

Impact of Currency Union on Trade: Comparative Analysis of EMU and SACU - Gravity Model Approach

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Abstract *This study uses the augmented gravity model to establish the impact of two different currency unions namely SACU and EMU on bilateral trade. These countries are 5 members SACU and 11 members of EMU. We used the most recent data for 16 countries collected over 15 years spanning between the years 2000 to 2014. The periods under study were divided into two and this are short run period (2000-2003) and the long run period (2000-2014). This study tries to investigate whether EMU and SACU leads to trade creation or diversion in the short run and in the long run. Secondly it tries to investigate whether bilateral trade between EMU and SACU leads to trade creation in the short run and in the long run and thirdly it tries to investigate whether the impact of EMU and SACU on trade produce consistent results. The results of comparative analysis showed that the effect of EMU and SACU on Trade produced consistent results both in the short run and in the long run.*

Key words SACU, EMU, fixed effect, random effect, parametric, currency union

JEL Codes: E24, E420, E520, F1, F4

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1. Introduction

The evolution of currency union and replacement of national currencies with single currencies have brought about benefits and costs to countries that adopted a single currency after giving up the sole authority over their own monetary autonomy. First there are benefits and costs associated with a currency union and these depend on the structural characteristics of currency union countries. The costs associated with currency union rests upon the loss in economic monetary authority after adoption of a common currency. In addition, the benefits of a currency union are associated with increased efficiency in bilateral trade, lower transactional costs associated with volatility of currency to exchange rate fluctuations which becomes a trade barrier thereby reducing exchange of goods and services across borders. Therefore formation of a currency union reduces the costs associated with individual country currency and it increases intra-union trade and fostering economic integration. The main objective of forming a currency union is to gain from bilateral trade and to reduce the transactional costs. Several studies have registered mixed reactions concerning the formation of a currency union among them Rose (2000) who postulated that countries in a currency union records almost triple in trade volumes between the member countries while other researches done by Persson, (2001) and others challenged the findings of Rose by arguing that the findings were over rated and at the same time pointing out that the explanatory variables used by Rose might have suffered from the problem of non-linearity and sample size. Another problem pointed out was the analytical technique in which Rose relied. Many countries are more concerned with the loss of autonomy over the management of their own currency and this is clear with the members of SACU who are still maintaining the monetary authority of their currency while using South African Rand as currency for their currency union. With respect to this, Frankel and Rose (2002) postulated that countries wishing to join a currency should not be concerned with their loss of monetary independence rather the net benefits of currency unions outweighs the costs.

Although Euro was introduced 1999 as a common currency for the first eleven members of EMU, SACU is the oldest currency union which was established in 1893 as Customs Union Convention (CUC) for use in Botswana Lesotho, two British territories of Southern Africa. Later in 1903 Swaziland became a member and thereafter it went through series of renegotiation then while South Africa became a member in 1910 with Namibia joining in 1990 after attaining independence. Currently there are still five members of SACU. Despite the benefits gained from intra-union among SACU members they also deposit their revenues from excise and custom duties to a common pool which is shared according to revenue sharing formula developed through agreements with the member countries. These revenues makes up to thirds of fiscal revenues in Namibia and three –quarters of revenues for Swaziland. This shows that in addition to bilateral trade, SACU members gains from pooled revenues collected across countries in SACU and this accounts to substantial government revenues for members in SACU. EMU on the other hand formed in 1999 for both economic and political integration has realized tremendous gains from formation of a currency union both in terms of huge trade volumes among EMU members and non-member countries but it has also fostered regional integration among many European member countries that joined EMU

after 1999. Currently there are 19 members of EMU with Lithuania being the 19th member having joined EMU in 2015. Formation of EMU was expected to not only stimulate trade but it was also expected to promote free movement of capital across EU at the same time becoming a unifying symbol. This paper focuses on the use of augmented gravity model to solve three specific objectives namely; first to investigate whether EMU and SACU leads to trade creation or diversion. Secondly it tries to investigate whether bilateral trade between EMU and SACU leads to trade creation in the short run and in the long run and thirdly it tries to investigate whether the impact of EMU and SACU on trade produce consistent results. The aim of the third objective is to examine on whether the type of currency union adopted matter by comparing the results of the impact of EMU and SACU on trade. This is done through comparative analysis in order to examine whether the impacts of the two currency unions on bilateral trade produce consistent results. The Study therefore focuses on two periods, the short run covering years 2000-2003 and long run covering years 2000-2015. In addition the study uses panel data which is analyzed by use of different estimation techniques which include; first the use parametric technique, which makes such non varying variables to act as explanatory variables. Thirdly we shall conduct a Breusch Pagan Multiplier test to find a more the suitable estimation technique between random effect estimation and that of parametric estimation and lastly we will conduct a Hausman test to distinguish between the random effect and fixed effect estimation technique to achieve plausible results.

