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Exchange rate and manufacturing sector performance in SACU states

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Abstract: This study sought to examine the impact of the exchange rate on manufacturing performance in SACU states. The manufacturing sector is an avenue for trade expansion and it is a vital source of innovation and competitiveness and it makes outsized contributions to exports and productivity growth. Manufacturing in SACU countries is hampered by structural shortcomings such as the exchange rate and other factors. Given this background, the study employed the panel group FMOLS and PMG approaches for the period 1995–2016. Results showed that the exchange rate, imports and FDI have a negative relationship with manufacturing performance. Exports and inflation had a positive relationship with manufacturing performance. Based on the findings of the study, it is recommended that SACU countries need to formulate informed policies that align the exchange rate to the actual needs of the manufacturing sector. Policymakers need to know which subsectors of the manufacturing sector will be affected by an exchange rate change and they also need to know the magnitude of the impact so that they can make informed decisions.

Subjects: Economics; Finance; Business, Management and Accounting; Industry & Industrial Studies

Keywords: manufacturing; exchange rate; GDP; trade

ABOUT THE AUTHOR

Dr Courage Mlambo's research interests lie in Development Economics, Politics and Economics in general. However, his research and publication repertoire is versatile including Exchange rate Economics, Economics of regulation, Monetary Economics, Labour economics, macroeconomics, Social Justice, Politics, Banking and Finance.

PUBLIC INTEREST STATEMENT

This study sought to examine the effect of the exchange rate on the performance of the manufacturing industry in general. The study drew from the fact that the manufacturing sector is one of the engines of growth for several countries and it is affected by the behaviour of the domestic currency. The manufacturing sector is also an avenue for trade expansion and it is a vital source of innovation and competitiveness and it makes outsized contributions to exports and productivity growth. Manufacturing in SACU countries is hampered by structural shortcomings such as the exchange rate and other factors. The study found that the exchange rate has a negative relationship with the manufacturing sector performance. Based on the findings of the study, it is recommended that SACU countries need to formulate informed policies that align the exchange rate to the actual needs of the manufacturing sector.

1. Introduction and background

The manufacturing sector plays a catalytic role in a modern economy and has many dynamic benefits crucial for economic transformation. Nel et al. (2006) and Ududechinyere and Mbam (2018) stress that the manufacturing industry has, traditionally, been one of the key drivers in most national economies. The DTI (2017) and Bhorat (2017) concur and assert that very few if any cases, anywhere in economic history, where a country has achieved sustained and sustainable economic development, which has not been led by manufacturing. The manufacturing sector is an avenue for trade expansion and it is a vital source of innovation and competitiveness and it makes outsized contributions to exports and productivity growth. Even though the tertiary sector in most economies is currently dominant as a percentage of the economy and employment creation, most of these economies were built from a strong manufacturing base (SEDA, 2012). The manufacturing sector, thus, provides a channel for stimulating the growth of other activities, such as tertiary services, and achieving specific outcomes, such as employment creation and economic empowerment. The manufacturing sector has the highest economic multipliers because of its value-addition, linkages to the upstream production sectors of the economy (mining and agriculture) and the downstream service sectors (DTI, 2017).

The development of a viable manufacturing sector is often seen as the key to self-sustaining development through the export of primary products (Schneider, 2000). The manufacturing sector is a very prominent and valuable industry and can contribute immensely to economic growth, job creation and export earnings. It can thus be said that the manufacturing sector is a wealth-producing or wealth-creating sector in the economy. However, it must be noted that for the manufacturing sector to bring positive outcomes, manufacturing firms should adopt strategies that make them competitive. For manufacturing firms to achieve a competitive standing, there must be enabling an environment that gives manufacturing firms a competitive edge both locally and globally. A strong and healthy manufacturing sector requires a strong and positive approach to bring about an environment conducive for manufacturing investment to grow and create jobs (Manufacturing Circle, 2014). There are several macroeconomic factors that can influence the performance of the manufacturing sector. These include, among other things, the value of the exchange rate. StatsSA (2016) concurs and states that the state of the local and global economy and the exchange rate are some of the factors that are watched closely when assessing the performance of manufacturing production.

David et al. (2010) held that in macroeconomic management, exchange rate policy as an important tool derives from the fact that changes in the rate of exchange have significant implications for a country's balance of payment position and even its income distribution and growth. A competitive currency is one factor which largely determines the presence and development of the manufacturing sector in any economy. Söderling (2000) concurs and asserts that adequate management of the real exchange rate is a crucial factor for the promotion of manufacturing exports. A competitive exchange rate is an important factor to boost a country's manufacturing sector. In other words, the value of the exchange rate is a contributing factor to the performance of any economy. It plays a significant role in determining the competitiveness of the economy.

