Nigeria, respectively the largest and third largest (17% and 13% of Africa's GDP) economies in Africa, must sign the agreement. At the time of writing, both countries claim to need more time for internal consultation before signing (Berahab & Dadush, 2018).[114] This thesis adds significant value to such debates, through three empirical chapters on economic integration.

In Chapter 2, we revisited the pioneering work by Baier and Bergstrand (2004), and extended their benchmark model to a sample of 106 countries for 1960 to 2011. Baier and Bergstrand were the first to empirically analyse the economic conditions under which PTAs are more likely to form, but since publication, there has been a rising prevalence of inter-continental trade agreements with a broader geographical scope. This trend suggests a clear change in the economic determinants of agreements (Gonzalez, 2012) and to establish if this is true, we focus on whether the

[113] We considered investigating the effects of failing trade agreements, but the observations in the data were insufficient to offer a valid line of research.
[114] South Africa has signed the tripartite free trade agreement, however (Koigi, 2017).

determinants of PTAs have changed. Our analysis shows that the economic determinants first identified by Baier and Bergstrand remain important, but that their roles have changed. One major driving force behind this evolution is that agreements *within regions* have already been exhausted, forcing countries to look *beyond regional partners* (hence explaining the broader geographical scope). In looking for new PTAs, countries act strategically, in efforts to overcome regional constraints and open up new trade opportunities in the global market. African countries however, do not need to act strategically because it is so poorly integrated, and should rather focus on implementing deep agreements. To that end, South Africa and Nigeria should sign the ACFTA. Lacking bilateral data between South Africa and Nigeria, Chapter 2 can only highlight the viability of a PTA between the two countries. However, knowing that the gravity model determinants of trade agreements still matter, the characteristics of the two large economies (being on the same continent, relatively proximate and distant from the RoW) support them signing the ACFTA, which will hence help make the agreement successful.

As data becomes increasingly available (Baier and Bergstrand, 2004 started with 54 countries, Márquez-Ramos et al., 2011 increased this to 66 countries, and our research includes 106), research will better be able to focus on the determinants of trade agreements within the developing world, such as between South Africa and Nigeria. Likewise, as new identifying data materialises for customs unions and economic unions, the effects of these deep levels of integration on trade costs can be studied. Moreover, since writing, the depth of trade cost data has improved, presently covering 208 countries and the period to 2015 (21 years). New data was also released last year by Hofmann, Osnago and Ruta (2017) on the content of PTAs, covering all PTAs notified to the WTO and in force as of December 2015. Used in conjunction with Kohl, Brakman and Garretsen (2015) and DESTA's data, there is lots of scope to expand this research, but also to focus down on specific subjects. One such investigation could be on the provisions within trade agreements most beneficial to the agricultural sector, thus helping focus the African debate and alleviating the problems of ambitious agendas and unclear prioritisation.

Assuming the ACFTA is implemented, reaping the rewards of the agreement requires prioritising the continent's ability to participate in international trade, in other words, lowering trade costs. In Chapter 3, we incorporated different dimensions of integration (existence, depth and duration), and attempted to capture *heterogenous* effects across degrees of integration. Comparable to previous research, our analysis of trade costs for 180 countries over the 1995–2012 period, finds significant reductions under all three hypotheses. Specifically, we find that forming a PTA reduces trade costs by 15.35%; forming an FTA reduces trade costs by 12.14%; and increasing the level of integration from an FTA to a CU, CM and EcU results in additional trade cost reductions of 7.03%, 10.06% and 5.84% respectively. Lastly, staying in an FTA, CU, CM, and EcU results in trade cost reductions of 56.28%, 70.24%, 27.44%, and 24.44% respectively. The 'duration' of agreements thus causes the largest reduction in trade costs, and the greatest relative change in international versus domestic sales.

Finally, as the lifeline to several economies in Africa, agriculture must benefit from the ACFTA because of the persistent challenges to food security in SSA. By investigating the effect of integration on agricultural productivity for 45 SSA over the period 1961–2014, we find no integration effect. To understand the underlying causes, we considered that countries might be specialising away from agricultural but found no evidence supporting this. Subsequently, we focussed on the relationship between regional integration and agricultural trade costs, comparing our SSA results with those from a global sample of 176 countries. We find that regional integration has not lowered agricultural trade costs in SSA, but it has done so for the World as a whole.

Therefore, to make a success of the ACFTA, an achievable agenda with clear priorities must be set, so that the agreement is fully implemented. To help ensure an achievable agenda that includes clear priorities, further research must incorporate the different provisions of trade agreements. Should the ACFTA be fully implemented, this thesis demonstrates that (agricultural) trade costs will fall, in turn, leading to increased agricultural production, and to increased participation in international

trade. Jointly, this means Africa will be able to feed itself and to grow sustainably. Moreover, the world's largest economies, the United States, the EU and China have much to gain from the success of the ACFTA because in 2050, Africa's population is projected to reach 2.5 billion and represent 26% of the world's total. It will, moreover, be a young population, and Africa's share of the world's potential labour force (age 15-64) will be 25%. With progress, Africa will be one of the world's most substantial consumer markets; will be home to the most abundant source of accessible minerals and raw materials; and could become a large source of inexpensive labour-intensive manufactured products (Berahab & Dadush, 2018).

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Appendix 2A: Countries included in Chapter 2

1	Albania†	**36**	Ghana†	**71**	Niger†
2	Angola†	**37**	Greece*†	**72**	Nigeria*
3	Argentina*†	**38**	Guatemala*†	**73**	Norway*†
4	Armenia	**39**	Hong Kong*†	**74**	Oman†
5	Austria*†	**40**	Hungary†	**75**	Pakistan†
6	Azerbaijan	**41**	Iceland†	**76**	Peru*†
7	Bahrain	**42**	India†	**77**	Philippines*†
8	Barbados	**43**	Indonesia*†	**78**	Poland†
9	Belarus	**44**	Iran*†	**79**	Portugal*†
10	Belgium*	**45**	Iraq*†	**80**	Qatar
11	Bolivia*†	**46**	Ireland*†	**81**	Romania
12	Bosnia and Herzegovina	**47**	Israel†	**82**	Saudi Arabia†
13	Brazil*†	**48**	Italy*†	**83**	Senegal†
14	Bulgaria†	**49**	Jamaica	**84**	Singapore*
15	Burkina Faso†	**50**	Japan*†	**85**	Slovakia
16	Cambodia†	**51**	Jordan†	**86**	Slovenia
17	Cameroon†	**52**	Kazakhstan	**87**	South Africa†
18	Canada*	**53**	Kenya	**88**	Spain*†
19	Chile*†	**54**	Kuwait	**89**	Sri Lanka†
20	China†	**55**	Kyrgyzstan	**90**	Sudan†
21	Colombia*†	**56**	Latvia	**91**	Sweden*†
22	Costa Rica*†	**57**	Lithuania	**92**	Switzerland*†
23	Croatia	**58**	Luxembourg†	**93**	Tajikistan
24	Cyprus†	**59**	Macedonia	**94**	Tanzania
25	Czech Republic	**60**	Madagascar†	**95**	Thailand*
26	Denmark*†	**61**	Malawi	**96**	Trinidad and Tobago
27	Dominican Republic†	**62**	Malaysia†	**97**	Tunisia†
28	Ecuador*†	**63**	Mali†	**98**	Turkey*†
29	Egypt*†	**64**	Malta	**99**	Turkmenistan
30	Estonia	**65**	Mexico*†	**100**	Uganda
31	Ethiopia	**66**	Moldova	**101**	Ukraine
32	Finland†	**67**	Morocco†	**102**	United Kingdom*†
33	France*†	**68**	Mozambique	**103**	United States of America*†
34	Georgia	**69**	Netherlands*	**104**	Uruguay*†
35	Germany*†	**70**	New Zealand†	**105**	Uzbekistan
				106	Yemen

Notes: * Country is part of BB's original regressions
† Country is part of the expanded cross-section regressions

These 106 countries are included in the panel data estimations. Australia and Venezuela are included in the original BB regressions but not in the panel. Countries

appearing in the expanded cross-section regressions but not in the panel are: Côte d'Ivoire, Republic of Korea, Saint Lucia, Syrian Arab Republic (Syria) and Viet Nam.