2. Literature review

2.1. Theoretical literature

The Formation of a currency union to create trade relies much on the strength of the membership rather than just the union Masson, (2007). Masson further postulated that for more trade benefits to be realized the currency union formed should internalize so much on high levels of trade rather than dwelling on the natural level of trade as predicted by the gravity model where the causal effect of currency union on bilateral trade is comparatively low. In addition to the membership and the areas of interest, the currency in use depends on the state of the central bank's independence and its objectives. Consequently the performance and properties of the currency depend on the priorities of the states in currency union and their financial needs. In addition, Ezekwesili (2011) found out that the net effect of a currency union relies on other factors such as the stability of the currency in use. In his findings, the net effect of WAEMU on intra-regional trade declined overtime and for this he attributed it to the depreciation of CFA Franc which might have boosted trade after 1994 but later declined over time. He further found out that stringent rules for monetary and fiscal discipline should ensure that countries joining the currency union do not affect the stability of the universal currency in use and this will reduce the shocks thereby stimulating trade. In addition, to stimulating trade Frankel and Rose (2000) found out that countries forming a currency union should be natural trading partners by virtue of country size, proximity and other linkages. They further found out that in spite of expanding bilateral trade countries in currency union gains from increasing per capita incomes.

The study by Wang *et al.* (2007) on the common monetary area of Southern Africa CMA using time series data spanning 1980-2005 confirmed that external shocks among other numerous country specific challenges affect the integration of the CMA countries. Such shocks which are inevitable for any country was not a major concern but how CMA responded mattered. While South Africa responded by adopting a flexible exchange rate regime other CMA members did not benefit from this and more so they suffered from fiscal deficits which were financed by domestic borrowings thereby lowering their reserves for international currencies. This hampered bilateral trade between EMU members considering that South Africa is the greatest beneficiary of EMU due to its industrial strength compared to other EMU members. In addition to maintaining a currency union, Wang *et al.* (2007) pointed out that the benefits of forming a currency union should steer economic growth and development between member countries but this is hampered by external shocks facing each country in a currency union especially to those countries which still maintains their own currencies. In line with that and to ensure stable economic benefits of trade by the currency union, currency union members are required to strengthen competitiveness through prudent fiscal and monetary policy and to align structural reforms towards a sustainable level.

According to their findings, Frankel and Rose (2002) found out that if Poland joined EMU, it could realize an increase in per capita income by a fifth. Further findings showed that even though currency union stimulates trade and economic development, other factors should be considered before countries joints a currency union. These include the scale of the economy either in terms of the size and other economic benefits. Different studies on the effect of currency union on bilateral trade have generated a heated debate on the suitability of the results produced by different methodologies used by researchers. To bridge this Kenen (2002) conducted an empirical analysis in order to produce conclusive findings on the gravity model approach used by Rose, (2000). Kenen (2002) concluded that the use of gravity model is more suitable method because it takes care of the parameters that affect bilateral trade. Persson (2001) conclusion was deemed to contain anomaly because he relied on testing the strength the effects of currency union by comparing the averages of trade

flows instead of using gravity model with a currency union dummy. The basis of forming a currency union was pegged on the objective of fostering bilateral trade of the countries joining the currency union but over time Rose.

2.2. Empirical literature

The findings of Masson (2007) in his research on the suitability of African countries to form a currency union found out that despite of doubling trade, asymmetries across trading countries would make regional currencies less desirable to some countries. In the study to find whether currency union stimulates trade Glick and Rose (2001) used a large panel data for bilateral trade of over 200 countries. Controlling for the currency unions and other influences that could affect trade through the gravity model; they found out that pair of countries which joined currency union in this period experienced a doubling trade while those which exited experienced a halved bilateral trade. Glick and Rose (2001) fixed effects estimates were not only consistent and statistically significant but it also drew a conclusion that countries which joined the currency union experienced 90% growth in bilateral trade. This gives an almost double growth in trade. In the study of Emu and its capability of boosting international trade Rose, (1999) in his findings postulated that EMU led to expansion of trade within Europe and that the rise in trade was enormous to an extent that it tripled. While Feldstein, (1997) postulated that using one currency over country specific currencies reduced transaction costs within the group of countries in a currency union stimulating trade.

Other studies on currency union on bilateral trade in West Africa Economic and Monetary Union –WAEMU Ezekwesili, (2011) using panel data spanning the year 1994 to 2006 for a period of 16 years and controlling for trade factors found out that trade increased three times between the members of Economic community of West Africa States (ECOWAS) which is more similar to that of Rose (2000) who found out that countries sharing a common currency traded three times more than the countries with their own currencies. Using similar data as Rose (2000), Persson (2001) found out that countries in a currency union experienced 40% increase in trade. Using panel data set that included samples of industrial countries in EMU and their bilateral trade data, Micco *et al.* (2003) found out that countries in EMU realized a significantly positive impact on trade and most significantly there was no trade diversion. During his study which covered the first four years after the establishment of EMU they found out that the impact of trade by shared EMU members range between (5%-10%) in comparison with a net effect range of between (9%-20%) with all other country pairs of non EMU countries and this concludes that formation of EMU did not only lead to trade creation between the EMU members alone but it also led to bilateral trade expansion with other non EMU members.

In their study of the impact of EMU on Eurozone Aristovnik and Matevz (2009) found out that the net effect of EMU on Eurozone trade rose from 10 to 15 % on average and this effect grew rapidly in 1999 more than the anticipated gradual growth. Consequently, Talvas, (2008) found out that trade shares between SACU members increased by 50% due to the adoption of CMA. The increased intra-union trade among SACU members prompted the urge by SADC members to join SACU by 2018 although Talvas (2008) found out that SADC had provided little supporting evidence of the costs and benefits of SACU together with factor mobility among the members of SADC together with the rationale that supports convergence of SADC into a single currency union with SACU.

