11. Integration and regional trade in sub-Saharan Africa

Festus Ebo Turkson

11.1 INTRODUCTION

Regional Trade Agreements (RTAs) in the form of free trade agreements or customs unions have been a major facet of the global multilateral trading system and trade relations amongst economies for well over fifty years. Since the early 1990s they have become increasingly important and popular in trade relations among nations to the extent that a steady increase in negotiations and establishment of RTAs has resulted. As of 15 January 2012, some 511 notifications of RTAs (counting goods and services separately) had been received by the GATT/WTO. Of these, 347 were in force, including 203 FTAs, 106 Economic Integration Agreements, 23 customs unions and 15 partial scope agreements.[1] Counting goods and services together there were 231 RTAs in force, including 128 that covered goods, 102 goods and services and one covering services only. All RTAs in the WTO are reciprocal trade agreements between two or more partners.

In spite of its popularity, the answer to the question of whether trade agreements increase bilateral trade flows among member countries has remained inconclusive ever since the seminal study by Tinbergen (1962). Using the gravity equation for international trade flows, Tinbergen (1962) sought to evaluate the effect of a free trade agreement (FTA) dummy among other covariates on bilateral trade flows. The results from Tinbergen's study suggested that the average treatment effect of FTAs was economically insignificant in explaining bilateral trade flows among member countries of the British Commonwealth.

Following from Tinbergen (1962), the various studies that have attempted to estimate the *ex post* effects of FTAs have at best come up with mixed results. Studies such as Bergstrand (1985), Harrigan (1993), Frankel et al. (1995), Lee and Swagel (1997), Head and Mayer (2000) and Chen (2002) did not find statistically significant effects of FTAs on trade. In contrast, Aitken (1973), Brada and Mendez (1985), Trefler (1993), Frankel (1997), Frankel et al. (1998) and Baier and Bergstrand (2005) found FTAs to have a statistically significant impact on bilateral trade flows among member countries.

The inconclusiveness of the *ex post* treatment effect of FTAs was confirmed by Ghosh and Yamarik (2004) in one of the most extensive FTA robustness analyses within the trade literature. Using cross-sectional data on the largest possible number of FTAs, Ghosh and Yamarik (2004) found no evidence of trade creation or trade diversion for any FTA, thereby concluding that the estimated average treatment effects of most FTAs are 'fragile' (that is, the varying estimates from various empirical analyses depend on the exact set of regressors that are selected in each study).

An important concern for quantitative estimates of the treatment effects of FTAs on trade flows has been the issue of the exogeneity of the FTA dummy within the gravity

framework. As indicated by Baier and Bergstrand (2007), the inability to find reliable *ex post* estimates of the FTA average treatment effect could be attributed to the failure of most studies to address econometrically the endogeneity of FTAs. According to these authors FTA dummies are not exogenous random variables; rather, they should be treated as endogenous within the gravity framework because for reasons unobservable to the econometrician (such as political factors, non-tariff barriers and domestic policies that inhibit bilateral trade), countries were more likely to select endogenously into FTAs. After controlling for the endogeneity of the FTA variables, Baier and Bergstrand (2007) produced striking empirical results that indicated a significant effect of FTAs on trade flows, with trade between two FTA member countries approximately doubling 10 years after signing the FTA. An important contribution by Baier and Bergstrand (2007) was the use of treatment effects of FTAs to estimate the bilateral trade effects of trade policies. Until then, the econometric analysis of treatment effect had been applied mainly within the labour economics literature.

This chapter follows Baier and Bergstrand (2007) by controlling for endogeneity of FTAs and in applying the treatment effect to estimate the *ex post* effect of RTAs and the EU-ACP PTA on bilateral trade flows involving 48 sub-Saharan African (SSA) countries using a panel of cross-sectional time series data from 1960 to 2006. This chapter contributes to the trade literature on SSA and to the current debate on whether trade agreements involving SSA countries actually increase the trade flows of member countries. Recently, the potential contribution of trade agreements to trade flows within SSA has come up for debate. Theoretical and empirical arguments have been advanced to contest the potential positive *ex post* effect of RTAs within SSA.

Theoretically it has been argued that given the similarities of comparative advantage and structural supply side characteristics, FTAs among SSA countries should not be expected to contribute significantly to bilateral trade flows of member countries. Empirically, the existence of institutional bottlenecks, the lack of political will and the nature of the complex web of overlapping RTA/PTA membership within SSA have been cited as factors that hamper SSA intra-regional trade, thereby minimizing the potential gains to trade that could have resulted in the absence of these factors.

In spite of the inability of RTAs to increase bilateral trade among SSA countries, the increasing interest in RTAs has not waned. Currently some Africa-wide trade integration initiatives are in place with the intention of bringing together intra-Africa RTAs and of establishing regional trading blocs with Asia and America (e.g. South Africa establishing FTAs with China and India) and signing up to the Economic Partnership Agreement (EPA) to replace the non-reciprocal EU-ACP preferential trade agreement.

What motivates the increasing interest in RTAs in SSA if the trade-enhancing impact of such RTAs has not been positive for SSA countries? Is it because SSA countries have realized from the experience of the EU that the process of regional integration when properly managed enhances trade among members more than cross-regional trade agreements? To address these questions the chapter begins with an overview of RTAs in SSA (section 11.2) and then briefly outlines the core theoretical intuition for trade agreements (section 11.3). The methodology is outlined in section 11.4, where the data are presented. Section 11.5 presents and discusses the results, and section 11.6 offers conclusions on prospects for RTAs in SSA.

11.2 TRADE AGREEMENTS IN SUB-SAHARAN AFRICA

The global interest in economic integration and trade agreements has been generally driven by economic, political and security considerations. Economically, as argued by Crawford and Fiorentino (2005), the proliferation of trade agreements has been driven partly by the desire of many countries to gain access either bilaterally or multilaterally to larger markets in view of the unwillingness of WTO members to commit to further multilateral liberalization.

For developing economies, the proliferation of trade agreements since the 1990s has stemmed from the desire to implement domestic trade reforms aimed at opening up their economies at a sustainable pace to competitive liberalization, facilitating the integration of their economies into the world trading system (Crawford and Fiorentino, 2005). With respect to SSA, current efforts to put in place regional and sub-region-wide trade integration initiatives have been aimed at bringing together intra-Africa RTAs and establishing regional trading blocs with Asia and America.

Regional Trade Agreements within Sub-Saharan Africa

Most RTAs within SSA have been established mainly in line with the objectives underlying the founding of the five main Regional Economic Communities (RECs) that make up SSA. One of the main objectives that have underlined most regional integration efforts within SSA has been the need to achieve 'collective self-sufficiency' for member countries/states through the establishment of single large trading blocs in the form of free trade areas and/or customs unions. Without exception, all the main RECs in SSA, namely the Economic Community of West African States (ECOWAS), the Economic Community of Central African States (ECCAS), the Southern Africa Development Corporation (SADC), the East African Community (EAC) and Intergovernmental Authority on Drought and Development (IGADD) have established RTAs in the form of free trade areas. Table 11.1 shows the list of countries in the various SSA RTAs and the EU and the year of joining the RTA.

Over the last decade, SSA has seen the emergence of cross-membership RTAs among countries belonging to different RECs in addition to the common markets that have been formed by two or more RECs. Yang and Gupta (2005) describe sub-Saharan Africa (SSA) as a dense web of RTAs (both FTAs and PTAs), with many countries belonging to more than two RTAs. This has resulted in a complex web of overlapping RTA membership, and although it has created implementation problems for the countries involved there are efforts in place to establish more such agreements. The proliferation of cross-regional RTAs has also seen most SSA countries belonging to cross-continent trading blocs such as the EU-ACP and US African Growth Opportunity Act (AGOA).

