The Effect of Exports in Sacu Countries: An Empirical Analysis Using Panel Data

Sunde Tafirenyika[1], **Cyril Ayetuoma Ogbokor**[2]

Abstract: Simultaneity bias is an issue that do arise in most cases, when all variables in a model are interdependent. The study responds to this challenge by employing panel data models to analyse the effects of exports in SACU countries. The study applies stationary data estimation techniques to a sample of five (5) SACU countries over the period 1980-2016. The study finds that exports positively and significantly affect GDP per capita in SACU region. In addition, the fixed effects and random effects models clearly show that heterogeneity effects are significant, while the time effects are not significant in explaining the GDP per capita in the SACU region. This implies that country differences such as institutional, political and economic policy systems, among others, not included in the models are significant in explaining GDP per capita in SACU region. Finally, the study finds that SACU countries are enjoying increasing returns to scale. On the policy front, it should be noted that the long-standing trade liberalisation and trade openness agendas of SACU have had a significant impact on economic growth and this has led to an upsurge in exports. Therefore, the SACU region, must focus more on structural transformation which involves moving their specialisation patterns to more sophisticated goods and services in order to bolster their comparative advantage in international markets which affects economic growth through exports.

Keywords: GDP per capita; exports; panel models; pooled model; fixed effects model; random effects model; SACU

JEL Classification: B17

1. Introduction

Over the years, the relationship between exports and economic growth has generated a lot of attention among development economists, researchers, social scientists and policy analysts, especially in countries belonging to the southern hemisphere. Contemporaneously, a large volume of empirical studies, which pertains to the relationship between exports and economic growth are found in the existing empirical literature with mixed results. Halicioglu (2007) using cointegration

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[1] Professor, PhD, Namibia University of Science and Technology (NUST), Namibia, Address: P. O. Box 26925, Windhoek, Namibia, Corresponding author: tsunde@nust.na.
[2] Professor, PhD, Namibia University of Science and Technology (NUST), Namibia and North-West University (NWU), South Africa, Address: Address: P. O. Box 26925, Windhoek, Namibia, E-mail: cogbokor@nust.na.

procedures and quarterly data from 1980 to 2005 for Turkey confirmed the validity of the export-led growth hypothesis. The results of the study also suggested unidirectional causality running from exports to industrial production. Yang (2008) pooled data from 44 countries for the period 1958 to 2004 examined the relationship between exports and economic growth. The results from most of the 44 countries used in the study gave credence to the export-led growth hypothesis, while a few of them proved otherwise. Mag (2010) strengthening the case for export-led growth hypothesis tested the relationship between exports and economic using South Korea as a test centre. The study found that exports propelled economic growth in South Korea, particularly during the period that the country experienced rapid economic growth. Kehinde et al., (2012) further buttressing the case for export-led growth hypothesis assessed the effect of exports on economic growth in Nigeria from 1970 to 2010 by employing time series econometric procedures; and inferred from the results of the study that increased participation in global trade helps Nigeria to reap static and dynamic benefits of international trade. In addition, the study recommended that the government of Nigeria should design appropriate strategies that can boost exports, stimulate foreign direct investment and maintain exchange rate stability in order for its economy to achieve and sustain higher growth rates.

However, some other documented studies in the existing empirical literature presents contradictory results (Hossain & Karunaratne, 2004; Cui & Shen, 2011; Adeleye, Adeteye & Adewuyi, 2015; Obadan & Okojie, 2016). Despite the differences in empirical results, most developing countries still regard exports as a powerful tool, especially when it comes to accelerating economic growth in their respective economies. Most of the documented quantitative empirical studies pertaining to the Southern Africa Customs Union (SACU) made use of a single country framework as against simultaneously pooling data from a number of countries (Zahonogo, 2016; Mosikari et al., 2016; Ocran & Biekpe, 2018). Therefore, a research gap does exist.

