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Regional trade agreements and intra – African trade

Abstract

Given the recent establishment of the African Continental Free Trade Area (AfCFTA) this study aims to estimate the treatment effect of membership to an African trade agreement on intra – African trade. Considering the formal formation of African trade agreements and the actual removal of tariff barriers in the past three decades, trade agreements seem to have played a supporting role at best in boosting intra- African trade. Furthermore, the elimination of non – tariff barriers seems to be at least of the same importance as the elimination of tariff barriers in order to increase intra – African trade.

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I. Introduction

The number of trade agreements has vastly increased in the past few decades without the exception of agreements on the African continent. Several methodological errors have led the past literature to fail to reach an unambiguous conclusion regarding the trade creating or trade distorting effects of these agreements. Given the recent establishment of the African Continental Free Trade Area (AfCFTA), aiming to establish a continent-wide free trade area, this study aims to estimate the effect of membership to African regional trade agreements on intra – African trade. The variety of African agreements has led to large differences regarding the level of economic integration between the agreements, hence the effect may be highly heterogeneous among differential agreements. Therefore, the effect will be estimated whilst allowing the effect to differ between agreements. Furthermore, the effect might also differ largely among sectors, consequently the effect in each sector will be estimated in order to assess the effectivity of trade agreements in boosting intra – African trade among sectors.

Whilst comparing all the active African trade agreements, only the Southern African Development Community (SADC) shows a significant positive, treatment effect after the formal formation of the agreement. All the other agreements fail to exhibit a significant effect either after the formal formation or after the actual removal of tariffs. On aggregate has the formation of trade agreements led to a significant increase in trade. However, this increase can mostly be attributed to the removal of other trade impeding barriers since the effect on trade after the removal of tariff barriers is not significant. Moreover, the significant effect of the formal formation of an agreement must be interpreted with caution due to reverse causality concerns. Furthermore, only a few sectors show to have benefitted from either tariff elimination or the formal formation of trade agreements. Altogether, based on the mixed findings whilst allowing the treatment effect to differ among agreements, the diverse findings on the sectoral level and the reverse causality concerns, regional trade agreements seems to have played an inferior role at best in boosting intra- African trade.

This paper proceeds as follows. Section II will discuss related literature regarding the effect of African trade agreements. Section III will give an historical overview of the different agreements considered in this study. Section IV discusses the added value to the existing body of literature. Section V will proceed to discuss the endogeneity issues underlying research regarding trade agreements and present the preferred specification. Section VI will discuss the data used in order to estimate the treatment effect. Section VII will present the results after which section VIII will conclude.

II. Literature review

The amount of trade agreements has drastically increased in the last couple of decades without the exception of Africa (Hofmann, Osnago, & Ruta, 2017). The establishment of the variety of African trade agreements has triggered the interest of researchers aiming to identify the causal effect of such agreements on trade. An early study by Musila (2005) builds upon the differing opinions regarding the formation and actual performance of south-south trade agreements around the 2000s. He analyses the trade creation and trade diversion effects of three large African trade agreements (Common Market for Eastern and Southern Africa (COMESA), Economic Community of Central African States (ECCAS), Economic Community of Western African States (ECOWAS)) by use of a modified gravity model. He uses a sample of 20 African countries and an extended version of the gravity model by including a set of dummies to measure the trade diversion and trade creation effects of each agreement. In order to include zeroes in his data he adds 1 to each zero and assigns the number 10 to a dummy variable if the statement is true and 1 otherwise. The empirical analysis shows no effect on trade for ECCAS but does show net welfare gains, namely higher trade creation than trade diversion, in the case of ECOWAS and COMESA. He attributes these differences to both the differences in actual implementation between the agreements and the differences regarding further economic integration between the alliances.

The study by Musila is illustrative for the two main problems affecting the credibility of a considerable amount of past research. Musila uses an augmented version of the gravity equation introduced by Tinbergen (1962), relating trade flows to the size of both countries and the distance between them based on physics without any economically appropriate theoretical foundation. Anderson and Van Wincoop (2003) show that estimating such a gravity equation without a proper theoretical foundation leads to omitted variable bias, causing an upward bias. The second issue affecting the credibility of the results comprises the treatment of zero trade flows, zeroes impose a problem since the gravity equation takes a log-linear form such that these observations automatically will be discarded. A solution utilized by many authors besides Musila is to arbitrarily assign a small, positive value to these recorded zeroes. Problems arise since the results will critically depend on the unit of measurement used, and thus the amount that is added if an arbitrarily chosen value is added (Head & Mayer, 2014).

Recent work by Afesorgbor (2017) acknowledges these shortcomings of the research by Musila and others regarding African trade agreements. Either omitted variable bias or the improper treatment of zeroes diminishes the credibility of the studies published in the two preceding

decades, hence explain the inconsistency of the results regarding the sign, magnitude, and significance. Afesorgbor derives a combined effect size using meta-analysis and uses the gravity model to estimate and compare the effects on trade for five African trade agreements. Trade data on 47 African countries covering the same time period as prior research is used, namely 1980-2006, in order to provide a comparative analysis. He finds positive and significant effects for only 2 of the 5 considered agreements (ECOWAS and SADC). The comparative exercise carried out by Afesorgbor highlights the importance of the use of a theoretically founded specification and the need to use a sensible method to deal with the large amount of recorded zeroes between country pairs. The presence of recorded zeroes can become a severe problem within the African context, the amount of zeroes within the data used by Afesorgbor being 55%. Lastly, he points out the need for a thorough understanding of the trade agreements in order to understand what drives an estimate. The next section will therefore give an historical overview of the different African trading blocs considered in this study.

The most recent studies do control for omitted variable bias using the framework proposed by Anderson and Van Wincoop (2003) and control for zero trade flows in a sensible way utilizing the Poisson pseudo- maximum-likelihood (PPML) method proposed by Silva and Tenreyro (2006). The PPML- estimator is a convenient and often used tool in the recent gravity literature since it also effectively solves the problem of heteroskedasticity within trade data (Yotov et al., 2016). Recent work by Riedel and Slany (2019) focusses on the specific subgroup of agreements which are part of the tripartite initiative, namely COMESA, the Southern African Development Community (SADC), and the East African Community (EAC). The initiative aims to merge the three agreements into one, large trade bloc. Riedel and Slany (2019) use the period before the initiative emerged to see how succesful the past trade promoting initiatives have been in these regions. They fail to find robust, positive estimates. Osabuohien, Efobi, Odebiy, Fayomi, and Salami (2019) focus specifically on members of one specific regional trade agreement (ECOWAS). Likewise they show inconsistent estimates regarding the effect of regional integration. Eventhough the coefficients are consistently positive, the estimates fail to hold statistical significance using a variety of specifications. The authors point out the fact that some countries are a member of another trade agreement (the West African Economic and Monetary Union (WAEMU)) as one of the factors driving the estimates. This denotes the importance to account for all active trade agreements whereas overlapping agreements may cause different trade patterns. Afesorgbor and Van Bergeijk (2014) share this view, finding a positive impact of complementing multi-membership.

III. Historical overview

As mentioned before, a considerable amount of African trade agreements has been formed over the past couple of decades. The variety of regional trade agreements has led to noteworthy differences between the agreements. Hoekman, Senber and Simbanegavi (2017) mention remarkable differences between intra-agreement tariffs, furthermore Musila (2005) pointed towards the characteristics of the alliances regarding economic integration as an explanation for the differences in estimated treatment effects. An indicative view of the depth of each agreement is given in appendix table A.1. Table A.1 shows the amount of policy areas covered, out of a total of 52, in each agreement as recognized by the study of Hofmann et al. (2017). This section will give an historical overview of the active agreements and presents a concise but thorough description for each of the African agreements known by the World Trade Organization (WTO) in order to better understand the results of this empirical study. Appendix table A.2 presents an overview of past and current members of each agreement.

III.I Common Market for Eastern and Southern Africa

The Common Market for Eastern and Southern Africa was formed in 1994 to replace a preferential trade area (PTA) (COMESA, 2019a). Due to the history as a PTA the focus has been on regional integration as a tool for welfare improvement. Whilst the implementation period should have ended in 2000, marking the start of a free trade area, only nine states successfully eliminated their tariffs on COMESA originating products (Djibouti, Kenya, Madagascar, Malawi, Mauritius, Sudan, Zambia and Zimbabwe), followed by Burundi and Rwanda in 2004. In 2015, 15 years after initially implementing the free trade area, 15 member countries have joined the free trade area (UNECA, 2019a). Whilst not all members have tariffs in accordance with the agreement, significant strides forward have been made in recent years. A third of all traded goods are free of tariffs, an increase by a factor of three in comparison with five years earlier, the average tariff within the COMESA region being only two percent (Riedel & Slany, 2019). The fact that economic integration takes time is uniquely shown in the case of the Democratic Republic of Congo. Even though DR Congo has been a member since the formation in 1994, it only entered the free trade area in 2015, still making strides towards finalizing the tariff phase-down process.

Whilst COMESA acknowledges the importance of deep integration in order to boost trade, and significant strides forward have been made, a lot of heterogeneity exists between countries in their ability to commit to the agreement. The most recent annual report covering the progress made up until 2017 shows these achievements and the challenges faced (COMESA, 2019b).

The progress made within the FTA shows that 89.2% of non-tariff barrier issues have been settled. The custom union was launched in 2009 in order to reach the next step in economic integration, but numerous difficulties prohibit the successful implementation of the custom union. The average alignment of external tariffs is only 34% and highly heterogeneous among countries. Furthermore, strides have been made in order to improve the free movement of persons in order to boost trade performance. Whilst some member countries have opened up, other countries fail to do so. According to the 2018 African Visa Openness report reciprocity is still only 19% within the COMESA area, just as high as the continent average (African Development Bank Group, 2018).

III.II Economic and Monetary Community of Central Africa

The Economic and Monetary Community of Central Africa (CEMAC) consist of six central African countries, initiated in 1994 and implemented in 1999. The member countries share a currency, the Central African CFA franc, and form a custom union, charging common tariffs to non-member imports. In theory all within-region tariffs should have been removed, but member countries have failed to act in accordance with the agreement, delaying the actual implementation of a full custom union (AGOA, 2019).

A lot of progress can be still be made in order to deepen economic integration. The restrictive policy of Equatorial Guinea and the relatively weak infrastructure, even though initiatives have been made to improve the infrastructure, prohibit the agreement to reach its full potential. Another concern regarding the effectivity of the agreement concerns the economic instability of member countries (Nono, 2016).

III.III East African Community

The East African Community was established by the Treaty for the Establishment of the East African Community in 1999, signed by Kenya, Uganda, and Tanzania. The EAC expanded in 2007 with the ascension of Burundi and Rwanda (UNECA, 2019b). The EAC is the most developed agreement in Africa, following the agreement in 1999, a custom union was formed in 2005 which Burundi and Rwanda entered in 2009, setting equal tariff barriers to non-member countries. The custom union was replaced in 2010 due to the formation of a common market, allowing the free movement of goods, services, capital, labour and persons. The maturity of the agreement is reflected in the fully liberalized goods market (Riedel & Slany, 2019) and the high visa openness reciprocity rate of 90%. The fact that the reciprocity rate is not 100% reflects the ascension of the relatively closed country South Sudan in 2016, which requires a visa on arrival

for Kenya, Rwanda, Tanzania, and Uganda and demands a visa travelling from Burundi (African Development Bank Group, 2019).

III.IV Southern African Development Community

The Southern African Development Community was established in 1992 as successor of the Southern Africa Coordination Conference (UNECA, 2019c). Founded in 1992, the first step towards regional integration was only set in 2008 with the establishment of the FTA, which got established after zero tariffs were obtained on 85% of inter-regional trade (SADC, 2019a). Angola and DR Congo remain outside of the free trade area, thus consisting of 13 members. Whilst 13 countries participate in the FTA some countries either have lagged behind in reducing their tariffs (Malawi and Zimbabwe) or have asked for exemptions for certain industries (Tanzania). Still, tariffs within the SADC area are very low, averaging 0.1 percent (SADC, 2019b; Riedel & Slany, 2019).

Whilst the SADC aspires to be an economically integrated area with a common market and common currency, initiatives in order to do so have not been successful. The first step forward would have been the formation of a custom union. Whilst the custom union was intended to be operational in 2010 capacity problems have led to further postponement (SADC, 2019c). Huge delays in implementing policies are reflected in the actual execution of the initiative that would have led to the free movement of persons, whilst the first draft of the initiative was proposed in 1996 thusfar only a handful of countries have actually granted visa-free entry (UNECA, 2019d).

III.V Economic Community of West African States

The Economic Community of West African States, consisting of 15 countries, was originally established in 1975, but due to changing macroeconomic circumstances it has been revised in 1993 (UNECA, 2019e). The revisions led to the focus on economic integration through the usual channels, starting with a free trade area. The initiative intended to establish the FTA was introduced in 1990 as the ECOWAS Trade Liberalization Scheme (ETLS). Whilst tariffs have been reduced since, the greatest challenge in fostering intra-regional trade lies in reducing non-tariff measures, marking the difficulty in successfully establishing a successful FTA. Despite these difficulties progress has been made into forming a common market, the main goal in order to reach further economic integration. In this respect, the agreement has been very successful in the free movement of persons, being the only African alliance having full free movement of person within the region. The next step towards a common market, the introduction of a

common external tariff, has been taken recently in 2015, and has been implemented by 10 member countries in 2016 (UNCTAD, 2019; ECOWAS, 2019).

Eight ECOWAS members also form a currency union, sharing the West African CFA franc, called the West African Economic and Monetary Union which got established in 1994 among 7-member, Guinea Bissau entering in 1997. WAEMU has the same goal as ECOWAS, fostering economic growth through economic integration. Whilst major steps forward have been set by the introduction of the free trade area and the custom union in 2000, the common market has not been finalized yet. Like ECOWAS, non-tariff measures are the biggest obstacle to further economic integration (UNCTAD, 2019).

III.VI Southern African Custom Union

The Southern African Custom Union (SACU), consisting of five countries, has a long and rich history. The current agreement got signed in 2002 and became active in 2004, but the initial agreement dates back to 1889. In 1910 the first agreement consisting of 5 member countries was signed in order to create a free trade area between members, a common external tariff towards non- members, and a revenue sharing formula for the custom and excise revenues. After a revision in 1969, negotiations on the current agreement started in 1994 and finished in 2002 (SACU, 2019). The intention of the agreement being an increase in within-region trade and increased economic integration through trade and investment.