The literature on exchange rate movement and manufacturing performance includes articles by the Gonenc and Yilmaz (2008), Aysan and Hacihasanoglu (2007), Dogruel and Dogruel (2010). These studies highlight that product differentiation, wage moderation and productivity gains are important channels in the manufacturing sector through which the industry responds to the competitiveness pressures which are caused by currency movement. Gonenc and Yilmaz (2008) established that imported input costs do act as a natural hedge against exchange rate movement, and this has an effect on competitiveness. This becomes important considering that the countries in the SACU region rely greatly on imported material for the production process.

The importance of the manufacturing sector is acknowledged by regional bodies such as the Southern African Customs Union (SACU). According to SACU (2019) regional industrialisation is expected to lead to

the growth of the region's industrial base, creation of employment opportunities for the people of the region, and establishment of sectoral complementarities in production. The Southern African Customs Union (SACU), comprising four small members—Botswana, Lesotho, Namibia, Swaziland (BLNS)—and South Africa, is the world's oldest customs union (it was formed in 1905) and arguably the most successful scheme of regional integration (RI) in sub-Saharan Africa (SSA) (Harvey, 2000; TIPS, 2019). In spite of its 100-year existence, the Southern African Customs Union (SACU) has only recently considered developing an explicit industrial policy capable of harnessing synergies generated through regional cooperation to enhance an integrated performance of the industrial sector of member states which would ultimately lead to increased productivity and hence competitiveness.

Research shows that South Africa is operating at 7.4% less of its manufacturing output in 2008 (Head, 2018) and manufacturing outlook remains gloomy (Menon, 2018). In Botswana, the manufacturing sector remains at an "infancy stage", contributing significantly less to the economy, compared to other sectors (Letsididi, 2014 and Keineetse Motlhanka and Keineetse; Motlhanka, 2018). In Namibia, the manufacturing sector has seen very little growth over the years and its contribution to GDP has remained stagnant between 1990 and 2015 (Nakale, 2015; Nambinga, 2017). Over the past five years, Lesotho's manufacturing sector has been in decline, leading to job losses (UNDP, 2017). In Eswatini, economic growth is being dampened by decelerating manufacturing resulting from shrinking external demand, notably an underperforming textile industry and the September 2017 European Free Trade Association ban on selected Eswatini exports (Africa Development Bank, 2019). Manufacturing in SACU countries is hampered by similar structural shortcomings such as the exchange rate and other factors (Association of SADC Chambers of Commerce and Industry (ASCCI), 2006, StatsSA, 206, and Nambinga, 2017).

The paper thus seeks to examine the impact of the exchange rate on manufacturing performance in SACU states. The empirical results revealed that the rand exchange rate, imports and FDI have a negative relationship with manufacturing performance. The paper is divided into five sections, following the introduction in the first section, section two provides a review of the available studies on the subject, section three presents the methodology which was utilised to carry out the study, whist section four and five discuss the findings and conclusion of the study.
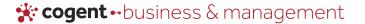
2. Literature review
In an attempt to understand the relationship between manufacturing and exchange rate movement, this section reviews previous studies that investigated the empirical relationship between manufacturing and exchange rate movement. The literature is reviewed starting at the international level and then the studies which have been done in the SACU countries.

2.1. International literature
The available studies on the effect of exchange rate movement on export performance indicate that the effect is not the same. Revenga (1992) finds that the appreciation of the dollar caused a fall in the level of employment, especially in manufacturing industries facing stronger competition from imports. Dekle (1998) shows a significant impact of the real exchange rate changes on Japanese manufacturing employment. Similarly, Aysan and Hacihasanoglu (2007) found that real exchange depreciation does not induce a huge increase in exports. The response to the exchange rate movements differs across the industries.

There are studies which indicate the extent to which exchange rate movement influences exports. Of these studies, Gonenc and Yilmaz (2008) highlight the importance of imports for manufacturing industries and how they influence the competitiveness of the industry. Dogruel, Dogruel and Dogruel (2010) explored the impact of real appreciation of Turkish Lira on manufacturing industries having different production structures. A panel regression was used for the period 1995–2007. The results confirmed that the share of imported inputs in total inputs and the profits gained from Dollar–Euro parity changes are important determinants of the competitiveness of the Turkish manufacturing. A study conducted by the European Commission (2009) for 25 EU countries

showed that real interest rates have a robust negative correlation with manufacturing output growth. Exchange rate fluctuations were important only for exporting sectors, with appreciation having a dampening effect on output. On the demand side, exports and intermediate demand were seen to be the most important manufacturing output driver. Government expenditure and imports had very little impact on the manufacturing sector.

