International Journal of Applied Business and Economic Research
Volume 16, Number 1, 2018, ISSN : 0972-7302
available at http: www.serialsjournals.com

IS SOUTHERN AFRICAN CUSTOM UNION (SACU) AN OPTIMUM CURRENCY AREA?

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Abstract: The primary aim of this study was to investigate if SACU could be an optimum currency area and so to form a common currency on trade. This is to try to challenge the envisaged implementation of common currency on trade in SADC. SACU, as at the investigation of this study has shown, is already having a monetary union. There is already a high labour mobility and given the gravity model, distance between the members is no hindrance. A progress has been made in realizing macroeconomic convergence such as inflation stability. The results also show that SACU economies are open. There is already a mutual trade in SACU and looking also at cultural ties within the member states, is also very high.

Keywords: SACU, optimum currency area, Inflation, exchange rates.

1. INTRODUCTION

Optimum currency area, currency union, trade, opportunity cost, Pareto efficiency criterion, exchange rate volatility, exchange rates, gravity model, inflation, endogeneity, quantitative method methodology, macroeconomic convergence.

SACU, throughout its history, has been characterised by severe divergences in policies, levels of development, political systems, and administrative capacity. Notwithstanding those disparities it managed, through extremely fraught political circumstances, to maintain virtually free internal trade behind a high common external tariff, while allowing for large revenue payments to the smaller members. The unique political and economic objectives influenced the characteristics of the SACU. Indeed, those agreement reflected both the dominance of South Africa during its period of isolation, and the revenue concerns of the landlocked countries of Botswana, Lesotho and Swaziland (BLS) following their independence from the United Kingdom. South Africa accounts for more than 90 per cent of total SACU GDP and assumed absolute discretion over external trade policy.

The democratic transition in South Africa provided an opportunity to comprehensively re-negotiate the customs union. These negotiations re-opened long standing policy debates, including the extent of trade diversion in SACU and its impact on the development of the lesser-developed members. There was also some optimism that the changed political terrain might enable deeper economic cooperation and regional integration in SACU. But revenue issues remained of foremost concern, with all parties looking to stabilise future payments and receipts. Rapid changes within both the regional and multilateral environments posed new challenges for SACU that had to be reflected in the Agreement. These included the implementation of a free trade agreement within the Southern African Development Community (SADC), the negotiations for a reciprocal trade agreement with the European Union (EU), ongoing WTO negotiations and plans to conclude an FTA between SACU and the USA (Szeben 2004).

In respect to the above, SACU over the years has undergone a lot of metamorphosis in terms of multilateral and bilateral engagements and political uncertainty in other member states, but fortunately all

these upheavals did not pose serious instabilities of proportional magnitudes (Szeben 2004). It is on the basis of this that, this research is fascinated to investigate the feasibility of SACU if it can be an optimum currency area using the following statistical techniques: E-views and regression analysis. The study endeavors to find out if SACU can be an optimum currency area. If this can be achieved based on the investigation in this study then it will be feasible for SACU to have a single currency.

Common currency leads to economic growth as there is no need for floating exchange rates. Countries adopting a single currency within one bloc have an advantage of managing trade flows within the member states. The problem with SADC is that there is cross cutting memberships, Botswana in SADC and SACU, Lesotho in SADC and SACU, South Africa in SADC and SACU, Namibia in SADC and SACU, and Swaziland in SADC and SACU.

1. BACKGROUND TO THE STUDY

The research is not trying to find a recipe but to use tools and previous research on this topic to investigate if SACU is an optimum currency area. The traditional theory of optimum currency areas will be heavily drawn because it concentrates on the cost of forming a monetary union and the benefits but more importantly on optimum currency area for Southern African custom union (SACU). Southern African custom union (SACU) is one of the oldest existing custom unions and most effective example of economic integration in Africa (Mc'Gowan, *et al.,* 2007: 323). It was established in 1910 pursuant to a Customs Union Agreement between the then Union of South Africa and the High Commission Territories of Bechuanaland, Basutoland and Swaziland. With the start of independence for these territories, the agreement was updated and on 11 December 1969. It was re-launched as the Southern African Custom Union (SACU) with the signing of an agreement between the Republic of South Africa, Botswana, Lesotho and Swaziland (SACU, 2010).

South Africa is the custodian of this pool (see appendix for formula of how the share is being calculated). Only the BLNS Member States' shares are calculated with South Africa receiving the residual. SACU revenue constitutes a substantial share of the state revenue of the BLNS countries (Van Niekerk 2008). The idea behind common currency is that two or more groups (usually countries) share a common currency. One of the main goals of forming a currency union is to synchronise and manage each country's monetary policy also referred to as a "monetary union". If SACU members decide to engage in common currency agreements with each other, then this could have potential effects on existing and potential trade agreements that each country has with each other and with countries outside the SACU group.

2. LITERATURE REVIEW

According to Kenen (1969) if the economy is well-diversified, it will avoid suffering from country specific shock. The product to be traded should be diverse within the area as it will stabilise capital formation (investment) and in so doing "serves to average out external shocks" (Kenen 1969:13). In repudiating Mundell's approach to OCA based on perfect labour mobility criteria, Kenen propounds that such mobility rarely prevails in reality.

Fleming (1971:476) is of the opinion that the member countries should have more or less same inflation rates to maintain fixed exchange rates, if not, it will be highly unlikely that OCA will be realised – this will be just a pipe dream.

Tavlas (1993:673) says that similarity in inflation rates is not a precondition but rather a desirable and attractive outcome. The problem with inflation is that it can be manipulated using policies such as inflation targeting.

Krueger (1997) emphasises that there is no tariffs that should be changed against the member of SACU and the free trade movement of goods and services in BLNS regions. He also elaborate the importance of charging external tariffs to none SACU members, for example EU, UK and USA.