Table 2A.1*:* Schematic representation of continental trading partners

			Continent 1						Continent 2										Continent 3			
			Country *j*																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Continent 1	Country *i*	1																				
		2	X																			
		3	X	X																		
		4	X	X	X																	
		5	X	X	X	X																
		6	X	X	X	X	X															
Continent 2		7																				
		8							X													
		9							X	X												
		10							X	X	X											
		11							X	X	X	X										
		12							X	X	X	X	X									
		13							X	X	X	X	X	X								
		14							X	X	X	X	X	X	X							
		15							X	X	X	X	X	X	X	X						
		16							X	X	X	X	X	X	X	X	X					
Continent 3		17																				
		18																	X			
		19																	X	X		
		20																	X	X	X	

Appendix 2B: Schematic literature review

Author(s) (Year)	Sample	Year	Dependent variable	Model type	Findings
Baier and Bergstrand (2004)	54	1996	FTA	Probit (qualitative choice)	Trade creating and trade diverting characteristics matter considerably.
De Groot, Linders, Rietveld & Subramanian (2004)	175	1998	Log total bilateral export, home-to-foreign	Gravity	Intangible factors are important barriers to trade: institutional quality (and quality of governance) has a significant, positive and substantial impact on bilateral trade flows.
Márquez-Ramos, Martínez-Zarzoso & Suárez-Burguet (2011)	66	1999	RIA (regional integration agreement)	Ordered logit	Economic and geographic factors are the most important; socio-political variables also explain the formation of RIAs.
Endoh (2006)	118	2003	PTA	Logit	Countries are more likely to form PTAs when they have similar incomes (smaller difference in GDP), high quality of governance, geographic distance between them decreases and the number of PTA partner countries or the bilateral intra-industry trade ratio increases.
Gonzalez (2012)	140	2006	FTA	Logit	New preferential partners are more distant and less similar in their factor endowments than preferential partners involved in earlier waves of regionalism.
	39	2008			
Mansfield & Reinhardt (2003)		1948-1998	PTA	"Directed dyad" model in which each dyad-year is analysed twice – logit specification[115]	Countries are more likely to form a PTA when (1) GATT/WTO membership rises, (2) a multilateral negotiating round is taking place and (3) they have recently participated in a GATT/WTO dispute, especially when (4) they obtained an unsatisfactory outcome in the dispute.

[115] For comparison, Mansfield and Reinhardt also estimate a more typical undirected dyad model.

Author(s) (Year)	Sample	Year	Dependent variable	Model type	Findings
Wu (2004)	150	1960-1998 1987-1998	Regional integration	Ordered probit	Democracy, economic freedom, the role of political and economic uncertainty, geographic characteristics, membership in multilateral organisations, per capita income and trade openness, are significant contributors to the chosen level of regional integration.
Vicard (2006)	55	1948-2001	Military Interstate Disputes (MID)	Probit (game theory)	Regionalism should be understood as a regulation mechanism: countries experiencing more interstate disputes are more likely to create a deep RTA, whereas international insecurity deters the formation of PTAs and FTAs.
Egger and Larch (2008)	10,430 unique country-pairs (15,753 in cross-section)	Eleven five-year intervals between 1950-2005; cross-section for 2005	PTA	Probit	PTA membership is found to create an incentive for other countries to form new PTAs or, even more so, to participate in existing ones. This interdependence is stronger among adjacent countries and, more generally, ones with a higher level of 'natural' bilateral trade.
Egger, Egger and Greenaway (2008)	Mainly OECD economies	1970 onwards	Trade structure	Probit	The likelihood of new PTA membership is influenced by economic fundamentals such as country size, factor endowments and trade and investment costs.

Appendix 2C: Supplementary regression results, and regression robustness checks

Table 2C.1: Cross-sectional probit regressions: comparison results using original BB data to new data

Data source	BB-Replication	New data			
Dependent var.	**FTA 1996**	**PTA 1996**	**PTA 2011**	**PTA 1996**	**PTA 2011**
Variables (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
PROXIMITY (Positive)	1.754*** (0.137)	0.919*** (0.166)	0.919*** (0.166)	0.883*** (0.219)	0.883*** (0.219)
REMOTE (Positive)	0.183*** (0.018)	0.234*** (0.023)	0.234*** (0.023)	0.352*** (0.061)	0.352*** (0.061)
RGDP (Positive)	0.237*** (0.033)	0.156*** (0.055)	0.156*** (0.055)	0.144* (0.075)	0.144* (0.075)
DRGDP (Negative)	-0.331*** (0.062)	-0.049 (0.098)	-0.049 (0.098)	-0.012 (0.121)	-0.012 (0.121)
DKL (Positive)	1.390*** (0.272)	1.428** (0.660)	1.428** (0.660)	-0.215 (0.428)	-0.215 (0.428)
Sq_DKL (Negative)	-0.267*** (0.076)	-0.917** (0.386)	-0.917** (0.386)	0.276** (0.130)	0.276** (0.130)
DROWKL (Negative)	-	-	-	-1.498*** (0.318)	-1.498*** (0.318)
Constant	4.000*** (1.218)	1.324 (1.837)	1.324 (1.837)	1.799 (2.602)	1.799 (2.602)
Observations	1,431	860	860	531	531
Pseudo R-squared	0.719	0.675	0.675	0.722	0.722

Notes: Results presented are for cross-sectional probit regressions on annual data, for either 1996 or 2011. The dependent variable (PTA) is dichotomous, taking the value 1 if country-pair *ij* is in an FTA, customs union, common market or economic union; or 0, otherwise. PROXIMITY is defined as the inverse of the natural logarithm of the distance between two countries; REMOTE as the remoteness of a pair of continental trading partners from the RoW; RGDP as the sum of the log of the GDP of countries *i* and *j* (total GDP, in millions of 1990 US dollars, converted at Geary Khamis PPPs); DRGDP as the absolute difference in the log of the GDPs of countries *i* and *j*; DKL as the absolute difference in the log of the capital-labour ratios of countries *i* and *j*; Sq_DKL as the square of DKL; and DROWKL as the absolute difference between the capital–labour ratios of the member countries and the RoW's capital–labour ratio. Column [1] is a re-estimation of BB's work using their original data, it is not a mirror of their output results. Columns [2] – [5] show the results of the same specification but with our newly collected data. Using the new data, the estimation outputs are equivalent for 1996 and 2011 because the inclusion of DKL renders the dependent variable of 2011 equivalent to that of 1996. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 2C.2: Cross-sectional logit regressions: contrasting results from the pooled and post-1996 sub-sample (new regionalism)

Dependent var.	**PTA 2011**		
Sample	**Full**		**Post 1996**
Dependent var. formation	**Any point since 1960**	**Post 1996**	**Post 1996**
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**
PROXIMITY (Positive)	1.784***	0.988***	1.418***
	(0.132)	(0.114)	(0.131)
REMOTE (Positive)	0.093***	-0.058**	0.018
	(0.019)	(0.029)	(0.024)
RGDP (Positive)	0.215***	0.056*	0.163***
	(0.029)	(0.029)	(0.034)
DRGDP (Negative)	-0.027	-0.052	-0.060
	(0.049)	(0.051)	(0.056)
DKL (Positive)	-0.298*	0.339	0.058
	(0.178)	(0.212)	(0.213)
Sq_DKL (Negative)	0.048	-0.048	-0.008
	(0.043)	(0.051)	(0.049)
DROWKL (Negative)	-0.005	-0.085	-0.015
	(0.070)	(0.098)	(0.084)
Constant	9.223***	5.059***	6.798***
	(1.260)	(1.184)	(1.250)
Observations	2,153	2,153	1,960
Pseudo R-squared	0.347	0.079	0.158

Notes: Results presented are for cross-sectional probit regressions on PTA 2011, using annual data. In column [1], the dependent variable is the result of the formation of trade agreements from any point since 1960. In column [2], our dependent variable is the result of the formation of trade agreements from any point since 1996 and, in column [3], our dependent variable is the result of the formation of trade agreements from any point since 1996 but excludes from the regression, the *ij* pairings that were in an agreement prior to 1996. These results are the output of a single cross-sectional estimate, whereas the outputs in Table 8 are the results of looped cross-sectional estimates for the 1960-2011 period. The slight difference in the number of observations between Table 2.5 and Table 2.7 is due to the trade flow data used to calculate REMOTE. The source of the data was chosen to maximise the number of countries included in the estimation. As a result, these results are not quite the same as those from the looped regressions. For additional notes, see Table 2C.1.