Considering this, the driving objective of the study is to determine the direct effect of exports on economic growth for the five SACU countries, namely Botswana, Namibia, Lesotho, Swaziland and South Africa for the period stretching from 1980 to 2016. Amongst the five SACU countries, Namibia, Botswana and South Africa are classified as middle-income developing countries. Moreover, the five SACU countries' also have a lot of similarities in terms of their economic structure. For instance, mining remains the main propeller of these countries. Hence, the justification for using these five countries in the study. The study contributes to the empirical literature in the following ways: To the best of the knowledge of the authors of the study, this is the first time that the direct effect of exports on economic growth for the selected five countries have been investigated. Moreover, the study made use of panel econometric techniques to estimate three models namely; pooled, fixed effects and random effects models. Besides, a comparative study of this magnitude is potentially expected to unveil pertinent information among the

countries under assessment. Furthermore, from a policy perspective, the study adds value to the five countries' exports policy through its results, findings and the policy alternatives that have been put forward. Although only SACU countries have been used as the test centre in the study; it is nevertheless envisaged that the various results, findings and policy choices arising from this study will potentially add value in some ways to the various strategies adopted by other developing countries in their search for greater economic prosperity.

The rest of the study is structured in the following way: Section two reviews empirical literature, while section three pertains to data, methods and model specification. Section four presents the estimation results. Thereafter, the models are estimated and discussed. Finally, the study suggests appropriate policy alternatives, and concludes by crafting avenues to further investigate the issue under consideration.

2. Empirical Literature

Documented empirical literature that assesses the relationship between exports and economic growth is huge. This is due to the perceived role of exports in achieving a higher level of economic growth on the part of nations. Nowadays, in the face of increasing interdependencies amongst the countries of the world, the importance of exports in the promotion of economic growth is even attracting more empirical inquiries. This section of the study attempts to present some of the previous studies on the issue under consideration in a chronological order.

Michealy (1977) used data for the period 1950 to 1973 to estimate the relationship between exports and economic growth for forty-one developing countries. The study model was developed based on Cobb Douglas production function. In the study, the rate of change of per capita GNP was used as a measure of economic growth, while the proportion of exports in the gross national product was used as a measure of export performance. This study found evidence of a positive correlation between the growth rate of exports and the rate of economic growth for the countries that were investigated.

Balassa (1978) through the application of the Cobb Douglas production function also estimated the relationship between exports and economic growth for eleven developing countries. The study was based on annual macroeconomic data for the period 1960 to 1973. The study made use of three ratios: growth of exports versus growth of output, growth of exports versus growth of output in net export and the average ratio of exports to output versus growth of output. The result indicated that exports expansion affects economic growth rates positively. Besides, the study provides evidence to further support export-led growth strategies as against import-substitution strategies.

Ocran and Biekpe (2008) also contributing to the empirical literature examined the impact of instability in primary commodity exports earnings and the level of commodity dependence on economic growth in sub-Saharan Africa. The authors applied fixed effects panel data estimator in the empirical estimation. The findings arising from the study indicate that there is a negative relationship between instability in exports earnings and economic growth. Moreover, the study results suggest that the level of commodity dependence matters, when it comes to determining economic growth in the region.

Kilavuz and Topcu (2012) assessed the effect of exports and imports on economic growth in twenty-two developing countries for the period 1998 to 2006. The study estimated two models through the application of panel data analysis. The results obtained from the first model indicate that high technology manufacturing industry exports and investment have a positive and significant effect on growth, while the result from the second model suggests that only high-tech manufacturing industry exports, investment and low-tech manufacturing import have a positive and significant effect on growth.

Kundu (2013) analysed the possibility of a causal relationship between exports and economic growth for seven selected Asian countries through the panel data approach. Combinations of fixed and random effect models were estimated. The estimated fixed effects model is suggestive of no significant relationship between GDP and exports for these countries, while the results arising from the estimated random effects model is indicative of no significant relationship between GDP and exports for the seven countries that were investigated. Indeed, the empirical findings provide further evidence to support the key role that exports play in the process of growth.

Biyase and Zwane (2014) through the application of panel econometric method tested the validity of the export-led hypothesis for thirty African countries for the period of 1990 to 2005. The authors utilised four panel data models: pooled ordinary least squares (OLS), fixed effects model (EF), random effects model (RE) and two-stage least squares (2SLS). The results arising from the estimated models provide evidence to support the export-led growth paradigm in Africa.