Maasdorp (1992), when countries enter into a free trade agreement, changes in trade flows arise due to changed conditions of competition, and he further classified these processes as trade creation and trade diversion. In his classical consideration, when a developing country enters into an FTA with an industrialised country, trade diversion effects are likely to dominate in the third

countries due to complementary production and trade structures.

Margaret (2003), another study on free trade agreement (FTA) was undertaken where he investigated the impact the agreement had on the RSA's trade with Southern Africa and the rest of the world. He used trade statistics for the periods 1999 – 2004 between the RSA and its trading partners to symbolise trade before and after the implementation of the agreement.

Hansohnm (2006), argued that when considering bilateral trade, import and export prices are not available on bilateral basis to be included in export and import demand functions. This is an important issue due to the fact that a country exports and imports of different commodities are to different trading partners.

Ngwenya (2002:26), SADC in turn, is envisaged together and after consolidation with other continental integration arrangements, notably the Common Market for Eastern and Southern Africa (COMESA), to play an important role in the development of the recently formed African Union.

3. DATA DESCRIPTION

All the data were obtained from the Quantec and World Bank. The data are annually and cover the period from 1980 to 2015. The period gives a clear trend of what happened during the apartheid era and after apartheid. In addition, 1980 to 2015 create enough observations to run a regression model.

The study estimates whether Southern African Custom Union (SACU) is an optimum currency area? Using the following equation:

$$EXR_t = f(CPI_t, GDP_t, \varepsilon t) \qquad 3.1$$

Where:

EXR = Exchange Rate

CPI = Consumer Price Index

GDP = Gross Domestic Product

[|" = Error term

EXR is a dependent variable. CPI and GDP are independent variables. These variables may have a positive

Table 4.1
Unit root test at levels
GDP for Botswana, South Africa, Swaziland, Lesotho and Namibia

Countries	*Model*	*ADF Lags*	*ADF (t-Statistics)* $\tau_t \tau_m \tau$	*Critical value at 5%*	*Conclusion*
South Africa	Trend and intercept	0	-1.036367*	-3.544284	Unit root
Botswana		0	-4.954520	-3.544284	No unit root
Namibia		0	-2.188218*	-3.544284	Unit root
Swaziland		0	-6.635619	-3.544284	No unit root
Lesotho		0	-2.514295 *	-3.544284	Unit root
South Africa	Intercept	0	2.636792*	-2.948404	Unit root
Botswana		0	-4.076660	-2.948404	No unit root
Namibia		0	0.523039*	-2.948404	Unit root
Swaziland		0	-4.463536	-2.948404	No unit root
Lesotho		0	0.408643*	-2.948404	Unit root
	None				
South Africa		0	7.161427*	-1.950687	Unit root
Botswana		0	-2.339063	-1.950687	No unit root
Namibia		0	3.244038*	-1.950687	Unit root
Swaziland		0	-2.881147	-1.950687	No unit root
Lesotho		0	4.272496*	-1.950687	Unit root

Eviews8 (2015)

* Statistically significant at 10% level

** Statistically significant at 5% level

*** Statistically significant at 1% level

or negative relationship depending on their results on the exchange rate. The model is specified as follows in the linear regression:

$$EXRt = \beta 0 + \beta 1 CPIt + \beta 2 GDPt + \varepsilon t \qquad 3.2$$

Where:

β_0 is a constant

β_1 is a coefficient that is, 1,2….n

4. DATA ANALYSIS AND INTERPRETATION

4.1. Formal unit root testing ADF test

The formal testing procedures presently accessible are used to examine each of the variables and countries. To form the integrating order I (1) of cross sectional countries, the Augmented Dickey Fuller (1981) is used to test each variable for unit root in levels, and then in the first difference form.

The table 4.1 above presents the results of running ADF test on all countries at levels in logarithm form with trend and intercept and intercept. The results above shows that log of GDP in five countries show the existence of unit root which is non-stationary in levels where there is only in none and unit root exists in South Africa, Namibia and Lesotho's GDP in intercept, trend and none which is also non-stationary. While Botswana and Swaziland are stationary (no unit root), thus the results from the above table 1 indicate that the null hypothesis of non-stationarity is rejected (unit root does not exist).

The results from table 3.2 show that when the ADF test is applied to GDP in five countries in first differences with the trend and intercept, intercept and none, all of the countries are stationary in first difference. Thus the null hypothesis of non -stationarity is rejected (no unit root) and the variables are integrated of order one I (1).

Table 4.2
Unit root at first difference
GDP for Botswana, South Africa, Swaziland, Lesotho and Namibia

Countries	*Model*	*ADF Lags*	*ADF (t-Statistics)* $\tau_t \tau_m \tau$	*Critical value at 5%*	*Conclusion*
South Africa	Trend and intercept	0	-4.607508	-3.548490	No unit root
Botswana		0	-9.016498	-3.548490	No unit root
Namibia		0	-5.636711	-3.548490	No unit root
Swaziland		0	-11.97929	-3.548490	No unit root
Lesotho		0	-6.101704	-3.548490	No unit root
South Africa	Intercept	0	-3.536253	-2.951125	No unit root
Botswana		0	-9.162617	-2.951125	No unit root
Namibia		0	-5.526027	-2.951125	No unit root
Swaziland		0	-12.27063	-2.951125	No unit root
Lesotho		0	-6.109149	-2.951125	No unit root
South Africa	None	0	-2.296058	-1.951000	No unit root
Botswana		0	-9.294214	-1.951000	No unit root
Namibia		0	-4.383657	-1.951000	No unit root
Swaziland		0	-12.39882	-1.951000	No unit root
Lesotho		0	-4.044292	-1.951000	No unit root

Eviews8 (2015)