Table 2C.3: Contrasting the cross-sectional logit results of persistent PTA membership (column [1]) to new PTA membership in selected years

Dependent var.	Persistent	New PTA				
VARIABLES (Expected sign)	PTA 2011	1973	1986	1995	2005	2009
	(1)	(2)	(3)	(4)	(5)	(6)
PROXIMITY (Positive)	1.459***	1.254***	0.633**	0.891***	0.123	0.501***
	(0.078)	(0.180)	(0.311)	(0.170)	(0.155)	(0.165)
REMOTE (Positive)	0.064***	0.278***	0.095	0.290***	0.084**	-0.102*
	(0.012)	(0.025)	(0.084)	(0.043)	(0.034)	(0.054)
RGDP (Positive)	0.195***	0.310***	0.536***	0.018	-0.057	-0.231**
	(0.023)	(0.088)	(0.104)	(0.055)	(0.048)	(0.103)
DRGDP (Negative)	-0.028	0.263**	0.134	0.155	-0.125	0.419***
	(0.035)	(0.129)	(0.216)	(0.095)	(0.091)	(0.113)
DKL (Positive)	-0.523***	0.225	3.341	4.338***	-0.951***	-0.484
	(0.189)	(1.592)	(4.000)	(1.265)	(0.283)	(0.843)
Sq_DKL (Negative)	-0.122*	-1.433	-5.510	-1.728***	0.182**	-0.176
	(0.071)	(0.950)	(3.729)	(0.476)	(0.078)	(0.259)
DROWKL (Negative)	0.399***	0.266	0.821***	0.103	-0.398**	1.055***
	(0.067)	(0.210)	(0.224)	(0.189)	(0.159)	(0.199)
Constant	6.190***	-2.796	-13.297***	-2.124	-0.446	2.555
	(0.751)	(2.343)	(4.010)	(1.497)	(1.621)	(2.766)
Observations	4,655	2,661	2,669	4,456	4,648	4,648
Pseudo R-squared	0.363	0.459	0.461	0.278	0.0607	0.142

Notes: Results presented are for cross-sectional logit results of persistent PTA membership (column [1]) compared to new PTA membership in different years. In column [1], the dependent variable is persistent, meaning that once the PTA dummy switches to 1, it stays 1 till the end of the period (2011). In columns [2] – [6], the dependent variable (New PTA) is defined only for instances when PTA_{t-1} is 0 and PTA_t is 1. Given that we present years with sufficient observations in the dependent variable (25 or more), we maintain sufficient degrees of freedom. The slight difference in the number of observations between Table 2.5 and Table 2.7 is due to the trade flow data used to calculate REMOTE. For additional notes, see Table 2C.1.

Table 2C.4: Static LPM results, comparing dated and lagged (by 5 years) explanatory variables

Dependent var.	**PTA 1960-2011**					
Lag	**No**	**5 years**	**No**	**5 years**	**No**	**5 years**
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PROXIMITY (Positive)	0.108***	0.114***	0.094***	0.100***	-	-
	(0.001)	(0.001)	(0.001)	(0.001)		
REMOTE (Positive)	0.007***	0.008***	0.008***	0.009***	-	-
	(0.000)	(0.000)	(0.000)	(0.000)		
RGDP (Positive)	0.018***	0.015***	0.049***	0.032***	0.049***	0.052***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)	(0.002)
DRGDP (Negative)	-0.005***	-0.004***	-0.006***	-0.005***	-0.026***	-0.021***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)	(0.005)
DKL (Positive)	-0.073***	-0.063***	-0.057***	-0.046***	-0.062***	-0.058***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.007)	(0.008)
Sq_DKL (Negative)	0.010***	0.008***	0.005***	0.003***	0.006***	0.003**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)
DROWKL (Negative)	0.021***	0.014***	-0.003**	0.019***	-0.003	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)
Constant	0.670***	0.780***	-0.096	0.140	-0.848***	-0.898***
	(0.011)	(0.011)	(.)	(26.612)	(0.039)	(0.044)
Fixed Effects	No		Country		Pairwise	
Observations	168,610	158,809	168,610	158,809	181,440	161,530
R-squared	0.237	0.231	0.363	0.351	0.081	0.078

Notes: Results presented are for static LPM regressions on annual data, over the 1960-2011 time horizon. In odd numbered columns, we compare results using dated and, in even numbered columns, lagged (by 5 years) explanatory variables. Fixed effects are included as indicated but not reported: '*Country'* – importer and exporter ('directional') fixed effects, and pairwise fixed effects. REMOTE is omitted from columns [5] and [6] because it has minimal within variation. For additional notes, see Table 2C.1.

Table 2C.5: Comparison of dynamic LPM and dynamic logit estimation outputs

Dependent var.	**PTA 1960-2011**			
Estimation method	**LPM**	**logit**	**LPM**	**logit**
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**
lagPTA	0941***	9.493***	0.927***	15.558***
	(0.002)	(0.204)	(0.002)	(0.857)
PROXIMITY (Positive)	0.010***	1.335***	-	-
	(0.001)	(0.065)		
REMOTE (Positive)	0.001***	0.143***	-	-
	(0.000)	(0.011)		
RGDP (Positive)	0.007***	1.822***	0.006***	8.698***
	(0.000)	(0.073)	(0.000)	(0.340)
DRGDP (Negative)	-0.000	-0.080**	-0.002***	-0.592
	(0.000)	(0.035)	(0.001)	(0.514)
DKL (Positive)	-0.004***	-0.101	-0.005***	-2.781***
	(0.001)	(0.167)	(0.001)	(0.668)
Sq_DKL (Negative)	0.000	-0.186***	0.000	0.431**
	(0.000)	(0.060)	(0.000)	(0.219)
DROWKL (Negative)	0.000	0.015	0.000	-0.148
	(0.001)	(0.106)	(0.001)	(0.245)
Constant	-0.073***	-29.567***	-0.097***	-
	(0.008)	(1.810)	(0.005)	
Fixed Effects	Country	Country	Pairwise	Pairwise
Observations	166,434	134,915	177,461	26,636
R-squared	0.920		0.853	
Pseudo R-squared		0.919		

Notes: Results presented provide a comparison of dynamic LPM regressions and dynamic logit regressions on annual data over the 1960-2011 time horizon, using '*Country*' – importer and exporter ('directional') fixed effects, and pairwise fixed effects (included but not reported). REMOTE is omitted from columns [3] and [4] because it has minimal within variation. For additional notes, see Table 2C.1.

Table 2C.6: Dynamic LPM results for PTAs, checking significance of distance in new regionalism (2)

Dependent var.	All PTAs: 1960-2011	Post 1996 PTAs	Post 2000 PTAs	Post 2004 PTAs
VARIABLES (Expected sign)	**(1)**	**(2)**	**(3)**	**(4)**
PROXIMITY (Positive)	0.140***	0.092***	0.046***	0.009***
	(0.007)	(0.006)	(0.004)	(0.001)
REMOTE (Positive)	0.061***	0.026***	0.014***	0.003***
	(0.005)	(0.004)	(0.002)	(0.001)
RGDP (Positive)	0.090***	0.091***	0.071***	0.034***
	(0.026)	(0.019)	(0.013)	(0.005)
DRGDP (Negative)	-0.005	-0.003	0.001	-0.001
	(0.004)	(0.003)	(0.002)	(0.001)
DKL (Positive)	-0.075***	-0.036***	-0.029***	-0.005***
	(0.010)	(0.008)	(0.005)	(0.002)
Sq_DKL (Negative)	0.004	-0.004	0.000	-0.003
	(0.009)	(0.007)	(0.005)	(0.002)
DROWKL (Negative)	-0.015*	-0.013**	-0.011***	-0.006***
	(0.008)	(0.006)	(0.004)	(0.001)
FE (*i*, *j* and *t*)	Yes	Yes	Yes	Yes
Observations	166,434	149,761	144,248	137,976
No. of PTAs	25,211	18,263	15,566	11,691

Notes: Column [1] is for the full sample (1960-2011); column [2] excludes PTAs formed prior to 1996; column [3] excludes PTAs formed prior to 2000; and column [4] excludes PTAs formed prior to 2004. Coefficients are adjusted for the long-run, and standardised. For additional notes, see Table 2C.1.