Currently, SACU has no tariff line between the member countries and levies a common tariff on non-member countries. Most Favoured Nation (MFN) tariffs are levied on imports from non-members with the exception of countries and trade blocs which have closed a trade agreement with SACU. Further economic integration is achieved through the Common Monetary Area which enables all member countries, except Botswana, to use the South African Rand as payment method, whilst the other national currencies are valued and exchanged at par with the rand (Chidede, 2019). Furthermore, persons are allowed to travel without a visa within the SACU-area (African Development Bank Group, 2019).

IV. Added value to the existing body of literature

This research will study the performance of African trade agreements. The formation of the African Continental Free Trade Area in 2018, aiming to establish a continent-wide free trade area (African Union, 2019), has renewed the interest into finding the treatment effect of being a member to a trade agreement within the African continent.

Most of the past studies regarding African trade agreements can be ignored as pointed out by Afesorgbor (2017). Part of the early studies fail to consider a proper theoretical framework. Anderson and Van Wincoop (2003) shows that not considering a theoretical framework whilst using the gravity methodology will lead to omission of the trade friction of the exporter and the importer to trade with all of their trade partners. Hence not using a proper theoretical foundation will lead to biased estimates. Another problem that is present within the literature is the arbitrary way of dealing with the large number of recorded zeroes within the data. Either omitting the zeroes from the data or adding an arbitrarily chosen positive number are solutions implemented in order to deal with recorded zeroes, both solutions are questionable. Omitting zeroes from the analysis will omit valuable information and the results will depend on the unit of measurement and thus the amount added if one utilizes the second method. Furthermore, more recent work using the gravity methodology considered either a very specific group of countries belonging to a certain trade agreement (Osabuohien et al., 2019) or a specific subgroup of agreements (Afesorgbor, 2017; Riedel & Slany, 2019). Moreover, these studies do find differential effects for the same agreement in corresponding specifications. Whereas Afesorgbor does find a weakly significant treatment effect for the COMESA agreement, Riedel and Slany fail to find a significant effect. This might be due to either the differential definition of the RTA variable, a different set of controls, or the use of a differing time period. These studies did consider the two major problems underlying earlier research but also point out the need to properly address other endogeneity issues. This study will present an elaborate discussion of the endogeneity issues and plausible solutions to which research regarding regional trade agreements is susceptible. Furthermore, none of these studies considered all the active African trade agreements, this study will therefore focus on all the African trade agreements officially noted by World Trade Organization (WTO) in order to estimate the treatment effect of participating in an African regional trade agreement.

Whilst past and recent research does not reach an unambiguous conclusion regarding the aggregate trade-creating effect of ECOWAS, Cissokho et al. (2012) do find robust evidence concentrating their attention to the agricultural sector. Furthermore, recent research utilizing the gravity methodology points out the likelihood of differential treatment effects across sectors (Anderson & Yotov, 2016). This research will therefore disentangle the aggregate effect, showing the attribution of each sector to the effect size. It might very well be plausible that whilst on aggregate participating in an agreement does not have a positive effect on bilateral trade it does have a positive effect in a single sector or subgroup of sectors, therefore

disregarding regional integration as being ineffective will be unjustified. Analogue to this reasoning, participating in a trade agreement may show to have a very strong positive effect on aggregate but may only show a positive effect in a single or a subgroup of sectors, hence taking regional integration to be successful in boosting bilateral trade in every sector will be unwarranted. The 16 sectors considered are shown in appendix table A.4. To my knowledge this has not been done in the context of African trade agreements, the most recent research mentioned before focus their attention to finding the aggregate treatment effect of membership to an African trade agreement.

V. Methodology

The most convenient way to estimate the treatment effect of belonging to a trade agreement would be to simply estimate equation (1), regressing the bilateral trade flow on a dummy denoting the presence of a trade agreement between the two countries. Alternatively, in order to allow different agreements to have a different treatment effect, the RTA-variable would consist of a set of a dummies, each representing a specific trade agreement.

$$X_{ij,t} = \alpha_0 + \alpha_1 RTA_{ij,t} + \varepsilon_{ij,t} \quad (1)$$

However, many variables can be named which will both influence the presence of a trade agreement and the volume of trade between the two countries, hence causing endogeneity issues. Improperly controlling for these endogeneity issues will lead to either an upward or downward bias dependent on the omitted variable considered. Furthermore, reverse causality may impose a serious threat to identification of the effect of interest. Most likely two countries which have a relatively high bilateral trade flow between each other will have a higher propensity to select into a trade agreement since the profit from forming an agreement will be higher within country pairs that tend to trade relatively more than country pairs that exhibit a negligible amount of bilateral trade. Hence, naively estimating regression (1) will lead to overestimation of the treatment effect. Lastly, whilst the formal formation of an agreement might have happened years ago, members may fail to commit to the agreement. Likewise, a country pair may already take advantage from being in a trade agreement before the formal date of entry into force since an agreement may only be revised. In this case, using the formal date of entry as reference might lead to measurement error in the independent variable, leading to underestimation of the true causal effect. These identification issues prohibit finding an unbiased estimate of the treatment effect. Consequently, all of these problems and feasible solutions will be discussed in order to present the reader a discussion of the endogeneity issues

affecting the findings, and to present the steps taken whilst deriving the preferred specification to estimate the causal effect of belonging to an African trade agreement on intra- African trade.

V.I Omitted variable bias

The gravity model, named according to the Newtonian theory of gravitation, and introduced by Tinbergen (1962) illustrates an early attempt into finding the causal effect of forming a trade agreement on the volume of bilateral trade. Without having a proper theoretical foundation, the gravity model relates the bilateral trade flow in a multiplicative form to the ability of the exporter to meet export demand, the ability of the importing country to import, and the transportation cost between the two countries. These variables are usually proxied by the gross national product (GNP) of the exporting and importing country and the geographical distance between them. Such a naïve gravity equation would take the log- linear form of equation (2):

$$\ln X_{ij,t} = \ln a_0 + a_1 \ln Y_{i,t} + a_2 \ln Y_{j,t} + a_3 \ln D_{ij} + a_4 \ln RTA_{ij,t} + \varepsilon_{ij,t} \quad (2)$$

Whilst the gravity equation fitted the data remarkably well, the lack of an economic theoretical foundation prohibited mainstream acceptance. The theoretically founded gravity model by Anderson and Van Wincoop (2003) took away these concerns but did expose the omitted variable bias problem heavily influencing former research using an a- theoretical gravity equation. Equation (3) shows the log- linear form of the theoretically founded gravity equation by Anderson and Van Wincoop (2003). In comparison with equation (2), not using a proper theoretical foundation will lead to omittance of the multilateral resistance terms depicted by $P_{i,t}$ and $P_{j,t}$. Hence the volume of bilateral trade is not only dependent on the height of the bilateral frictions between two countries but is furthermore influenced by the average height of the trade frictions of the exporter and the importer with all their trade partners.

$$\ln X_{ij,t} = \ln a_0 + a_1 \ln Y_{i,t} + a_2 \ln Y_{j,t} + a_3 \ln D_{ij} + a_4 \ln RTA_{ij,t} + \alpha_5 P_{i,t} + \alpha_6 P_{j,t} + \varepsilon_{ij,t} \quad (3)$$

If we take the multilateral resistance terms to have a negative effect on the bilateral volume of trade and the correlation between the formation of an RTA and the multilateral resistance term to be negative, omitting the multilateral resistance term will lead to overestimation of the true causal effect. Observing high outward resistance and high inward resistance to trade do indeed plausible lead to a lower volume of trade between two countries. Furthermore, the formation of an RTA between a country pair will reasonable reduce the trade cost between both countries, hence the multilateral resistance of both countries, which is defined as the average resistance to

trade with all their partners, is negatively affected. Therefore, it seems like a plausible line of reasoning to expect overestimation whilst omitting the multilateral resistance terms, emphasizing the need to properly include these terms in the estimation. Common practice within the literature is to include exporter- and importer time fixed effects in order to control for the multilateral resistance terms.

Common practice within the gravity literature is to include a set of bilateral control variables in order to capture the bilateral trade cost. The usual set of controls consist of the geographical distance between the two countries, and dummies denoting the presence of a shared border, shared language, and existence of a trade agreement. Even whilst using the proper theoretical framework and additionally using the set of bilateral controls, Baier and Bergstrand (2007) still express concerns regarding endogeneity. Unobservable characteristics which impede trade but make the formation of an agreement more fruitful may lead to underestimation. Baier and Bergstrand propose the use of panel data, instead of the usual cross-sectional attempts, in order to exploit country pair fixed effects in order to control for the endogeneity issues. Even though the country pair fixed effects do indeed form a more complete way to control for country pair specific time-invariant factors than a limited set of controls, it is very implausible to solve all the endogeneity issues plaguing research concerning trade flows and trade agreements. As will be discussed in sections V.II and V.III reverse causality and measurement error will still impose endogeneity issues, even after including country pair fixed effects.

Riedel and Slany (2019) include the absolute value of the difference between the log of the gross domestic product (GDP) per capita of both countries in order to control for the effect of disparities in development. Throughout their analysis they either find an insignificant or negative effect of the difference on the volume of bilateral trade. Furthermore, Baier and Bergstrand (2004) find that the probability of two countries selecting into a trade agreement is positively related to the economic similarities between both countries. Based on the negative effect of the economic disparity of both countries and their bilateral trade flows and the negative relationship between forming an agreement and economic disparity, omitting the absolute economic difference will lead to overestimation of the treatment effect. Other determinants mentioned by Baier and Bergstrand (2004) influencing the probability of selecting into a trade agreement include the size of both the importer and the exporter, the distance between both countries, the difference in past capital-labour endowment, and the likelihood of both countries to trade with other countries besides the partner country. All of these are perfectly captured by either the exporter- or importer time fixed effects or the country pair fixed effects.

Properly controlling for the endogeneity issues arising from omitted variable bias will lead to the estimation of equation (4), the first three terms on the right-hand side representing the exporter time fixed effects, importer time fixed effects, and the country pair fixed effects, which are represented by a set of exporter year, importer year or country pair specific set of dummies.

$$\ln X_{ij,t} = \theta_{i,t} + \varphi_{j,t} + \gamma_{ij} + \alpha_1 RTA_{ij,t} + a_2(|\ln income\ difference_{ij,t}|) + \varepsilon_{ij,t} \quad (4)$$

Lastly, the most recent literature has proceeded to include intra- national trade flows in the analysis (Bergstrand, Larch & Yotov, 2015; Baier, Yotov & Zylkin, 2019). Adding intra-national trade flows would allow the researcher to control for the effect of globalization by adding an interaction term between a dummy which equals one in the case of international trade and a time trend. Whilst it is plausible that the ongoing process of globalization affects the ability of the exporter and the importer to either export or import, I believe that such an effect is perfectly captured by the exporter- and importer time fixed effects which are included in the analysis. Additionally, Yotov et al. (2016) argue that including intra- national trade flows will allow the researcher to take the trade diversion from national sales into account, hence leading to a higher estimated treatment effect. Whilst this might be correct, the specific aim of this study is to estimate the effect on the volume of the international trade flow, the diverging effect of entering a trade agreement on intra- national trade is outside the scope of this article.

V.II Reverse causality

Whilst several solutions have been suggested by the literature in order to resolve the issues regarding omitted variables, reverse causality is still a prevalent issue. Afesorbor and Van Bergeijk (2014) claim that specifically focussing on intra-African trade reverse causality may not pose a problem since intra- African trade is historically low. Still, it is plausible to assume that even within the African continent country pairs that trade relatively more choose to select into a trade agreement since the expected benefits are high compared to country pairs that only trade to a negligible extent. Looking at the geographical location of the African trade agreements, all the trade agreements form a contagious bloc of countries, hence countries that are part of an agreement are more likely to trade with each other regardless of being part of the trade agreement. The data available on intra- African trade flows does not diminish the reverse causality concerns. The year prior to the most recent ascension to the East African Community of Burundi and Rwanda in 2007, Kenya was importer to more than half of the totally recorded intra- African exports of Burundi; Rwanda, Uganda and Tanzania being the fourth, sixth and seventh largest African importers. Considering the case of Rwanda, Kenya even covered two

third of the intra-African exports of Rwanda; Burundi, Uganda and Tanzania being the second, fifth and sixth largest African importer. Hence these relatively large trade flows with the members of the EAC might have been a reason to enter the agreement.

The optimal solution would be to find an instrumental variable that is strongly related to the probability of selecting into a trade agreement and does not influence the volume of bilateral trade through another channel than through its effect on the probability of selecting into an agreement. Unfruitful attempts have been made in the literature, the main issue being the violation of the exclusion restriction (Baier & Bergstrand, 2007). The set of variables that might be suitable as an instrument, significantly influencing the probability of selecting into an agreement, also affects the volume of bilateral trade. As mentioned before, and illustrated by use of the data, it is plausible that a higher volume of bilateral trade between two countries increases the likelihood of the two countries forming a trade agreement. As a proper solution has not presented itself yet, the estimated coefficients will merely reflect an upper bound of the treatment effect and must thus be interpreted with caution.

Common practice within the literature in order to take away some of the concerns regarding reverse causality is to add a variable measuring the future RTA level as displayed in equation (5). If the formation of an RTA is exogenous to the volume of bilateral trade the future RTA level must not have an effect on the current bilateral trade flow. Whilst this might indeed take away some of the concerns, even if the future RTA level does exhibit a significant negative effect on current trade levels this might simply reflect a reduction of current trade flows in anticipation of the formation of an agreement (Baier & Bergstrand, 2007). A significant positive coefficient will substantiate the reverse causality concerns and point out the need for a cautious interpretation of the results.

$$\ln X_{ij,t} = \theta_{i,t} + \varphi_{j,t} + \gamma_{ij} + \alpha_1 RTA_{ij,t} + \alpha_2 RTA_{ij,t+1} + a_3 (|\ln income\ difference_{ij,t}|) + \varepsilon_{ij,t} \quad (5)$$

V.III Measurement error

The most convenient way to define the variable measuring the presence of a trade agreement would be to use a dummy which equals one the year in which both countries belonging to a bilateral flow of goods are part of the same agreement. Either according to table A.3 if both countries are founding member or according to table A.2 if one or both countries entered in a certain year. Since large differences exist between the agreements regarding the actual implementation of the initiatives lined out in the agreement in order to promote trade through

further economic integration, this might incorrectly mark a country as being part of an agreement whilst in practice nothing has changed. Contrarily, a country pair may already reap the benefits from free trade before the official date of entry into force since an agreement may only be revised. Since this will almost for certain cause measurement error, leading to underestimation of the true causal effect, the wrong conclusion might be formed based on a treatment effect estimated in such a way. All the African agreements have the shared goal of forming an economic union. The usual steps start from forming a free trade area, followed by a custom union, a common market and ultimately an economic union. According to this rationale the commitment of member countries to actually reduce tariffs can be seen as a better indication of the first step taken to achieve economic integration instead of either the date on which the agreement was formed or when a country formally entered the agreement. Considering the recent establishment of the African Continental Free Trade Area the capability of the removal of tariff barriers to boost bilateral trade is of special interest, introducing an additional reason to use the actual removal of tariffs as indication of the entrance into an agreement.