* Statistically significant at 10% level

** Statistically significant at 5% level

*** Statistically significant at 1% level

Table 4.3
Unit root at levels
Exchange rate for Botswana, South Africa, Swaziland, Lesotho and Namibia

Countries	*Model*	*ADF Lags*	*ADF (t-Statistics)* $\tau_t \tau_m \tau$	*Critical value at 5%*	*Conclusion*
South Africa	Trend and intercept	6	-2.482713*	-3.544284	Unit root
Botswana		6	-2.488868*	-3.544284	Unit root
Namibia		6	-3.550218	-3.544284	No unit root
Swaziland		6	-3.550220	-3.544284	No unit root
Lesotho		6	-2.007602*	-3.544284	Unit root
South Africa	Intercept	6	-1.656657*	-2.948404	Unit root
Botswana		6	-0.114934*	-2.948404	Unit root
Namibia		6	0.768326*	-2.948404	Unit root
Swaziland		6	-0.857155*	-2.948404	Unit root
Lesotho		6	-0.534128*	-2.948404	Unit root
South Africa	None	6	-1.608496*	-1.950687	Unit root
Botswana		6	2.553575*	-1.950687	Unit root
Namibia		6	0.768326*	-1.950687	Unit root
Swaziland		6	0.768326*	-1.950687	Unit root
Lesotho		6	-1.618725*	-1.950687	Unit root

Source: Eviews8 (2015)

* Statistically significant at 10% level

** Statistically significant at 5% level

*** Statistically significant at 1% level

The table 4.3 above presents the results of running ADF test on all countries at levels in logarithm form with trend and intercept and intercept. The results above shows that log of exchange rate in five countries show the existence of unit root which is non-stationary in levels where there is only in none and unit root exists in more in all countries in constant and none, while in trend unit root exist in South Africa, Botswana and Lesotho's exchange rate in trend, trend and none which is also non-stationary. While Swaziland and Namibia are stationary (no unit root) in trend, thus the results from the above table 4.3 indicates that the null hypothesis of non-stationarity is rejected (unit root does not exist) and accepted in constant and none (unit root existed).

The results from table 4.4 show that when the ADF test is applied to exchange rate in five countries in first differences with the trend and intercept, intercept and none, all of the countries are stationary in first difference. Therefore, the null hypothesis of non -stationarity is rejected (no unit root) and the countries are integrated of order one I (1).

The table 4.5 above presents the results of running ADF test on all countries at levels in logarithm form with trend and intercept and intercept. The results above shows that log of inflation rate (CPI) in five countries show the existence of unit root which is non-stationary in levels where there is only in none and unit root exists in South Africa in level and none Botswana, Namibia, Swaziland, while no unit root exists in trend and constant, none in all four countries expect South Africa , thus the results from the above table 5 indicates that the null hypothesis of non-stationarity is rejected (unit root does not exist) and accepted in constant and none (unit root existed).

Table 4.4
Unit root at first difference
Exchange rate for Botswana, South Africa, Swaziland, Lesotho and Namibia

Countries	*Model*	*ADF Lags*	*ADF (t-Statistics)* $\tau_t \tau_m \tau$	*Critical value at 5%*	*Conclusion*
South Africa	Trend and intercept	0	-4.973955	-3.548490	No unit root
Botswana		0	-4.674230	-3.548490	No unit root
Namibia		0	-6.177329	-3.548490	No unit root
Swaziland		0	-6.177330	-3.548490	No unit root
Lesotho		0	-5.325390	-3.548490	No unit root
South Africa	Intercept	0	-4.996143	-2.951125	No unit root
Botswana		0	-4.739801	-2.951125	No unit root
Namibia		0	-6.282054	-2.951125	No unit root
Swaziland		0	-6.282054	-2.951125	No unit root
Lesotho		0	-5.382380	-2.951125	No unit root
South Africa	None	0	-4.815741	-1.951000	No unit root
Botswana		0	-3.922859	-1.951000	No unit root
Namibia		0	-5.948732	-1.951000	No unit root
Swaziland		0	-5.948733	-1.951000	No unit root
Lesotho		0	-5.149889	-1.951000	No unit root
Eviews8 (2015)					

* Statistically significant at 10% level
** Statistically significant at 5% level
*** Statistically significant at 1% level

Table 4.5
Unit root at levels
Inflation rate for Botswana, South Africa, Swaziland, Lesotho and Namibia

Countries	*Model*	*ADF Lags*	*ADF (t-Statistics)* $\tau_t \tau_m \tau$	*Critical value at 5%*	*Conclusion*
South Africa	Trend and intercept	0	-2.399531*	-3.544284	Unit root
Botswana		0	-3.792730	-3.544284	No unit root
Namibia		0	-5.654350	-3.544284	No unit root
Swaziland		0	-4.965836	-3.544284	No unit root
Lesotho		0	-6.606054	-3.544284	No unit root
South Africa	Intercept	0	0.756852*	-2.948404	Unit root
Botswana		0	-3.048815	-2.948404	No unit root
Namibia		0	-4.888887	-2.948404	No unit root
Swaziland		0	-3.398919	-2.948404	No unit root
Lesotho		0	-5.212479	-2.948404	No unit root
South Africa	None	0	4.635905*	-1.950687	Unit root
Botswana		0	-1.075522*	-1.950687	Unit root
Namibia		0	-1.806195*	-1.950687	Unit root
Swaziland		0	-1.776657*	-1.950687	Unit root
Lesotho		0	-2.378485	-1.950687	No unit root
Eviews8 (2015)					

* Statistically significant at 10% level
** Statistically significant at 5% level
*** Statistically significant at 1% level

Table 4.6
Unit root at first difference
Inflation rate for Botswana, South Africa, Swaziland, Lesotho and Namibia