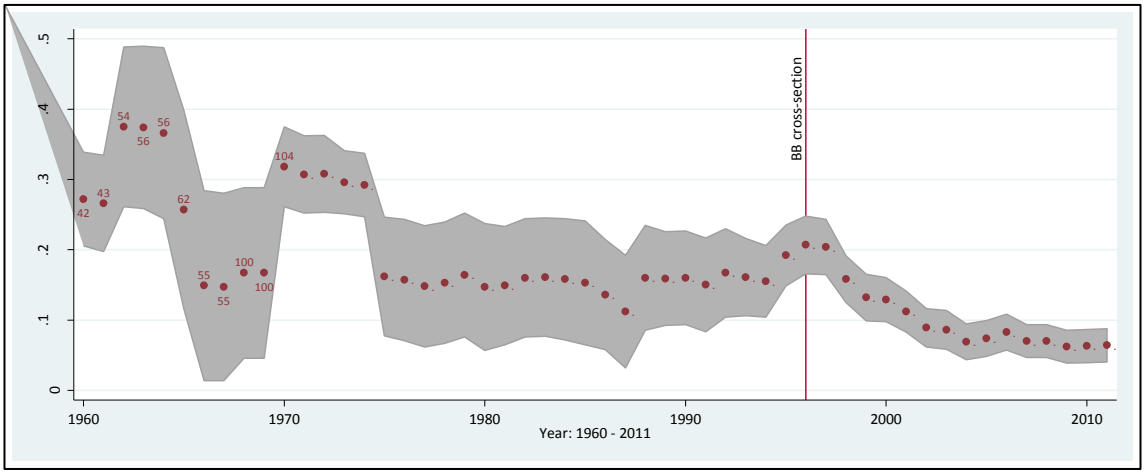
Table 2C.7: Dynamic LPM regression results of PTA (1960–2011): Adding DCont, REMOTE_a and REMOTE variables iteratively

Dependent var.	**PTA 1960-2011**		
	(1)	**(2)**	**(3)**
lagPTA	0.943***	0.943***	0.941***
	(0.002)	(0.002)	(0.002)
PROXIMITY	0.010***	0.010***	0.009***
	(0.001)	(0.001)	(0.001)
DCont	0.009***	0.009***	0.100***
	(0.001)	(0.001)	(0.008)
REMOTE_a		0.003*	0.004**
		(0.002)	(0.002)
REMOTE			-0.010***
			(0.001)
RGDP	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)
DRGDP	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
DKL	-0.004***	-0.004***	-0.003***
	(0.000)	(0.001)	(0.001)
Sq_DKL	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
DROWKL	-0.001**	-0.001*	-0.001**
	(0.001)	(0.001)	(0.001)
Constant	0.031	-0.104***	-0.115***
	(.)	(0.024)	(0.024)
FE (*i*, *j* and *t*)	Yes	Yes	Yes
Observations	179,050	166,434	166,434
R-squared	0.921	0.922	0.922

Notes: Results presented are for dynamic LPM regressions on annual data, over the 1960-2011 time horizon (full sample). REMOTE includes the binary continent dummy, DCont; whereas REMOTE_a excludes DCont. '*Country'* – importer and exporter ('directional') fixed effects are included but not reported.

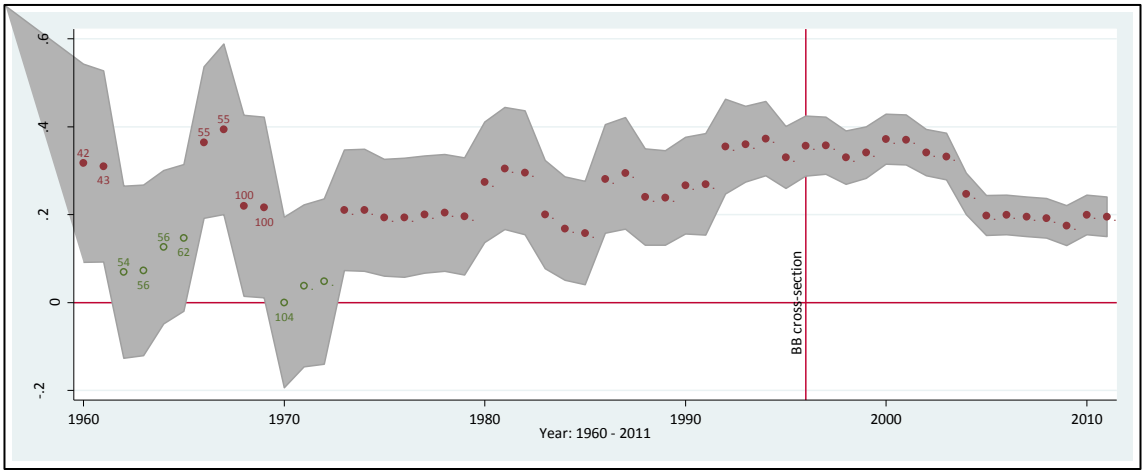
Appendix 2D: Rolling window plots of economic determinants

Figure 2D.1: Rolling coefficient estimates of REMOTE for 1960–2011, estimated in cross-section



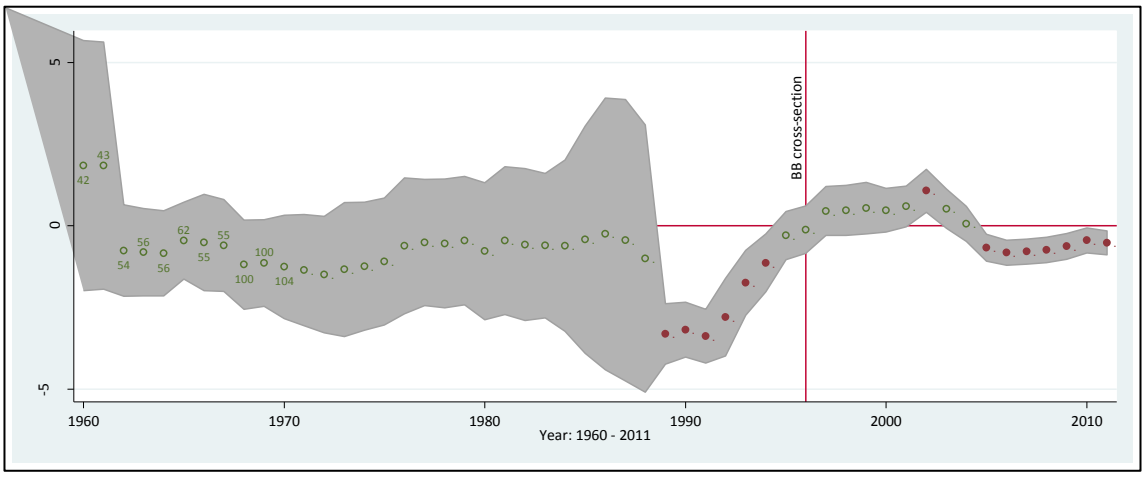
Notes: For the first decade, numbers represent the number of bilateral agreements. The shaded area is a 95% confidence interval; where present, solid red dots indicate significance at the 5% level and open green dots indicate insignificance at the 5% level. 1996, the year chosen for BB's cross-sectional estimate, is indicated by the vertical (red) line. Expected sign is positive.

Figure 2D.2: Rolling coefficient estimates of RGDP for 1960–2011, estimated in cross-section



Notes: See notes for Figure 2D.1.

Figure 2D.3: Rolling coefficient estimates of DKL for 1960–2011, estimated in cross-section



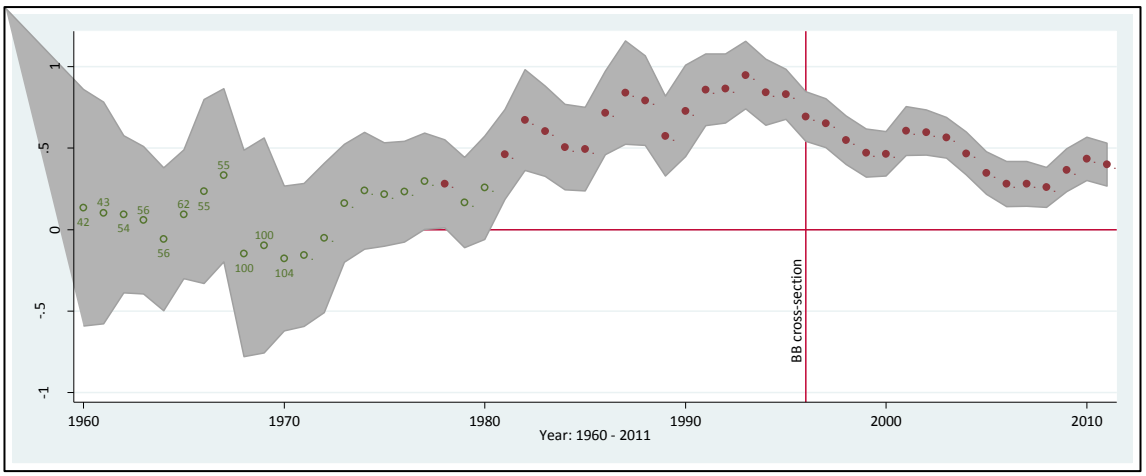
Notes: See notes for Figure 2D.1.

Figure 2D.4: Rolling coefficient estimates of Sq_DKL for 1960–2011, estimated in cross-section



Notes: See notes for Figure 2D.1.