By use of the preferential rates obtained through TRAINS, a country pair will be marked as member of an agreement if both countries commit to liberalisation by the elimination of tariffs. The entire removal of tariffs is typically a continuous process starting from lowering the tariffs below the level of the tariffs levied on partner countries outside of a certain agreement, gradually declining the tariffs towards zero. A country pair may plausible already benefit from the extensive removal of tariffs between the countries, whilst complete removal is not attained because the elimination of tariffs within certain sectors is delayed for various reason. Whilst the persistence of tariffs in certain sectors or product groups may indeed effectively protect domestic producers from import competition and thus impeding the bilateral trade flow within these sectors or product groups, I deem it unlikely that a country pair will not take advantage from the extensive removal off tariffs before full tariff liberalisation has occurred. In order to take such a phase down process into account, a country or sector will be marked as committing to tariff liberalisation if 85% of all product groups are free of tariffs in a certain year.

Literature studying the effect of regional trade agreements typically allows for phased in effects by adding lagged variables measuring the presence of an agreement one or two periods earlier as shown in equation (6) (Baier & Bergstrand, 2007; Anderson & Yotov, 2016). Considering the fact that the RTA variables in these studies are based on the date of entry into force these might be especially important since the actual implementation is not as sudden as such a date

suggests. But even whilst defining the RTA variable based on the actual removal of tariffs, adding lagged values of the dummy variable might still unveil valuable information. All the African agreements aim to achieve economic integration beyond the formation of a free trade area. Whereas the successful implementation of the free trade area can be seen as the first fruitful step towards deeper economic integration, it will also plausible allow countries to divert their focus to other fields of interest in order to reach further economic integration. Since deeper economic integration can reasonably be expected to further lower trade barriers, hence increasing the bilateral trade flow, the treatment effect can be expected to partly load on these lagged variables.

$$\ln X_{ij,t} = \theta_{i,t} + \varphi_{j,t} + \gamma_{ij} + \alpha_1 RTA_{ij,t} + \alpha_2 RTA_{ij,t-1} + \alpha_3 RTA_{ij,t-2} + \alpha_4 (|\ln income\ difference_{ij,t}|) + \varepsilon_{ij,t} \quad (6)$$

V.IV Data issues

A prevailing issue whilst analysing trade flows is the presence of recorded zeroes. Considering the log- linear form of the gravity equation researchers have often chosen either to exclude trade flows with a recorded zero from the analysis or to impute an arbitrarily chosen amount in order for the observation to be useful. Neglecting observations without recorded trade flows may lead to the loss of a considerable amount of observations and useful data. Furthermore, whilst adding an arbitrarily chosen amount the results will depend on the unit of measurement and thus the amount that is added to each observation (Head & Mayer, 2014). Specifically, within the context of intra-African trade proper treatment of zero trade flows is important because of the large amount of informal, unrecorded trade flows (Riedel & Slany, 2019). The amount of zeroes within the used total trade dataset is 45%. The issue of zero trade flows is even more severe on the sectoral level, the average amount of zero trade flows being 75%. A second issue whilst analysing trade flows is the presence of heteroskedasticity within trade data (Yotov et al., 2016). As ordinary least square (OLS) assumes homoskedasticity, improper treatment of the data will lead to inconsistent estimates. Silva and Tenreyro (2006) argue that, in the presence of heteroskedasticity, the log- linear form of the gravity model may introduce another reason of inconsistent OLS estimates due to Jensen’s inequality¹.

In order to tackle these issues, the Poisson pseudo maximum likelihood estimator proposed by Silva and Tenreyro (2006) will be used. Silva and Tenreyro (2006) show that heteroskedasticity is indeed a problem within the gravity literature and show robust results of the PPML -estimator

¹ “Jensen’s inequality implies that the $E \ln (y) \neq \ln E (y)$ ” (Silva & Tenreyro, 2006, p. 1).

considering several different heteroskedasticity patterns, furthermore the PPML – estimator allows for the inclusion of recorded zeroes. Since the PPML – estimator does not require the data to be Poisson distributed and solves both issues in a fairly straightforward way it is widely adopted within the gravity literature. In a 2011 follow-up study Silva and Tenreyro show that the PPML- estimator continues to perform well even if the proportion of zeroes in the data is high, which makes it a very useful estimator considering the high number of zeroes within African trade data.

V.V Concluding remarks

Taking the endogeneity issues and proposed solutions previously discussed into account, the preferred specification by use of the PPML-estimator will be equation (7) shown below. Equation (7) will additionally be used whilst estimating the treatment effect in various sectors by substituting the country time fixed effects by sector specific country time fixed effects and using the sectoral trade flow as dependent variable. Equation (7) will also be estimated whilst substituting the RTA- variable by a set of dummies, each dummy representing a different agreement, in order to allow the treatment effect to differ between the different agreements. Moreover, equation (7) will be estimated whilst allowing for phased in effects like presented in equation (6) and whilst adding the future RTA-level similar to equation (5) in order to test for reverse causality.

$$X_{ij,t} = \exp (\theta_{i,t} + \varphi_{j,t} + \gamma_{ij} + \alpha_1 RTA_{ij,t} + a_2 (|\ln income\ difference_{ij,t}|) + \varepsilon_{ij,t} \quad (7)$$

Either computational constraints or multicollinearity problems prohibit including country pair fixed effects whilst using the Poisson methodology. Riedel and Slany (2019) refrain from interpreting their results using equation (7) based on these potential problems, therefore the country pair fixed effects are substituted by the set of gravity controls including the logarithm of the distance between both capital cities and dummy variables indicating the presence of a contiguous border, a common official language, and a common colonial history whilst using Poisson.

In their proposed estimator Silva and Tenreyro (2006) make use of robust standard errors. Yotov et al. (2016) point out that since a panel data set of country pairs is exploited, serial correlation may exist in the error term within a country pair over time, therefore standard errors clustered by country pair will be used.

VI. Data

VI.I The dataset

A panel dataset will be constructed using several data sources. Adjustment to a change in bilateral trade cost such as entering into a trade agreement takes time. Therefore, following the literature, a panel dataset using 5-year intervals will be exploited (Baier & Bergstrand, 2007; Yotov et al., 2016). The preferred years will be 2017, 2012, 2007, 2002, 1997, and 1992. Since the issue of missing data is more severe in the earliest year, 1993 and 1994 will additionally be collected if data is missing. Varying the interval between 3 and 5 years will not change the estimates significantly (Yotov et al., 2016). Not only will using intervals give each country pair time to adjust to trade cost changes, it will also limit the influence of certain countries with more recorded data. Since missing data is a major problem within the African context, using a panel of consecutive years may lead to one country or a subgroup of countries with more recorded data to have a large influence on the results.

Aggregated export flows and disaggregated sectoral export flows will be obtained through the UNSD Commodity Trade (UN COMTRADE) database. The UN COMTRADE database contains detailed trade data from 1962 onwards in thousands of US\$ (WITS, 2019). The data is rescaled by a factor of 1000; hence the bilateral export flow is expressed in millions of US dollars. The 16 sectors of the harmonized system that will be used in the sectoral analysis are presented in table A.4. Table 1 displays the descriptive statistics of the aggregate bilateral export flow of the 45 African exporters which are included in the dataset, the large difference in observations between the nominal trade flow and the natural logarithm of the nominal trade flow shows the large amount of zeroes in the data. A complete list of the exports and the available years are shown in appendix table A.5, sectoral data availability may deviate slightly.

Table 1: Descriptive statistics.

Variable	Observations	Mean	Minimum	Maximum	Std. dev.
<i>Panel A.</i>	<i>Total trade</i>				
Exports	10,933	18,462.15	0	5,046,720	150,241.6
Ln (Exports)	6,162	5.146	-13.816	15.434	4.778
<i>Panel B.</i>	<i>Sectoral trade</i>				
Exports	162,493	1,240.309	0	4,620,234	25,496.66
Ln (Exports)	41,065	2.877	-13.816	15.35	5.274

Note: Descriptive statistics are shown for bilateral trade. Exports is expressed in millions of US dollars.

Gravity controls will be obtained through the CEPII database. The CEPII database consists of the usual set of gravity controls, including distance between both capitals, contiguity, the presence of a common language, and a dummy indicating if the country pair has ever been in a colonial relationship. In order to add the absolute difference in GDP per capita to the analysis, the exporter and importer GDP per capita will be retrieved from the World Development Indicators report by the World Bank Group which shows the most current and accurate data regarding economic development (World Bank Group, 2019b).

VI.II Regional trade agreements

The most straightforward way of defining the variable denoting the presence of a trade agreement would be, as mentioned before, to use the formal date of entry into force as shown in table A.3. Additionally, membership will be adjusted based on countries entering and leaving an agreement, as shown in table A.2. Hence, the RTA- variable will denote the presence of an agreement in years in which both countries of a country pair are formally part of an agreement.

As discussed before this might unjustified mark a country pair as either outside of an agreement or part of an agreement. Tariff date from the TRAINS database is used in order to construct the country profiles is shown in appendix 2 table A.6 and table A.7. The tariff data is constructed in such a way that it shows either the most favoured nation tariffs or the preferential tariffs levied on a certain group of countries denoted by an agreement specific code. Whereas the preferential tariff data does only show the product groups on which preferential tariffs are levied, the preferential tariffs are merged with the most favoured nation tariffs. A full country profile on which the degree of tariff liberalization can be based remains after removing the duplicates. Product groups with missing tariffs are assumed to be free of tariffs. Usually less than one percent of the tariffs were missing, moreover these missing values have not been the decisive factor in defining a country pair as either being part of an agreement or not being part of an agreement. Therefore, even though it might be an implausible assumption it will not affect the results. A more conservative approach is taken on the sectoral level. Whereas on the sectoral level a smaller amount of tariffs can be the decisive factor in defining a sector as either liberalised or non-liberalised only the missing values which are defined as preferential tariffs are assumed to be free of tariffs. In some instances a country specific preferential tariff profile is available besides an agreement specific preferential tariff profile of which the country is a member. In such cases the country profile is based on the country specific preferential tariffs, the agreement specific preferential tariffs, and the most favoured nations tariffs. In some instances the fact that the agreement specific tariffs do not apply to a certain member country

is explicitly specified, in such instances the country specific preferential tariffs are not merged with the agreement specific preferential tariffs. Lastly, whilst member countries may not benefit from the preferential tariffs granted to a sub group of members they may on the sectoral level benefit from free trade with another member country based on the most favoured nation tariffs. Therefore, a trade flow is assumed to benefit from membership to an agreement if both countries are formally a member of an agreement and the sector is liberalized under the most favoured nation tariffs of the importing country.

An major issue whilst using tariff data is missing data, therefore certain assumptions need to be made. Firstly, if the first year in which a full tariff profile can be made shows that the importing country has not committed to tariff reductions, all preceeding years will be marked as the country being outside of the agreement. On the sectoral level the same assumption will be made, even if some sectors are free of tariffs in this first observation. Secondly, in some instances the first full tariff profile shows that the importing country has committed to tariff liberalisation for member countries of a certain agreement. In such instances the NSF- Kellog Institute database on economic integration agreements is used to complete the tariff data. The NSF- Kellog database classifies a country pair on a scale from 1 to 6 based on the level of economic integration up until 2012. A value of 3 or higher shows the presence of free trade between a country pair. Appendix 3 describes the adjustments based on the NSF- Kellog database.

Lastly, multimembership is an often occuring phenomenon within African trade agreements. Therefore, a country pair is additionally considered to be committing to tariff reduction under a certain agreement if they already do so under another agreement. For example, under the SADC- agreement 2007 is the first year in which Botswana reduced their tariffs enough in order to be considered as committing to the agreement. But under the SACU agreement they already reduced tariffs in 2002 to the full extent and the NSF- Kellog Database shows the presence of free trade already in the first year of the sample. Therefore the countries that are both a member of SADC and SACU are considered to benefit from free trade under the SADC agreement from the start of the agreement in 2000 as noted by the WTO.

Table 2 exhibits the large difference in outcome between the two approaches. Whilst based on the formal entry into force in 23.1% of all observation a trade agreement is present, only in 7.9% of all observation is an agreement present based on the actual removal of tariffs.

Table 2: Descriptive statistics RTA variable.

Variable	Observations	Mean	Minimum	Maximum	St. dev.
FTA	10,933	0.079	0	1	0.269
RTA	10,933	0.231	0	1	0.421

Table 2: The first row shows descriptive statistics for the RTA- variable based on the actual removal of tariffs. The second row shows descriptive statistics based on the formal entry into force of the trade agreements.

VII. Results

Figure 1 shows an indicative view of the development of intra- African trade since 1992 onwards. Since trade flow of members of an actual FTA is missing before 2000, hence assumed zero, the figure may give a slightly distorted image before 2000. Nevertheless, the average trade flow between countries which stay out of an agreement does barely change over time, whilst the trade flow between countries who are part of an agreement does rise sharply since the start of the 21 century. Furthermore, trade rises even more between countries pairs who benefit from free trade in comparison to countries who are part of an agreement irrespective of the actual implementation of the agreement. At the same time does the amount of formal trade agreements barely change since the start of the 21 century whilst the amount of free trade agreements does rise gradually over time. Hence the increase in trade between member countries may for a large part be attributed to the actual removal of tariff barriers. Since many other factors besides being part of an agreement and the removal of tariff barriers may have caused these trade flows to diverge in such a way, the next sections will try to unveil which contribution the regional trade agreements have made to the increase in intra- African trade in the past three decades.