Although the proliferation of RTAs in Africa can be attributed mainly to the desire of SSA countries to establish FTAs or customs unions within sub-regions in order to increase trade and attract foreign direct investment (FDI), there is no evidence of increased intra-Africa trade relative to trade with the developed and other non-African developing countries. This is mainly because most RTAs within the SSA are very shallow, that is, the actual degree of internal liberalization and integration is very limited. Few SSA RTAs have a full customs union with zero internal tariffs and a common external

Table 11.1 List of countries and year of joining RTA

Sub-Saharan Africa				Europe	
ECOWAS (1975*)		SADC (1980*)		EU-25 (1958*)	
Ghana	1975	Angola	1980	Belgium	1958
Burkina Faso	1975	Botswana	1980	France	1958
Cape Verde	1976	Lesotho	1980	Italy	1958
Côte d'Ivoire	1975	Malawi	1980	Luxembourg	1958
Gambia	1975	Mozambique	1980	Netherlands	1958
Ghana	1975	Swaziland	1980	Germany	1958
Guinea	1975	Tanzania	1980	Denmark	1973
Guinea Bissau	1975	Zambia	1980	Ireland	1973
Liberia	1975	Zimbabwe	1980	United Kingdom	1973
Mali	1975	Namibia	1990	Greece	1981
Mauritania	1975–2000	South Africa	1994	Portugal	1986
Niger	1975	Mauritius	1995	Spain	1986
Nigeria	1975	Seychelles	1997–2005	Austria	1995
Senegal	1975	Madagascar	1980	Finland	1995
Sierra Leone	1975	Congo, DR	1997	Sweden	1995
Togo	1975			Cyprus	2004
		EAC (1967*, 2000*)		Czech Rep.	2004
ECCAS (1985*)		Burundi	2000	Estonia	2004
Angola	1999	Kenya	1967–78, 2000	Hungry	2004
Cameroon	1985	Rwanda	2000	Latvia	2004
Central Africa Rep.	1985	Tanzania	1967–78, 2000	Lithuania	2004
Congo	1985	Uganda	1967–78, 2000	Malta	2004
Congo, DR	1985			Poland	2004
Gabon	1985	IGADD (1986*)		Slovakia	2004
Sao Tome and Principe	1985	Kenya	1986	Slovenia	2004
Chad	1985	Ethiopia	1986		
Eq. Guinea	1985	Eritrea	1993		
Burundi	1985	Somalia	1986		
Rwanda	1985	Djibouti	1986		
		Uganda	1986		

Note: * indicates year in which RTA was founded.

tariff (EAC from 2005 the most recent, the South African Customs Union (SACU) the oldest). In fact, many of the RTAs have involved minimal liberalization of intra-regional trade.

EU Trade Agreements with Sub-Saharan Africa

Most trade agreements between SSA countries and non-African countries have been with developed countries, especially the European Union (EU) and the United States (US). As traditionally the two largest importers of goods from SSA, the EU and US have several schemes and/or agreements with SSA countries, most of which are mainly aimed

at assisting SSA to benefit from the gains of international trade in furtherance to ensuring economic growth and poverty reduction.

The genesis of the EU's trade partnership with SSA can be traced back to the signing of the Yaoundé Convention I in 1962 between the then European Economic Community (EEC) member states and 17 SSA countries and Madagascar. Being the first partnership agreement in history, the Yaoundé Convention I granted preferential trade arrangements such as duty free access of specified goods from the 17 SSA countries and Madagascar into the European market. The agreement was renewed by the Yaoundé Convention II in 1969 and it lasted until 1975 when it was replaced by the Lomé Convention.

The Lomé Convention signed in the first quarter of 1975 was between nine EEC member states and 46 developing countries from SSA, the Caribbean and the Pacific, formally known as the ACP countries. It provided duty free access to the EC market for agricultural and mineral exports from the ACP countries. The Lomé Convention, which was renegotiated three times under the Lomé Conventions II, III and IV and which was in force for 25 years, resulted in about ECU 30 billion of aid and investment to ACP countries apart from the trade preferences.

By the time the Lomé Conventions were replaced in 2000 by the Cotonou Agreement, the number of ACP countries participating had increased from 46 under the Lomé I Convention to 70 countries. The signing of the Cotonou agreement between the then 15 EU member countries and 77 ACP countries[2] in 2000 was in response to the continuing incompatibility of the Lomé Conventions with GATT and WTO rules for RTAs because the preferences were not reciprocal and the category of ACP countries (the eligibility criterion) was arbitrary. There was also some concern with the inability of the Lomé Conventions to produce the economic benefits that were expected.

The Cotonou agreement, a transformation of the previous convention into a system of trade and cooperation pacts with individual nations from 2000 to 2020, was aimed at assisting the ACP countries to reduce and eventually eradicate poverty and to gradually integrate into the world economy. One of the major changes introduced by the Cotonou agreement was the proposal to replace the non-reciprocal trade preferences that existed under the previous agreements with reciprocal Economic Partnership Agreements (EPAs) between the EU and individual RTAs composed of ACP countries (Morrissey, 2011 provides a full discussion of EPAs).

Under the EPAs which were expected to be in effect in 2008, the duty free access to EU markets for ACP exports was to be reciprocated by ACP countries also providing duty free access to their markets for EU exports. This implied that under the Cotonou agreement, the ACP countries were to continue enjoying the non-reciprocal duty free access to the EU market over the first seven years (i.e. from 2000/2001 to 2007/2008) and then from 2008 to 2020 sign onto the EPA. The replacement of the Cotonou agreement with the EPAs was to ensure that the PTA between the EU and ACP countries became 'WTO compliant'.

11.3 BASIC THEORY OF TRADE AGREEMENTS

The literature, theoretical and empirical, on trade agreements and bilateral trade flows has been extensive and varied, but inconclusive with regard to the *ex post* effect of trade

agreements on bilateral trade flows. The various theoretical models and/or arguments only pointed to the potential important effects and causal channels through which trade agreements can impact on bilateral trade flows without coming up with conclusions. The broader picture that has emerged from the empirical literature has only confirmed the inconclusive nature of the theoretical debate.

The main theoretical argument advanced by those who are pessimistic about the impact of trade agreements on bilateral trade flows is grounded on the traditional Heckscher–Ohlin model. The key insights of the Heckscher–Ohlin model were that factor endowment differences could be a basis for trade, and that trade could lead to factor price convergence between trading partners. According to the Heckscher–Ohlin model, countries should export products that utilize their abundant factor endowments and import products that utilize the countries' scarce factor endowments. This implies that a capital-abundant country will export products from its capital-intensive industries to labour-abundant countries, and the labour-abundant countries, by importing capital-intensive goods, will in return export labour-intensive products to the capital-abundant countries.

For developing countries, especially SSA countries endowed with abundant natural resources, the Heckscher–Ohlin model implies specialization in the production and export of natural resource-based (i.e. primary) products to capital-abundant developed countries. Thus, based on the Heckscher–Ohlin model, SSA countries will be expected to trade more with developed countries or other capital-abundant developing countries (North–South trade) than among themselves (South–South trade). Granted that the Heckscher–Ohlin model explains the pattern of trade flows, regional trade agreements are not expected to contribute significantly to bilateral trade within SSA as compared to trade agreements with developed and/or capital-abundant developing countries (North–South trade).

The basis for the trade creation versus trade diversion argument against trade agreements is grounded in the seminal work by Viner (1950). In his analysis of the immediate static effect of PTAs, Viner (1950) argued that a trade agreement in the form of a PTA does not necessarily improve the welfare of a member country because it may lead to trade diversion (i.e. imports shifting away from the most efficient world supplier to an inefficient member country) significantly higher than the trade created from the PTA. Viner (1950) argued that a trade agreement only improves the welfare of its members if the benefits obtained from the trade created dominate the losses from trade diversion.