Figure 2D.5: Rolling coefficient estimates of DROWKL for 1960–2011, estimated in cross-section



Notes: See notes for Figure 2D.1.

Appendix 3A: List of plurilateral agreements[116]

Countries	FTA	CU	CM	EcU
Predominantly developed	**ASEAN-ANZERTA (2010)**: Australia, New Zealand and ASEAN members **Baltic FTA (BAFTA 1999-2004)**: Estonia, Latvia, Lithuania **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) **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 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 **Czech Republic-Slovak Republic (1993-2004)**	**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	**Euro Area (1999)**: Austria, Belgium, Cyprus (2008), Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta (2008), Netherlands, Portugal, Slovak Republic (2008), Slovenia (2008), Spain

[116] Only plurilateral FTAs included in the table due to space constraints. For a comprehensive list of all FTAs, please refer to Baier, Bergstrand and Clance (2018).

	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 **North American Free Trade Agreement (NAFTA) 1994)**: Canada, Mexico, US			
Predominantly developing	**Arab Common Market (ACM) (1965)**: Egypt, Iraq, Syria, Yemen **Association of Southeast Asian Nations (ASEAN) (2000)**: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar (Burma), Philippines, Singapore, Thailand, Vietnam	**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	**East African Community (EAC) (2001)**: Burundi (2008), Kenya, Rwanda (2008), Tanzania, Uganda	**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 American Common Market (CACM3) (1993): Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua **Colombia -Northern Triangle FTA (2007)**: 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 **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)	Lucia, Saint Vincent and the Grenadines, Suriname (1996), Trinidad and Tobago **Eurasian Economic Community (EURASIAN) (2010)**: Belarus, Kazakhstan, Russia **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		Central African Republic, Chad, Equatorial Guinea, Gabon

	Pacific Island Countries Trade Agreements (PICTA) (2003): 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			

Source: Baier, Bergstrand and Clance (2018).

Appendix 3B: Explicitly excluding observations for PTA

Table 3B.1 presents Poisson regression results, in which we model EoT on PTA. We do this for: (1) Only those bilateral pairs that formed a PTA within the 18 years (moving from 0 to 1); (2) excluding pairs that were always in a PTA; (3) excluding pairs that were never in a PTA and (4) all country-pairs, i.e., no exclusions. Poisson regressions do not use the within-transformation, so Stata does not automatically drop the pairs for which there is no variation.[117] Thus, each of the regressions in Table 3B.1 uses a different dataset due to our explicit exclusions, and thus the different coefficients for PTA.

Table 3B.1: Poisson regression results of Ease of Trade (1995–2012) on PTA

Dependent var.	**Ease of Trade (1995 – 2012)**			
Exclude observations for RTA which are:	**No exclusions**	**Always equal to 0 or 1**	**Always equal to 1**	**Always equal to 0**
	(1)	**(2)**	**(3)**	**(4)**
PTA	0.033***	0.015**	0.043***	0.004
	(0.005)	(0.004)	(0.005)	(0.005)
Observations	183,312	18,828	174,402	27,738
Country-pairs	10,184	1,046	9,689	1,541
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes
R-squared	0.798	0.949	0.885	0.884

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) and the PTA dummy, defined as the inverse of trade costs, and which is equal to unity if two countries are members of the same trade agreement respectively. An agreement consists of FTA, CU, CM and EcU. The data are annual, comprising up to 183,312 observations for 10,184 trade pairs among up to 180 countries over the 1995-2012 time horizon. Pairwise fixed effects are included but not reported. In this analysis, we limit the sample to include country-pairs in column [2] that form an RTA within the 18 years (moving from 0 to 1); In column [3], we exclude pairs that were always in an RTA; and in column [4], we exclude pairs that were never in an RTA. We compare columns [2] - [4] to the 'no exclusions' results in column [1]. Column [1] is thus the same as column [2] of Table 3.2. To account for the missing trade costs data for many country-pair years, the 'trade cost premium' is 5% lower than the lowest EoT/invesre trade costs observed within the individual country-pair. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

[117] Email correspondence with Joao Santos Silva.

Appendix 3C: Robustness

Hypothesis 1: Regressions on the raw data and alternative cut-offs/trade cost premiums

The OLS results of Table 3C.1 are our baseline for comparison, using the raw data sample (120,869 observations). For presentational purposes, the coefficient of RTA is multiplied by 100 to make the coefficients clearly distinguishable.

Table 3C.1: Least Squares regression results: Effect of PTA on Ease of Trade (1995–2012) – raw data

Dependent var.	**Ease of Trade (1995-2012)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
PTA x100	0.276***	0.118***	0.118***	0.074***	0.043***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.104	0.492	0.492	0.494	0.533
FE (*i, j, t*)	-	*ij*	*i* & *j* & *ij*	*ij* & *t*	*it, jt* & *ij*

Notes: The PTA coefficient is multiplied by 100 to make the coefficients clearly distinguishable. Results presented are for least squares regressions of the Ease of Trade and the PTA dummy, which is equal to unity if two countries are members of the same trade agreement, an agreement consisting of FTA, CU, CM and EcU. The data are annual, comprising 119,691 observations for 9,128 trade pairs among up to 175 countries over the 1995-2012 time horizon. Stata uses only 119,691 observations because 1,178 singleton observations are dropped.[118] (The Stata command *xtreg* is used for the model in column [1], *reghdfe* for all others.) Ease of Trade in the missing years is assumed (time-invariantly) 5% lower than the lowest EoT/inverse trade costs observed within the individual country-pair. Fixed effects are included as indicated but not reported: *i* & *j* – importer and exporter ('directional') fixed effects; *ij* – pairwise fixed effects; *t* – time fixed effects; *it* & *jt* – directional-time fixed effects. White heteroscedasticity-robust p-values in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

[118] The fixed effects estimator explains "within-group" variation, but when a group has 1 member, there is no "within-group" variation to explain.

Table 3C.2: Least Squares regression results: Effect of PTA on Ease of Trade (1995–2012) – modified data

Dependent var.	**Ease of Trade (1995-2012)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
PTA x100	0.215***	0.100***	0.100***	0.062***	0.047***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.120	0.525	0.525	0.528	0.561
FE (*i, j, t*)	-	*ij*	*i* & *j* & *ij*	*ij* & *t*	*it, jt* & *ij*

Notes: The data are annual, comprising 183,204 observations for 10,178 trade pairs among up to 178 countries over the 1995-2012 time horizon. Stata uses only 183,204 observations for our linear regressions because 108 singleton observations are dropped. For additional notes, see Table 3C.1.

To check the robustness of our Poisson results, we use alternative values for the trade cost premium, varying in the range from 1% to 99%. Selected results from this range are presented in columns [1] – [5] in Table 3C.3, along with the results generated by replacing all missing observations for EoT with 0 (reflecting infinitely high trade costs) in column [6].

Table 3C.3: Poisson regression results comparing a range of artificial minimums for Ease of Trade (1995–2012)

Dependent var.	**Ease of Trade (1995-2012)**					
Change to EoT variable:	**Bilateral minimum less:**					**Missing changed to 0**
	1%	**30%**	**50%**	**75%**	**90%**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PTA	0.035***	0.020***	0.009	-0.008	-0.017**	-0.022**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)
Observations	183,312	183,312	183,312	183,312	183,312	151,541
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.797	0.804	0.809	0.816	0.820	0.804

Notes: The data are annual, comprising 183,312 observations for 10,184 trade pairs among up to 180 countries over the 1995-2012 time horizon. Pairwise fixed effects are included but not reported. In this analysis we use alternative values for the 'trade cost premium', varying the margins from 1% to 90%. Columns [1] - [7] show margins of 1, 10, 20, 30, 50, 75 and 99% respectively. The first three columns thus reflect the results of Table 3.3 and the remaining columns demonstrate what happens as we move to the extreme/infinity (missing EoT observations changed to 0). For additional notes, see Table 3C.1.

Hypothesis 1: Regressions on the alternatively modified data

Column [1] of Table 3C.4 presents the results of regressing EoT on RTA using the raw data. Following the three data modifying techniques mentioned, columns [2] – [4] demonstrate how the coefficient of RTA changes under the different techniques. In column [2], the missing EoT observations are changed to 0; in column [3], we assume that EoT is (time-invariantly) 5% lower than the lowest EoT/inverse trade costs observed within the individual country-pair; and in column [4], we use pair fixed effects to construct EoT.