Countries	*Model*	*ADF Lags*	*ADF (t-Statistics)* $\tau_t \tau_m \tau$	*Critical value at 5%*	*Conclusion*
South Africa	Trend and intercept	6	-2.308578*	-3.548490	Unit root
Botswana		6	-8.985036	-3.548490	No unit root
Namibia		6	-8.354573	-3.548490	No unit root
Swaziland		6	-8.276357	-3.548490	No unit root
Lesotho		6	-10.14949	-3.548490	No unit root
South Africa	Intercept	6	-2.709996*	-2.951125	Unit root
Botswana		6	-9.097821	-2.951125	No unit root
Namibia		6	-8.395514	-2.951125	No unit root
Swaziland		6	-8.355658	-2.951125	No unit root
Lesotho		6	-10.30437	-2.951125	No unit root
South Africa	None	6	-1.811996*	-1.951000	Unit root
Botswana		6	-9.082053	-1.951000	No unit root
Namibia		6	-2.951125	-1.951000	No unit root
Swaziland		6	-8.371267	-1.951000	No unit root
Lesotho		6	-10.45106	-1.951000	No unit root

Eviews8 (2015)

* Statistically significant at 10% level
** Statistically significant at 5% level
*** Statistically significant at 1% level

The results from table 4.6 show that when the ADF test is applied to inflation rate (CPI) in five countries in first differences with the trend and intercept, intercept and none, all of the countries are stationary in first difference, except for South Africa. Therefore the null hypothesis of non -stationarity is rejected (no unit root) and the countries are integrated of order one I(1).

4.4. Cointegration analysis

Outlines the existence of an equilibrium or stationarity relationship among two or more times series each of which is individually non stationary.

Table 4.7
Johansen Co-integration test (Trace and Max-Eigenstatistic)
These are the results from GDP in five countries

Hypothesized No. of CE(s)	*Eingenvalue*	*Trace Statistic*	*0.05 Critical value*	*Max-Eigen Statistic*	*0.05 Critical value*
None	0.537318	59.34772	69.81889	26.20434	33.87687
At most 1	0.413362	33.14338	47.85613	18.1338	27.58434
At most 2	0.242371	15.00958	29.76707	9.437104	21.13162
At most 3	0.135587	5.572476	15.49471	4.953971	14.2646
At most 4	0.018027	0.618505	3.841466	0.618505	3.841466

Eviews8 (2015)

Trace test indicates 1 cointegrating equation(s) at the 0.05 level

Max-eigenvalue test indicates 2 cointegrating equation(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Table 4.7 above gives the results from Johansen cointegration test. The first column of the table gives tests for hypothesized number of cointegrated equation where the null hypothesis, pr, ranging from no of cointegration relationship(r = p) up to most two cointegration vectors. The second column gives the eingen-values in descending order, while the third and fifth column reports the corresponding trace statistics and max-eingen statistics generated. The fourth and sixth column reports the critical values at the five per cent levels. The results ofthe trace test statistic shows two cointegrating equations at 5% level, having the acceptance of the null hypothesis of cointegration of the series.

The findings show that both the Trace and Maximum Eigen value test are not significant at 5 percent level. These results prove that the variables are not tied together in a single way in the long run; there is unique long run equilibrium relationship. Therefore, there is no cointegration relationship in the trace static model and cointegration relationships in the maximum Eigen model. Therefore, the existence of a long run relationship of the model can be seen within an Error Correction Model (ECM).

Table 4.8
Johansen Co-integration test (Trace and Max-Eingenstatistic)
These are the results from Inflation in five countries

HypothesizedNo.of CE(s)	*Eingenvalue*	*Trace Statistic*	*0.05 Critical value*	*Max-Eigen Statistic*	*0.05 Critical value*
None*	0.729768	99.74758*	69.81889	44.48817*	33.87687
At most 1*	0.571178	55.25940*	47.85613	28.78822*	27.58434
At most 2	0.351242	26.47118	29.76707	14.71166	21.13162
At most 3	0.292244	11.75953	15.49471	11.75231	14.2646
At most 4	0.018027	0.007217	3.841466	0.007217	3.841466

Eviews8 (2015)

Trace test indicates 1 cointegrating equation(s) at the 0.05 level

Max-eigenvalue test indicates 2 cointegrating equation(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Table 4.8 above gives the results from Johansen cointegration test. The first column of the table gives tests for hypothesised number of cointegrated equation where the null hypothesis, pr, ranging from no of cointegration relationship(r = p) up to most two cointegration vectors. The second column gives the eingen-values in descending order, while the third and fifth column reports the corresponding trace statistics and max-eingen statistics generated. The fourth and sixth column reports the critical values at the five per cent levels.

The findings ofthe trace test statistic shows two cointegrating equations at 5% level, having the rejection of the null hypothesis of no cointegration of the series. On the other hand, the maximum eigenvalue statistic indicates the presence of two cointegrating equations at 5% level.The trace test shows that there is 5 per cent significance co-integration equation. This is shown by comparing the trace statistics as it shows that 99.747758 is greater than critical value 69.81889 and 28.78822 is also greater than the critical value 27.58434.The max-eingen statistic that indicates that there is 5 percent significance cointegration. This is realised by comparing the max-eingen statistics as it shows that 44.48817 is greater than the critical value 33.87687 and 28.78822 is also greater than the critical value 27.58434. The findings show that both the Trace and Maximum Eigen value test are significant at 5 percent level. These findings prove that the variables are tied together in a single way in the long run; there is no unique long run equilibrium relationship. Thus there is one cointegration relationship in the trace static model and two cointegration relationships in the maximum Eigen model. Therefore,

the existence of a long run relationship of the model can be seen within an Error Correction Model (ECM).