Within the trade literature, the three main factors that have been found to be responsible for substantial trade creation and welfare gains are geographical proximity, intra-industry and inter-industry trade determinants. As found by Wonnacott and Lutz (1989) and Krugman (1991), a sizeable amount of trade creation results from trade agreements between geographically close countries because of lower transportation costs (i.e. the concept of 'natural trading partners'). Substantial trade creation also results from economies of scale in the presence of differentiated products when the two countries signing the trade agreement are large and of similar economic size. In addition, in situations where there are significant differences in factor endowment ratios, comparative advantage ensures that there are potentially significant gains from trade creation.

Findings from studies conducted on the trade effect of FTAs in SSA within the trade literature have confirmed the fragility of the estimated effect of the FTA treatment on

trade flows. The findings from the studies on SSA such as Johnson (1995), Lyakurwa et al. (1997), Gunning (2001), ECA (2004) and Yang and Gupta (2005) confirmed the conventional belief that RTAs in SSA have not enhanced trade among member countries as a result of lack of complementary products, high external trade barriers, inadequate trade facilitation infrastructure, less product differentiation, unwillingness to import from high cost members, small market size and lack of strong and sustained political commitment and hence shallow integration.

On the other hand, other studies such as Deme (1995), Elbadawi (1997), Cernat (2001), Carrere (2004), Coulibaly (2007), EAC (2008) and Afesorgbor and Bergeijk (2011) found RTAs within SSA to have significantly increased trade flows among member countries, suggesting that SSA RTAs have been trade-creating. For instance, Deme (1995), using a panel of ECOWAS countries from 1975 to 1991, estimated the *ex post* effect of the ECOWAS FTA. Applying different estimation procedures, Deme (1995) found ECOWAS members to have traded between 0.5 to 1.7 times more than non-ECOWAS members. Elbadawi (1997) found the presence of SSA RTAs to have increased intra-regional imports by 31 per cent on average without causing any trade diversion. Cernat (2001), using a pooled cross-section of members within ECOWAS, SADC and COMESA for the years 1994, 1996 and 1998, found a strong case of increased trade among ECOWAS (compared to non-ECOWAS members) and SADC members (as compared to non-SADC members). Cernat (2001) attributed the positive trade impact of ECOWAS and SADC RTAs to the greater trade facilitation that existed amongst members. This finding was confirmed by Carrere (2004) using a panel of 150 countries' bilateral trading with ECOWAS, SADC, WAEMU and COMESA countries between 1962 and 1996. After controlling for possible endogeneity, Carrere found RTAs in ECOWAS and SADC to have contributed to increased intra-regional trade flows by a factor of 0.2 and 2.7 times respectively.

In a more recent study, Afesorgbor and Bergeijk (2011), using a gravity model of 35 countries between 1995 and 2006, estimated the relative impact of ECOWAS and SADC RTAs on bilateral trade compared to the EU-ACP PTA. The authors found ECOWAS and SADC membership to have significantly increased bilateral trade flows more than the EU PTA. They also found SADC membership to have a stronger impact compared to ECOWAS. On the trade impact of multi-membership, Afesorgbor and Bergeijk (2011) argued that it depended critically on the characteristics of the overlapping RTA. Although Afesorgbor and Bergeijk (2011) attempted to control for some econometric concerns normally associated with using the gravity model to assess the impact of RTAs, the authors treated the RTA dummy as exogenous, thereby failing to control for the potential endogeneity of the RTA. Afesorgbor and Bergeijk (2011) argued that membership of SSA RTAs was by and large determined by geographical factors rather than trade and therefore the possibility that SSA countries which trade more intensively were more likely to form an RTA was very unlikely. If in a world of identical countries, two countries who are 'natural trading partners' do benefit from an FTA more than two unnatural trading partners (Frankel et al., 1995; 1996 and 1998) then it is more likely that such SSA countries would form an RTA. Thus the RTA treatment in Afesorgbor and Bergeijk (2011) does not correct for the bias introduced by most SSA countries' self-selection into the respective RTAs. This chapter will follow Baier and Bergstrand (2007) in addressing the bias introduced by self-selection into RTAs within SSA.

11.4 METHODOLOGY AND DATA

The standard approach to identifying the *ex post* effect of trade agreements on trade flows since the pioneering study by Tinbergen (1962) has been to estimate the gravity model of trade. One main critique that has been made against most studies that have employed the gravity model to assess the impact of trade agreements (preferential or regional) on bilateral trade flows has been with respect to the assumption made about the agreement dummy. Most studies have assumed an exogenous dummy variable to represent the effect of belonging to a trade agreement. As noted by Trefler (1993) and Baier and Bergstrand (2005), in reality trade agreement dummies are not exogenous because, for unobservable reasons, countries can endogenously select into a trade agreement. According to Baier and Bergstrand (2007), the potential endogeneity of the trade agreement (either RTA or PTA) dummy could be attributed to omitted variables and sample selection bias as well as measurement errors.

If trade agreements are endogenous, then it might explain why previous studies which assumed trade agreements to be exogenous have not been able to reach a consensus on their impact on bilateral trade flows. The results from these studies have either under- or over-estimated the effect on trade. Recently, many studies such as Egger (2000; 2002), Egger and Pfaffermayr (2003; 2004) and Baier and Bergstrand (2007) have come up with various ways in which the endogeneity bias can be dealt with.

According to Egger (2000), panel data methods that incorporate bilateral-specific effects are most appropriate for dealing with issues of endogeneity bias and allow for heterogeneity when estimating the gravity model. This is so because panel data methods allow for disentangling country-specific effects from time-invariant effects thereby correcting for omission bias and allowing for heterogeneity. Egger and Pfaffermayr (2003) indicate that an estimator that can control for bilateral-specific effects as in a fixed effect model can be used because it allows for incorporating unobserved factors that simultaneously explain bilateral trade between the two countries, thereby leading to unbiased and efficient results.

Another method proposed for dealing with the endogeneity bias is the Hausman–Taylor panel method, originally proposed by Hausman and Taylor (1981) and Amemiya and MaCurdy (1986), which incorporates time-invariant variables that are correlated with bilateral-specific effects in the estimation (Egger and Pfaffermayr, 2004). Based on instrumental variables, the Hausman–Taylor panel estimator assumes that some of the explanatory variables are correlated with the individual-level random effects (denoted below as the error term η_i) but none are correlated with the idiosyncratic error (denoted below as ε_{it}). The Hausman–Taylor estimator thus uses the average values of the time-varying exogenous variables and the deviations from these averages as instruments for the time-invariant endogenous variables.

Empirical Strategy

This chapter estimates a multiplicative gravity equation using a panel of bilateral trade flows and standard gravity covariates. To correct for omitted variables and selection bias arising from the endogeneity of the preferential and regional trade agreement dummies (included to capture the impact of the various intra-SSA RTAs, and the EU-ACP trade

agreements), this chapter will adopt the Hausman–Taylor panel technique to estimate the gravity equation of the form (where subscripts i and j refer to exporting and importing countries respectively):

$$X_{ijt} = \varphi_0 . Y_{it}^{\varphi_1} . Y_{jt}^{\varphi_2} . d_{ij}^{\gamma} . Z_{ijt}^{\alpha_k} . BLOC_{ijt}^{\beta} . \eta_{ij} . \upsilon_t . \varepsilon_{ij} \tag{11.1}$$

Two models of equation (11.1) will be estimated using the random effects, fixed effects and Hausman–Taylor estimations. In more specific form, the first model will capture the effects of non-reciprocal preferential trade agreement between SSA and the EU (i.e. EU–ACP PTA). The econometric specification in logs is of the form:

$$\begin{aligned} \ln(X_{ijt}) = {} & \varphi_0 + \varphi_1 \ln(Y_{it}) + \varphi_2 \ln(Y_{jt}) + \gamma \ln(d_{ij}) + \alpha_1 COLO_{ij} + \alpha_2 COMCUR_{ijt} \\ & + \alpha_3 LLK + \alpha_4 REMOTE_{ijt} + \beta_1 EUSSA + \beta_2 SSAEU\,PTA_{ijt} \\ & + \phi_t + \varepsilon_{ij} \end{aligned} \tag{11.2}$$

As noted in equations (11.1) and (11.2), bilateral exports, X_{ij} at time t, is specified to be a function of GDP (Y), the distance between them (d_{ij}), a vector Z of controls thought to proxy for other aspects of bilateral and country characteristics (Z_{ij}) such as colonial link ($COLO$), common currency ($COMCUR$), landlocked nature of the bilateral trading countries (LLK), remoteness to capture multilateral resistance ($REMOTE$), trade agreement dummies, time dummies (φ_t) and a well-behaved error term (ε_{ij}). The construction of variables is explained below.