Zahonogo (2016) explored the relationship between trade openness and economic growth with data covering the period of 1980 to 2012 for forty-two sub-Saharan African countries. The author applied the pooled mean group estimation technique. The study provides two important results. Firstly, the results indicate that a trade threshold does exist below which greater trade openness would lead to economic growth and vice versa. Secondly, the results indicate an inverted U-curve, suggesting the non-fragility of the connection between economic growth and trade openness for sub-Saharan countries.

Mosikari et al., (2016) examined the relationship between manufactured exports and economic growth in Southern African Development Community (SADC) during the period stretching from 1980 to 2012 using panel cointegration approach. The results suggest that manufactured exports had a positive impact on economic growth in SADC. Besides, unidirectional causality running from economic growth to manufactured exports was found. By implication, countries in dire need of increasing their manufactured exports would need to first accelerate the process of economic growth in their respective economies.

Mohmoodi and Mahmoodi (2016) investigated the causal relationship between foreign direct investment (FDI), exports and economic growth using two panels of developing countries (eight European and eight Asian). The authors employed panel VECM causality approach to carry out the study. The European panel results indicate bidirectional causality between GDP and FDI, and unidirectional causality running from GDP and FDI to exports in the short-run. Correspondingly, the Asian panel results suggest bidirectional causality between exports and economic growth in the short-run. In addition, the study found evidence of long-run causality running from exports and FDI to economic growth, as well as long-run unidirectional causality running from economic growth and exports to FDI for both panels.

Beser and Kilic (2017) also contributing to the empirical literature, estimated the causal relationship between exports and economic growth for five selected countries (Turkey, Iran, Israel, Egypt and Russia) for the period 1989 to 2015 through the application of panel data technique. The study found a bidirectional relationship between exports and growth for all the five countries that were examined.

Saeed and Hatem (2017) analyzed the effect of exports on economic growth in oil exporting countries, namely, Bahrain, Saudi Arabia, Qatar, United Arab Emirates, and Oman during the period 1990 to 2014 based on three models, pooled ordinary least squares, fixed effects model, and random effects model. The empirical results reveal that growths in the five countries during the period under assessment were exports-driven. The results arising from the study also allude to the fact that investment in capital formation is necessary for economic growth.

The results arising from the empirical literature on exports and economic growth that the study reviewed are conflicting. Therefore, whether exports would necessarily promote economic growth in a country or not remains arguable. This study employs panel econometric mechanisms to investigate this relationship using SACU countries as the test centre.

3. Data, Methods and Model Specification

3.1. Data Description

The selected countries all belong to the Southern Africa Customs Union (SACU). Of these countries, South Africa, Namibia and Botswana are ranked as middle-income developing countries, while Lesotho, and Swaziland are ranked as low-income developing countries. The estimation period is 1980 to 2016 and it was chosen on the basis of the availability of data. In cases where the data was unavailable, extrapolation and interpolation techniques were employed to fill the gaps. In the case of Namibia, where there was no data for exports and education before 1990, the exponential extrapolation technique which assumes that the variable will increase (decline) at the same annual rate in each future year as during the base period was used:

$$P_t = P_l * \exp(rx) \tag{1}$$

where r = average annual growth rates of the variable during the base period, P_t = variable extrapolation for the target year, P_l = variable in the launch year, x = number of years in the extrapolation horizon.

The same method was also employed to fill the gaps in education for various countries. The advantages of using simple extrapolation and interpolation are obvious. First, they allow the researcher to expand the sample size from a small database. Second, they can be applied at low cost, and can also be applied retrospectively to produce many consistent extrapolations that are comparable over time (Sunde, 2015). However, there are also disadvantages associated with this extrapolation technique that need to be considered. The main problem associated with the use of extrapolation and interpolation methods is that the researcher introduces an element of artificiality into the variables since the same share on the year on year change is utilised, which may be at variance with reality (Arestis et al., 2007).