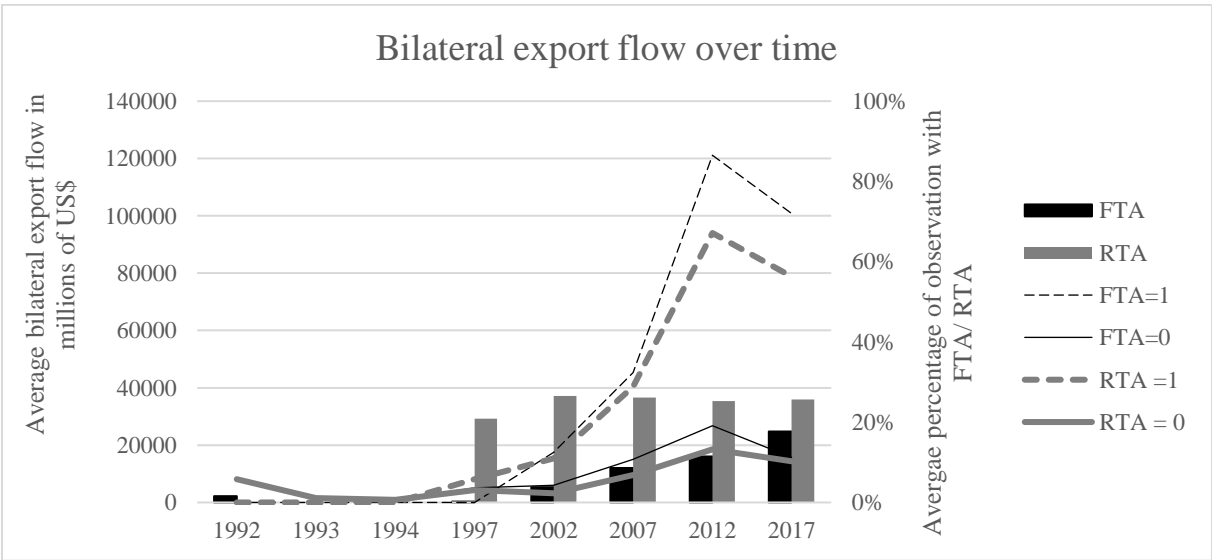


Figure 1: Average bilateral intra- African export flow over time.

VII.I Agreement specific treatment effect

Many trade agreements have been formed in order to boost intra – African trade. As discussed in section II, large differences exist between the agreements, hence differences can be expected in the effectiveness of these agreements in boosting trade. Table 3 shows the results of the log-linear- and Poisson regressions whilst allowing the treatment effect to differ between agreements. Results are reported if both countries have committed to tariff liberalisation, and if both countries are formally part of an agreement^{2,3}. Since the Poisson regressions are estimated with controls instead of country pair fixed effects the large change in estimates may not only be caused by the inclusion of the large amount of zeroes and the use of the Poisson methodology but also by the fact that bilateral controls are used instead of country pair fixed effects. The log – linear results whilst using bilateral controls instead of country pair fixed effects are reported in column (2) and (4). Comparing the log- linear- and Poisson results whilst using bilateral controls in column (4) and (6), a large part of the estimates shows corresponding significance. Hence, a large part of the significant treatment effects found whilst using the Poisson methodology can be attributed to the use of the set of bilateral controls instead of country pair fixed effects. Therefore, the more conservative estimates using the log- linear regression including country pair fixed effects, reported in column (1) and (3), are the preferred estimates and will be interpreted.

Considering the results in column (1) only CEMAC shows a weakly significant, positive effect of the removal of tariff barriers. The removal of tariff barriers has increased trade tremendously by 379.7% ($e^{1.568} - 1$) within the CEMAC region, the other agreements do not show a significant effect of tariff barrier removal on trade. However, the absolute height of the CEMAC - coefficient must be taken with caution since the coefficient exhibits only weak significance. The insignificant results of ECOWAS and WAEMU might partly be explained by the overall trend shown in figure 1, which shows a downward trend after 2012 among all groups of country pairs. Since ECOWAS and WAEMU countries only removed their tariff barriers in the last period, this might explain the insignificance of the results regarding the effect of tariff liberalisation.

² Appendix table A.9 shows the results if a country pair is marked as part of an agreement if both countries are formally part of the agreement and the importer has removed tariff barriers.

³ The results may have been influenced by the relatively high threshold of 85% tariff liberalisation before marking a country pair as part of an FTA, the results using a 50 % threshold do not show significant differences with the result reported here and can be found in appendix table A.10

Considering the formal formation or formal entry into an agreement in column (3), only SADC shows a significant, positive effect indicating that the formal formation of the agreement has led to a 159.6% increase in trade among members. Furthermore, CEMAC does as in column (1) show a weakly significant positive effect. The results regarding SADC are in line with the findings by Afesorgbor (2017) and Riedel and Slany (2019) who find consistent positive estimates of membership to SADC. In contrast to Riedel and Slany (2019), EAC and COMESA do not show to have led to an increase in trade either after the removal of tariff barriers or after the formal formation of the agreement.

SACU does not show a significant effect of the formal formation of the agreement. Since all SACU – members are a member of SADC in addition to being a member of SACU, being a member of an agreement has increased trade by 159.6% among SACU members. Furthermore, the insignificant coefficient of SACU indicates no additional benefits of being a member of SACU in addition to being a member of SADC. These results are in line with Afesorgbor and Van Bergeijk (2014) who do not find a positive effect of multi membership within the SADC region. Whilst Afesorgbor and Van Bergeijk (2014) do find a positive effect of multimembership in the ECOWAS region, the results do not point towards added benefits of multimembership with the ECOWAS region. This might be explained by the fact that they include regional economic integration initiatives that are not noted by WTO in their analysis. However, the results regarding ECOWAS and WAEMU are in line with the findings by Osabuohien et al. (2019) who did not find conclusive evidence regarding the trade creating effects of deeper economic integration within the ECOWAS region.

In conclusion, either the formal formation of an agreement or the actual removal of tariffs has not led to an undisputed increase in any of the agreements besides the SADC which shows a positive effect after the formal formation of the agreement. The expected differences based on the level of economic integration do not emerge from the results. The agreements which have reached a higher level of economic integration do not show remarkable differences. Considering the recent developments regarding continental wide integration, the remaining part of the paper will concentrate on the average treatment effect of membership to any regional trade agreement on intra- African trade.

Table 3: Agreement specific results; log linear and Poisson.

	Log linear		Poisson			
	(1)	(2)	(3)	(4)	(5)	(6)
ECOWAS	-0.504 (-0.67)	0.579 (0.81)			0.546 (1.23)	
WAEMU	0.163 (0.18)	0.256 (0.29)			-0.14 (-0.26)	
CEMAC	1.568* (1.78)	1.256** (2.25)			2.514*** (3.98)	
COMESA	0.568 (1.27)	1.451*** (4.35)			0.873*** (3.44)	
SADC	-0.037 (-0.10)	1.151*** (3.10)			-0.068 (0.27)	
SACU	-	-1.006 (-1.26)			-1.318*** (-2.98)	
EAC	0.217 (0.33)	1.484* (1.87)			0.809** (2.17)	
ECOWAS formal			0.158 (0.12)	0.461 (1.29)		1.189*** (3.06)
WAEMU formal			0.003 (0.01)	1.113*** (2.65)		-0.227 (-0.55)
CEMAC formal			1.512* (1.71)	1.137** (2.10)		1.703*** (3.47)
COMESA formal			0.699 (1.55)	1.813*** (5.93)		1.341*** (5.08)
SADC formal			0.954** (1.98)	1.895*** (4.98)		1.426*** (5.57)
SACU formal			2.14 (1.49)	0.097 (0.13)		-1.248*** (-2.89)
EAC formal			0.279 (0.38)	2.109*** (2.85)		1.867*** (4.32)
Ln(income difference)	-0.257 (-1.31)	0.001 (0.01)	-0.235 (-1.19)	0.049 (0.56)	-0.161 (-1.54)	-0.068 (-0.60)

Table 3: Continued.

	Log linear				Poisson	
	(1)	(2)	(3)	(4)	(5)	(6)
Country – year effects	Yes	Yes	Yes	Yes	Yes	Yes
Country pair effects	Yes	No	Yes	No	No	No
Gravity controls	No	Yes	No	Yes	Yes	Yes
N	6,054	5,931	6,054	5,931	10,087	10,087
R ²	0.047	0.476	0.058	0.483	0.804	0.827

Note: The log linear regression uses the natural logarithm of exports in millions of US\$ as dependent variable. The Poisson regressions uses exports in millions of US\$ as dependent variable. The set of gravity controls consists of the natural logarithm of the distance between the capital cities and dummies indicating the presence of a contiguous border, a common language, and a common colonial history. Constant included. Whilst the correlation between ECOWAS and WAEMU is high (0.72) excluding either one does not change the results. Standard errors are clustered by country pair. T- statistics are shown between parentheses in the case of a log linear regression, z – statistics are shown in the case of a Poisson regression. *, **, *** denote significance at the 10% 5%, and 1% level.

VII.II Total bilateral trade

Table 4 shows the results estimating the average treatment effect of membership to a trade agreement on intra- African trade⁴. Results are reported if both countries have committed to the removal of tariff barriers whilst both being part of an agreement, if the importer has committed to the removal of tariff barriers whilst both being part of an agreement, and if both countries are formally part of an agreement⁵.

The results show that the removal of tariffs barriers has not led to an increase in trade. However, the formal entry into an agreement shows to have significantly increased trade by 202.2%. Whereas the regional trade agreements aim to reduce trade barriers beyond the removal of tariff barriers, the significant effect of formal RTA membership and the insignificant effect of being part of an FTA points out the inferior role of tariff barrier removal in boosting intra- African trade. Furthermore, reciprocal tariff removal does not increase trade more between a country

⁴ The Poisson regression results are reported in appendix table A.11.

⁵ The results may have been influenced by the relatively high threshold of 85% tariff liberalisation before marking a country pair as part of an FTA, the results using a 50% threshold do not show significant differences with the result reported here and can be found in appendix table A.12. Since results using a 50% percent threshold do not show remarkably differences with the results using an 85% threshold, the 85% threshold will be used in the remainder of the paper.

pair, the (insignificant) increase in bilateral trade being higher if the importer has removed tariff barriers irrespective of the amount of tariff liberalisation of the exporter. The results regarding tariff liberalisation are in line with the results of Riedel and Slany (2019) who test the effect of the effectively applied import tariff on imports. The difficulty in using the actual imports tariffs shows as they had to work around 67.8% of missing data. They find that the height of the applied tariffs does not significantly affect the amount of trade.

Table 4: RTA membership and intra- African trade; log linear results.

	Log linear		
	(1)	(2)	(3)
FTA	0.121 (0.47)		
FTA importer		0.307 (1.13)	
RTA formal			1.106*** (3.46)
Ln(income difference)	-0.258 (-1.31)	-0.265 (-1.34)	-0.245 (1.25)
Country – year effects	Yes	Yes	Yes
Country pair effects	Yes	Yes	Yes
Gravity controls	No	No	No
N	6,054	6,054	6,054
R ²	0.047	0.048	0.065

Note: The natural logarithm of exports in millions of US\$ is used as dependent variable. Constant included. Standard errors are clustered by country pair. T- statistics are shown between parentheses. *, **, *** denote significance at the 10% 5%, and 1% level.

Whilst the significant effect of formally entering a trade agreement may reflect the effectiveness of such an agreement to resolve other trade barriers besides tariff barriers, it may also simply reflect a largely overestimated treatment effect because of reverse causality. Table 5 shows the results whilst either adding the future RTA level in order to check for reverse causality or whilst allowing for phased in effects⁶. The future RTA level displays a weakly significant correlation to the current trade flow in the case of the FTA variable and in the case of the RTA variable.

⁶ The Poisson regression results are reported in appendix table A.13.

Since the correlation between the current trade flow and the future RTA level cannot be ruled out the estimated treatment effect should be interpreted with caution.

Whilst allowing for phased in effects, the effect of removing tariff barriers loads primarily on the first lag of the FTA variable. Whilst having an FTA in the year of the trade flow does not have an immediate significant effect on the trade flow, the first lag exhibits a large positive effect, hence after being in an FTA for more than 5 years trade increases by 99.57%. (column (3)). This may reflect the time it takes to adjust to a change in trade cost; however, this is at least partly solved by the structure of the panel. The fact that countries will shift their focus towards reducing other trade impeding barriers after removing tariff barriers is another plausible explanation for this result.

The effect of entry into a formal RTA consistently loads on the current year variable, staying significantly positive across all specifications. However, this result must be interpreted with caution, considering the weakly significant correlation of the future RTA level with the current trade flow in specification (9). Furthermore, the insignificance of the lagged variables may present indirect evidence of the inferior role played by tariff barrier removal in boosting intra – African trade. Considering the fact that most trade agreements are phased- in over time, if tariff barrier removal would have played a dominant role in increasing trade, the effect of membership to an agreement would be expected to at least partly load on the lagged variables.

Table 5: Additional results log linear.

	Log linear								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	I	II	III	I	II	III	I	II	III
FTA	0.16 (0.61)	-0.004 (-0.02)	0.006 (0.02)						
FTA importer				0.346 (1.27)	0.146 (0.51)	0.158 (0.55)			
RTA formal							1.121*** (3.50)	0.891** (2.45)	0.841** (2.31)
RTA _{t+1} ¹	0.32 (1.29)		0.468* (1.78)	0.284 (1.17)		0.401 (1.55)	0.175 (0.73)		0.432* (1.68)
RTA _{t-1} ¹		0.541* (1.73)	0.691** (2.15)		0.735** (2.23)	0.831** (2.50)		0.258 (0.88)	0.323 (1.11)

Table 5: Continued.