Dummy variables for trade agreement(s) with reference to EU and SSA are included as $EUSSA_{ijt}$, (to capture the effect of the non-reciprocal part of the PTA: in this case i = EU and j = SSA), and $SSAEU\,PTA_{ijt}$ (preferential treatment offered to exports from SSA to the EU, where i = SSA and j = EU). The reference category refers to bilateral country pairs that do not belong to the EU-ACP PTA at time t (Appendix 11A defines all regional dummy variables).

To isolate the impact of RTAs on trade within sub-regions in SSA, this chapter estimates a second model to include regional trade agreements within SSA. This model will seek to capture the effect of ECOWAS, EAC, SADC, ECCAS and IGADD RTAs on bilateral exports. The reference category in this case refers to bilateral country pairs that do not belong to the same RTA or are not members of any RTA (i.e. no RTA) at time t. The econometric specification of (11.2) in logs is of the form:

$$\begin{aligned} \ln(X_{ijt}) = {} & \varphi_0 + \varphi_1 \ln(Y_{it}) + \varphi_2 \ln(Y_{jt}) + \gamma \ln(d_{ij}) + \alpha_1 CONTIGUITY_{ij} + \alpha_2 COLO_{ij} \\ & + \alpha_3 COMCUR_{ijt} + \alpha_4 LLK + \alpha_5 REMOTE_{ijt} + \beta_1 ECOWAS_{ijt} \\ & + \beta_2 EAC_{ijt} + \beta_3 SADC_{ijt} + \beta_4 ECCAS_{ijt} \\ & + \beta_5 IGADD_{ijt} + \phi_t + \varepsilon_{ij} \end{aligned} \tag{11.3}$$

There are econometric issues to be resolved to ensure the parameter estimates are unbiased and consistent. With a panel of bilateral trade flows, standard gravity covariates and dummies for bilateral trade agreements, fixed effects is preferred to random effects or differencing the data and using OLS. Baier and Bergstrand (2007) and Egger (2000) favour fixed effects to address the issue of omitted variables and selection bias arising from the endogeneity of the RTA.

In the presence of correlation of unobserved characteristics with some explanatory variables the random effect estimator produces biased and inconsistent estimates of the parameters. As an alternative (i.e. that eliminates the correlation) the within estimator or the fixed effects estimator is used. The fixed effects estimator consists of transforming the data into deviations from their means so that even in the presence of correlation of unobserved characteristics with some explanatory variables, the estimator yields unbiased and consistent estimates of the parameters. Transforming the data into deviations from their means as is the case with the fixed effects estimator will eliminate the time-invariant variables, making it impossible to obtain parameter estimates for such variables. In addition, the fixed effects estimator does not control for variations across countries.

The choice of the Hausman–Taylor estimator is to control for the variation across countries while at the same time incorporating time-invariant variables that are correlated with bilateral-specific effects in the estimation. By making use of instrumental variables that are uncorrelated to unobservable characteristics, the Hausman–Taylor panel technique has proven to be more efficient than random or fixed effect techniques. The Hausman–Taylor panel technique also allows for the correction of the endogeneity bias from the trade agreement dummy within the gravity framework. As noted by Baier and Bergstrand (2007), trade agreement dummy coefficients have been underestimated because generally the dummy within the gravity framework is correlated negatively with the error term leading to the classical 'attenuation bias' of the FTA coefficient towards zero.

Data Description

Data for our analysis is obtained from the 'square' gravity dataset for all world pairs of countries for the period 1960 to 2006 by CEPII.[3] The main variables relating to the standard gravity covariates were obtained from the CEPII distance datasets and these were merged with the matrix of bilateral trade flows using standard ISO codes for countries and for any year between 1948 and 2006. In order to focus our analyses on SSA and the EU, we concentrate mainly on bilateral trade relations involving SSA and 25 EU countries from 1960 to 2006. This leaves us with a panel of observations of 247 032 bilateral country-years involving 73 countries (25 EU member countries and 48 SSA countries) over 47 years. After dropping the missing trade flow values the panel observations are reduced to 165 022 bilateral country-years. Positive bilateral trade flows occur for 116 335 (about 71 per cent) of the observations while the remaining 48 687 (about 29 per cent) observations were zero-valued flows.

Main variables

- Bilateral exports (X_{ij} and X_{ji}): the data on bilateral trade as contained in the dataset used by Head et al. (2010) was sourced from the International Monetary Fund's Direction of Trade Statistics (DOTS).
- Measures of economic size (GDP): GDP measured at current US dollars.
- Measures of distance and other country characteristics: are sourced from CEPII.
- Remoteness of country pair: a proxy variable for multilateral resistance to trade. Following Brun et al. (2005) and Baier and Bergstrand (2004), we calculate average remoteness by taking a simple average of the weighted mean of the

distance of countries *i* (exporting country) and *j* (importing country) to all their trading partners, where the weights are the proportions of world GDP held by the trading partners.

- Trade agreement variables: the dummies for each RTA are listed in Appendix 11A.

Table 11.2 presents descriptive statistics for average bilateral exports, trade intensity and economic size (as measured by GDP) for the different blocs or RTAs within SSA and for the EU. As is evident from the summary statistics, there are large differences in the incidence of bilateral trade flows, trade intensity index and GDP across regions. SSA countries on average had lower GDP and export values, but higher trade intensity index than members of the EU.

Over the period 1960 to 2006, average exports from SSA countries to the EU were significantly higher than imports from the EU. This gives an indication of the trade-enhancing effect of the non-reciprocal EU-ACP PTA. Compared to trade amongst member countries within an RTA, without exception average exports to the EU under the EU-PTA were significantly higher. The evidence in Table 11.2 also supports the positive relation posited between GDP and bilateral trade flows. The average GDP within blocs is closely related to the average bilateral exports within the bloc. Larger blocs in SSA (in terms of economic size as measured by average GDP) exported more within than with non-members.

A striking feature observed in Table 11.2 is the correlation between the trade intensity index and trade flows within blocs. The trade intensity index is significantly higher for country pairs within an RTA than for country pairs belonging to the EU-SSA PTA.

Table 11.2 Summary statistics

Region/Bloc	Exports		Trade Intensity		GDP	
	Millions (US$)		Index[a]		Billions (US$)	
	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
EU	6379	11662.3	1.97	2.9	513.1	645.4
SSA-EU	57.4	239.2	1.4	3.8	n.a.	n.a.
EU-SSA	51.3	236.1	1.4	5.3	n.a.	n.a.
ECOWAS	14.9	62.4	50.3	153.4	6.3	12.9
SADC	37.6	133.1	53.4	134.3	13.6	37.47
EAC	26.2	81.2	197.3	339.1	3.7	4.8
ECCAS	5.1	10.5	83.1	247.6	5.3	5.1
IGADD	32.1	84.5	706.6	2314.9	6.4	5.2
No RTA (SSA)	6.0	35.4	35.4	310.0	8.2	22.6

Notes:
Figures are simple averages (mean) and standard deviation (std dev.) for all pairs over the whole period.
n.a. = not applicable.

a. Trade Intensity Index is the ratio of the total trade share of destination in total exports of the origin country to the share of the destination in the total exports of the world. Calculated as:

$$TII = \frac{\sum X_{ij} / \sum X_{iw}}{\sum X_{wj} / \sum X_{w}}$$

Generally the correlation between the trade intensity and trade flows observed confirms evidence from other studies indicating that countries implementing an RTA tend to have a higher trade intensity index.