3. Methodology of research

3.1. Gravity Model

The use of gravity model in researches to find the reason behind bilateral trade creation and diversion has shaped the way economists define international trade. In reference to this model bilateral trade between two countries are explained by their economic volumes of their Gross national products (GDP), their geographic distances between the trading partners, population, the product of their land areas and a set of dummy variables representing some institutional characteristics and related country-country characteristics. Initially the study of trade was faced by various challenges of model misspecification and Anderson, (1979) begun by deriving gravity equation through product differentiation approach. However Helpman and Krugman (1985) modeled this using framework that differentiated products with increasing returns in order to justify gravity model. The development of gravity model is traced back to the Newton's law of universal gravitation which stated that gravitational force was given as:

$$F_{ij} = g \cdot \frac{(M_{ij})^{\beta_0} \cdot (M_j)^{\beta_1}}{(D_{ij})^2} \quad (1)$$

They incorporated the use of national income, the geographical distances between the trading partners, population, the product of their land areas and a set of dummy variables which represented a set of some institutional characteristics and

related country-country characteristics. The increase in distance resulted in rising transportation cost of goods from one country and another in trade.

$$\log(\text{Trade}_{ijt}) = A + \beta_0 \log(Y_{it}) + \beta_1 \log(Y_{jt}) - \beta_3 \log(D_{ij}) + \varepsilon_{ijt} \quad (2)$$

In the generated linear model, A is the constant term. β_0 , β_1 and β_2 are the coefficients under estimation and ε is the disturbance term (error term) which takes into account other exogenous variables that affects trade between the countries but is not included in the model. The estimated linear model above shows that Volume of trade is directly proportional to national income of two trading countries and inversely proportional to distances between them. Hence, the more the distance between trading partners, the less the volume of trade between them.

The Gravity Equation

In this research we adopt the gravity equation used by Rose, (2000) on the effect of common currency on mutual trade links between countries. The gravity model used by Rose (2000) is given as:

$$\ln(H_{ijt}) = \beta_0 + \beta_1 \ln(Y_{it}Y_{jt}) + \beta_2 \ln(D_{ij}) + \beta_3(\text{MU}_{ij}) + \beta_4(X_{ij}^4) + \dots \beta_n(X_{ij}^n) + \varepsilon_{ij} \quad (3)$$

The variables X_{ij}^4 to X_{ij}^n represent other exogenous variables that may affect the trade between the two countries.

In this study, we modify the Rose (2000) gravity equation (4) to suit our objectives of the study. To satisfy the assumption of linearity of parameters we use a log functional form.

$$\ln(\text{Trade}_{ijt}) = \beta_0 + \beta_1 \ln(\text{GDP}_{it}) + \beta_2 \ln(\text{GDP}_{jt}) + \beta_3(\text{Common_Language}_{ij}) + \beta_4(\text{Boarder}_{ij}) + \beta_5(\text{Landlocked}_{ij}) + \beta_6 \ln(\text{Distance}_{ij}) + \beta_7 \ln(\text{Product_of_landarea}_{ij}) + \beta_8 \text{EMU}_{ijt} + \beta_9 \text{SACU}_{ijt} + \beta_{10} \text{CUC}_{ijt} + \varepsilon_{ij} \quad (4)$$

Short Run Effect of EMU and SACU on trade

Table A1. Model Selection test: Parametric Vs. Random

Test type	EMU	SACU
Breusch Pagan (LM) test	$X^2(01) = 0.00$	$X^2(01) = 0.00$
	P = 1.0000	P = 1.0000
Sign.level 1%, 5%, 10%	Insignificant at any level	Insignificant at any level
Decision	For H_0	For H_0

Where: H_0 : Parametric estimator is consistent

H_1 : Random effect estimator is consistent

The LM test shows that the individual effects are correlated with the regressors hence we fail to reject null. Hence the variances across entities are zero hence no random effects. Therefore the Parametric estimator is consistent for EMU and SACU in the short run.

Table A2. Model Selection test: Random Vs. Fixed

Test type	EMU	SACU
Hausman test	$X^2(7) = 1.84$	$X^2(7) = 1.95$
	P = 0.9682	P = 0.9625
Sign.level 1%, 5%, 10%	Insignificant at any level	Insignificant at any level
Decision	For H_0	For H_0

Where: H_0 : Random effect estimator is consistent

H_1 : Fixed effect estimator is consistent

Therefore Random estimator is consistent for EMU and SACU in the short run because we fail to reject null in both.

Model Selection

The Hausman tests for the null hypothesis are that the variances across entities are not equal to zero and that the individual specific effects are uncorrelated with the regressors. According to Hausman test we fail to reject null hypothesis. Therefore random effect estimator holds according to Hausman test. However, the Breusch Pagan (LM) test failed to hold for random effect estimation technique hence we can conclude that the estimates for parametric technique are significant

and more suitable for both EMU and SACU. Therefore this study will use parametric technique to establish whether EMU and SACU leads to trade creation or trade diversion in the short run.