	Log linear								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	I	II	III	I	II	III	I	II	III
RTA _{t-2} ¹		-0.251 (-0.69)	-0.093 (-0.25)		-0.43 (-1.27)	-0.277 (-0.78)		0.249 (0.95)	0.41 (1.48)
Ln(income difference)	-0.26 (-1.32)	-0.253 (-1.29)	-0.259 (-1.31)	-0.267 (-1.35)	-0.257 (-1.30)	-0.26 (-1.32)	-0.241 (-1.22)	-0.255 (-1.29)	-0.247 (-1.25)
N	6,054	6,054	6,054	6,054	6,054	6,054	6,054	6,054	6,054
R ²	0.051	0.046	0.052	0.052	0.049	0.053	0.068	0.065	0.074

Note: The natural logarithm of exports in millions of US\$ is used as dependent variable. Country- year effects and country pair fixed effects are included. Constant included. Standard errors are clustered by country pair. T-statistics are shown between parentheses. *, **, *** denote significance at the 10% 5%, and 1% level. 1: The lead and lagged RTA indicate the lead and lag of the RTA- variable used in the specific column, hence in column 1- 3 it indicates the lead and lag of the FTA –variable, in column 4-6 it indicates the lead and lag of the FTA importer –variable and in column 8-9 it indicates the lead and lag of the RTA formal – variable.

VII.III Sectoral bilateral trade

Whilst the general effect of formally belonging to a trade agreement has been positive, the effect might differ significantly across sectors. Table 6 and 7 show the results of the effect of RTA membership in each sector⁷.

Whilst the results showed a strongly significant treatment effect of formally entering an agreement, the disaggregated results show only in a few sectors a (weakly) significant effect. Textile and machinery show a weak significant effect of formally entering a trade agreement, the treatment effect within the machinery sector being negative. The food sector is the only sector showing a strong significant positive effect, formally entering an agreement leading to a 333.6% increase in intra- African trade. Whilst the presence of a formal RTA does increase trade in the food sector, the results do not show a significant effect of tariff barrier removal on trade in the food sector. Even though the average tariff in the food sector is higher than in any other sector, shown in figure 2, other factors seem to play a more important role in boosting intra- African trade.

⁷ The Poisson regression results are reported in appendix table A.14 and appendix table A.15.

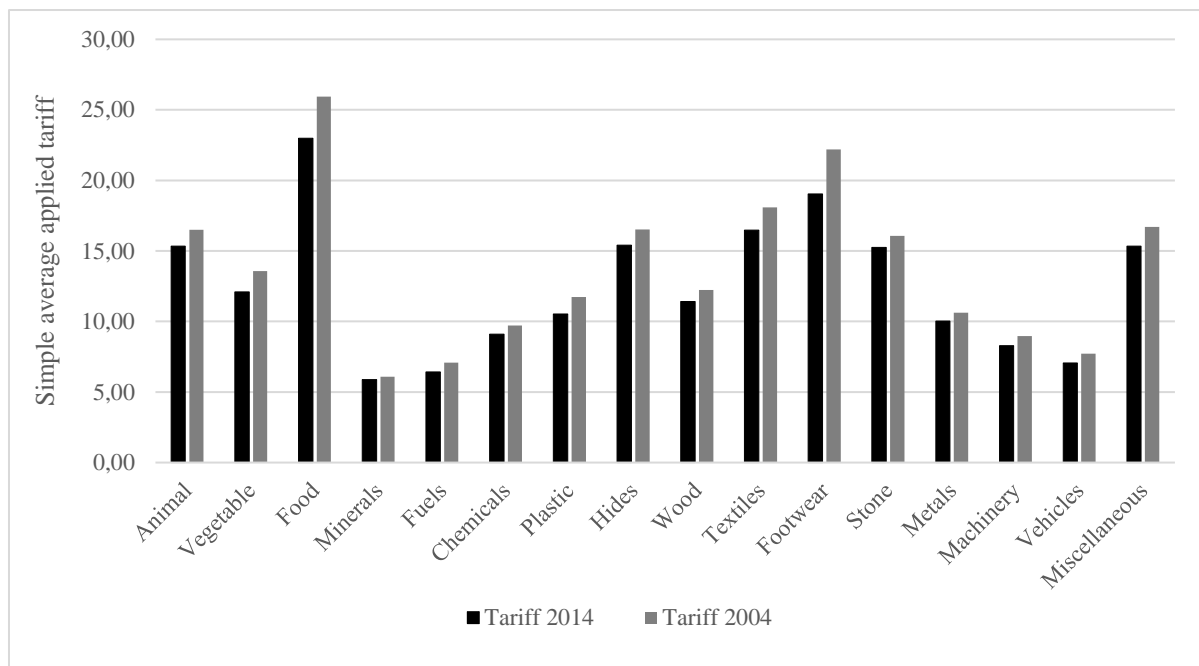


Figure 2: Simple average African import tariffs.

Note: Simple average of applied import tariffs to the world. 34,03% of missing data in 2014, 45,34% missing data in 2004.

Plastic, footwear, and metal show, in contrast to the aggregate results regarding tariff barrier removal, a significant positive effect of tariff removal. Furthermore, the effect on trade if the importer has removed tariff barriers is higher than if both countries have removed tariff barriers. Hence, in line with the (insignificant) aggregate findings, reciprocal tariff barrier removal does not increase trade more between a country pair than the unilateral lowering of tariff barriers. Comparing the tariffs levied on imports from countries outside of an agreement, only footwear has remarkably higher tariffs than the other sectors.

Hence, no clear-cut image emerges showing the fact that sectors suffering from higher tariffs benefit more from tariff removal than sector already benefitting from relatively low tariffs. Furthermore, whilst on average regional trade agreements show to be effective in boosting intra-African trade, the sectoral analysis unveils the fact that only in a handful of sectors trade has significantly increased after either the lowering of tariff barriers or the formal formation of a trade agreement.

Table 6: Log linear results sector 1 – 8 .

	Animal	Vegetable	Food	Minerals	Fuels	Chemicals	Plastics	Hides
FTA	-0.326	0.66	0.314	-0.03	-0.501	0.103	1.38***	-1.302
	(-0.56)	(1.48)	(0.74)	(-0.04)	(-0.71)	(0.26)	(2.64)	(-1.36)
N	1,964	2,805	2,985	1,742	1,799	2,920	2,657	1,406
R ²	0.036	0.046	0.042	0.013	0.058	0.012	0.015	0.045
FTA	-0.398	0.50	0.447	0.151	0.174	0.256	1.54***	-0.665
importer	(-0.65)	(1.13)	(1.06)	(0.18)	(0.27)	(0.58)	(3.05)	(-0.69)
N	1,964	2,805	2,985	1,742	1,799	2,920	2,657	1,406
R ²	0.035	0.045	0.043	0.014	0.059	0.013	0.015	0.048
RTA	-0.267	0.668	1.467**	-0.846	0.264	-0.247	0.736	-0.963
formal	(-0.34)	(1.09)	(2.30)	(-0.79)	(0.29)	(-0.43)	(0.99)	(-0.84)
N	1,964	2,805	2,985	1,742	1,799	2,920	2,657	1,406
R ²	0.036	0.051	0.051	0.01	0.06	0.011	0.015	0.044

Note: The natural logarithm of exports in millions of US\$ is used as dependent variable. Country- year effects and country pair effects are included. The absolute value of the difference between the logarithm of income and a constant are included in all regression but not reported for the sake of brevity. Standard errors are clustered by country pair. T- statistics are shown between parentheses. *, **, *** denote significance at the 10% 5%, and 1% level.

Table 7: Log linear results sector 9 – 16.

	Wood	Textile	Footwear	Stone	Metals	Machinery	Vehicles	Miscellaneous
FTA	0.588	0.119	1.881**	0.082	1.361***	-0.54	-0.293	-0.421
	(1.24)	(0.27)	(2.40)	(0.14)	(2.77)	(-1.26)	(-0.55)	(-1.01)
N	3,004	3,322	1,752	2,173	2,856	3,350	2,497	3,366
R ²	0.024	0.018	0.03	0.014	0.021	0.031	0.056	0.039
FTA	0.484	0.501	2.621***	0.326	1.758***	-0.361	-0.077	0.387
importer	(1.00)	(1.08)	(3.25)	(0.55)	(3.64)	(-0.85)	(-0.15)	(0.98)
N	3,004	3,322	1,752	2,173	2,856	3,350	2,497	3,366
R ²	0.023	0.021	0.032	0.015	0.022	0.03	0.056	0.043

Table 7: Continued.

	Wood	Textile	Footwear	Stone	Metals	Machinery	Vehicles	Miscellaneous
RTA	-0.228	1.112*	0.404	0.27	0.204	-1.017*	-0.508	0.807
formal	(-0.30)	(1.87)	(0.32)	(0.37)	(0.32)	(-1.66)	(-0.72)	(1.10)
N	3,004	3,322	1,752	2,173	2,856	3,350	2,497	3,366
R ²	0.019	0.028	0.025	0.015	0.017	0.027	0.053	0.048

Note: The natural logarithm of exports in millions of US\$ is used as dependent variable. Country- year effects and country pair effects are included. The absolute value of the difference between the logarithm of income and a constant are included in all regression but not reported for the sake of brevity. Standard errors are clustered by country pair. T- statistics are shown between parentheses. *, **, *** denote significance at the 10% 5%, and 1% level.

VIII. Conclusion

Given the recent establishment of the African Continental Free Trade Area, this research has studied the effect of African regional trade agreements on intra- African trade in the past three decades. Considering all regional trade agreements known by the WTO none of these trade agreements shows strong evidence regarding the positive effect of tariff barrier removal. Furthermore, only the Southern African Development Community exhibits a significant positive treatment effect of the formal formation of the agreement. Even though the agreements specific estimates display the expected heterogeneity, the expected differences based on the level of economic integration do not emerge.

Considering the aggregate treatment effect, the formal entry into a trade agreement does show to have strongly increased intra- African trade. Furthermore, the removal of tariff barriers does not show to have attributed to an increase in trade. Hence, tariff barrier removal shows to be subordinate to resolving other trade impeding barriers. Adding a lead and one and two period lagged variables to the regression confirms these findings. The treatment effect of being a member to an FTA primarily loads on the first lagged variables. Hence, after tariff barrier removal countries shift their attention successfully to the removal of other trade impeding barriers. Furthermore, the phased- in effects after the formal formation of an agreement do not exhibit a significant effect. Nevertheless, the results should be interpreted with caution. The lead RTA variable displays a weakly significant correlation with the current trade flow; hence the estimated treatment effect must be interpreted with caution based on reverse causality concerns.

Following the sectoral analysis, only a few sectors exhibit a significant effect of the lowering of tariff barriers or the formal entry into a trade agreement. Altogether, African regional trade agreement seems to play an inferior role at best in boosting intra- African trade. Furthermore, tariff barrier removal shows to be subordinate to the removal of other trade impeding barriers on aggregate in order to boost intra- African trade. Hence, given the recent establishment of the African Continental Free Trade Area, the elimination of non-tariff barriers seems to be at least of equal importance as the removal of tariff barriers in order to effectively boost intra- African trade.

Whilst I believe that the current research has done the best given the available data to estimate the treatment effect of either belonging to a formal trade agreement, or being member of a trade agreement after the actual removal of tariff barriers on intra- African trade, several limitations and recommendations for future research remain. Firstly, whilst the unavailability of sufficient tariff data has prohibited the use of the actual import tariffs, future research may exploit the possible increase in data quality over the years and estimate the effect of the decrease in tariff barriers following the African Continental Free Trade Area. Secondly, whilst the current research has estimated the effect on intra- African trade, the effect of these economic integration initiatives on other economically important areas has been outside the scope of the article. Hence the effect of such agreements on the wide diversity of other economic areas such as economic growth, employment, income, and the distribution of income seem like relevant topics for future researchers.

Appendix 1: Additional tables

Table A.1: Number of policy areas covered by each RTA.

COMESA	CEMAC	EAC	SADC	ECOWAS	WAEMU	SACU
29	15	34	12	20	13	11

Note: policy areas covered in each active African agreement according to Hofmann et al. (2017).

Table A.2: Overview of African RTA membership.

COMESA	CEMAC	EAC ¹	SADC	ECOWAS	WAEMU	SACU
Angola ¹	Cameroon	Burundi ²	Angola	Benin	Benin	Botswana
Burundi	Central African Republic	Kenya	Botswana	Burkina Faso	Guinea-Bissau	Swaziland
Comoros	Chad	Rwanda ²	DR Congo	Cabo Verde	Burkina Faso	Lesotho
DR Congo	Congo	Tanzania	Swaziland	Ivory Coast	Ivory Coast	Namibia
Djibouti	Equatorial Guinea	Uganda	Lesotho	Ghana	Mali	South Africa
Egypt ¹	Gabon	South Sudan ²	Madagascar ³	Guinea	Niger	
Eritrea			Malawi	Guinea-Bissau	Senegal	
Ethiopia			Mauritius	Liberia	Togo	
Swaziland			Mozambique	Mali		
Kenya			Namibia	Niger		
Lesotho ¹			Seychelles	Nigeria		
Libya ¹			South Africa	Senegal		
Madagascar			Tanzania	Sierra Leone		
Malawi			Zambia	The Gambia		
Mauritius			Zimbabwe	Togo		
Mozambique ¹						
Namibia ¹						
Rwanda						

Table A.2: Continued.

COMESA	CEMAC	EAC	SADC	ECOWAS	WAEMU	SACU
Seychelles ¹						
Sudan						
Tanzania ¹						
Uganda						
Zambia						
Zimbabwe						

Note: list compiled from combining information from World Trade Organization (2019), World Bank Group (2019a), SADC (2019c), and (EAC, 2019).

1 These countries left or entered during the research period. Lesotho and Mozambique left in 1997. Tanzania left in 2000. Namibia left in 2004. Angola left in 2007. Egypt entered in 1999. Seychelles entered in 2001. Lybia entered in 2005.

2 Burundi and Rwanda entered in 2007. South Sudan Entered in 2016.

3 Entered in 2005.

Table A.3: Formal data of entry into force of the agreements.

RTA	Date of entry into force	Year considered to be in force
COMESA	08-Dec-1994	1995
CEMAC	24-Jun-1999	2000
EAC	07-Jul-2000	2000
SADC	01-Sep-2000	2001
ECOWAS	23-Aug-1995	1996
WAEMU	01-Jan-2000	2000
SACU	15-Jul-2004	2005

Note: information obtained from the World Trade Organization (2019).

Table A.4: Sectors of the Harmonized System.

Sector 2 digit codes	Description
01 – 05	Animal
06- 15	Vegetable
16-24	Food production
25-26	Minerals
27	Fuels
28-38	Chemicals
39-40	Plastic, rubber and articles thereof

Table A.4: Continued.

Sector 2 digit codes	Description
41-43	Raw hides and skins, leather, fur skins and articles
44-49	Wood
50-63	Textiles and textile articles
64-67	Footwear
68-71	Stone, glas
72-83	Metals
84-85	Machinery and mechanical appliances
86-89	Vehicles, aircraft, vessels and associated
90-99	Miscellaneous

Note: source: UN TRADE STATISTICS (2019).