3.2. Variables and Data Sources

To study the effect of exports on economic growth, we apply a linear estimation of panel data that has 6 variables. This helps to clarify and properly figure out the effect of exports on Economic growth in SACU countries (see Appendix A). Table 1 defines the variables and the data source of each variable:

Table 1. Variables used in the models

No.	Variable	Description	Source
1	Y	Gross domestic product per capita	The World Bank
2	E	Total exports as a percentage of GDP	The World Bank
3	LF	labour	The World Bank
4	K	Gross fixed capital formation as a percentage of GDP	The World Bank
5	EDU	Secondary school enrolments	The World Bank
6	DEM	Democracy (1 if democratic and 0 otherwise)	Authors

3.3. Model Specification and Empirical Method

To show the direct effect of exports on economic growth, we apply an estimate based on a production function that describes the situation of countries characterized by an open economy including exports. All the other variables included in the model are treated as control variables in this study. The basic model is written as follows:

$$Y = \left[\left(\overset{+}{K}, \overset{+}{LF} \right); \overset{+}{E}, \overset{+}{EDU}, \overset{+}{DEM} \right] \tag{2}$$

The augmented Cobb Douglas production function including all these variables is expressed as:

$$Y_{it} = AK^{\delta_1} LF^{\delta_2} E^{\delta_3} EDU^{\delta_4} DEM^{\delta_5} \tag{3}$$

In equation (3), A shows the level of technology utilized in the country which is assumed to be constant. The returns to scale are associated with capital (K), labour (LF), exports (E), education (EDU) and democracy (DEM), which are shown by δ_1, δ_2, δ_3, δ_4 and δ_5, respectively. The variables used are converted to natural logarithms to create the nonlinear form of Cobb-Douglas production. The linear Cobb-Douglas production function is given as follows:

$$Y_{it} = \log(A) + \delta_1 \log(K_{it)} + \delta_2 \log(LF_{it}) + \delta_3 log(E_{it}) + \delta_4 \log(EDU_{it}) + \delta_5 \log(DEM_{it}) + \varepsilon_{it} \tag{4}$$

By keeping technology constant, the linear model can be written as follows:

$$Y_{it} = \delta_0 + \delta_1 \log(K_{it)} + \delta_2 \log(LF_{it}) + \delta_3 log(E_{it}) + \delta_4 \log(EDU_{it}) + \delta_5 \log(DEM_{it}) + \varepsilon_{it} \tag{5}$$

In equation (5), the returns to scale are associated with δ_1, δ_2, δ_3, δ_4 and δ_5, respectively.

In panel data, there are several ways to model individual heterogeneity, including using the pooled, fixed effects and random effects models. These three models are estimated using the ordinary least squares (OLS) technique. To choose between the fixed effects and the random effects models, the study used the likelihood ratio test

(to test for redundant fixed effects) and the Hausman test (to test for correlated random effects), respectively.

4. Estimation Results

4.1. Correlation Analysis

Table 2 shows that all the variables included in the model are positively correlated, which implies that an increase in each of the variables leads to an increase in another variable. The table indicates that there is a strong positive correlation between gross domestic product per capita and exports ($r = 0.7514$). In addition, all the other control variables (LF and EDU) except gross fixed capital formation (K) are characterised by positive and strong correlation with gross domestic product per capita. The study did not include the democracy variable in the correlation analysis because it is a dummy variable, which assumes a value of zero (0) when the country is not democratic and a value of one (1) when the country is democratic. The correlation results also show that there is no reason for us to suspect the existence of multicollinearity since all the correlations between the variables are not very close to either $+1$ or -1.

Table 2. Correlation matrix of the variables

Variables	Y	LF	K	E	EDU
Y	1	0.6255	0.4598	0.7514	0.6417
LF	0.6255	1	0.3193	0.3920	0.4708
K	0.4598	0.3193	1	0.7593	0.1048
E	0.7514	0.3920	0.7593	1	0.4778
EDU	0.6417	0.4708	0.1048	0.4778	1

Source: Authors' analysis

The panel data estimation results for pooled, fixed effects and random effects[1] are presented in Table 3. The study used the white heteroscedasticity-consistent standard errors and covariances to correct for the presence of heteroscedasticity. The study also used the method proposed by Baltagi (2001, pp. 82-83) to correct the model for serial correlation. This method was later applied by De Wet and Van Eyden (2005) and Torres-Reyna (2007).