11.5 RESULTS AND DISCUSSION

The results as shown in Table 11.3 are obtained from estimating the gravity equation (11.2) using the random effect, fixed effect and Hausman–Taylor estimators. The results

Table 11.3 Impact of EU-SSA PTA on bilateral trade with SSA

Variables	Dependent variable: Log(Exports *ijt*)		
	Fixed Effects	Hausman–Taylor	
		(1)	(2)
Log of GDP *it*	0.858***	0.834***	0.859***
	(0.0579)	(0.0171)	(0.0181)
Log of GDP *jt*	0.585***	0.643***	0.622***
	(0.0423)	(0.0163)	(0.0170)
Log of distance *ij*		−0.451**	−0.458**
		(0.216)	(0.216)
Colonial link *ij*		2.151***	2.153***
		(0.232)	(0.232)
Common currency *ijt*	0.804***	0.791***	0.791***
	(0.126)	(0.0831)	(0.0831)
Remoteness *ijt*	0.252***	0.00142	0.00310
	(0.0862)	(0.0273)	(0.0274)
Number landlocked *ij*		−0.783***	−0.785***
		(0.0972)	(0.0972)
SSA-EU PTA *ijt*	0.144**	0.161***	0.153***
	(0.0625)	(0.0243)	(0.0244)
EU to SSA *ijt*	0.413***	0.420***	1.145***
	(0.0428)	(0.0232)	(0.139)
Non-EU to SSA *ijt*			0.558***
			(0.136)
Constant included	Yes	Yes	Yes
Controlled for time effect	Yes	Yes	Yes
Number of observations	61 468	61 468	61 468
Number of bilateral pairs	2273	2273	2273

Notes:
Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Time dummies are included but not reported for brevity.
Country *i* and *j* refers to exporter and importer country respectively.
'Non-EU' refers to European countries that were not members of EEC/EU in the relevant year.
'Number landlocked' refers to the number of bilateral countries *ij* that is/are landlocked (i.e. takes the value of 0, 1, or 2).

obtained confirm the robustness to using the alternative estimators: the Hausman test result shown in Appendix Table 11A.1 rejects the null hypothesis that the regressors and individual effects (heterogeneity) are not correlated ($Chi^2(54) = 874.95$ is significant at 1 per cent level). This indicates the presence of correlation between individual heterogeneity and the covariates of the estimated gravity model, implying the inappropriateness of the random effect model.

Theoretically, when unobserved time-invariant bilateral variables are likely to be correlated with the trade agreement dummy they are best controlled for using the bilateral 'fixed effects' rather than the random effects which assumes zero correlation between the unobservables and the trade agreement dummy. The Hausman test results confirm similar findings by Egger (2000) and Baier and Bergstrand (2007). In line with this we concentrate on the parameter estimates obtained under the fixed effects and Hausman–Taylor estimators.

EU-ACP PTA

Table 11.3 shows fixed effects and alternative Hausman–Taylor estimates of the gravity equation (11.2) controlling for time and bilateral fixed effects. The difference in the two specifications relates to the reference category, in this case the 'untreated' country pairs. The untreated in specification (11.1) are any pair for which either country *i* or *j* at time *t* was a non-EU European country and thus not party to the EU-ACP PTA; the untreated in specification (11.2) are any pair for which *i* is SSA and *j* a non-EU European country at time *t*.

The results in Table 11.3 show the parameter estimates for the average impact of the non-reciprocal EU-SSA PTA treating SSA as a bloc. The model performed satisfactorily as most of the core control variables in the gravity equation had significant coefficients with expected signs. Importer and exporter GDP, colonial link, common currency and remoteness of the pair from all trading partners as expected exert a significant positive effect on bilateral exports. The number of landlocked countries in the pair exerts a negative significant impact on bilateral trade, confirming prior expectations. With regard to remoteness of the country pair from all trading partners, although the results from the fixed effects estimator confirm expectations that the more remote the two trading partners are from the rest of their trading partners the more they trade (the coefficient is significant with the expected positive sign), this is not confirmed under the alternative specifications of the Hausman–Taylor estimator (under columns 2 and 3 of Table 11.3).

With regard to the average treatment effect of the presence of the PTA, the estimate obtained under specification (11.1) suggests that bilateral exports from SSA to the EU increased on average by 17.5 per cent ($\exp^{0.161} = 1.175$) and imports by 52.2 per cent ($\exp^{0.420} = 1.522$) compared to the untreated (i.e. bilateral exports between pairs that were both not parties to the EU-ACP PTA). The PTA coefficient estimates in specification (11.2) of 0.153 (for exports from SSA to EU) and 1.145 (for imports to SSA from the EU) confirm that the presence of the EU-ACP PTA increased trade between SSA and the EU.

The quantitative estimates obtained suggest that the average treatment effect of the presence of the PTA increased bilateral exports from SSA and the EU by 16.5 per cent

($\exp^{0.153} = 1.165$) and imports by about 214 per cent ($\exp^{1.145} = 3.142$). Thus, by controlling for imports from other European countries (i.e. non-EU) as in specification (11.2), the average treatment effect of the non-reciprocal EU-ACP PTA increases substantially from 0.42 to 1.15. Estimates obtained from specification (11.2) also indicate that imports to SSA from Europe were significantly higher for EU members than non-EU members, suggesting the trade-enhancing effect of the EU-ACP PTA, despite its non-reciprocal nature.

RTAs within SSA

To measure the *ex post* trade effect of RTAs in SSA, estimates were obtained for gravity equation (11.3). The results as shown in Table 11.4 confirm expectations with specific reference to the core control variables in the gravity equation. The Hausman test in Appendix Table A11.2 also confirms the presence of correlation between the unobserved time-invariant bilateral variables and the covariates of the estimated gravity model, hence our concentration on estimates obtained under the fixed effects and especially Hausman–Taylor estimators. The alternative specifications under the Hausman–Taylor estimators relate to the average treatment effect of belonging to a particular RTA and RTA membership in SSA, shown as specifications (11.1) and (11.2) respectively.

Exporter and importer GDP, colonial link and remoteness of the pair from all trading partners as expected exert a significant positive effect on bilateral exports among SSA countries. Estimates obtained for the average treatment effect of the presence of an RTA within SSA (shown in specification (3) of Table 11.4) indicate that trade between country pairs belonging to the same RTA increased on average by 28.8 per cent ($\exp^{0.253} = 1.288$). This implies that within SSA, trading with an RTA member country was more beneficial than with other non-member SSA countries. This provides support for current efforts to form common markets among RTAs (such as COMESA). With regard to specification (11.2), the estimates obtained reveal interesting asymmetries.

While the presence of an RTA within SADC and ECOWAS increased trade amongst members, the estimates for ECCAS and IGADD suggest that on average member countries traded less relative to pairs that do not belong to the same RTA. Interestingly the presence of the RTA in EAC had no effect on trade among members relative to non-members. This might be due to the long period of inactivity within the EAC or to how trade is measured (some cross-border trade is unrecorded and some intra-regional trade is in fact re-exports or transit goods).