Table A.5: Data availability exporting countries.

Country	1992	1993	1994	1997	2002	2007	2012	2017
Algeria	X			X	X	X	X	X
Angola						X	X	
Benin					X	X	X	X
Botswana					X	X	X	X
Burkina Faso				X	X	X	X	X
Burundi		X		X	X	X	X	X
Cameroon				X	X	X	X	X
Cape Verde				X	X	X	X	X
Central African Republic		X		X	X	X	X	X
Comoros				X	X	X	X	
Congo, Rep.		X				X	X	X
Cote d'Ivoire				X	X	X	X	X
Egypt			X	X	X	X	X	X
Ethiopia				X	X	X	X	
Sudan				X	X		X	X
Gabon		X		X	X	X		
Gambia, The				X		X	X	X

Table A.5: Continued.

Country	1992	1993	1994	1997	2002	2007	2012	2017
Ghana				X	X	X	X	X
Guinea				X	X	X		
Kenya	X			X	X	X		X
Lesotho					X		X	X
Libya						X		
Madagascar	X			X	X	X	X	X
Malawi			X	X	X	X	X	X
Mali				X	X	X	X	X
Mauritania					X	X	X	X
Mauritius		X		X	X	X	X	X
Morocco		X		X	X	X	X	X
Mozambique			X	X	X	X	X	X
Namibia					X	X	X	X
Niger				X	X	X	X	
Nigeria				X	X	X	X	X
Rwanda				X	X	X	X	
Sao Tome and Principe					X	X	X	X
Senegal				X	X	X	X	X
Seychelles			X	X	X	X	X	X
Sierra Leone					X			X
South Africa	X			X	X	X	X	X
Swaziland					X	X		X
Tanzania				X	X	X	X	X
Togo			X	X	X	X	X	X
Tunisia	X			X	X	X	X	X
Uganda			X	X	X	X	X	X
Zambia				X	X	X	X	X
Zimbabwe					X	X	X	X

Appendix 2: Overview of tariff liberalization

The level of tariff liberalization of each country is shown. The codes which are used in the TRAINS database to denote a certain group of COMESA members are used in order to present a somewhat concise overview. Table A.8 shows the countries which belong to a certain code group. Most favoured nation tariffs are shown if at least 50% of product groups is free of tariffs under most favoured nation tariffs.

Burundi, Kenya, Rwanda, Zambia and Zimbabwe all show to have opened up to Libya and Seychelles in an early observation. But fail to do so to either Libya or Seychelles in their last observation in 2016. Since all COMESA members who have added Libya and Seychelles as preferential tariff beneficiary have removed and added them between 2012 and 2017, and the COMESA members who have an observation in 2017 have added both to the list of preference beneficiaries the same assumption is made for COMESA members who do not have an observation in 2017.

Table A.6: Overview of tariff liberalization 1992 – 2002.

Country	1992	1997	2002
Benin			2006: 24,02% of product groups are free of tariffs for WAEMU members.
Botswana			Full tariff liberalization for SACU members, 72,51% of product groups are free of tariff for SADC members.
Burkina Faso			2006: 24,08% of product groups are free of tariffs for WAEMU members.
Burundi			0,92% of product groups are free of tariffs for COMESA members (N16).
Cameroon			
Chad			
Comoros			
Congo Republic			
Cote d'Ivoire			2006: 23,85% of product groups are free of tariffs for WEAMU members.

Table A.6: Continued.

Country	1992	1997	2002
Djibouti			2006: Full tariff liberalization for COMESA members (N28).
Egypt			2005: Full tariff liberalization for COMESA members (N27).
Equatorial Guinea Eritrea			2006: 0,31% of product groups are free of tariffs for COMESA members (N23 and N28).
Ethiopia Sudan		1996: 65,89% of product groups are free of tariffs for COMESA members (N16).	2006: Full tariff liberalization for COMESA members (N28).
Gabon Ghana Guinea Guinea Bissau			2006: 24,02% of product groups are free of tariffs for WAEMU members
Kenya		1994: 3,51% of product groups are free of tariffs for COMESA members (N16).	2005: full tariff liberalization for COMESA (N28) and EAC members.
Lesotho		2001: Full tariff liberalization for SACU members. 55,43% of product groups are free of tariffs under MFN tariffs.	2004: full tariff liberalization for SACU members. 78,91% of product groups are free of tariffs for SADC members. 55,43% under MFN – tariffs in 2001.
Madagascar			2005: full tariff liberalization for COMESA members (N27).

Table A.6: Continued.

Country	1992	1997	2002
Malawi	1996: 7,67% of product groups are free of tariffs for COMESA members (N16).	2001: 13.30% of product groups are free of tariffs for COMESA members (N16). 36,79% of product groups are free of tariffs for SADC members.	2006: 13.50% of product groups are free of tariffs for COMESA members (N16). 37,35% of product groups are free of tariffs for SADC members. 37,12% for South Africa.
Mali			2006: 23,35% of product groups are free of tariffs for WAEMU members.
Mauritius	1996: 17,88% of product groups are free of tariffs for COMESA members (N16).	2000: 55,07% of product groups are free of tariffs for COMESA members (N16).	2004: Full tariff liberalization for COMESA (N27) members. 2005: 93,85% for SADC members. 86,29% for South Africa. 55,74% under MFN- tariffs.
Namibia		2001: Full tariff liberalization for SACU members.	Full tariff liberalization for SACU members. 84,86% of product groups are free of tariffs for SADC members. 55,43% under MFN tariffs.
Niger			2006: 24,02% of product groups are free of tariffs for WAEMU members
Nigeria			
Rwanda		2001: 6,96% of product groups are free of tariffs for COMESA members (N16).	2003: 7,20% of product groups are free of tariffs for COMESA members (N16).
Senegal			2006: 23,99% of product groups are free of tariffs for WEAMU members
Seychelles			
Sierra Leone			

Table A.6: Continued.

Country	1992	1997	2002
South Africa		2000: full tariff liberalization for SACU members. 72,25% of product groups are free of tariffs for SADC members.	Full tariff liberalization for SACU members. 72,49% of product groups are free of tariffs for SADC members.
Swaziland		2001: Full tariff liberalization for SACU members.	Full tariff liberalization for SACU members. 72,49% of all product groups are free of tariffs for SADC members. 63,64% of all product groups are free of tariffs under MFN tariffs.
Tanzania		1998: 4,03% of all product groups are free of tariffs for COMESA members (N16).	2003: 32,13% of all product groups are free of tariffs for EAC members. 2005: 43,11% of product groups are free of tariffs for SADC members. 41,37% for South Africa
Togo			24,02% of product groups are free of tariffs for WAEMU members.
Uganda	1994: 6,85% of product groups are free of tariffs for COMESA members (N16).	2000: 15,55% of product groups are free of tariffs for COMESA members (N16).	15,89% of product groups are free of tariffs for COMESA members (N16).
Zambia			
Zimbabwe	1996: 28,05% of all product groups are free of tariffs for COMESA members (N16).	1998: 29,83% of all product groups are free of tariffs for COMESA members (N16). 7,39% for South Africa. 99,32% for Malawi, Namibia, and Botswana.	

Table A.7: Overview of tariff liberalization 2007 – 2017.

Country	2007	2012	2017
Benin	25,02% of product groups are free of tariffs for WAEMU members.	Differing tariff profiles towards member countries. Amount of tariff liberalization is between 15,91 and 23,99%.	Full tariff liberalization for WAEMU and ECOWAS members.
Botswana	Full tariff liberalization for SACU members 99,58% of product groups are free of tariff for SADC members. 2008: 99,94% for SADC members. No change for SACU. 55,72% of product groups are free of tariffs under MFN tariffs.	Full tariff liberalization for SACU members 99,98% of product groups are free of tariff for SADC members. 2013: 99,98% for SADC members. No change for SACU. 58,46% of product groups are free of tariffs under MFN tariffs.	Full tariff liberalization for SACU members 99,98% of product groups are free of tariff for SADC member, except Angola, Congo DR, Seychelles, addition of Madagascar as SADC beneficiary. 57,96% of all product groups free of tariffs under MFN.
Burkina Faso	25,02% of product groups are free of tariffs for WEAMU members.	Differing tariff profiles towards member countries. Amount of tariff liberalization is between 15,91 and 23,99%	Full tariff liberalization for WAEMU and ECOWAS members.
Burundi	Full tariff liberalization for COMESA members (M05). 2008: No changes.	Full tariff liberalization for COMESA members (M05) and EAC members. 2013: addition of Seychelles. No changes for EAC countries.	Full tariff liberalization for COMESA members (A07) and EAC members.
Cameroon	Full tariff liberalization for CEMAC members.	Full tariff liberalization for CEMAC members.	2014: Full tariff liberalization for CEMAC members.
Central African Republic	Full tariff liberalization for CEMAC members.	2013: Full tariff liberalization for CEMAC members.	Full tariff liberalization for CEMAC members.
Chad	Full tariff liberalization for CEMAC members.	2013: Full tariff liberalization for CEMAC members.	2016: Full tariff liberalization for CEMAC members.

Table A.7: Continued.

Country	2007	2012	2017
Comoros	2008: full tariff liberalization for COMESA members (M05). 16,63% of all product groups are free of tariffs for imports from Ethiopia and Uganda.	Full tariff liberalization for COMESA members (M05). 2,39% of all product groups are free of tariffs for imports from Ethiopia and Uganda. 2013: addition of Seychelles. 12,40% of product groups are free of tariffs for imports from Ethiopia and Uganda.	Full tariff liberalization for COMESA members (M12).
Congo Republic	Full tariff liberalization for CEMAC members.	2013: Full tariff liberalization for CEMAC members.	2015: Full tariff liberalization for CEMAC members.
Cote d'Ivoire	25,02% of product groups are free of tariffs for WEAMU members.	Differing tariff profiles towards member countries. Amount of tariff liberalization is between 15,91 and 20,43%	Full tariff liberalization for WAEMU and ECOWAS members.
Djibouti	2008: addition of Comoros of Libya	No changes.	Different tariffs for Libya, 99,79% of product groups free of tariffs.
Egypt	2009: addition of Seychelles		
Equatorial Guinea	Full tariff liberalization for CEMAC members.		
Eritrea			
Ethiopia	2008: 4,08% of product groups are free of tariffs for COMESA members (M05 and M07).	4,26% of product groups are free of tariffs for COMESA members (M07 and M12).	4,11% of product groups are free of tariffs for COMESA members (M05 and M07).
Sudan	2008: No changes. 2009: addition of Comoros, Libya and Seychelles. Tariff liberalization for imports from Ethiopia in 2011.	No changes.	No changes.

Table A.7: Continued.

Country	2007	2012	2017
Gabon	Full tariff liberalization for CEMAC members.	Full tariff liberalization for CEMAC members.	Full tariff liberalization for CEMAC members.
Ghana	27,89% of product groups are free of tariffs for ECOWAS members.	2013: 30,09% of product groups are free of tariffs for ECOWAS members.	Full tariff liberalization for ECOWAS members.
Guinea			Full tariff liberalization for ECOWAS members.
Guinea Bissau	25,02% of product groups are free of tariffs for WEAMU members.	Differing tariff profiles towards member countries. Amount of tariff liberalization is between 15,91 and 23,99%.	Full tariff liberalization for WAEMU and ECOWAS members.
Kenya	Addition of Comoros and Libya as COMESA beneficiary. No changes within EAC.	No changes. 2013: addition of Seychelles.	2016: no changes.
Lesotho	Full tariff liberalization for SACU members. 99,58% of product groups are free of tariffs for SADC members. 55,70% under MFN tariffs.	Full tariff liberalization for SACU members. 99,98% of product groups are free of tariffs for SADC members. 58,46% under MFN tariffs.	Full tariff liberalization for SACU members. 99,98% of product groups are free of tariffs for SADC members except Angola, Congo DR, and Seychelles, addition of Madagascar as SADC beneficiary. 57,96% of product groups are liberalized under MFN - tariffs
Madagascar	Addition of Comoros and Libya as COMESA beneficiary. 84,86% of product groups are free of tariffs for SADC members. 84,90% for South Africa; 100% for Swaziland	No changes within COMESA and Swaziland tariffs. 96,04% of product groups are free of tariffs for SADC members.	Addition of Seychelles. 99,68% of product groups are free of tariffs for SADC members except Angola, and Congo DR. Full tariff liberalization for Swaziland.

Table A.7: Continued.

Country	2007	2012	2017
Malawi	2008: 37,45% of product groups are free of tariffs for SADC members. 37,63% for South Africa. Full tariff liberalization for COMESA members (M05). 14,05% of product groups are free of tariffs for	45,82% of product groups are free of tariffs for SADC members. 45,80% for South Africa. 96,73% for Mozambique. Full tariff liberalization for COMESA members (M05). 33,35% of product groups are free of tariffs for COMESA members (M07).	99,90% of product groups are free of tariffs for SADC members. 71,66% for South Africa. 99,96% for Mozambique. No changes for COMESA (M05). 36,4% of product groups are free of tariffs for COMESA members (M07).
Mali	25,02% of product groups are free of tariffs for WAEMU members.	Differing tariff profiles towards member countries. Amount of tariff liberalization is between 15,91 and 23,99%	Full tariff liberalization for WAEMU and ECOWAS members.
Mauritius	99,86% of product groups are free of tariffs for COMESA members (M05). 84,03% for COMESA (M07) members. 94,08% of product groups are free of tariffs for SADC members.	98,35% of product groups are free of tariffs for COMESA members (M12). 93,89% for COMESA (M07) members. 98,16% of product groups are free of tariffs for SADC members.	Full tariff liberalization for COMESA members (M12). 94,84% of product groups are free of tariffs for COMESA members (A08). 99,98% of product groups are free of tariffs for SADC members. 94,84% under MFN - tariffs.
Namibia	99,96% of product groups are free of tariffs for SACU members. 99,54% for SADC members. 55,70% under MFN tariffs.	99,98% of product groups are free of tariffs for SACU members. 99,96% for SADC members. 58,87% under MFN – tariffs.	99,98% of product groups are free of tariffs for SACU members. 99,87% for SADC members, except Angola, Congo DR, and Seychelles, addition of Madagascar as beneficiary. 57,96% of product groups are free of tariffs under MFN – tariffs.