To assess the effect of exports in SACU countries, the study estimate equation 5 in section 3.3. The pooled OLS model used does not have both the cross-sectional and time series dummies. However, both the fixed effects and the random effects models employed, used both the cross-sectional and time dummies and the study found that the cross-sectional dummies were significant, while the time dummies were not in

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[1] Note that either the least squares dummy variable (LSDV) or the "Within" estimator may be used to estimate the fixed effects model.

both models. This implies that the individual country differences are important in explaining the gross domestic product per capita in SACU countries. These country differences may include factors, such as institutional, political and economic policy systems, among others.

4.1.1. The Pooled Model

It should be noted that the pooled estimation model is the most restrictive of the three specifications employed, since it does not account for cross-sectional heterogeneity within the SACU region. It assumes a common intercept for the whole panel. The exports coefficient appears low at 0.678974 compared with similar studies on developing countries by Were (2015). However, compared to the study by Ee (2016), the latter coefficient is like what he found for the Southern Africa region. The magnitude and positive sign on the coefficient of exports indicates that exports positively influence real GDP per capita in the SACU region. In addition, the significance of the exports indicates that they are an important source of economic growth in the region. The coefficient of determination is also high at 90.1 percent, which implies that the greater part of the variation in GDP per capita is explained by the variables included in the model.

4.1.2. The Fixed Effects Model

It should be noted that the fixed effect model acknowledges cross-section heterogeneity and also assumes a unique intercept for each sampled country. This is accomplished by including a matrix of dummies in the LSDV estimator. Furthermore, the "within" estimator wipes out "cross-section effects", this means that the study estimate the same coefficients of the regression equation which run through the origin. In this case, the first order conditions of least squares are used to calculate the fixed effects. The estimated coefficients are nevertheless the same. As a result, the study only reports the LSDV estimation results in Table 5. The *F* test for fixed effects rejects the null hypothesis of homogeneous cross-sections which bolsters the presence of these effects (Baltagi, 2001, pp 82-83; De Wet & Van Eyden, 2005).

It should be noted that fixed effects may denote differences in institutional, political and economic policy systems which are excluded from the specification, but are however, accounted for in the estimation, which results in improved representative estimates. This is proved by the fact that the fixed effects model has the highest adjusted coefficient of determination value of about 96 percent. It is against this background that, the study regards this model as most robust and representative specification. The export coefficient of 0.400580 is lower than that of the pooled model, but it is still positive and significant in explaining the GDP per capita in SACU countries.

4.1.3. The Random Effects Model

The random effects model also takes account of the cross-section heterogeneity, but then it varies from the fixed effect model because it assumes that a specific distribution generates these cross section-heterogeneity effects. The loss in degrees of freedom, is just the same as what we have in the fixed effects models and it is subsequently avoided. The LM test for random effects[1] rejects the null of no cross-section heterogeneity in favour of the random effects specification. Once again, the export coefficient of 0.617088 has the correct positive sign, and it is also significant in explaining the movements of GDP per capita. The time dummy in the random effects model does not explain GDP per capita in SACU countries.

Table 3. Effects of exports in SACU countries

Variable	Pooled OLS	Fixed effects	Random effects
C	-0.329218	-1.80728***	-2.533542***
LF	0.326553***	0.781291***	0.090246
K	0.105948	0.009384	0.060528*
E	**0.678974***	**0.400580***	**0.617088***
EDU	0.043352***	0.001198	0.039839**
DEM	0.225152***	0.346272***	-0.007794
D_i	N	Yes	Yes
D_t	N	N	N
Adjusted R^2	0.908567	0.959642	0.817857
Fixed Effects		F = 57.63***	
Random effects			LM = 38.41***

Source: Authors' analysis

Notes: *, **, and *** denote significance or rejection of the null hypothesis at 10%, 5% and 1% levels of significance, respectively. Country specific fixed effects are reported in Appendix B. N means "none" and Y means "yes". D_i and D_t denote the cross-sectional effects and the time effects, respectively.