4.5. Error Correction Model (ECM)

The ECM techniques allow the long run and short run dynamics to be estimated in a single step. The constant term of the single error correction framework is a combination of the short run and long run constant. This technique has an advantage as it isolates the speed of adjustment parameter which indicates how quickly the system returns to equilibrium after a random shock.

Table 4.9
Results of ECM for GDP

Variable	*Coefficient*	*Standard Error*	*t-Statistic*
Dlog (GDPNA)	8.31	3.70	2.245
Dlog (GDPLE)	-1.70	1.83	-0.926
Dlog (GDPBO)	1.01	0.967	1.041
Dlog (GDPSW)	1.687	1.088	1.549*
ECM (-1)	0.285	0.200	1.425
C	25.31	6.571	3.850

t-ratio of estimates,* and ** denote a t-ratio significant at the 1% and 5% respectively.
R^2 =0.2538
Adjusted R-squared = 0.1206

A 1% increase in economic growth in Namibia will lead to an 8.31% positive change in GDP in SA, GDP in Lesotho will lead to -1.70% decline, while GDP in Botswana shows 1.01% and GDP Swaziland leads by 6.87%. The results show a positive GDP in SA, while the theory say increase in the gross domestic product can trigger greater productivity and better the economy, therefore, creating more growth in an upward spiral cycle, negative growth is the opposite. By fostering specialization and the transfer of technology, leading directly to faster economic growth and improved standards of living.

The ECM (-1) is positive and non-significant. This term distinguish the long run relationship. It reflects attempts to correct deviation from the long-run equilibrium path. Its coefficient is interpreted as the speed of adjustment or the amount of disequilibrium transmitted each period to economic growth. Its magnitude is 0.285implying that about 28% of disequilibrium is corrected in subsequent period.

Table 4.10
Results of ECM for Exchange Rates

Variable	*Coefficient*	*Standard Error*	*t-Statistic*
Dlog (EXRATENA)	1.00	6.85	1.46*
Dlog (EXRATESA)	-5.97	1.18	-0.505
Dlog (EXRATELE)	-1.13	8.54	-1.32*
Dlog (EXRATEBO)	-6.30	3.61	-1.744
ECM (-1)	0.77	0.18	4.27
C	4.92	1.30	0.47

t-ratio of estimates,* and ** denote a t-ratio significant at the 1% and 5% respectively.
R^2 =1.000
Adjusted R-squared = 1.000

A 1% increase in exchange rate in Namibia will lead to an 1% positive change, EXRATE in SA will lead to -5.97% decline, while EXRATE in Lesotho shows -1.13%, Namibia 1% and exchange rate in Botswana leads by -6.30%.Thus, the results are different from the theory, finding that an decrease in exchange rate, that is, When there is a decline and the exchange rate goes down, the exports of a country will be cheaper and imports will become more expensive, e.g. a decline of the dollar makes US exports more competitive. Therefore there will be a raise in exports and diminish in quantity of imports. Therefore, domestic firms will benefit from bigger sales. It may lead to job creation and lower unemployment, especially in exporting industries. The boost in X-M will help raise Aggregate Demand (AD) and as a result, lead to higher economic growth.

The ECM (-1) is positive and non-significant. This term distinguish the long run relationship. It reflects attempts to correct deviation from the long-run equilibrium path. Its coefficient is interpreted as the speed of adjustment or the amount of disequilibrium transmitted each period to economic growth. Its magnitude is 0.77 implying that about 77% of disequilibrium is corrected in subsequent period.

Table 4.11
Results of ECM for inflation rates (CPI)

Variable	*Coefficient*	*Standard Error*	*t-Statistic*
Dlog (INFLANA)	-0.102	0.093	1.102**
Dlog (INFLALE)	0.31	0.065	0.475**
Dlog (INFLABO)	0.17	0.249	0.686**
Dlog (INFLASW)	0.199	0.153	1.297**
ECM (-1)	0.099	0.069	1.429
C	6.40	0.605	10.57

t-ratio of estimates,* and ** denote a t-ratio significant at the 1% and 5% respectively.

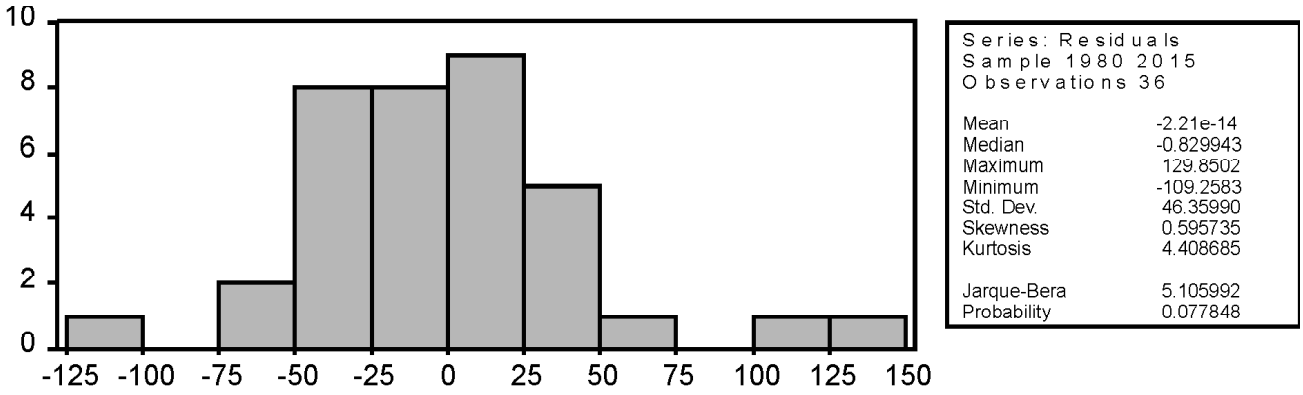
R^2 =0.146

Adjusted R-squared = -0.0061

A 1% increase in inflation in SA will lead to a 1% positive change, INFLA in Namibia will lead to -0.102% decline, while INFLA in Lesotho shows 0.31%, Swaziland 0.199% and inflation rate in Botswana leads by 0.17%. Deflation is potentially very damaging to the economy and can lead to poorer consumer spending and lower growth. For example, when prices are declining, consumers are encouraged to delay purchasing. Moderate inflation rate reduce the real value of debt. If there is deflation, the real value of debt increases leading to a squeeze on disposable incomes. Moderate rates of inflation are sign of a healthy economy. With economic growth, usually get a degree of inflation and moderate prices.