Short Run Effect of EMU and SACU on trade

This covers the period 2000 through 2003. Since EMU was established on 1st January, 1999 using data for the year 2000 to 2003 to establish the short run effects of EMU on trade is desirable. Even though SACU was established in 1910, selection of these periods for the short run effect is also desirable because it the same period that SACU and EMU traded.

Parametric Technique

The Hausman test and Breusch Pagan LM test found that the parametric technique is the most desirable estimation method since random effect and fixed effect techniques failed to hold because they were highly insignificant at any level.

Table 1.Short Run

Variable	EMU Coefficient	SACU Coefficient
lnpgdpexp	2.129*** (0.227)	2.116*** (0.245)
lnpgdpimp	2.129*** (0.227)	2.115*** (0.245)
border	1.563*** (0.204)	1.083*** (0.233)
landlocked	-1.919*** (0.138)	-1.941*** (0.138)
Indistance	-2.425*** (0.266)	-3.841*** (0.380)
lnprdtlnndarea	1.213*** (0.085)	1.297*** (0.096)
emu	1.266*** (0.402)	
sacu		-1.469** (0.629)
Constant	-2.826* (1.676)	2.073 (2.822)
Observations	954	954
Adjusted R ²	0.816	0.816

From the above results the variables for exporter Per capita GDP, importer Per capita GDP, shared border, dummy variable for landlocked, distance between countries and product of land areas for both EMU and SACU were highly significant at 1% level. In addition currency union variables of EMU and SACU are highly significant at 1% and 5% respectively. To establish whether EMU and SACU leads to trade creation and diversion, we focus on the significance effect of their coefficients. From our analysis, the coefficient of EMU shows a significantly positive effect of 1.266. This implies that countries that joined EMU experienced three times increase in trade volumes ($e^{(1.266)} = 3.55$). This shows that between the years 2000 to 2004, countries in EMU experienced 255% increase in trade volumes between its member countries. Therefore this shows that the formation of EMU led to trade creation in the short run. In addition, the coefficient of SACU from our analysis shows a significantly negative effect of -1.469. This shows that countries in SACU experienced 77%, ($e^{(-1.469)} = 0.23$) decline in trade volume for the periods 2000 to 2003. This therefore shows that the net effect of SACU on trade was negative leading to a trade diversion.

Long Run Effect of EMU and SACU on trade

Table A3. Model Selection test: Parametric Vs. Random

Test type	EMU	SACU
Breusch Pagan (LM) test	$X^2(01) = 0.00$	$X^2(01) = 0.00$
	P = 1.0000	P = 1.0000
Sign.level 1%, 5%, 10%	Insignificant at any level	Insignificant at any level
Decision	For H ₀	For H ₀

Where: H₀: Parametric estimator is consistent

H₁: Random effect estimator is consistent

The Breusch Pagan test failed to reject null for both currency unions therefore parametric estimator is consistent for both EMU and SACU in the long run.

Table A4. Model Selection test: Fixed Vs. Random

Test type	EMU	SACU
Hausman test	$X^2(8) = 45.08$	$X^2(8) = 43.23$
	$P = 0.0000$	$P = 0.0000$
Sign.level 1%, 5%, 10%	significant at any level	significant at any level
Decision	For H_1	For H_1

Where: H_0 : Random effect estimator is consistent

H_1 : Fixed effect estimator is consistent

The Hausman test shows that the individual specific effects are correlated with the regressors hence the null hypothesis is rejected for both currency unions and therefore fixed effect estimator is consistent for both EMU and SACU in the long run. In these tests, we can conclude that the fixed effect estimation technique is significant and therefore more suitable for both EMU and SACU. The Breusch Pagan (LM) test failed to reject null and proved that parametric estimation is more suitable. However, the Hausman test rejected null proving that fixed effect estimation technique is more suitable.

Model Selection

To choose between fixed effect estimation technique and parametric technique, we follow Cameron and Trivedi (2009) Microeconometrics who argued that fixed effect estimation is more suitable than parametric estimation because fixed effects captures the effects of important variables in the model. Therefore this study will use fixed effect estimation technique to establish whether EMU and SACU leads to trade creation or diversion in the long run.

Long Run Effect of EMU and SACU on trade

The long run period covers the year 2000 through 2014 a total of 15 years. Both the fixed effect and parametric technique are viable but we shall use the fixed effect technique to control for the endogeneity and also to that the analysis will be in line with Cameron and Trivedi (2009) Microeconometrics that the fixed effect estimation is more suitable and desirable than parametric estimation because fixed effects captures the effects of important variables in the model.

Fixed effect estimation Technique

The Hausman test found that the individual specific effects are correlated with the regressors hence the assumption that the variances across entities are equal to zero. This makes fixed effect estimation technique more desirable and consistent for both EMU and SACU in the long run.