Table 3C.4: Fixed Effects Poisson regression results: Effect of PTA on Ease of Trade (1995–2012) – robustness of data

Dependent var.	**Ease of Trade (1995-2012)**			
Modification to dataset:	**None**	**Technique 1**	**Technique 2**	**Technique 3**
	(1)	**(2)**	**(3)**	**(4)**
PTA	0.046***	-0.022***	0.033***	0.346***
	(0.006)	(0.007)	(0.005)	(0.013)
Observations	120,869	151,541	183,312	324,734
Country-pairs	5,461	10,184	10,184	18,528
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes
R-squared	0.813	0.804	0.798	0.813

Notes: We account for the missing trade costs data for many country-pair years: column [1] presents the raw data; in column [2], the missing EoT observations are changed to 0; in column [3], we assume that Ease of Trade is (time-invariantly) 5% lower than the lowest EoT/inverse trade costs observed within the individual country-pair; and in column [4], we use pair fixed effects to construct Ease of Trade. For additional notes, see Tables 3C.1 and 3C.3.

Hypothesis 1: Poisson regressions with interval data and lagged PTA

The coefficient of PTA in Table 3C.5 remains positive and significant, suggesting that endogeneity is not a concern.

Table 3C.5: Poisson regression results of Ease of Trade on lagged PTA

Dependent var.	Ease of Trade (1995-2012)				
Change to PTA	None	Lag variable by:			
		1yr	2yrs	5yrs	10yrs
	(1)	(2)	(3)	(4)	(5)
PTA	0.026***	0.019***	0.017***	0.028***	0.025***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes	Yes
R-squared	0.798	0.798	0.798	0.798	0.798

Notes: We use alternative lag lengths for PTA to account for potential endogeneity: Column [1] is the baseline specification with no lag, and columns [2] – [5] include a lag length of 1, 2, 5 and 10 years respectively. For additional notes, see Tables 3C.1 and 3C.3.

Table 3C.6 provides the regression results in which we check for feedback between $u_{ij,t}$ and $PTA_{ij,t+i}$, as in Wooldridge (2002).

Table 3C.6: Poisson regression results of Ease of Trade on future PTA

Dependent var.	Ease of Trade (1995-2012)		
Change to PTA	None	Lead variable by:	
		5yrs	5 & 10yrs
	(1)	(2)	(3)
PTA	0.033***	0.030***	0.026***
	(0.005)	(0.005)	(0.006)
PTA_{t+5}		-0.004	-0.004
		(0.004)	(0.004)
PTA_{t+10}			-0.005
			(0.003)
FE (*it, jt, ij*)	Yes	Yes	Yes
R-squared	0.798	0.798	0.798

Notes: We use two lead lengths for PTA to account for potential feedback: Column [1] is the baseline specification with no lag, column [2] includes a lead of 5 years and column [3] a lead of 5 and 10 years. For additional notes, see Tables 3C.1 and 3C.3.

Following Piermartini and Yotov's (2016) recommendation, Table 3C.7 provides regression results using interval data, rather than consecutive years, to account for adjustment in bilateral trade flows in response to trade policy or other changes in trade costs. Column (1) uses a 3-year interval and includes 1997, 2000, 2003, 2006, 2009 and 2012, and column (2) uses a 4-year interval and includes 1996, 2000, 2004, 2008 and 2012.

Table 3C.7: Poisson regression results of Ease of Trade on PTA using interval data

Dependent var.	**Ease of Trade (1995-2012)**	
Interval data of:	**3yrs**	**4yrs**
	(1)	**(2)**
PTA	0.037***	0.052***
	(0.007)	(0.009)
Observations	56,694	46,705
Country-pairs	9,449	9,341
FE (*it, jt, ij*)	Yes	Yes
R-squared	0.903	0.932

Notes: Column [1] uses 3-year interval data, and includes {1997, 2000, 2003, 2006, 2009 and 2012}, and column [2] uses 4-year interval data, including {1996, 2000, 2004, 2008 and 2012}. For additional notes, see Tables 3C.1 and 3C.3.

Table 3C.8 shows the heterogeneity Poisson regression results for Hypothesis 2 when using dummy variables that are switched on once a specific level of integration is reached.

Table 3C.8: Poisson regression results for Ease of Trade (1995–2012) by level of development – Hypothesis 2 (Specification 1)

Dependent var.	**Ease of Trade (1995-2012)**			
Exporter	**Developed**	**Developing**	**Developed**	**Developing**
Importer	**Developed**	**Developing**	**Developing**	**Developed**
	(1)	**(2)**	**(3)**	**(4)**
FTA	0.014	0.037***	0.020***	0.051***
	(0.009)	(0.004)	(0.006)	(0.015)
CU	-0.109***	0.036*	0.000	0.106**
	(0.038)	(0.019)	(0.033)	(0.051)
CM	0.042	0.114***	0.046	-0.044
	(0.044)	(0.026)	(0.036)	(0.053)
EcU	0.091***	-0.115***	-0.024	0.107***
	(0.022)	(0.029)	(0.022)	(0.015)
Observations	16,437	86,670	40,646	39,559
Country-pairs	1,747	5,892	3,260	3,272
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes
R-squared	0.897	0.909	0.934	0.934

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) regressed on **Integration**, using Equation (2a), which includes a dummy variable for each level of integration: FTA, CU, CM and EcU. The dummy is equal to unity when country-pairs are in the specific level of integration, and zero otherwise. The data are annual, covering the 1995-2012 time horizon. In column [1], there are a total of 1,604 FTAs, 196 CUs, 2,475 CMs and 1,185 EcUs: CUs thus account for just 3.59% of all PTAs. In column [2], there are a total of 4,177 FTAs, 1,315 CUs, 128 CMs and 432 EcUs: CMs thus account for just 2.12% of all PTAs. In column

[3], there are a total of 3,150 FTAs, 566 CUs, 493 CMs and 42 EcUs: EcUs thus account for just 0.99% of all PTAs. In column [4], there are a total of 2,769 FTAs, 125 CUs, 419 CMs and 24 EcUs: CUs thus account for just 3.75% of all PTAs, and EcUs just 0.72%. The mean Ease of Trade for each column is: 0.008 for column (1), 0.004 for columns (2) – (4). White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Hypothesis 2: Poisson regressions excluding specific customs unions

Table 3C.9: Poisson regression results for Ease of Trade (1995–2012) on PTA: Bilateral and plurilateral samples

Dependent var.	**Ease of Trade (1995-2012)**				
Hypothesis:	**One**			**Two**	
Sample:	**Full**	**Bilateral**	**Plurilateral**	**Full**	**Plurilateral**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
PTA	0.033***	0.046***	0.029***	-	-
	(0.005)	(0.012)	(0.004)		
FTA	-	-	-	0.027***	0.023***
				(0.005)	(0.004)
CU	-	-	-	0.080***	0.074***
				(0.016)	(0.016)
CM	-	-	-	0.116***	0.114***
				(0.013)	(0.013)
EcU	-	-	-	0.184***	0.183***
				(0.020)	(0.020)
Observations	183,312	2,104	181,208	183,312	181,208
Country-pairs	10,184	117	10,069	10,184	10,069
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes	Yes
R-squared	0.798	0.998	0.797	0.798	0.797

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) modelled on PTA for the full sample in column [1], the bilateral sample in column [2] and the plurilateral sample in column [3]. In column [4], we replicate our baseline Hypothesis 2 results; and in column [5], we present Hypothesis 2 run on the plurilateral sample. The data are annual, covering the 1995-2012 time horizon. The mean Ease of Trade for all columns is 0.004, except for column [2], which has a mean of 0.009. For additional notes, see Tables 3C.1 and 3C.3.

The results in column [1] of Table 3C.10 have two idiosyncrasies, both the result of the large, negative and significant coefficient on CU. Therefore, our results in Table 3C.10 also exclude (a) the Gulf Co-operation Council Customs Union members, (b) the Caribbean Community and Common Market member countries, and (c) MERCOSUR. These results suggest that the GCC is the primary reason for the negative

CU coefficient in columns [1] and [3] and, therefore, for the negative CM coefficients as well.