Comparatively SADC seemed to have done better in terms of intra-regional trade than ECOWAS. While the presence of the RTA in SADC increased trade among member countries by about 110 per cent ($\exp^{0.744} = 2.104$), belonging to ECOWAS increased trade among members by about 65 per cent ($\exp^{0.499} = 1.647$) compared to non-members. The stronger average treatment effect of SADC is due to the inclusion of South Africa, SADC's export of more diversified products and the extension of tariff-free access to both primary and industrial products among member countries. The sheer size of the trade involving South Africa has resulted in South Africa being the only country within SSA having a different PTA with the EU outside the EU-ACP PTA.

The significant results for ECOWAS are surprising given the shallow integration but

Table 11.4 Impact of SSA RTAs on bilateral trade within SSA

Variables	Dependent variable: Log(Exports *ijt*)		
	Fixed Effects	Hausman–Taylor	
		(1)	(2)
Log of GDP *it*	0.438***	0.451***	0.450***
	(0.116)	(0.0446)	(0.0445)
Log of GDP *jt*	0.0994	0.106**	0.103**
	(0.108)	(0.0431)	(0.0430)
Log of distance *ij*		−1.272***	−1.350***
		(0.150)	(0.151)
Colonial link *ij*		0.739***	0.736***
		(0.199)	(0.201)
Common currency *ijt*	0.346**	0.343***	0.377***
	(0.175)	(0.0716)	(0.0706)
Contiguity *ijt*		1.559***	1.525***
		(0.368)	(0.372)
Number landlocked *ij*		−0.511***	−0.516***
		(0.143)	(0.144)
Remoteness *ijt*	0.306*	0.404***	0.390***
	(0.176)	(0.0706)	(0.0705)
ECOWAS *ijt*	0.480***	0.499***	
	(0.155)	(0.0627)	
EAC *ijt*	0.0325	0.0400	
	(0.255)	(0.130)	
SADC *ijt*	0.733***	0.744***	
	(0.147)	(0.0735)	
ECCAS *ijt*	−0.201	−0.199**	
	(0.247)	(0.0956)	
IGADD *ijt*	−0.484	−0.500***	
	(0.365)	(0.171)	
RTA *ijt*			0.253***
			(0.0470)
Constant included	Yes	Yes	Yes
Controlled for time effect	Yes	Yes	Yes
Number of observations	27993	27993	27993
Number of bilateral pairs	1670	1670	1670

Notes:
Robust standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Time dummies are included but not reported for brevity.
Country *i* and *j* refers to exporter and importer country respectively.

may be due to the Francophone sub-group and/or specific regional trade such as in petroleum or textile/garment re-exports.

From the evidence shown by the results in Tables 11.3 and 11.4, regional trade agreements have increased trade within SSA among members within the different

sub-regions in SSA, more than with the EU under the non-reciprocal PTA. The results also indicate that although member countries within the sub-regions are more inclined to trade amongst themselves than with other countries that are not part of their respective RTAs, the EU-SSA PTA has offered the member countries within the sub-region a larger market to import from compared to what other non-member EU countries have offered. This could be as a result of the strong colonial link between most of SSA and leading EU countries, especially France and Britain.

Zero-Valued Trade Flows

As a result of the existence of zero-valued trade flows in the sample, we perform sensitivity analysis to assess the treatment effect of the trade agreement variables when the zero-valued trade flows are included in the estimation. To this end, we estimate equations (11.2) and (11.3) using the negative binomial pseudo maximum likelihood estimator (NBPML), one of the family of Poisson Pseudo-Maximum Likelihood estimators considered most appropriate in this context (Burger et al., 2009).

The use of the NBPML allows for the inclusion of zero-valued trade flows and for controlling for the unobserved heterogeneity between countries. This will enable us to pick up the effects, if any, that the trade agreement variable has in explaining why countries do not trade. Table 11.5 shows the results of the estimates obtained from the NBPML estimator.

The significance of the over-dispersion parameter in Table 11.5 confirms the presence of unobserved heterogeneity not accounted for in the conditional mean when the zero-valued trade flows are accounted for in the estimation. This gives legitimacy to the use of the NBPML estimator. Compared to the results obtained in Tables 11.3 and 11.4, the inclusion of the zero-valued trade flows decreased marginally the estimated parameters for the standard covariates of the gravity equation while maintaining the level of significance and sign. In terms of the estimates of the average treatment effect of the RTA dummies, though the results obtained indicate a relatively higher effect for the EU-ACP PTA and a lower effect for the SSA RTAs compared to the results obtained in the case of positive valued trade flows, generally the results confirm the positive impact of EU-ACP PTA, ECOWAS and SADC RTAs on trade flows. For instance in the case of the EU-ACP PTA, the average effect on SSA exports to the EU under the PTA was higher at an increase of 24 per cent compared to 17.5 per cent obtained for positive valued flows. With regards to EU exports to SSA, the inclusion of zero-valued trade flows indicates a trade impact of 160 per cent ($\exp^{0.955} = 2.60$) compared to 214 per cent regarding positive trade flows.

After controlling for non-EU exports to SSA, the results in column 2 of Table 11.5 indicate a trade impact of 23 per cent ($\exp^{0.208} = 1.23$) compared to 16.5 per cent. In terms of the ECOWAS and SADC RTAs the inclusion of zero-valued trade flows reduces the impact of the respective RTAs on trade flows from 65 per cent and 110 per cent to 35 per cent ($\exp^{0.302} = 1.35$) and 25 per cent ($\exp^{0.222} = 1.25$) respectively. In addition, the impact of the EAC RTA is found to have significantly increased trade flows of member countries by 24 per cent ($\exp^{0.215} = 1.24$) compared to the zero impact obtained in Table 11.4. Across specifications the ECCAS RTA is found to have decreased trade of member countries by 22 per cent and 52 per cent with regard to positive flows and the inclusion of zero-valued flows respectively.

Table 11.5 Impact of EU-SSA PTA and SSA RTAs: controlling for zero valued flows

Variables	Dependent Variable: Exports *ijt*			
	EU-SSA PTA		SSA RTAs	
	(1)	(2)	(3)	(4)
Log of GDP *it*	0.357***	0.316***	0.129***	0.104***
	(0.00535)	(0.00587)	(0.0173)	(0.0172)
Log of GDP *jt*	0.224***	0.274***	0.0451***	0.0260*
	(0.00506)	(0.00585)	(0.0155)	(0.0154)
Log of distance *ij*	−0.497***	−0.497***	−0.182***	−0.211***
	(0.0276)	(0.0277)	(0.0223)	(0.0217)
Colonial link *ij*	0.449***	0.445***	0.526***	0.530***
	(0.0249)	(0.0249)	(0.0354)	(0.0355)
Common currency *ijt*	0.596***	0.586***	0.0624*	0.0419
	(0.0513)	(0.0512)	(0.0366)	(0.0359)
Contiguity *ijt*			0.00366	−0.0202
			(0.0410)	(0.0409)
Number landlocked *ij*	−0.0810***	−0.0771***	−0.225***	−0.240***
	(0.0156)	(0.0157)	(0.0252)	(0.0246)
Remoteness *ijt*	0.0389***	0.0436***	0.146***	0.123***
	(0.00824)	(0.00828)	(0.0265)	(0.0265)
SSA-EU PTA *ijt*	0.214***	0.208***		
	(0.0153)	(0.0156)		
EU to SSA *ijt*	0.436***	0.955***		
	(0.0135)	(0.0330)		
Non-EU to SSA *ijt*		0.524***		
		(0.0305)		
ECOWAS RTA *ijt*			0.302***	
			(0.0348)	
EAC RTA *ijt*			0.215***	
			(0.0614)	
SADC RTA *ijt*			0.222***	
			(0.0386)	
ECCAS RTA *ijt*			−0.416***	
			(0.0551)	
IGADD RTA *ijt*			0.0859	
			(0.0866)	
SSA RTA *ijt*				0.0527***
				(0.0260)
Constant included	Yes	Yes	Yes	Yes
Bilateral fixed effects	Yes	Yes	Yes	Yes
Controlled for time effect	Yes	Yes	Yes	Yes
Over-dispersion (ln *r*)	−0.294***	−0.294***	−0.214***	−0.214***
Number of observations	76912	76912	58659	58659
Number of bilateral pairs	2288	2288	1785	1785

Notes:
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Time dummies are included but not reported for brevity.
Country *i* and *j* refers to exporter and importer country respectively.