Estimation Technique: Short Run: Fixed effect

Table 2. Long Run

Variable	EMU Coefficient	SACU Coefficient
lnpgdpexp	2.080*** (0.105)	2.041*** (0.114)
lnpgdpimp	2.079*** (0.105)	2.040*** (0.114)
language	0.286*** (0.099)	0.256*** (0.098)
border	1.133*** (0.138)	0.684*** (0.138)
landlocked	-2.138*** (0.090)	-2.157*** (0.090)
Indistance	-2.737*** (0.175)	-4.097*** (0.164)
lnprdtIndarea	1.183*** (0.046)	1.263*** (0.051)
emu	1.187*** (0.230)	

Variable	EMU Coefficient	SACU Coefficient
sacu		-1.426*** (0.292)
Constant	-0.624 (0.918)	4.303*** (1.324)
Observations	3546	3546
Adjusted R ²	0.786	0.786

The results of the fixed effect estimation techniques shows that the variables for exporter Per capita GDP, importer Per capita GDP, common language, shared border, dummy variable for landlocked, distance between countries and product of land areas for both EMU and SACU are highly significant at 1% level. To establish whether EMU and SACU leads to trade creation and diversion in the long run, we draw our attention to the significance level and net effect of their coefficients. From our analysis, the coefficient of EMU shows a significantly positive effect of 1.187. This implies that countries that joined EMU experienced three times increase in trade volumes ($e^{(1.187)} = 3.28$). This shows that between the years 2000 to 2014, countries in EMU experienced 228% increase in trade volumes between its member countries. Therefore this shows that the formation of EMU led to trade creation in the long run. Consequently, the coefficient of SACU from our analysis shows a significantly negative effect of -1.426. This shows that countries in SACU experienced 76%, ($e^{(-1.426)} = 0.24$) decline in trade volume in the period 2000 to 2003. This therefore shows that the net effect of SACU on trade was negative leading to a trade diversion in the long run.

3.2. Effects of bilateral trade between SACU and EMU on Trade

3.2.1. Short Run and Long Run Effects

In this section we shall represent the bilateral trade between countries in EMU and SACU as trade between one Currency union and another Currency union (CUC). This refers to volume of trade between two currency union countries (inter-union trade). In our analysis we shall use a dummy variable to ensure that we capture only bilateral trade between SACU and EMU and we omit intra-union trade. This will assist in establishing whether inter-union trade between SACU and EMU leads to trade creation or diversion in the short run and in the long run. Therefore this will help answer the second objective of the study.

Table B1. Model Selection test: Parametric Vs. Random

Test type	CUC	
	Short Run	Long Run
Breusch Pagan (LM) test	$X^2(01) = 0.00$ P = 1.0000	$X^2(01) = 0.00$ P = 1.0000
Sign.level 1%, 5%, 10%	Insignificant at any level	Insignificant at any level
Decision	For H ₀	For H ₀

Where: H₀: Parametric estimator is consistent

H₁: Random effect estimator is consistent

The Breusch Pagan test failed to reject null both in the short run and in the long run.

Table B2. Model Selection test: Fixed Vs. Random

Test type	CUC	
	Short Run	Long Run
Hausman test	$X^2(4) = 4.43$ P = 0.2183	$X^2(8) = 28.59$ P = 0.0004
Sign.level 1%, 5%, 10%	Insignificant at any level	significant at any level
Decision	For H ₀	For H ₁

Where: H₀: Random effect estimator is consistent

H₁: Fixed effect estimator is consistent

In the short run, we fail to reject null therefore random effect estimation technique is more suitable than fixed effect according to Hausman test. However, in the long run we reject null hypothesis and we accept alternative hypothesis that fixed effect estimation technique is consistent in the long run. Hence according to Hausman test random effect estimator is consistent in the short run and fixed effect estimator is consistent in the long run.

Model Selection in the Short Run

Choosing between random effect estimation and parametric estimation in the short run, Cameron and Trivedi (2009) Microeconometrics postulated that parametric estimation is more suitable than random effect. Therefore we shall use parametric technique to establish whether inter-union trade between SACU and EMU lead to trade creation or diversion in the short run.

Model Selection in the Long Run

In the long run, we follow Cameron and Trivedi (2009) Microeconometrics to choose between fixed effect estimation technique and parametric technique. Cameron and Trivedi (2009) argued that fixed effect estimation is more suitable than parametric estimation because fixed effects captures the effects of important parameters. Therefore this study will use fixed effect estimation technique to establish whether inter-union trade between EMU and SACU lead to trade creation or diversion.

Short Run and Long Run Effect of inter-union trade between EMU and SACU

Following the Breusch Pagan tests, Hausman test and being in line with Cameron and Trivedi (2009) Microeconometrics we therefore use parametric estimation technique to establish the impact of bilateral trade between EMU and SACU members in the short run. In addition we shall use the fixed effect technique in the long run because it is more suitable than parametric technique. The short run period covers a total of 4 years from the year 2000 through 2003 while the long run period covers a total of 15 years from the year 2000 through 2014.