The ECM (-1) is positive and non-significant. This term distinguish the long run relationship. It reflects attempts to correct deviation from the long-run equilibrium path. Its coefficient is interpreted as the speed of adjustment or the amount of disequilibrium transmitted each period to economic growth. Its magnitude is 0.099 implying that about 1% of disequilibrium is corrected in subsequent period.

4.6. Diagnostic testing

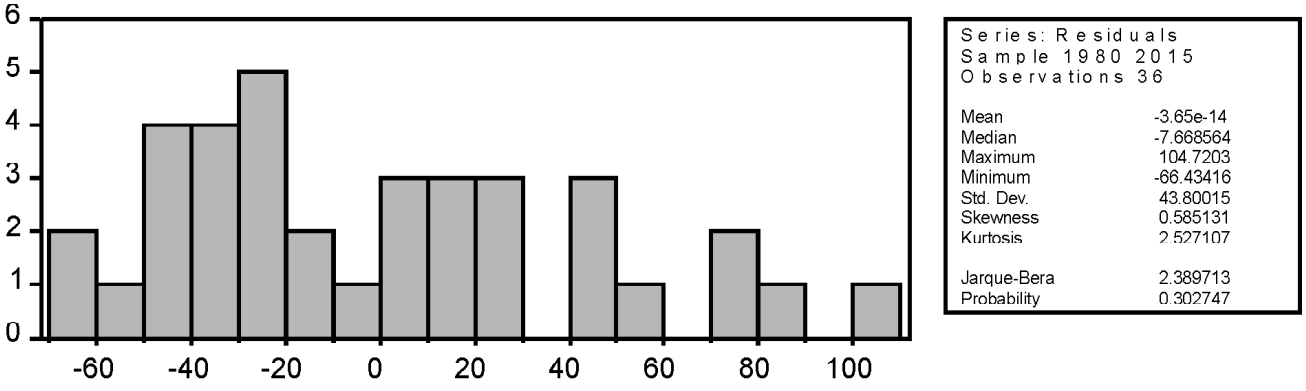


Eviews 8 (2015)

Figure 4.3.1: Normality test on the residuals (GDP on five different countries)

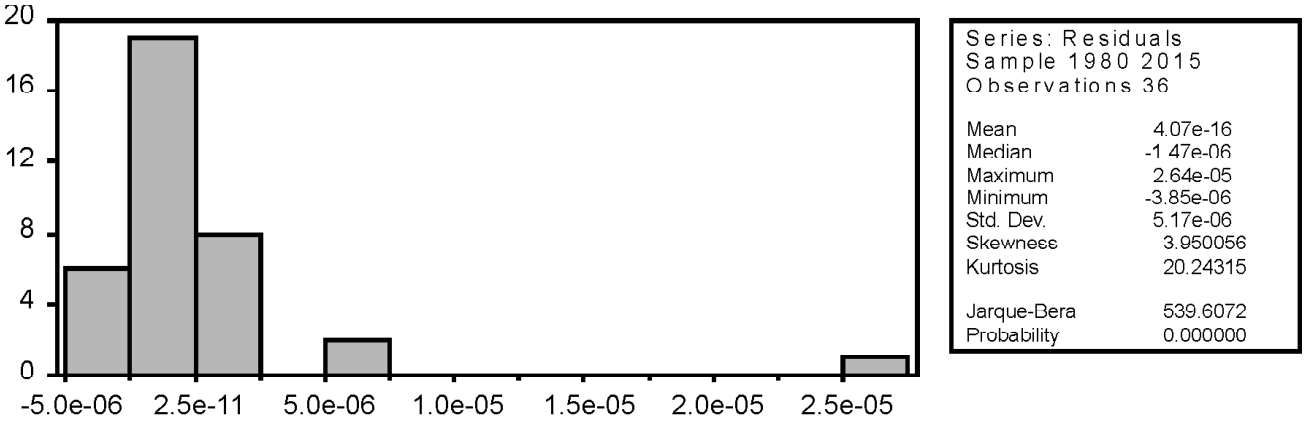
The *Jarque-Bera* test statistics test whether the residuals are normally distributed. The null hypothesis for the above figure 4.3.1 is that the residual are not normally distributed. The decision rule for the rest is that if P< 0.05 level of significance then the null hypothesis should be rejected. The result for the probability is 0.077848 which is more than the 0.05 level of signification; therefore the study rejects the null hypothesis. This means that the residuals are normally distributed for the present study.

The *Jarque-Bera* test statistics test whether the residuals are normally distributed. The null hypothesis for the above figure 4.3.2 is that the residual are not normally distributed. The decision rule for the rest is that if P< 0.05 level of significance then the null hypothesis should be rejected. The result for the probability is 0.302747 which is more than the 0.05 level of signification; therefore the study rejects the null hypothesis. This means that the residuals are normally distributed for the present study.