Table 3C.10: Developed country-pairs: Poisson regression results for Ease of Trade (1995–2012) under Hypothesis 2, excluding specific customs unions

Dependent var.	**Ease of Trade (1995-2012)**			
Exclusions:	**None**	**GCCCU**	**CARICOM**	**MERCOSUR**
	(1)	**(2)**	**(3)**	**(4)**
FTA	0.014	0.015	0.013	0.014
	(0.009)	(0.010)	(0.009)	(0.009)
CU	-0.095**	-	-0.096**	-0.095**
	(0.039)		(0.039)	(0.039)
CM	-0.053**	-0.069***	-0.055**	-0.053**
	(0.022)	(0.023)	(0.022)	(0.022)
EcU	0.038	0.033	0.039	0.038
	(0.024)	(0.024)	(0.024)	(0.024)
Observations	16,437	13,517	15,107	16,158
R-squared	0.897	0.905	0.899	0.897

Notes: Results presented are for Fixed Effects Poisson model for Ease of Trade (EoT) regressed on **Integration**, using Equation [2.7a], which includes a dummy variable for each level of integration: FTA, CU, CM and EcU. The dummy is equal to unity when country-pairs are in the specific level of integration, and zero otherwise. The data are annual, covering the 1995-2012 time horizon. The mean Ease of Trade for all columns is 0.008. For additional notes, see Tables 3C.1 and 3C.3.

Hypothesis 1 – 3: Results from our panel model with interactive fixed effects

Table 3C.11: Results for Hypothesis 1 – 3: Comparing Poisson fixed effects to interactive fixed effects results

Dependent var.	**Ease of Trade (1995-2012)**					
Hypothesis	**One (Existence)**		**Two (Depth)**		**Three (Duration)**	
Estimation method:	**Poisson**	**Interactive**	**Poisson**	**Interactive**	**Poisson**	**Interactive**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PTA	0.033***	0.049***			0.022***	0.019***
	(0.005)	(0.000)			(0.006)	(0.000)
FTA	-	-	0.027***	0.042***	-	-
			(0.005)	(0.000)		
CU	-	-	0.080***	0.099***	-	-
			(0.016)	(0.000)		
CM	-	-	0.116***	0.149***	-	-
			(0.013)	(0.000)		
EcU	-	-	0.184***	0.146***	-	-
			(0.020)	(0.000)		
Duration in FTA	-	-	-	-	0.003***	0.007***
					(0.001)	(0.000)
Duration in CU	-	-	-	-	0.002	0.000
					(0.001)	(0.723)
Duration in CM	-	-	-	-	0.011***	0.010***
					(0.001)	(0.000)
Duration in EcU	-	-	-	-	0.013***	0.009***
					(0.003)	(0.000)

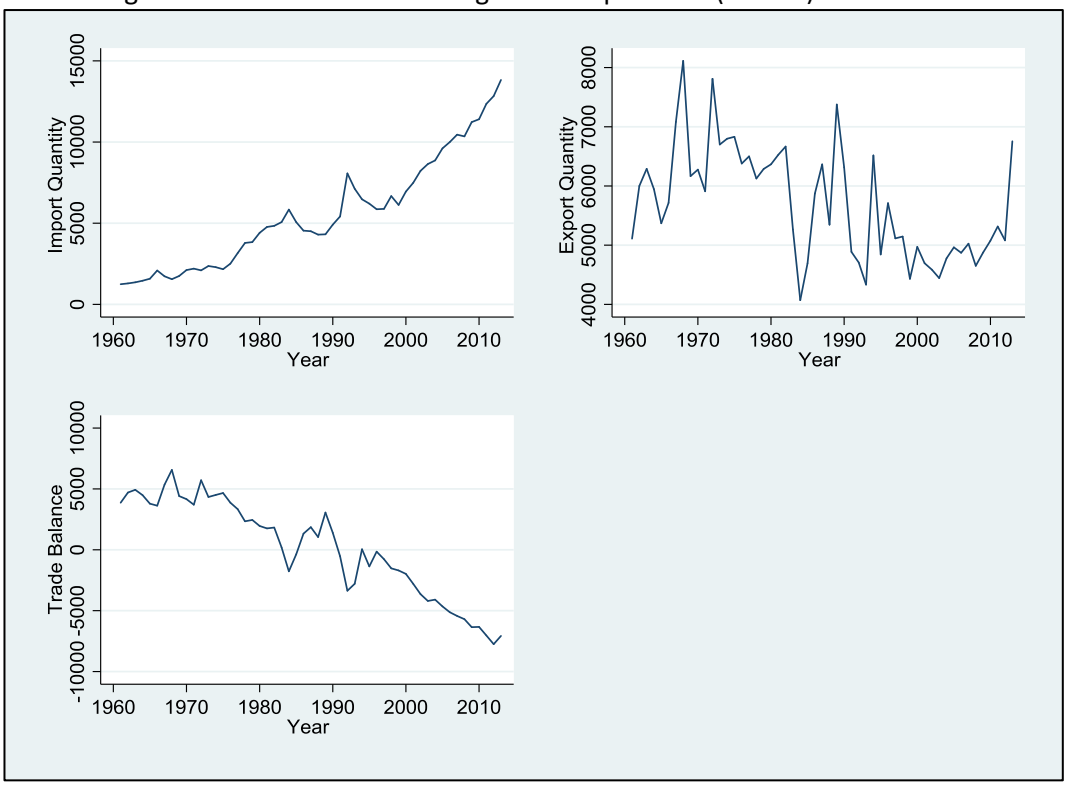
Notes: For each hypothesis, the table has two columns. The first shows the Poisson results, as can be found in the main text and the second shows the interactive fixed effects model with 2 dimensions, estimated with the *regife* command. Since the interactive fixed effects model is estimated by least squares, we multiply the coefficients of these respective columns by 100 for presentation purposes, and therefore we provide robust p-values rather than standard errors. White heteroscedasticity-robust standard errors are reported in parentheses for columns [1], [3] and [5]. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Appendix 4A: List of Sub-Saharan African countries

1	Angola	16	Gabon	31	Namibia
2	Benin	17	Gambia	32	Niger
3	Botswana	18	Ghana	33	Nigeria
4	Burkina Faso	19	Guinea	34	Rwanda
5	Burundi	20	Guinea-Bissau	35	Sao Tome and Principe
6	Cameroon	21	Ivory Coast	36	Senegal
7	Cape Verde	22	Kenya	37	Seychelles
8	Central African Republic	23	Lesotho	38	Sierra Leone
9	Chad	24	Liberia	39	South Africa
10	Comoros	25	Madagascar	40	South Sudan
11	Congo, Dem. Rep.	26	Malawi	41	Swaziland
12	Congo, Rep.	27	Mali	42	Tanzania
13	Equatorial Guinea	28	Mauritania	43	Togo
14	Eritrea	29	Mauritius	44	Uganda
15	Ethiopia	30	Mozambique	45	Zambia
				46	Zimbabwe

Appendix 4B: Trade in agricultural products

Figure 4B.1: SSA's trade in agricultural products (tonnes): 1961–2013



Notes: Panel 1 and 2 are SSA's imports and exports of agricultural products respectively. Panel 3 represents the trade balance.

Source: Figures created using FAOSTAT data.

Table 4B.1: The inclusion of agriculture in SSA's seven RTAs

Agreement	Agriculture covered in:
SADC	Chapter 7, Article 21: Food security, land and agriculture.
EAC	Chapter 18: Agriculture and food security.
COMESA	Chapter 18: Co-operation in agriculture and rural development.
SACU	Part 8, Article 39: Agricultural policy.
CEMAC	Section III: Agriculture, livestock and fisheries.
ECOWAS	Chapter IV (Article 25): Co-operation in food and agriculture.
WAEMU	The coordination of agriculture is included under Article 4.

Appendix 4C: List of 26 WTO provisions

Type	Provisions
WTO+	Agriculture AD and CVM Customs administration Export restrictions Import restrictions IPR Investment Public procurement SPS Services State aid STE TBT
WTOX	Capital mobility Competition Environment Labour
IQ	Consultations Definitions Dispute settlement Duration and termination Evolutionary clause Institutional framework Objectives Plan and schedule Transparency

Appendix 4D: Additional regression results

Table 4D.1: Least squares regression results of net agricultural production, and net agricultural production per capita, on integration variables and population (1961–2014)

Dependent variable:	**Net agricultural production (1961 – 2014)**				**Net agricultural production per capita (1961 – 2014)**			
Hypothesis tested:	**Existence**	**Depth**	**Duration**	**Combined**	**Existence**	**Depth**	**Duration**	**Combined**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
RTA	-5.969**	-	-	-1.296	-8.282*	-	-	-8.660
	(2.837)			(4.822)	(4.570)			(8.893)
No. of RTA partners	-	-0.469	-	-0.136	-	-0.618	-	0.339
		(0.390)		(0.510)		(0.661)		(0.860)
Total RTAs	-	1.407	-	-4.590	-	5.123	-	-6.490
		(4.218)		(4.067)		(8.235)		(9.613)
Average duration in RTA(s)	-	-	1.284**	1.696***	-	-	2.828**	3.263**
			(0.579)	(0.639)			(1.244)	(1.481)
Population (millions)	0.450*	0.485*	0.412*	0.415	0.615	0.659*	0.535	0.503
	(0.245)	(0.254)	(0.243)	(0.266)	(0.376)	(0.376)	(0.372)	(0.366)
Constant	32.168***	31.970***	36.696***	35.094***	117.302***	118.339***	126.135***	124.302***
	(2.533)	(2.809)	(3.025)	(3.152)	(5.226)	(5.078)	(5.711)	(5.691)
FE (*i* and *t*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.715	0.715	0.720	0.727	0.243	0.239	0.275	0.287
Overall R-squared	0.768	0.768	0.772	0.778	0.553	0.551	0.573	0.580