Estimation Technique: Short Run: Parametric

Long Run: Fixed Effect

Table 3. CUC

Variable	Short Run Coefficient	Long Run Coefficient
Inrgdpexp	2.121*** (0.060)	2.076*** (0.034)
Inrgdpimp	2.121*** (0.060)	2.078*** (0.034)
language	0.759*** (0.115)	0.892*** (0.074)
border	0.700*** (0.206)	0.317*** (0.117)
landlocked	-0.794*** (0.091)	-1.034*** (0.073)
Indistance	-1.849*** (0.270)	-2.255*** (0.189)
InprdtIndarea	0.245*** (0.064)	0.242*** (0.036)
cuc	-0.921*** (0.216)	-0.811*** (0.161)
Constant	-23.858*** (1.450)	-21.185*** (0.920)
Observations	954	3546
Adjusted R ²	0.907	0.869

The results show that the coefficients of the parameters both in the short run and in the long run are all highly significant at 1% level. The direction effects of the coefficient are in line with the literature of gravity model. The variables for the exporter Percapita GDP, the importer Percapita GDP, common language, shared border and products of land areas are positive and that of landlocked and distance between countries are negative. The coefficient for the CUC is negative both in the short run and in the long run indicating decline in trade. To establish whether bilateral trade between EMU and SACU leads to trade creation and diversion in the long run we check for coefficient values of CUC.

In the short run the coefficient of CUC is negative; (-0.921) and it is highly significantly at 1% level. This implies that inter-union trade (trade between EMU and SACU) led to a 60% decline in trade in the short run ($e^{(-0.921)} = 0.398$). This shows that bilateral trade between EMU and SACU members led to trade diversion in the short run.

Consequently in the long run the coefficient of CUC is negative (-0.811) and it is highly significant at 1% level. This shows that bilateral trade between EMU and SACU members led to a decline in trade by 56% in the long run ($e^{-0.811} = 0.444$). However, the trade diversion declined by 4%, (60-56)%, in the long run. This indicates that bilateral trade between EMU and SACU slightly improved trade by a margin of 4% at the end of 2014. This figure is however small. Therefore, we can conclude that bilateral trade between EMU and SACU led to trade diversion both in the short run and in the long run. However, the diversion slightly (almost negligible) declined in the long run.

3.2.2. Effect of CUC on Trade: Augmented Gravity model with EMU and SACU

In this section we shall find the effect of CUC on both the bilateral trade between EMU and SACU at the same time finding the effect of EMU and SACU on trade. In this empirical analysis we use an augmented gravity model with EMU and SACU but every separate model is extended to include CUC. This is helpful in two ways; first it will assist us to establish the net effect of CUC on EMU and the net effect CUC on SACU. This will establish whether bilateral trade between EMU and SACU led to trade creation or diversion among EMU intra-union trade and SACU intra-union trade. This will assist in establishing whether bilateral trade between the two currency union countries affected the trade among individual members of similar currency union. This therefore tries to support the second objective.

Short Run Effects of CUC

Table C1. Model Selection test: Parametric Vs. Random

Test type	Short Run	
	CUC with EMU	CUC with SACU
Breusch Pagan (LM) test	$X^2(01) = 0.00$	$X^2(01) = 0.00$
	P = 1.0000	P = 1.0000
Sign.level 1%, 5%, 10%	Insignificant at any level	Insignificant at any level
Decision	For H_0	For H_0

Where: H_0 : Parametric estimator is consistent

H_1 : Random effect estimator is consistent

The Breusch Pagan test failed to reject null both for EMU and SACU in the short run. Therefore, parametric estimator is consistent in the short run for both EMU and SACU.

Table C2. Model Selection test: Fixed Vs. Random

Test type	Short Run	
	CUC with EMU	CUC with SACU
Hausman test	$X^2(8) = 2.47$	$X^2(8) = 2.47$
	P = 0.9633	P = 0.9633
Sign.level 1%, 5%, 10%	Insignificant at any level	Insignificant at any level
Decision	For H_0	For H_0

Where: H_0 : Random effect estimator is consistent

H_1 : Fixed effect estimator is consistent

The Hausman tests failed to reject null for both EMU and SACU in the short run. Therefore according to Hausman test random effect estimator is consistent for both EMU and SACU in the short run.

Model Selection in the Short Run

However, choosing between random effect estimation and parametric estimation in the short run, Cameron and Trivedi (2009) Microeconometrics postulated that parametric estimation is more suitable than random effect. Therefore we shall use estimates for parametric technique to establish whether CUC led to trade creation or trade diversion for both EMU and SACU in the short run.

Estimation Technique: Short Run: Parametric

Table 4. Short Run

Variable	CUC with EMU Coefficient	CUC with SACU Coefficient
lnpgdpexp	1.880*** (0.219)	1.880*** (0.219)

Variable	CUC with EMU	CUC with SACU
	Coefficient	Coefficient
lnpgdpimp	1.880*** (0.219)	1.880*** (0.219)
border	1.378*** (0.256)	1.378*** (0.256)
landlocked	-1.876*** (0.159)	-1.876*** (0.159)
Indistance	-3.073*** (0.422)	-3.073*** (0.422)
lnprdtIndarea	1.278*** (0.084)	1.278*** (0.084)
cuc	1.072** (0.517)	-1.005** (0.406)
emu	2.077*** (0.549)	
sacu		-2.077*** (0.549)
Constant	-0.034 (1.984)	2.043 (2.328)
Observations	954	954
Adjusted R ²	0.817	0.817

From the analysis, the coefficients of the parameters are all highly significant at 1% level. However CUC is significant at 5% level. The direction effects of the coefficients are in line with the literature of gravity model. The variable for language was dropped because it was insignificant at any level.