Source: Eviews8 (2015)

Figure 4.3.2: Normality test on the residuals (INF on five different countries)



Source: Eviews8 (2015)

Figure 4.3.3: Normality test on the residuals (EXR on five different countries)

The *Jarque-Bera* test statistics test whether the residuals are normally distributed. The null hypothesis for the above figure 4.3.3 is that the residual are not normally distributed. The decision rule for the rest is that if P< 0.05 level of significance then the null hypothesis should be rejected. The result for the probability is 0.000 which is less than the 0.05 level of signification, therefore the study accept the null hypothesis. This means that the residuals are not normally distributed for the current study.

Table 4.12
Serial correlation test on the residuals (GDP)
Breusch-Godfrey Serial Correlation LM Test

F-statistic	2.510135	Prob.F(4.31)	0.0619
Obs*R-squared	8.807375	Prob. Chi-Square(4)	0.0661

Eviews 8 (2015)

The table 4.12 above outlines the results for the serial correlation on the residuals, from the output of *Breusch-Godfrey*. The null hypothesis of the study is that there is no serial correlation in the residuals. The probability value from the result is 0.0619 and 0.0661; in the case the null hypothesis is accepted. This means that there is no serial correlation in the residuals.

Table 4.13
Serial correlation test on the residuals (INF)
Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.696895	Prob.F(4.31)	0.5999
Obs*R-squared	2.970113	Prob. Chi-Square(4)	0.5628

Eviews8 (2015)

The table 4.13 above outlines the results for the serial correlation on the residuals, from the output of *Breusch-*

Godfrey. The null hypothesis of the study is that there is no serial correlation in the residuals. The probability value from the result is 0.599 and 0.5628; in the case the null hypothesis is accepted. This means that there is no serial correlation in the residuals.

Table 4.14
Serial correlation test on the residuals (EXR)
Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.657347	Prob.F(4.31)	0.6262
Obs*R-squared	2.314739	Prob. Chi-Square(4)	0.5893

Eviews 8 (2015)

The table 4.14 above outlines the results for the serial correlation on the residuals, from the output of *Breusch-Godfrey*. The null hypothesis of the study is that there is no serial correlation in the residuals. The probability value from the result is 0.6262 and 0.5893; in the case the null hypothesis is accepted. This means that there is no serial correlation in the residuals

Table 4.15
Heteroscedasticity test: ARCH (GDP)
Heteroscedasticity Test: ARCH

F-statistic	78.99190	Prob. F(1.33)	0.0000
Obs*R-squared	24.68675	Prob. Chi-Square(1)	0.0000

Eviews 8 (2015)

Table 4.15 outlines the result of heteroscedasticity on the residuals, from the output of heteroscedasticity test: ARCH the study test the null hypothesis that there is no heteroscedasticity up to order q in the residual. The probability value from the result is 0.0000; the study rejects the null hypothesis. This means that for the current study there is heteroscedasticity up to order q in the residual.

Table 4.16
Heteroscedasticity test: ARCH (INF)
Heteroscedasticity Test: ARCH

F-statistic	1.078287	Prob. F(1.33)	0.3066
Obs*R-squared	1.107451	Prob. Chi-Square(1)	0.2926

Eviews 8 (2015)

Table 4.16 outlines the result of heteroscedasticity on the residuals, from the output of heteroscedasticity test: ARCH the study test the null hypothesis that there is no heteroscedasticity up to order q in the residual. The probability value from the result is 0.3066 and 0.2926; the study accepts the null hypothesis. This means that for the current study there is no heteroscedasticity up to order q in the residual.

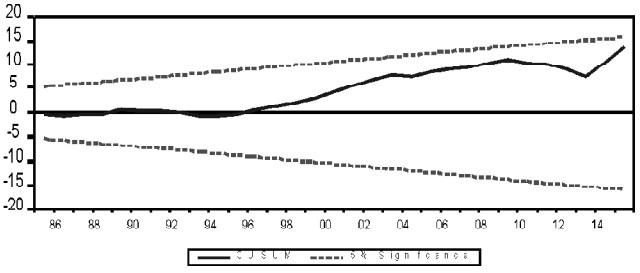
Table 4.17
Heteroscedasticity test: ARCH (EXR)
Heteroscedasticity Test: ARCH

F-statistic	0.068142	Prob. F(1.33)	0.7957
Obs*R-squared	0.072122	Prob. Chi-Square(1)	0.7883

Eviews 8 (2015)

Table 4.17 outlines the result of heteroscedasticity on the residuals, from the output of heteroscedasticity test: ARCH the study test the null hypothesis that there is no heteroscedasticity up to order q in the residual. The probability value from the result is 0.7957 and 0.7883; the study accepts the null hypothesis. This means that for the current study there is no heteroscedasticity up to order q in the residual.

4.7. Stability test (GDP)



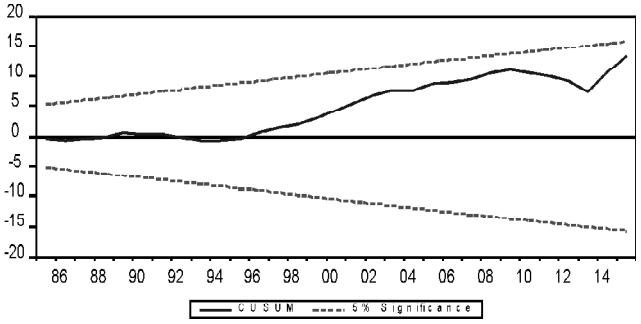
Eviews 8 (2015)

Figure 4.3.4: Cusum test

The stability cusum test is applied to evaluate the stability of the long run coefficient together with the short run dynamics. The cusum test point that the null hypothesis (i.e. that the regression equation is correctly stated) cannot be rejected if the plot of these statistics remains within the critical bound of the 5 percent significant level.

The figure 4.3.4 shows cusum test from 1980 to 2015 the stability of the parameters remain outside the critical bounds of parameter stability.