Tkalec and Vizwk (2009) analysed the impact of macroeconomic policies on manufacturing production in Croatia. They used multiple regressions in order to assess how personal consumption, investments, interest rates, the real effective exchange rate, government consumption, fiscal deficit and foreign demand affect the output of 22 manufacturing sectors. The results suggested that changes in fiscal conditions, the real effective exchange rate and personal consumption mostly affect low technological intensity industries. Production in low technological intensity industries on average increased with the exchange rate depreciation, while in high and medium–high technological intensity industries it contracted as a result of depreciation.

Polodoo et al. (2011) examine the impact of exchange rate volatility on the macroeconomic performance of Small Island Developing States (SIDS). Taking a sample of 15 SIDS, the study analyzes econometrically the impact of exchange rate volatility on major macroeconomic variables, namely economic growth, external trade and foreign direct investment on the SIDS. The OLS with robust standard error results indicates that exchange rate volatility impacts negatively on current account balance but positively on the growth rate of the economies studied. In another study, Ozcelebi and Yildirim (2011) found out that the effects of exchange rates and price levels of Turkey, Germany and Russia may play a major role in determining the industrial production differences according to the results forecast error variance decompositions and impulse response functions analysis.

Ehinomen and Oladipo (2012) examined the impact of exchange rate management on the growth of the manufacturing sector in Nigeria. It was found that in Nigeria, exchange rate appreciation has a significant relationship with domestic output. And that exchange rate appreciation will promote growth in the manufacturing sector. Baltar et al. (2016) developed an investment model that considers the effect of changes in the real exchange rate, taking into account that the effect of the real exchange rate on the Brazilian manufacturing investment operates through demand and cost channels. The main results are that the investment responsiveness to changes in the exchange rate takes place mainly through imports, especially due to the effect of currency appreciation on imports of final goods. In general, the higher competition with imported products has offset the positive effect caused by cheaper imported inputs or capital goods. Hunegnaw (2018) investigates the effects of real exchange rates on manufacturing exports in 10 East African countries. The study used pooled mean group and mean group estimators with an Autoregressive Distributed Lag procedure to analyze disaggregated manufacturing exports, unlike past studies that often examined aggregate exports by adopting traditional empirical methods subject to various shortcomings. Findings suggest that exchange rate devaluation matters for export performance in Eastern Africa.

Oriji et al. (2019) estimated the impact of exchange rate (EXCH) movements on the manufacturing sector in Nigeria over the period 1981–2016. Time series data and ordinary least square (OLS) estimation technique were employed in this study to address the specified objective. Specifically, the findings showed that EXCH, government capital expenditure (GCEXP), imports and FDI were positively related to MGDP. Falaye et al. (2018) examined the impact of exchange rates on the performance of the Nigerian manufacturing sector using the independent variables of exchange rates like inflation rates, capacity utilization rate, the manufacturing sector's foreign direct investments, and imports over a period of 25 years. Unit Root test, Johansen co-integration test, Granger causality test and Error Correction Model were used to test how stationary, long-run relationship, causal relationship, and the short and long-run equilibrium relationships, respectively. The empirical results of the study showed that devaluation of the Naira had a negative impact on the performance of the Nigerian manufacturing sector.

2.2. Literature on SACU states

The available studies on the SACU states have largely been done at the country level. Masalila and Motshidisi (2003) state that the exchanged rate affects the manufacturing industry and it is this reason why the exchange rate policy in Botswana reflects the need to promote the competitive position of Botswana's non-traditional exports and import substitution activities. Motlaleng (2004) computed and to compare real exchange rate (RER) indexes for Botswana based on different measures in order to assess Botswana's competitiveness relative to its major trading partners. The study showed that Botswana has been gaining competitiveness relative to its major trading partners over the study period. This shows that the Bank of Botswana has indeed achieved its main objective of maintaining a competitive and a credible exchange rate policy, which protects the interest of domestic exporters. In Lesotho, The World Bank (2007) states that a sharp appreciation of the Rand against the US dollar between 2002 and 2005 brought a significant challenge for exporters, especially in the garment industry, that rely upon exports to the United States. This shows that the exchange rate has had an impact on the manufacturing sector. In Namibia, Mushendami and Namakalu (2016) showed that the exchange rate can affect the manufacturing sector through its impact on consumer inflation. In a study done by Salami (2018) in Eswatini, it was found that an increase in exchange rate would negatively affect the manufacturing sector.

In South Africa, Rowbotham, Saville and Mbululu (2014) analysed the weakening rand between 2011 and 2014 and finds no evidence of improved manufacturing performance. The author also fails to see any discernible relationship between currency and manufacturing output from 2011 to 2014. Bishop cited in kilian (2014) also notes that the manufacturing did not benefit from the weakening rand in 2013. A report commissioned by the Department of Trade and Industry revealed that weakening rand has not led to an improvement in SA's export performance, but has resulted in local manufacturing firms cutting back on domestic investment (Maqutu, 2014). Lings cited Duncan (2014) held that there is no indication that the weaker Rand is helping to improve South Africa's trade balance. It is for this reason that Retief (2011) the Rand is weak, that does not necessarily stimulate demand (Holburn 2011).