When CUC and EMU are regressed jointly in the augmented gravity model in the short run the coefficient of CUC is positive; (1.072) and is significantly at 5% level. This implies that bilateral trade between EMU and SACU increased by almost three times, ($e^{(1.072)} = 2.92$). This shows that with EMU, bilateral trade between EMU and SACU increased by 192% in the short run. Hence CUC leads to trade creation in EMU in the short run. When CUC and SACU are regressed jointly in the augmented gravity model in the short run the coefficient of CUC is negative; (-1.005) and is significantly at 5% level. This shows that bilateral trade between SACU and EMU reduced by a third ($e^{(-1.006)} = 0.366$). This implies that with SACU, bilateral trade between EMU and SACU declined in the short run. Hence CUC leads to trade diversion in SACU in the short run. This is further proven by a negatively highly significant coefficient of SACU (-2.077). This which shows that EMU experienced 87.4% ($e^{(-2.077)} = 1.25$) decline in trade in the short run. Therefore the net effect of CUC is that it stimulated trade volumes in EMU but it led to a decline in trade volumes in SACU. Hence EMU gained from CUC than SACU did from CUC.

Long Run Effects of CUC

Table C3. Model Selection test: Parametric Vs. Random

Test type	Long Run	
	CUC with EMU	CUC with SACU
Breusch Pagan (LM) test	$\chi^2(01) = 0.00$	$\chi^2(01) = 0.00$
	P = 1.0000	P = 1.0000
Sign.level 1%, 5%, 10%	Insignificant at any level	Insignificant at any level
Decision	For H ₀	For H ₀

Where: H₀: Parametric estimator is consistent

H₁: Random effect estimator is consistent

The Breusch Pagan test failed to reject null for both EMU and SACU in the Long run. Therefore according to Breusch Pagan test, parametric estimator is consistent in the long run.

Table C4. Model Selection test: Fixed Vs. Random

Test type	Long Run	
	EMU	SACU
Hausman test	$\chi^2 (9) = 46.20$	$\chi^2 (9) = 46.20$
	$P = 0.0000$	$P = 0.0000$
Sign.level 1%, 5%, 10%	significant at any level	significant at any level
Decision	For H_1	For H_1

Where: H_0 : Random effect estimator is consistent

H_1 : Fixed effect estimator is consistent

According to Hausman test, we reject null therefore fixed effect estimation technique is more suitable than random effect.

Model Selection

Consequently, fixed effect estimator is more suitable than parametric estimation in the long run, Cameron and Trivedi (2009) Microeconometrics because fixed effect estimation captures the effects of important variables in the model. Therefore this study will use fixed effect estimation technique to establish the impact of CUC on inter-union trade between EMU and SACU in order to find whether it lead to trade or not.

Estimation Technique: Long Run: Fixed Effect

Table 5. Long run

Variable	CUC with EMU	CUC with SACU
	Coefficient	Coefficient
lnpgdpexp	1.815*** (0.126)	1.815*** (0.126)
lnpgdpimp	1.814*** (0.126)	1.814*** (0.126)
language	0.378*** (0.102)	0.378*** (0.102)
border	0.916*** (0.149)	0.916*** (0.149)
landlocked	-2.079*** (0.091)	-2.079*** (0.091)
Indistance	-3.365*** (0.242)	-3.365*** (0.242)
lnprdtIndarea	1.264*** (0.051)	1.264*** (0.051)
cuc	1.126*** (0.300)	-0.970*** (0.236)
emu	2.096*** (0.334)	
sacu		-2.096*** (0.334)
Constant	1.984* (1.150)	4.080*** (1.323)
Observations	3546	3546
Adjusted R^2	0.787	0.787

Table 5 above shows that the coefficients of the parameters are highly significant at 1% level. The direction effects of the coefficients are in line with the literature of gravity model.

When CUC and EMU are jointly regressed in the augmented gravity model in the long run, the coefficients of EMU and CUC are positively significant at 1% level. This shows that they both stimulate trade. The coefficient of CUC is (1.126) implying that bilateral trade between EMU and SACU increased three times, ($e^{(-0.921)} = 3.08$) in the long run. This shows that bilateral trade from EMU to SACU increased by 208% in the long run. This shows that with EMU, bilateral trade between EMU and SACU increased by 208% in the short run. Hence CUC leads to trade creation in EMU in the long run.

This is further proven by a positively highly significant coefficient of EMU (2.096) which shows that EMU experienced eight times ($e^{(2.096)} = 8.31$) increase in trade in the long run. Consequently when CUC and SACU are jointly regressed in the

augmented gravity model, the coefficients of SACU and CUC are negative and highly significant at 1% level. This shows a decline in trade. The coefficient of CUC is (-0.970) implying that bilateral trade between SACU and EMU declined by 62%, ($e^{-0.970} = 0.379$) in the long run. In line with that the highly and negatively significant coefficient of SACU (-2.096) shows that SACU experienced 87.7% ($e^{-2.096} = 0.123$) decline in trade.