4.8. Stability test (CPI)

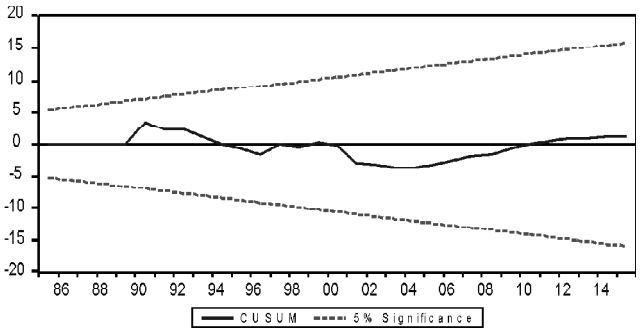


Eviews 8 (2015)

Figure 4.3.5: Cusum test

The stability cusum test is applied to evaluate the stability of the long run coefficient together with the short run dynamics. The cusum test point that the null hypothesis (i.e. that the regression equation is correctly stated) cannot be accepted if the plot of these statistics remains within the critical bound of the 5 percent significant level. The figure 4.3.5 shows cusum test from 1980 to 2015 the stability of the parameters does not remain within the critical bounds of parameter stability.

4.9. Stability test (EXR)



Eviews 8 (2015)

Figure 4.3.6: Cusum test

The stability cusum test is applied to evaluate the stability of the long run coefficient together with the short run dynamics. The cusum test point that the null hypothesis (i.e that the regression equation is correctly stated) cannot be rejected if the plot of these statistics remains within the critical bound of the 5 percent significant level. The figure 4.3.6 shows cusum test from 1980 to 2015 the stability of the parameters remain outside the critical bounds of parameter stability.

Table 4.18
Ramsey reset test on residuals (GDP)

	Value	*Df*	*Probability*
F-Statistic	4.09E-05	(1.30)	0.9949
Likelihood ratio	4.91E-05	1	0.9944

Eviews 8 (2015)

The Ramsey reset test, also known as the regression specification error test is applied. The p-value from the results is 0.9949 and 0.9944 which are more than the critical p-value=0,05, therefore, the null hypothesis of the mis-specification in the model is accepted. This means that the model is statistically well specified and that the residual is normally distributed.

Table 4.19
Ramsey reset test on residuals (INF)

	Value	*Df*	*Probability*
F-Statistic	0.051673	(1.30)	0.8217
Likelihood ratio	0.061954	1	0.8034

Eviews 8 (2015)

The Ramsey reset test, also known as the regression specification error test is applied. The p-value from the results is 0.8217 and 0.8034 which are more than the critical p-value=0,05, therefore, the null hypothesis of the mis-specification in the model is accepted. This means that the model is statistically well specified and that the residual is normally distributed.

Table 4.20
Ramsey reset test on residuals (EXR)

	Value	*Df*	*Probability*
F-Statistic	0.084175	(1.30)	07737
Likelihood ratio	0.100868	1	0.7508

Eviews 8 (2015)

The Ramsey reset test, also known as the regression specification error test is applied. The p-value from the results is 0.7737 and 0.7508 which are more than the

critical p-value=0,05, therefore, the null hypothesis of the mis-specification in the model is accepted. This means that the model is statistically well specified and that the residual is normally distributed.

5. CONCLUSION

The research found that there is a relatively better macroeconomic convergence in all SACU members as there is cointegration as the swing patterns of all the variables as tested (inflation, GDP and exchange rates) are in the same direction. There is also a more or less same inflation rates (dependent variable) which is one of the most important criteria for a region to be regarded as optimum currency area. The positive relationship between inflation, GDP and the exchange rates within the member states as shown by the graphs augers well for the possibility of SACU to be an optimum currency area. South Africa as the big economy in the member states will have to come to the rescue if any of the member states experiences some economic shocks, this can be modelled as in the Euro Zone, as is the case with Greece at the moment.

The fiscal cliff experienced in the US and the austerity measures taken in Europe are a good lesson for SACU to be contending with in the event of problems that can be encountered in SACU in future. The quantitative conclusion is that optimum currency area has a positive effect on the overall economic development for the member states. It would be wise for SACU to be an optimum currency area as the results lead to this conclusion. The general conclusion is that EXRt hypothesis holds for SACU economies given stationarity series and cointegration within the system and the region is potentially an optimum currency area and can proceed with the formation of a single currency.

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APPENDICES

(i) FORMULAS FOR THE CALCULATION OF REVENUE POOL IN SACU

SACU member states deposit their customs and excise collections in a common revenue pool which they share using a formula that has evolved over the years. According to the new RSF the total payment (P) to each SACU member country (*i*) is calculated from its share of three different components: $Pi = Ci + Ei + Di$

Where:

$$C_1 = \frac{M_i}{\sum_{i=1}^{i=n} M} * C \qquad (1)$$

$$E_i = \frac{GDP}{\sum_{i=1}^{i=n} GDP} * C \qquad (2)$$

$$D_1 = \left[1 - \left(\frac{GDPC_i}{\sum_{i=1}^{i=n} GDPC_1}\right)/10\right] * D/n = \left[11 - \left(\frac{GDPC_i}{\sum_{i=1}^{i=n} GDPC_i}\right)\right] * D/10n \qquad (3)$$

And:

C = total customs duties collected in SACU (the customs component)

E = total excise duties collected in SACU less D (the excise component)

D = a predetermined share (initially 15%) of total excise duties collected in

GFPi = GDP on country *i*

Mi = total intra-SACU imports of country *i*

n = number of member countries in SACU (Kirk, Stern: 2003)

Under the 2002 revenue sharing formula, the BLNS countries together get nearly half of the collections although their joint gross domestic product is less than 10 percent of SACU GD