11.6 CONCLUSION

In order to estimate a gravity model augmented with measures of trade agreements, the chapter made use of bilateral trade flows and key gravity covariates from the CEPII database on 73 countries (48 SSA and 25 EU countries) over the period 1960 to 2006. Using different estimation techniques, we find RTAs within ECOWAS and SADC had a positive and significant impact on intra-RTA bilateral trade, ECCAS RTA had a negative impact, and the EAC and IGADD RTAs had no significant effect.

In some cases the relative impact of the treatment effect of RTA was found to have increased trade flows higher than the non-reciprocal EU-ACP PTA. The results therefore indicate the need for developing countries, especially within SSA, to focus on expanding and integrating regional markets in order to significantly improve trade performance. The regional markets could be seen as a 'nursery market' where the member countries could learn to improve efficiency and competitiveness in order to be able to compete favourably within the global trading system.

We make a contribution to the literature on the potential impact of trade agreements on trade flows within sub-Saharan Africa in many ways. Our use of a panel data with bilateral fixed and time effects allowed for controlling the endogeneity of the trade agreement variable, unlike most previous studies on SSA. In addition we accounted for multilateral price resistance by the inclusion of the bilateral remoteness indicator (as in Frankel et al. 1997). We also explicitly deal with the zero-valued flows using the NBPML estimator.

One important issue that came up in assessing the bilateral trade effect of trade agreements is the failure to capture the general equilibrium comparative static effects of trade agreements. The study failed to capture the impact of the EU-ACP PTA and SSA RTAs on trade with non-members as well as trade among non-members. We also failed to capture the interactive effects of the trade agreement dummies with covariates of the gravity model. As indicated by Baier and Bergstrand (2007) the bilateral trade effects of free/regional trade agreements could be influenced by economic size, per capita incomes and distance between two countries.

Although we acknowledged that the nature of the FTA could also influence its trade effect, we were unable to control for this. The use of remoteness as a proxy for multilateral price resistance has been described as inappropriate in controlling for multilateral resistance. Rather, studies such as Egger (2000), and Baier and Bergstrand (2007) have prescribed the use of importer-time and exporter-time effects to control for the time-varying multilateral price resistance terms.

On future research, we recommend an extension of this study on the bilateral trade effects of the EU-ACP PTA and RTAs in SSA to control for the interactive effects between the trade agreement variable and economic size, per capita incomes and distance. In addition, an estimate of the average treatment effect of RTAs could be alternatively obtained by use of panel data with bilateral and country and time fixed effects or differenced panel data with country and time effect. This will obviate the use of the remoteness indicator as a proxy for multilateral price resistance, a variable that has been criticized as being inappropriate by various studies.

NOTES

1. Source: http: //www.wto.org/english/tratop_e/region_e/region_e.htm.
2. Made up of 48 SSA countries, 14 Caribbean countries or states and 15 Pacific countries or states.
3. Centre d'Etudes Prospectives et d'Informations Internationales (Institute for Research on the International Economy) data as generated and used by Head et al. (2010).

REFERENCES

Afesorgbor, S.K. and Van Bergeijk, P.A.G. (2011), Multi-membership and the Effectiveness of Regional Trade Agreements in Western and Southern SSA: A Comparative Study of ECOWAS and SADC, The Hague: Institute of Social Studies *ISS Working Paper Series vol. 520*.

Aitken, N.D. (1973), The Effect of the EEC and EFTA on European Trade: A Temporal Cross-Section Analysis, *American Economic Review*, 5, 881–92.

Amemiya, T. and MaCurdy, T.E. (1986), Instrumental Variables Estimation of an Error Components Model, *Econometrica*, 54 (4), 869–80.

Baier, S.L. and Bergstrand, J.H. (2004), Economic Determinants of Free Trade Agreements, *Journal of International Economics*, 64 (1), 29–63.

Baier, S.L. and Bergstrand, J.H. (2005), Do Free Trade Agreements Actually Increase Members' International Trade?, *Federal Reserve Bank of Atlanta Working Paper No. 2005-3*.

Baier, S.L. and Bergstrand, J.H. (2007), Do Free Trade Agreements Actually Increase Members' International Trade?, *Journal of International Economics*, 71 (1), 72–95.

Bergstrand, J. (1985), The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence, *Review of Economics and Statistics*, 67 (4), 474–81.

Brada, J.C. and Mendez, J.A. (1985), Economic Integration among Developed, Developing and Centrally Planned Economies: A Comparative Analysis, *Review of Economics and Statistics*, 67 (4), 549–56.

Brun, J.F., Carrere, C., Guillaumont, P. and De Melo, J. (2005), Has Distance Died? Evidence from a Panel Gravity Model, *World Bank Economic Review*, 19 (1), 99–120.

Burger, M., Van Oort, F.V. and Linders, G.J. (2009), On the Specification of the Gravity Model of Trade: Zeros, Excess Zeros and Zero-Inflated Estimation, *Spatial Economic Analysis*, 4 (2), 167–90.

Carrere, C. (2004), African Regional Economics: Impact on Trade with or without Currency Unions, *Journal of African Economies*, 13 (2), 199–239.

Cernat, L. (2001), Assessing Regional Trade Arrangements: Are South to South RTAs more Trade Diverting?, *Policy Issues in International Trade and Commodities Study Series No. 16*, Geneva: UNCTAD.

Chen, N.A. (2002), Intra-national versus International Trade in the European Union: Why Do National Borders Matter?, *CEPR Discussion Paper No. 3402*, London.

Coulibaly, S. (2007), Evaluating the Trade Effect of Developing Regional Trade Agreements: A Semi-Parametric Approach, *World Bank Working Paper No. WPS 4220*, Washington, DC.

Crawford, J. and Fiorentino, R.V. (2005), The Changing Landscape of Regional Trade Agreements, *World Trade Organisation Discussion Paper No. 8*, Geneva.

Deme, M. (1995), The Impact of ECOWAS on Intraregional Trade Flows: An Empirical Investigation, *The Review of Black Political Economy*, Winter, 113–29.

EAC (2008), *Trade Report 2007*, Arusha, Tanzania: East African Community.

ECA (2004), *Assessing Regional Integration in Africa*, Addis Ababa: Economic Commission for Africa.

Egger, P. (2000), A Note on the Proper Econometric Specification of the Gravity Equation, *Economics Letters*, 66 (1), 25–31.

Egger, P. (2002), An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials, *The World Economy*, 25 (2), 297–312.

Egger, P. and Pfaffermayr, M. (2003), The Proper Panel Econometric Specification of the Gravity Equation: A Three-way Model with Bilateral Interaction Effects, *Empirical Economics*, 28 (3), 571–80.

Egger, P. and Pfaffermayr, M. (2004), Distance, Trade and FDI: A Hausman–Taylor SUR Approach, *Journal of Applied Econometrics*, 19 (2), 227–46.

Elbadawi, I. (1997), The Impact of Regional Trade and Monetary Schemes on Intra-Sub-Saharan Africa Trade, in A. Oyejide, I. Elbadawi and P. Collier (eds), *Regional Integration and Trade Liberalization in Sub-Saharan Africa Volume 1*, London: Macmillan Press, pp. 210–55.

Frankel, J. (1997), *Regional Trading Blocs in the World Economic System*, Washington, DC: Institute for International Economics.