4. Results

4.1. Comparative analysis

To achieve the third objective of the study on whether the impacts of EMU and SACU on trade produce consistent results, we use the empirical result analysis obtained from objective one and two. In this section we will compare different results in order to establish the net effect of bilateral trade between EMU and SACU on the intra-union trade among SACU and EMU member countries. In addition we shall use the results of augmented¹ Gravity Model with EMU and SACU. This will guide policy makers when making decisions regarding the establishment of currency unions and to understand the differences in impacts of diverse currency unions on trade. Many studies have projected a positive effect of forming currency unions in order to stimulate trade but there exist special cases where the actual. In this section, we are trying to establish whether the effect of the two currency unions (EMU and SACU) on trade produce consistent results and depending on the findings of the comparative analysis we can give policy recommendations. This will assist countries willing to form currency unions to understand the other modalities that could hinder the achievement of a currency union.

Table 6. Comparative Analysis

		Effect on Trade			
		Technique	Short Run	Technique	Long Run
SACU		Parametric	-1.469** (0.629) Diversion	Fixed Effect	-1.426*** (0.292) Diversion
EMU		Parametric	1.266*** (0.402) Creation	Fixed Effect	1.187*** (0.230) Creation
CUC		Parametric	-0.921*** (0.216) Diversion	Fixed Effect	-0.811*** (0.161) Diversion
CUC with EMU	CUC	Parametric	1.072** (0.517) Creation	Fixed Effect	1.126*** (0.300) Creation
	EMU		2.077*** (0.549) Creation		2.096*** (0.334) Creation
CUC with SACU	CUC	Parametric	-1.005** (0.406) Diversion	Fixed Effect	-0.970*** (0.236) Diversion
	SACU		-2.077*** (0.549) Diversion		-2.096*** (0.334) Diversion
EMU with SACU	EMU	Parametric	1.005** (0.406) Creation	Fixed Effect	0.970*** (0.236) Creation
	SACU		-1.072** (0.517) Diversion		-1.126*** (0.300) Diversion

From table 6 above we can conclude all estimation techniques have produced consistent results. Secondly the effects of EMU and SACU on trade have produced consistent effects both in the short run and in the long run. Therefore from the comparative analysis above we can conclude that:

- 1) EMU leads to trade creation in the short run and in the long run

¹ Augmented Gravity Model with EMU and SACU results are presented in table 7 at the Appendix

- 2) SACU leads to trade diversion in the short run and in the long run
- 3) The effect of CUC on trade depends with the kind of currency union such that it leads to trade creation in EMU.
- 4) Formation of currency union stimulate trade both in the short run and in the long run

Therefore we can postulate that the net effect of currency union on trade depends not only on its formation but also the volumes of trade. Secondly we are still indifference on whether currency union countries should adopt one currency in order to stimulate trade because the two currency unions under study exhibit different characteristics in terms of economic development and the scale of the economy. These show that the volumes of trade, the currency to be adopted, the levels of economic development and the scale of the economy are the factors that countries.

5. Conclusions and prospects

In this study we use an augmented gravity model to establish the impact of two different currency unions namely SACU and EMU on bilateral trade. The analysis is divided into two periods namely short run spanning from the year 2000 through 2003 and long run spanning from the year 2000 to 2015. The study involves the use of panel data of 16 countries in EMU and SACU. In this study we try to solve three objectives namely: first to investigate whether EMU and SACU leads to trade creation or diversion in the short run and in the long run. Secondly it tries to investigate whether bilateral trade between EMU and SACU leads to trade creation in the short run and in the long run and thirdly it tries to investigate whether the impact of EMU and SACU on trade produce consistent results. The third objective is achieved through comparative analysis in order to examine whether the impacts of the two currency unions on bilateral trade produce. This will aid policy making especially for countries wishing to join a currency union in order to decide whether to form one common currency like in EMU or to adopt a currency of one of the member in the currency union while maintaining the autonomy of their specific independent currencies like in SACU. Different estimation techniques are used these include parametric technique, the fixed effects estimation technique and thirdly we use random effects estimation technique. Breusch Pagan Multiplier test and Hausman test will also be used to distinguish between the random effect, fixed effect estimation technique and parametric estimation.

5.1 Effect of EMU and SACU on Trade

In the short run, parametric technique proved to be more suitable than random and fixed effect estimation. However in our analysis it was found that the coefficients of SACU were negative and this showed that EMU led trade diversion in the short run. Further analysis in the long run found that the fixed effect estimation technique was more suitable because it takes care with the problems of endogeneity. In the long run, the results of the study showed that just like in the short run, EMU lead to trade creation while SACU lead to trade diversion. The two estimation techniques produced consistent effects of EMU and SACU both in the short run and in the long run. We therefore conclude that according to this study, the currency union of EMU has a positive and highly significant impact on trade leading to trade creation while the currency union of SACU has a negative but highly significant impact on trade which led to trade diversion.

5.2. Effects of bilateral trade between SACU and EMU on Trade

In the short run parametric estimation technique was more suitable than fixed effect estimation and random effect estimation. The coefficient of bilateral trade between EMU and SACU was negative and this showed that inter-union trade between EMU and SACU lead to trade diversion in the short run. Consequently in the long run using fixed effect estimation technique the coefficient of bilateral trade between EMU and SACU was negative which also indicated that inter-union trade between EMU and SACU lead to trade diversion in the long run. Secondly with the use of one currency across countries in a currency union, countries would gain more than adopting another country's currency while still maintaining their own currency.

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