Notes: The table shows the results of regressing net agricultural production (and net agricultural production per capita) on variables representing existence, depth and duration aspects of integration. In columns [1] and [5], the RTA dummy equals 1 for years in which a country was in at least one RTA; and 0 otherwise. In columns [2] and [6], we sum the number of RTA partners per country and count the number of RTAs countries are involved in. In columns [3] and [7], we count the number of years in which a country has been in an RTA, and average this across agreements (the count resets to 0 if membership lapses for whatever reason). In columns [4] and [8], we combine the existence, duration and depth variables to explain the dependent variable. The data are annual, comprising 2,414 observations for 46 countries over the 1961-2014 time horizon. The Stata command *xtreg* is used for the models. Fixed effects are included as indicated but not reported: *i* – country fixed effects and *t* – time fixed effects. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1

Table 4D.2: Least squares regression results of net agricultural production on integration variables (1961–2014): differentiating between FTAs and CUs

Dependent variable:	**Net agricultural production (1961 – 2014)**						
Hypothesis tested:	**One**		**Two**			**Three**	**Combined**
	Existence	**Existence**	**Depth**	**Depth**	**Depth**	**Duration**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
RTA	-5.969**	-	-	-	-	-	-
	(2.837)						
FTA	-	-11.406*	-	-	-	-	-2.675
		(5.866)					(14.446)
CU	-	-3.396	-	-	-	-	-3.667
		(3.201)					(25.724)
FTA or CU	-	-	-2.584*	-1.033	-1.667	-	2.016
			(1.530)	(3.604)	(3.440)		(13.236)
No. of FTA partners	-	-	-	-1.062*	-1.442*	-	-0.865
				(0.618)	(0.799)		(1.228)
No. of CU partners	-	-	-	-0.096	-0.408	-	-0.409
				(0.546)	(0.648)		(0.579)
Total RTAs	-	-	-	-	6.328	-	0.563
					(4.977)		(5.614)
Average duration in RTA(s)	-	-	-	-	-	1.284**	1.327**
						(0.579)	(0.649)
Population (millions)	0.450*	0.456*	0.452*	0.466*	0.479*	0.412*	0.436*

	(0.245)	(0.250)	(0.246)	(0.263)	(0.249)	(0.243)	(0.260)
Constant	32.168***	33.932***	31.809***	34.709***	35.486***	36.696***	36.541***
	(2.533)	(2.901)	(2.609)	(3.104)	(3.233)	(3.025)	(3.600)
FE (*i* and *t*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.715	0.722	0.713	0.724	0.726	0.720	0.732
Overall R-squared	0.768	0.774	0.767	0.775	0.777	0.772	0.782

Notes: The table shows the results of regressing net agricultural production on variables representing existence, depth and duration aspects of integration. In column [1], the RTA dummy equals 1 for years in which a country was in at least one RTA; and 0 otherwise. Similarly, in column [2], the FTA and CU dummies equal 1 for years in which a country was in at least one FTA/CU; and 0 otherwise. In column [3], we include a categorical variable for which 1 equals FTAs and 2 CUs; and 0 otherwise. In column [4], we add the number of FTA and CU partners per country and, in column [5], include the number of RTAs countries are involved in. In column [6], we count the number of years in which a country has been in an FTA and CU (the count resets to 0 if membership lapses for whatever reason). In column [7], we combine the existence, duration and depth variables to explain the dependent variable. The data are annual, comprising 2,417 observations for 46 countries over the 1961-2014 time horizon. The Stata command *xtreg* is used for the models. Fixed effects are included as indicated but not reported: *i* – country fixed effects and *t* – time fixed effects. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Analogously to Chapter 3, Table 4D.1 provides the results of checking for potential feedback between $u_{ij,t}$ and $RTA_{ij,t+1}$, as in Wooldridge (2002). Future RTAs could depend on $u_{ij,t}$ if countries choose to base future participation on domestic shocks in the past; or if policymakers choose RTA members at time $t+1$ who had a low $u_{ij,t}$. Neither RTA_{t+5} or RTA_{t+10} is significant, hence we believe feedback is not occurring.

Table 4D.3: Least squares regression results of net agricultural production on integration variables (1961–2014)

Dependent var.	**Net agricultural production (1961 – 2014)**		
Change to RTA	**None**	**Lead variable by:**	
		5yrs	**5 & 10yrs**
	(1)	**(2)**	**(3)**
RTA	-8.758***	-7.841**	-7.125**
	(3.091)	(3.226)	(3.509)
RTA_{t+5}	-	2.415	1.685
		(2.280)	(2.036)
RTA_{t+10}	-	-	1.548
			(2.006)
Extent (market access)	0.001**	0.001**	0.001**
	(0.001)	(0.001)	(0.001)
Trade Openness	-8.472**	-8.641**	-8.657**
	(3.938)	(4.000)	(3.999)
Average duration in RTA(s)	1.156*	1.226**	1.274**
	(0.600)	(0.604)	(0.595)
Population (millions)	0.281	0.281	0.282
	(0.180)	(0.180)	(0.179)
Constant	44.170***	44.564***	44.645***
	(5.431)	(5.527)	(5.495)
FE (*i* and *t*)	Yes	Yes	Yes

Notes: We use two lead lengths for RTA to account for potential feedback: Column [1] is the baseline specification with no lag, column [2] includes a lead of 5 years and column [3] a lead of 5 and 10 years. The data are annual, comprising 1,998 observations for 45 countries over the 1961-2014 time horizon. The Stata command *xtreg* is used for the models. Fixed effects are included as indicated but not reported: *i* – country fixed effects and *t* – time fixed effects. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 4D.4: Poisson regression results for Hypothesis 1, 2 and 3 and a combination of all three: SSA countries compared to the World

Dependent var:	**Agricultural Ease of Trade (1995-2012)**							
Region:	**Sub-Saharan Africa**				**World**			
Hypothesis:	**One: Existence**	**Two: Depth**	**Three: Duration**	**Combined**	**One: Existence**	**Two: Depth**	**Three: Duration**	**Combined**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
RTA	0.026	-	0.006	0.086	0.014***	-	-0.000	0.113***
	(0.029)		(0.030)	(0.069)	(0.004)		(0.004)	(0.020)
FTA	-	0.012	-	-0.099	-	0.015***	-	-0.107***
		(0.031)		(0.073)		(0.004)		(0.020)
CU	-	-	-	-	-	0.119***	-	-
						(0.020)		
CM	-	0.068	-	-	-	0.223***	-	0.042**
		(0.056)				(0.010)		(0.021)
EcU	-	-0.121*	-	-0.105	-	0.238***	-	-0.012
		(0.066)		(0.082)		(0.014)		(0.024)
Duration in FTA	-	-	0.026***	0.026***	-	-	0.007***	0.004***
			(0.005)	(0.005)			(0.001)	(0.001)
Duration in CU	-	-	0.021	0.025	-	-	0.003***	0.002
			(0.015)	(0.015)			(0.001)	(0.001)
Duration in CM	-	-	0.000	-0.006	-	-	0.027***	0.022***
			(0.006)	(0.008)			(0.001)	(0.001)
Duration in EcU	-	-	-0.012*	-0.007	-	-	0.013***	0.016***
			(0.007)	(0.008)			(0.002)	(0.002)
FE (*it, jt, ij*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.940	0.940	0.942	0.942	0.921	0.922	0.925	0.926

Notes: Results presented are for Fixed Effects Poisson model for Hypothesis 1 in columns [1] and [5], Hypothesis 2 in columns [2] and [6], and Hypothesis 3 in columns [3] and [7]. The hypotheses are combined in columns [4] and [8]. The data are annual, comprising 2,341 observations among 44 countries (SSA) and 65,633 observations among 176 countries (World) over the 1995-2012 time horizon. Fixed effects are included as indicated but not reported: *i* & *j* – importer and exporter ('directional') fixed effects; *ij* – pairwise fixed effects; *t* – time fixed effects; *it* & *jt* – directional-time fixed effects. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.