Frankel, J.A., Stein, E. and Wei, S. (1995), Trading Blocs and the Americas: The Natural, the Unnatural, and the Super-Natural, *Journal of Development Economics*, 47 (1), 61–95.
Frankel, J.A., Stein, E. and Wei, S. (1996), Regional Trade Agreements: Natural or Super-Natural, *NBER Working Paper No. 5431*, Cambridge, MA.
Frankel, J.A., Stein, E. and Wei, S. (1997), Extension of Empirical Analysis, in J. Frankel (ed.), *Regional Trading Blocs in the World Trading System*, Washington, DC: Institute for International Economics.
Frankel, J.A., Stein, E. and Wei, S. (1998), Continental Trading Blocs: Are They Natural or Supernatural?, in J.A. Frankel (ed.), *The Regionalization of the World Economy*, Chicago: University of Chicago Press, pp. 91–113.
Ghosh, S. and Yamarik, S. (2004), Are Preferential Trade Agreements Trade Creating? An Application of Extreme Bounds Analysis, *Journal of International Economics*, 63, 369–95.
Gunning, J. (2001), Trade Blocs: Relevant for Africa?, *Journal of African Economies*, 10 (3), 311–35.
Harrigan, J. (1993), OECD Imports and Trade Barriers in 1983, *Journal of International Economics*, 34 (1–2), 91–111.
Hausman, J.A. and Taylor, W.E. (1981), Panel Data and Unobservable Individual Effects, *Econometrica*, 49 (6), 1377–98.
Head, K. and Mayer, T. (2000), Non-Europe: The Magnitude and Causes of Market Fragmentation in the EU, *Weltwirtschaftliches Archiv*, 136 (2), 285–314.
Head, K., Mayer, T. and Ries, J. (2010), The Erosion of Colonial Trade Linkages after Independence, *Journal of International Economics*, 81 (1), 1–14.
Johnson, O.E.G. (1995), Regional Integration in Sub-Saharan Africa, *Journal of European Integration*, 18 (2/3), 201–34.
Krugman, P. (1991), *Geography and Trade*, Cambridge, MA: MIT Press.
Lee, J. and Swagel, P. (1997), Trade Barriers and Trade Flows across Countries and Industries, *Review of Economics and Statistics*, 19 (3), 372–82.
Lyakurwa, W., McKay, A., Ng'eno, N. and Kennes, W. (1997), Regional Integration in Sub-Saharan Africa: A Review of Experiences and Issues, in A. Oyejide, I. Elbadawi and P. Collier (eds), *Regional Integration and Trade Liberalization in Sub-Saharan Africa Volume 1*, London: Macmillan Press, pp. 159–209.
Morrissey, O. (ed.) (2011), *Assessing Prospective Trade Policy: Methods Applied to EU-ACP Economic Partnership Agreements*, London: Routledge.
Tinbergen, J. (1962), An Analysis of World Trade Flows, in J. Tinbergen (ed.), *Shaping the World Economy*, New York: Twentieth Century Fund.
Trefler, D. (1993), Trade Liberalisation and the Theory of Endogenous Protection: An Econometric Study of U.S. Import Policy, *Journal of Political Economy*, 101 (1), 138–60.
Viner, J. (1950), *The Customs Union Issue*, New York: Carnegie Endowment for International Peace.
Wonnacott, P. and Lutz, M. (1989), Is There a Case for Free Trade Areas?, in J.J. Schott (ed.), *Free Trade Areas and US Trade Policy*, Washington, DC: Institute for International Economics, AEI Press, pp. 59–84.
Yang, Y. and Gupta, S. (2005), Regional Trade Arrangements in Africa: Past Performance and the Way Forward, *IMF Working Paper No. 05/36*, Washington, DC: IMF.

APPENDIX 11A DEFINITIONS OF RTA DUMMY VARIABLES

SSA-EU PTA *ijt*: Dummy = 1 if *i* is a SSA country and *j* is a member of the European Union (EU), and at time *t* are in a PTA and therefore *i* enjoys preferential access to *j*, 0 if otherwise.

EU to SSA *ijt*: Dummy = 1 if *i* is a member of the European Union (EU) and *j* is a SSA country within the EU-PTA but since the PTA is non-reciprocal *i* does not enjoy preferential access to *j*, 0 if otherwise.

Non-EU to SSA *ijt*: Dummy = 1 if *i* is a European country and *j* is a SSA country but at time *t* the exporting European country *i* did not belong to the EU, 0 if otherwise.

NO RTA *ijt*: Dummy = 1 if *i* and *j* are SSA countries but at time *t* did not belong to the same RTA, 0 if otherwise.

ECOWAS RTA *ijt*: Dummy = 1 if *i* and *j* are both members of the ECOWAS RTA at time *t*, 0 if otherwise.

SADC RTA *ijt*: Dummy = 1 if *i* and *j* are both members of the SADC RTA at time *t*, 0 if otherwise.

EAC RTA *ijt*: Dummy = 1 if *i* and *j* are both members of the EAC RTA at time *t*, 0 if otherwise.

ECCAS RTA *ijt*: Dummy = 1 if *i* and *j* are both members of the ECCAS RTA at time *t*, 0 if otherwise.

IGADD RTA *ijt*: Dummy = 1 if *i* and *j* are both members of the IGADD RTA at time *t*, 0 if otherwise.

Table 11A.1 Hausman specification test (EU-SSA PTA)

	Coefficients		Difference	Standard Errors
	Fixed Effects	Random Effects		
	(b)	(B)	(b−B)	Sprt(diag(Vb−V_B))
Log of GDP_{it}	0.8581170	0.8390221	0.0190949	0.0130259
Log of GDP_{jt}	0.5845815	0.6966238	−0.1120423	0.0115290
Common $currency_{ijt}$	0.8036591	0.7840661	0.0195929	
$Remoteness_{ijt}$	0.2515513	0.1964484	0.0551029	0.0229279
SSA-EU PTA_{ijt}	0.1435094	0.1504180	−0.00690870	0.00434580
EU-SSA_{ijt}	0.4129647	0.4306912	−0.0177265	0.00355300

b = consistent under H_0 and H_a; obtained from xtreg
B = inconsistent under H_a, efficient under H_0; obtained from xtreg
Test: H_0: difference in coefficients not systematic
$Chi^2(52) = (b - B)'[(Vb - VB)^{-1}](b - B) = 874.95$***
Therefore (Vb − VB) is not positive definite

Table 11A.2 Hausman specification test (SSA RTAs)

	Coefficients		Difference	Standard Errors
	Fixed Effects	Random Effects		
	(b)	(B)	(b−B)	Sprt(diag(Vb−V_B))
Log of GDP_{it}	0.4378570	0.4351746	0.0026824	0.0295054
Log of GDP_{jt}	0.0994362	0.1149450	−0.0155088	0.0277369
Common $currency_{ijt}$	0.3462007	0.3656664	−0.0194657	0.0258597
$Remoteness_{ijt}$	0.3063363	0.5463640	−0.2400278	0.0458166
$ECOWAS_{ijt}$	0.4796592	0.4981975	−0.0185383	0.0190739
EAC_{ijt}	0.0325111	0.0934482	−0.0609371	0.0147411
$SADC_{ijt}$	0.7327090	0.8005959	−0.0678868	0.0224084
$ECCAS_{ijt}$	−0.2010432	−0.1821071	−0.0189361	0.0199964
$IGADD_{ijt}$	−0.4838700	−0.3566104	−0.1272596	0.0451953

b = consistent under H_0 and H_a; obtained from xtreg
B = inconsistent under H_a, efficient under H_0; obtained from xtreg
Test: H_0: difference in coefficients not systematic
$Chi^2(55) = (b - B)'[(Vb - VB)^{-1}](b - B) = 503.55$***
Therefore (Vb − VB) is not positive definite