To recap, our estimation results of the effects of exports in SACU countries are consistent with the empirical findings of earlier studies (Balassa, 1978; Abou-Stait, 2005; Emine & Topcu, 2012; Biyase & Zwane, 2014; Mahmoodi & Mahmoodi, 2016; Saeed, 2017). The three models estimated consistently found that exports are positively and significantly related with GDP per capita in SACU countries. However, the fixed effects model is the one established to be the best specification for the current study. It should be noted that all control variables had the correct signs and most them were significant in explaining GDP per capita. In addition, all the coefficients of determination were high even though that of the fixed effects model was the highest. We suggested in Section 3 that the returns to scale are associated with δ_1, δ_2, δ_3, δ_4 and δ_5, respectively. This means that given the model of the

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[1] See (Greene, 2000, p. 572; De Wet & Van Eyden, 2005).

effects of exports on GDP per capita estimated, SACU countries are enjoying increasing returns to scale since the summation of these parameters give 1.6. This means that if all the factors included in the model are increased by 1 percent real GDP per capita increases by 1.6 percent.

5. Conclusions and Policy Recommendations

The main purpose of the study was to analyse the effects of exports in SACU countries using panel data models. We increased the degrees of freedom of the estimation by using a long sample to generate more representative estimates because the panel data techniques incorporate both the time series and the cross sectional-dimensions of the data. Another overarching reason for utilising these methods is the fact that we can determine country heterogeneity, hence capturing unobservable individual country effects which therefore result in superior estimates. First, the study tested for the correlation among the key variables in the models to rule out the existence of multicollinearity among the variables. Second, the study estimated the pooled, the fixed effects and the random effects models. All the three models manifestly indicate that exports positively and significantly explain the GDP per capita in the SACU region. In addition, the fixed effects and the random effects models show that the heterogeneity effects are significant, while the time effects are not significant in explaining the GDP per capita in the SACU region. This implies that country differences such as institutional, political and economic policy systems, among others not included in the models are significant in explaining GDP per capita in the SACU region. Finally, given the model of the effects of exports on GDP per capita estimated, SACU countries are enjoying increasing returns to scale.

The study findings provide significant corollaries with regards to policy implications and its relevance is far from being parochial. In addition, developing countries of Africa and other regions can draw some vital lessons from our findings. It should be noted that the long-standing trade liberalisation and trade openness agendas of SACU have had a significant impact on economic growth and this has led to an upsurge in exports. Nevertheless, the emerging markets, such as the SACU region, should focus more on structural transformation which involves moving their specialisation patterns to more sophisticated goods and services to bolster their comparative advantage in international markets and economic growth through exports. Finally, the potential future research studies can be instituted for other regions and on the other factors effecting economic growth using other competing methods such as GMM, two-stage least squares etc. under the panel data methods.

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APPENDIX A

List of countries studied

Country	Abbreviated name
Botswana	BOT
Lesotho	LES
Namibia	NAM
South Africa	SA
Swaziland	SWA

Source: Authors' created

APPENDIX B

Country specific fixed effects

Dependant variable Y

Method: GLS (Cross Section Weights)

Sample: 1980-2016

White heteroscedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LF	0.781291	0.089136	8.765180	0.0000
K	0.009384	0.028007	0.335071	0.7380
E	**0.400580**	**0.034075**	**11.75598**	**0.0000**
EDU	0.001198	0.013457	0.089004	0.9292
DEM	0.346272	0.055847	6.200371	0.0000
BOT_C	-10.82404	0.859431	-12.59443	0.0000
LES_C	-12.14056	0.943595	-12.86627	0.0000
NAM_C	-10.86805	0.874423	-12.42883	0.0000
SA_C	0.781291	0.089136	8.765180	0.0000
SWA_C	0.009384	0.028007	0.335071	0.7380
R-squared	0.964882		Mean dependent variable	7.592884
Adjusted R-squared	0.963023		S.D. dependent variable	0.879059
S.E. of regression	0.169037		Sum squared residual	4.857524
F-statistic	518.9857		Durbin-Watson stat	1.885882
Prob. (F-statistic)	0.000000		Second-Stage SSR	4.857524

Source: Authors' analysis