Table A.7: Continued.

Country	2007	2012	2017
Niger	25,02% of product groups are free of tariffs for WEAMU members	Differing tariff profiles towards member countries. Amount of tariff liberalization is between 15,91 and 23,99%.	Full tariff liberalization for WAEMU and ECOWAS members.
Nigeria		2015: full tariff liberalization for ECOWAS members	2016: full tariff liberalization for ECOWAS members.
Rwanda	2006: 99,83% of product groups are free of tariffs for COMESA members (N28).	2008: Comoros, Libya, Seychelles. Full tariff liberalization for COMESA members (N23) and EAC members.	Full tariff liberalization for COMESA members (A35) and EAC members.
Senegal	25,02% of product groups are free of tariffs for WEAMU members	Differing tariff profiles towards member countries. Amount of tariff liberalization is between 15,91 and 23,99%.	Full tariff liberalization for WAEMU and ECOWAS members.
Seychelles	MFN tariffs: 87,83% of product groups free of tariffs.	2015: 98,26% of product groups are free of tariffs for COMESA members (A35).	98,75% of product groups are free of tariffs for COMESA members (M12). 88,08% of product groups are free of tariffs under MFN tariffs.
Sierra Leone	2010: 1,37% of products are free of tariffs for ECOWAS members.	1,37% of products are free of tariffs for ECOWAS members.	
South Africa	99,96% of product groups are free of tariffs for SACU members. 99,54% for SADC members. 55,70% of product groups free of tariffs under MFN – tariffs.	99,98% of product groups are free of tariffs for SACU members. 99,96% for SADC members. 58,52% of product groups free of tariffs under MFN – tariffs.	99,98% of product groups are free of tariffs for SACU members. 99,87% for SADC members, except Angola, Congo DR, Seychelles, addition of Madagascar as beneficiary. 57,96% under MFN – tariffs.

Table A.7: Continued.

Country	2007	2012	2017
Swaziland	99,96% of product groups are free of tariffs for SACU members, 99,54 for SADC members. 55,70% under MFN tariffs.	99,98% of product groups are free of tariffs for SACU members. 99,96% for SADC members. 58,35% under MFN tariffs.	99,96% of product groups are free of tariffs for SACU members. 99,87% for SADC members, addition of Madagascar as beneficiary, removal of Angola, Congo DR, and Seychelles as beneficiary. 57,96% of product groups are free of tariffs under MFN tariffs.
Tanzania	Full tariff liberalization for Uganda. 84,86% for Kenya. 50,61% for SADC members. 41,63% for South Africa.	Full tariff liberalization for EAC members.	2016: Full tariff liberalization for EAC members. 99% for SADC members.
Togo	25,02% of product groups are free of tariffs for WAEMU members.	Differing tariff profiles towards member countries. Amount of tariff liberalization is between 15,91 and 23,99%	Full tariff liberalization for WAEMU and ECOWAS members.
Uganda	92,09% of all product groups are free of tariffs for Kenya. Full liberalization for Tanzania.	Full tariff liberalization for EAC members.	2016: Full tariff liberalization for EAC and COMESA (A07) members.
Zambia	2003: full tariff liberalization for COMESA members (N25). 2005: addition of Burundi and Rwanda. 2008: 78,27% of all product groups is free of tariffs for SADC members.	99,79% of all product groups are free of tariffs for COMESA (M12) members. 95,35% of all product groups are free of tariffs for SADC members. 96,93% for South Africa.	2013: 99,79% of all product groups are free of tariffs for COMESA (A07) members. 2016: 96,37% of all product groups are free of tariffs for SADC members. 97,43% for South Africa.

Table A.7: Continued.

Country	2007	2012	2017
Zimbabwe	99,90% of all product groups is free of tariffs for all COMESA members (M05). 31,83% for Eritrea, Ethiopia, Seychelles, Uganda.	2011: 34,01% of all product groups are free of tariffs for COMESA members (N16). 99,01% for SADC members. 88,75% for South Africa.	99,35% of all product groups are free of tariffs for COMESA members (N16). 98,16% for SADC members. 84,28% for South Africa.

Table A.8: COMESA names.

Code	Countries
N16	Burundi, Comoros, Ethiopia, Djibouti, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Zimbabwe, Swaziland, Uganda, Egypt, Tanzania, Zambia
N23	Angola, Burundi, Comoros, Congo DR, Ethiopia, Eritrea, Djibouti, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Zimbabwe, Sudan, Swaziland, Uganda, Egypt, Zambia
N25	Djibouti, Kenya, Madagascar, Malawi, Mauritius, Zimbabwe, Sudan, Egypt, Zambia
N27/ N28	Burundi, Djibouti, Kenya, Madagascar, Malawi, Mauritius, Rwanda, Zimbabwe, Sudan, Egypt, Zambia
M05/ A35	Burundi, Comoros, Djibouti, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Zimbabwe, Sudan, Egypt, Zambia
M07	Angola, Congo DR, Ethiopia, Eritrea, Seychelles, Swaziland, Uganda
M12	Burundi, Comoros, Djibouti, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Zimbabwe, Sudan, Egypt, Zambia
A07	Burundi, Comoros, Djibouti, Kenya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Zimbabwe, Sudan, Egypt, Zambia

Note: agreement codes used in the TRAINS database and countries belonging to these agreement codes are displayed.

Appendix 3: NSF – Kellog Institute database usage

The following adjustments are made based on the NSF – Kellog database in case of missing tariff data:

1. ECOWAS appears only in the most recent years as full FTA. The NSF- Kellog database does not mark the member countries as being part of a free trade agreement, hence until the first observation which shows tariff liberalization ECOWAS members are assumed to fail to reduce their tariffs.
2. The first observation of SACU members shows full tariff liberalization in the first observation in either 2000, 2001 or 2002. The NSF- Kellog database marks the countries belonging to SACU as benefitting from free trade from the start of the research period in 1992.
3. All CEMAC members show full tariff liberalization in the first observation in 2007. The NSF- Kellog database shows that the member countries benefit from free trade from the start of the agreement in 2000.
4. Comoros shows no import tariffs in 2008 on COMESA (M05) countries with no record before this date. The NSF- Kellog database marks 2006 as the first year in which these countries benefit from free trade.
5. Djibouti has only one year in which tariff data is available. The group of countries that benefit from free trade in 2006 all benefit from 2001 onwards besides Rwanda and Burundi. No additional countries benefit from free trade in later years.
6. Egypt, Sudan, Madagascar, Kenya, and Mauritius all grant free tariffs towards COMESA (N27 or N28) countries between 2004 and 2006. As Djibouti all these countries benefit from free trade from 2001 onwards besides Rwanda and Burundi.
7. Malawi shows fully liberalized tariff lines in 2008 for COMESA (M05) countries where in 2006 only 13,50% of all product groups were free of tariffs. The NSF- Kellog database shows that the group of countries that benefitted from free trade in 2008 already benefitted in 2007.
8. Mauritius showed enough tariff liberalization towards SADC countries in the first year in which the SADC countries appeared as preferential tariff beneficiary. Of these countries Botswana, Malawi, Namibia, Swaziland, Zambia, Zimbabwe, Lesotho, and South Africa benefitted from 2001 onwards according to the NSF database.

9. Kenya and Uganda show full tariff liberalization for EAC countries in the first observation in 2005. The NSF Kellogg database shows the presence of free trade already in 2001.
10. Rwanda misses 2007. Comoros and Libya added as COMESA beneficiaries in 2008, NSF Kellogg database shows already so in 2007.
11. Tanzania misses preferential tariff data for SADC members between 2007 and 2015, the NSF database show they the SADC members benefit from free trade from 2009 onwards.
12. Zambia show first full tariff profile in 2003 showing liberalized tariff for imports from COMESA (N25) members. All of these except Mauritius and Zimbabwe benefit from free trade from 2001 onwards.
13. Zimbabwe misses preferential tariff data between 1998 and 2007. In 2007 the tariff data shows free trade from COMESA (M05) countries. Of these Djibouti, Egypt, Kenya, Madagascar, Malawi, Mauritius, and Sudan already benefitted in 2002. The SADC members as preferential tariff beneficiaries show up first in 2011 as a full FTA. The NSF Kellogg database shows that Botswana, Swaziland, Lesotho, Malawi, Mauritius Namibia, and South Africa already benefit from free trade from 2001 onwards. Tanzania, Zambia, and Mozambique do so from 2009 onwards. Furthermore, 2012 is not available, the countries that benefit from free trade in 2016 according to the tariff profile also benefit in 2012 except Uganda and Ethiopia.
14. Congo, DR shows no preferential tariffs. The NSF- Kellogg database shows no tariffs on imports from Libya and Comoros from 2005 onwards.
15. Libya shows no preferential tariffs, The NSF- Kellogg database shows no tariffs on imports from Egypt and Sudan from 2005 onwards and no tariffs on imports from the other COMESA members from 2006 onwards.

Appendix 4: Additional results

Table A.9: Agreement specific results; tariff liberalization importer.

	Log linear	Poisson
	(1)	(2)
ECOWAS importer	-0.274 (-0.37)	0.541 (1.24)
WAEMU importer	-0.047 (-0.05)	-0.121 (-0.22)
CEMAC importer	1.545* (1.76)	2.405*** (3.98)
COMESA importer	0.493 (1.11)	0.828*** (3.29)
SADC importer	0.627 (1.46)	0.696** (2.40)
SACU importer		-1.617*** (-3.59)
EAC importer	0.203 (0.29)	0.995*** (2.76)
Ln(income difference)	-0.259 (-1.32)	-0.167 (-1.61)
Country – year effects	Yes	Yes
Country pair effects	Yes	No
Gravity controls	No	Yes
N	6,054	10,087
R ²	0.05	0.812

Note: The log linear regression uses the natural logarithm of exports in millions of US\$ as dependent variable. The Poisson regressions uses exports in millions of US\$ as dependent variable. The set of gravity controls consists of the natural logarithm of the distance between the capital cities and dummies indicating the presence of a contiguous border, a common language, and a common colonial history. Constant included. Whilst the correlation between ECOWAS and WAEMU is high excluding either one does not change the results. Standard errors are clustered by country pair. T- statistics are shown between parentheses in the case of a log linear regression, z – statistics are shown in the case of a Poisson regression. *, **, *** denote significance at the 10% 5%, and 1% level.

Table A.10: Agreement specific results using a 50% threshold.

	Log linear		Poisson	
	(1)	(2)	(3)	(4)
ECOWAS 50	-0.51 (-0.68)		0.545 (1.22)	
WAEMU 50	0.164 (0.18)		-0.14 (-0.26)	
CEMAC 50	1.565* (1.78)		2.516*** (3.98)	
COMESA 50	0.615 (1.38)		0.867*** (3.44)	
SADC 50	0.019 (0.05)		-0.083 (-0.33)	
SACU 50			-1.307*** (-2.97)	
EAC 50	0.199 (0.30)		0.807** (2.17)	
ECOWAS importer 50		-0.264 (-0.36)		0.527 (1.21)
WAEMU importer 50		-0.046 (-0.05)		-0.108 (-0.20)
CEMAC importer 50		1.542* (1.75)		2.391*** (4.01)
COMESA importer 50		0.441 (0.96)		0.858*** (3.38)
SADC importer 50		0.651 (1.43)		0.826*** (2.71)
SACU importer 50				-1.582*** (-3.57)
EAC importer 50		0.311 (0.46)		1.081*** (2.95)
Ln(income difference)	-0.258 (-1.31)	-0.263 (-1.34)	-0.161 (-1.55)	-0.171 (-1.64)

Table A.10: Continued.

	Log linear		Poisson	
	(1)	(2)	(3)	(4)
Country – year effects	Yes	Yes	Yes	Yes
Country pair effects	Yes	Yes	No	No
Gravity controls	No	No	Yes	Yes
N	6,054	6,054	10,087	10,087
R ²	0.047	0.051	0.804	0.814

Note: The log linear regression uses the natural logarithm of exports in millions of US\$ as dependent variable. The Poisson regressions uses exports in millions of US\$ as dependent variable. The set of gravity controls consists of the natural logarithm of the distance between the capital cities and dummies indicating the presence of a contiguous border, a common language, and a common colonial history. Constant included. Whilst the correlation between ECOWAS and WAEMU is high excluding either one does not change the results. Standard errors are clustered by country pair. T- statistics are shown between parentheses in the case of a log linear regression, z – statistics are shown in the case of a Poisson regression. *, **, *** denote significance at the 10% 5%, and 1% level.

Table A.11: RTA membership and intra- African trade; Poisson results.

	Poisson		
	(1)	(2)	(3)
FTA	0.552*** (2.95)		
FTA importer		0.888*** (4.66)	
RTA formal			1.339*** (7.88)
Ln(income difference)	-0.13 (-1.14)	-0.112 (-1.36)	-0.019 (-0.18)
Country – year effects	Yes	Yes	Yes
Country pair effects	No	No	No
Gravity controls	Yes	Yes	Yes
N	10,087	10,087	10,087

Table A.11: Continued.

	Poisson		
	(1)	(2)	(3)
R ²	0.793	0.804	0.819

Note: Exports in millions of US\$ is used as dependent variable. The set of gravity controls consists of the natural logarithm of the distance between the capital cities and dummies indicating the presence of a contiguous border, a common language, and a common colonial history. Constant included. Standard errors are clustered by country pair. Z – statistics are shown between parentheses. *, **, *** denote significance at the 10% 5%, and 1% level.

Table A.12: General results using a 50% threshold.

	Log linear		Poisson	
	(1)	(2)	(3)	(4)
RTA 50	0.148 (0.57)		0.547*** (2.93)	
RTA 50 importer		0.33 (1.16)		0.984*** (4.99)
Ln(income difference)	-0.259 (-1.32)	-0.266 (-1.35)	-0.13 (-1.14)	-0.12 (-1.13)
Country – year effects	Yes	Yes	Yes	Yes
Country pair effects	Yes	Yes	No	No
Gravity controls	No	No	Yes	Yes
N	6,054	6,054	10,087	10,087
R ²	0.047	0.049	0.793	0.806

Note: The log linear regression uses the natural logarithm of exports in millions of US\$ as dependent variable. The Poisson regressions uses exports in millions of US\$ as dependent variable. The set of gravity controls consists of the natural logarithm of the distance between the capital cities and dummies indicating the presence of a contiguous border, a common language, and a common colonial history. Constant included. Standard errors are clustered by country pair. T- statistics are shown between parentheses in the case of a log linear regression, z – statistics are shown in the case of a Poisson regression. *, **, *** denote significance at the 10% 5%, and 1% level.

Table A.13: Additional results Poisson.

	Poisson								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	I	II	III	I	II	III	I	II	III
FTA	0.454*** (2.65)	0.362* (1.93)	0.251 (1.35)						
FTA importer				0.768*** (4.45)	0.836*** (3.97)	0.731*** (3.50)			
RTA formal							1.261*** (7.78)	1.134*** (3.72)	0.882** (2.29)
RTA _{t+1} ¹	0.393* (1.90)		0.403* (1.94)	0.384* (1.83)		0.367* (1.73)	0.123 (0.73)		0.288 (1.43)
RTA _{t-1} ¹		0.471** (2.05)	0.488** (2.15)		0.198 (0.87)	0.151 (0.68)		-0.08 (-0.40)	-0.062 (-0.30)
RTA _{t-2} ¹		-0.081 (-0.29)	-0.087 (-0.32)		-0.224 (-1.00)	-0.162 (-0.162)		0.436* (1.77)	0.524* (1.92)
Ln(income difference)	-0.126 (-1.10)	-0.128 (-1.13)	-0.125 (-1.10)	-0.111 (-1.03)	-0.113 (-1.08)	-0.112 (-1.05)	-0.021 (-0.19)	-0.014 (-0.12)	-0.017 (-0.15)
N	10,087	10,087	10,087	10,087	10,087	10,087	10,087	10,087	10,087
R ²	0.794	0.795	0.80	0.805	0.805	0.805	0.819	0.828	0.83

Note: Exports in millions of US\$ as dependent variable. The set of gravity controls is included consisting of the natural logarithm of the distance between the capital cities and dummies indicating the presence of a contiguous border, a common language, and a common colonial history. Constant included. Standard errors are clustered by country pair. Z – statistics are shown between parentheses. *, **, *** denote significance at the 10% 5%, and 1% level. 1: The lead and lagged RTA indicate the lead and lag of the RTA- variable used in the specific column, hence in column 1- 3 it indicates the lead and lag of the FTA –variable, in column 4-6 it indicates the lead and lag of the FTA importer –variable and in column 7-9 it indicates the lead and lag of the RTA formal – variable.

Table A.14: Poisson results sector 1 – 8.

	Animal	Vegetable	Food	Minerals	Fuels	Chemicals	Plastics	Hides
FTA	0.062*	0.149	0.46**	1.11***	0.259	0.442	0.727***	-1.338*
	(1.92)	(0.87)	(2.15)	(3.13)	(0.54)	(1.60)	(3.26)	(-1.88)
N	9,038	9,545	9,566	8,253	8,433	9,170	9,048	8,063
R ²	0.853	0.833	0.833	0.948	0.842	0.845	0.789	0.83
FTA importer	0.774**	0.302*	0.933***	1.517***	1.759***	0.404	0.726***	0.341
	(2.31)	(1.75)	(4.09)	(5.27)	(4.36)	(1.45)	(2.99)	(0.80)
N	9,038	9,545	9,566	8,253	8,433	9,170	9,048	8,063
R ²	0.853	0.833	0.897	0.95	0.871	0.845	0.788	0.809
RTA formal	1.855***	0.785***	1.247***	0.963***	1.725***	0.652***	0.571**	0.434
	(5.82)	(4.36)	(5.96)	(3.26)	(6.48)	(2.89)	(2.53)	(1.03)
N	9,038	9,545	9,566	8,253	8,433	9,170	9,048	8,063
R ²	0.87	0.833	0.895	0.942	0.882	0.836	0.779	0.808

Note: Exports in millions of US\$ is used as dependent variable. Country year effects and the set of gravity controls are included in the Poisson regressions. The set of gravity controls consists of the natural logarithm of the distance between the capital cities and dummies indicating the presence of a contiguous border, a common language, and a common colonial history. The absolute value of the difference between the logarithm of income and a constant are included in all regression but not reported for the sake of brevity. Standard errors are clustered by country pair. Z- statistics are shown between parentheses. *, **, *** denote significance at the 10% 5%, and 1% level.

Table A.15: Poisson results sector 9 – 16.

	Wood	Textile	Footwear	Stone	Metals	Machinery	Vehicles	Miscellaneous
FTA	0.703**	-0.178	0.373	1.953***	0.076	0.929***	1.112**	-0.011
	(2.48)	(-0.68)	(1.10)	(3.09)	(0.18)	(4.06)	(2.56)	(-0.05)
N	9,079	9,120	8,144	8,705	9,232	9,004	8,712	9,162
R ²	0.929	0.936	0.932	0.993	0.746	0.983	0.803	0.944
FTA importer	0.737***	-0.09	0.239	2.147***	0.586	1.014***	1.189***	0.221
	(2.62)	(-0.30)	(0.72)	(3.21)	(1.55)	(4.21)	(2.67)	(0.89)
N	9,079	9,120	8,144	8,705	9,232	9,004	8,712	9,162
R ²	0.928	0.936	0.932	0.993	0.745	0.983	0.804	0.944

Table A.15: Continued.

	Wood	Textile	Footwear	Stone	Metals	Machinery	Vehicles	Miscellaneous
RTA	1.059***	0.299	1.119***	1.916***	0.399	1.237***	0.791*	1.18***
formal	(4.36)	(1.04)	(3.79)	(3.88)	(1.30)	(6.39)	(1.70)	(4.67)
N	9,079	9,120	8,144	8,705	9,232	9,004	8,713	9,162
R ²	0.928	0.934	0.94	0.993	0.742	0.984	0.773	0.944

Note: Exports in millions of US\$ is used as dependent variable. Country year effects and the set of gravity controls are included in the Poisson regressions. The set of gravity controls consists of the natural logarithm of the distance between the capital cities and dummies indicating the presence of a contiguous border, a common language, and a common colonial history. The absolute value of the difference between the logarithm of income and a constant are included in all regression but not reported for the sake of brevity. Standard errors are clustered by country pair. Z- statistics are shown between parentheses. *, **, *** denote significance at the 10% 5%, and 1% level.

References

- Afesorgbor, S. K. (2017). Revisiting the effect of regional integration on African trade: evidence from meta-analysis and gravity model. *The Journal of International Trade & Economic Development*, 133-153.
- Afesorgbor, S. K., & Van Bergeijk, P. A. (2014). Measuring Multi-Membership in Economic Integration and its Trade Impact: A Comparative Study of ECOWAS and SADC. *South African Journal of Economics*, 518-530.
- African Development Bank Group. (2018). *Africa Visa Openness Report 2018*. Plateau: African Development Bank.
- African Development Bank Group. (2019, May 2). *Africa Visa Openness*. Retrieved from Visa Openness Index: <https://www.visaopenness.org/>
- African Union. (2019, May 15). *Agreement Establishing the African Continental Free Trade Area*. Retrieved from African Union: <https://au.int/en/treaties/agreement-establishing-african-continental-free-trade-area>
- AGOA. (2019, May 2). *Regional Info: CEMAC*. Retrieved from AGOA.info: <https://agoa.info/profiles/cemac.html>
- Anderson, J. E., & Van Wincoop, E. (2003). Gravity with Gravitas: A Solution to the Border Puzzle. *American Economic Review*, 170-192.
- Anderson, J. E., & Yotov, Y. V. (2016). Terms of trade and global efficiency effects of free trade agreements, 1990-2002. *Journal of International Economics*, 279-298.
- Baier, S. L., & Bergstrand, J. H. (2004). Economic determinants of free trade agreements. *Journal of International Economics*, 29-63.
- Baier, S. L., & Bergstrand, J. H. (2007). Do free trade agreements actually increase members' trade? *Journal of International Economics*, 72-95.
- Baier, S. L., Yotov, Y. V., & Zylkin, T. (2019). On the widely differing effects of free trade agreements: Lessons from twenty years of trade integration. *Journal of International Economics*, 206 - 226.

- Bergstrand, J. H., Larch, M., & Yotov, Y. V. (2015). Economic integration agreements, border effects, and distance elasticities in the gravity equation. *European Economic Review*, 307-327.
- Chidede, T. (2019, May 2). *Southern African Customs Union (SACU) 's trade and tariff profile*. Retrieved from tralac: <https://www.tralac.org/blog/article/13807-southern-african-customs-union-sacu-s-trade-and-tariff-profile.html>
- Cissokho, L., Haughton, J., & Makpayo, K. (2012). Why is Agricultural Trade within ECOWAS So High? *Journal of African Economies*, 22-51.
- COMESA. (2019a, May 1). *About us*. Retrieved from COMESA: <https://www.comesa.int/company-overview-2/>
- COMESA. (2019b, May 2). *COMESA BiAnnual Report 2017-2016*. Retrieved from COMESA: https://www.comesa.int/2019/02/21/comesa-biannual-report-2016_17_en/
- EAC. (2019, July 16). *History of the EAC*. Retrieved from East African Community: <https://www.eac.int/eac-history>
- ECOWAS. (2019, May 2). *ECOWAS Commission Annual Report*. Retrieved from Economic Community for West African States: <http://www.ecowas.int/documentation/ecowas-commission-annuel-report/>
- Head, K., & Mayer, T. (2014). Chapter 3 - Gravity Equations: Workhorse, Toolkit, and Cookbook. In *Handbook of International Economics* (pp. 131-195). Elsevier.
- Hoekman, B., Senber, L. W., & Simbanegavi, W. (2017). Integrating African Markets: The Way Forward. *Journal of African Economies*, ii3-ii11.
- Hofmann, C., Osnago, A., & Ruta, M. (2017). *Horizontal depth : a new database on the content of preferential trade agreements (English)*. Washington, D.C.: World Bank Group.
- Musila, J. W. (2005). The Intensity of Trade Creation and Trade Diversion in COMESA, ECCAS and ECOWAS: A Comparative Analysis. *Journal of African Economies*, 117-141.

- Nono, G. M. (2016, May 2). Integration Efforts in Central Africa: The Case of CEMAC. *UNU-CRIS Working Papers*. Retrieved from <http://cris.unu.edu/sites/cris.unu.edu/files/W-2014-16.pdf>
- Osabuohien, E. S., Efobi, U. R., Odebiy, J. T., Fayomi, O. O., & Salami, A. O. (2019). Bilateral Trade Performance in West Africa: A Gravity Model Estimation. *African Development Review*, 1-14.
- Riedel, J., & Slany, A. (2019). The potential of African trade integration – Panel data evidence for the COMESA-EAC-SADC Tripartite. *The Journal of International Trade & Economic Development*. doi:10.1080/09638199.2019.1575457
- SACU. (2019, May 2). *About SACU*. Retrieved from SACU Southern African Custom Union: <http://www.sacu.int/show.php?id=394>
- SADC. (2019a, May 2). *History and treaty*. Retrieved from Southern African Development Community: <https://www.sadc.int/about-sadc/overview/history-and-treaty/#Transformation>
- SADC. (2019b, May 2). *Free Trade Area*. Retrieved from Southern African Development Community: <https://www.sadc.int/about-sadc/integration-milestones/free-trade-area/>
- SADC. (2019c, May 2). *Custom Union*. Retrieved from Southern African Development Community: <https://www.sadc.int/about-sadc/integration-milestones/customs-union/>
- Santos Silva, J. M., & Tenreyro, S. (2006). The log of gravity. *Review of Economics and Statistics*, 614-658.
- Santos Silva, J., & Tenreyro, S. (2011). Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator. *Economic Letters*, 220-222.
- Tinbergen, J. (1962). Shaping The World Economy: Suggestions for an International Economic Policy. *Twentieth Century Fund: New York*.
- UN Comtrade. (2019, May 23). *Harmonized Commodity Description and Coding Systems (HS)*. Retrieved from UN TRADE STATISTICS: <https://unstats.un.org/unsd/trade/kb/Knowledgebase/50018/Harmonized-Commodity-Description-and-Coding-Systems-HS>

- UN TRADE STATISTICS. (2019, June 14). *HS 2002 Classification by Section*. Retrieved from UN TRADE STATISTICS:
<https://unstats.un.org/unsd/trade/b/Knowledgebase/50043/HS-2002-Classification-by-Section>
- UNCTAD. (2019, May 2). *Regional Integration and Non-Tariff Measures in the Economic Community of West African States (ECOWAS)*. Retrieved from United Nations Conference on Trade and Development:
https://unctad.org/en/PublicationsLibrary/ditctab2018d1_en.pdf
- UNECA. (2019a, May 1). *Regional Economic Communities*. Retrieved from United Nations Economic Commission for Africa: <https://www.uneca.org/oria/pages/comesa-trade-and-market-integration>
- UNECA. (2019b, May 2). *EAC – East African Community*. Retrieved from United Nations Economic Community for Africa: <https://www.uneca.org/oria/pages/eac-%E2%80%93-east-african-community>
- UNECA. (2019c, May 2). *SADC - Southern African Development Community*. Retrieved from United Nations Economic Commission for Africa:
<https://www.uneca.org/oria/pages/sadc-southern-african-development-community>
- UNECA. (2019d, May 2). *SADC - Free Movement of Persons*. Retrieved from United Nations Economic Commission for Africa: <https://www.uneca.org/pages/sadc-free-movement-persons>
- UNECA. (2019e, May 2). *ECOWAS - Economic Community of West African States*. Retrieved from United Nations Economic Commission for Africa:
<https://www.uneca.org/oria/pages/ecowas-economic-community-west-african-states>
- WITS. (2019, May 9). *About WITS*. Retrieved from WITS World Integrated Trade Solution:
https://wits.worldbank.org/about_wits.html
- World Bank Group. (2019a, May 1). *Content of Deep Trade Agreements*. Retrieved from The World Bank: <https://datacatalog.worldbank.org/dataset/content-deep-trade-agreements>
- World Bank Group. (2019b, May 9). *World Development Indicators*. Retrieved from The World Bank: <https://datacatalog.worldbank.org/dataset/world-development-indicators>

World Trade Organization. (2019, April 16). *List of all RTAs, including accessions to RTAs.*

Retrieved from World Trade Organization:

<http://rtais.wto.org/UI/PublicAllRTAList.aspx>

Yotov, Y. V., Piermartini, R., Monteiro, J.-A., & Larch, M. (2016). *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model Online Revised Version.* Geneva: WTO.