Schussler (2014) explained that while some economists would say that the weaker currency would boost manufacturing, tourism and exports, evidence in volume data shows that this is not the case in South Africa,[1] which is housing a "very sick currency. Kantor (2014) notes that Businesses in SA should not hope for an increase in the risks of doing business in South Africa reflected in a weaker rand. They should rather wish for the benefits of a stronger rand that reveal a strong global economy. Roodt cited in Maqutu (2014) notes that the desired currency level was a "moving target". This was because the rand could fall to a weak enough level, but not for long, then there would be calls for it to be even weaker.

3. Methodology

3.1. Data sources

The empirical analysis of this study is carried out by using annual panel data which was collected from the World Bank development indicators for all the five states. The sample period spans from 1995 to 2016 and the study was carried out by using 105 annual observations. The study used panel data because panel data have greater capacity for modeling the complexity of human behavior than a single cross-section or time series data (Hsiao, 2007; Andre, 2017). Andre (2017) further argues that sample selectivity and biases due to omitted variables can be controlled with panel data.

3.2. Model specification

The specification of an econometric model was based on economic theory and empirical literature relating to the link between exchange rate and manufacturing sector performance. On that premise, this study modified Yaqub's (2010) model. Yaqub (2010) investigated the effect of exchange rate on the output of the agricultural and manufacturing sectors in Nigeria. Based on the model employed by Yaqub (2010) and taking into account the nature of the SACU states, the study developed the following regression model:

$$MNF_{it} = \beta_0 + \beta_1 EXCH_{it} + \beta_2 INT_{it} + INF + \beta_4 IMP_{it} + \beta_5 FDI_{it} + \beta_6 EXP_{it} + \varepsilon_{it} \qquad (1)$$

where MNF is the manufacturing GDP, EXCH is the exchange rate, INT is the interest rate, INF is inflation, IMP is imports, FDI is foreign direct investment and EXP is exports ε_{it} is the error term.

3.3. Definition of variables and expected priori

Variable symbol	Variable definition	Apriori Sign	Source of data
INT	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. (Chikezie, 2015.	-	World Bank development Indicators
IMP	Imports of goods and services comprise all transactions between residents of a country and the rest of the world (Morris and Einhorn, 2008 cited in Edwards and Jenkins, 2013 and Bhorat, 2017)	-	World Bank development Indicators
FDI	Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. (Emmanuel (2016) and Pulstova (2016)	+	World Bank development Indicators
EXP	Exports of goods and services represent the value of all goods and other market services provided to the rest of the world Kucera et al. (2012:1126) as cited in Malan and Steenkamp (2015)	+	World Bank Development indicators
EXCH	Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages. (Maqutu, 2014)	-	World Bank development Indicators
MNF	This is the contribution of the manufacturing sector to GDP		World Bank development Indicators
INF	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services. (Sergii as cited in Modebe and Chijindu (2016)	-	World Bank development Indicators

3.4. Estimation procedure

3.4.1. Unit root

The importance of a priori check of the existence of unit roots in the panel data comes from the already known effect that the presence of unit roots in time series may cause a misinterpretation of estimated results (Barreira & Rodrigues, 2005). In light of this, this study conducted some stationarity tests to check if the statistical properties of a time series do not vary with time. The Levin, Lin and Chu (LLC), Lm, Pesaran and Shin (LPS) and ADF Fischer test were used. The original paper (Levin et al., 2002) follows a three-step procedure. In step 1, they carry out separate ADF regressions for each individual in the panel and generate two orthogonalized residuals. Step 2 requires estimating the ratio of long-run to short-run innovation standard deviation for each individual. In the final step they compute the pooled t-statistics (Morshed, 2010). The major drawback of the LLC test is that it restricts ρ to be homogeneous across all *i*. As Maddala (1999) pointed out, the null may be fine for testing convergence in growth among countries, but the alternative restricts every country to converge at the same rate (Kutlu, 2009).

The null may be fine for testing convergence in growth among countries, but the alternative restricts every country to converge at the same rate Kutlu (2009). That is to say, the null and the alternative hypothesis of the Fisher Augmented Dickey–Fuller (ADF) unit root test is the same as for the IPS unit root test. Both the IPS and Fisher tests combine information based on individual unit root tests while IPS requires a balanced panel, Fisher tests can be used to test unbalanced panel.

3.4.2. Panel cointegration test

The presence of stationary in the data implies that there might be an existence of a long-run relationship. In order to test there presence of long-run relationship between variables in the data, the Pedroni Panel Cointegration Test and the Fisher panel cointegration were employed. According to Morshed (2010) Pedroni (1999) describes the seven test statistics, "The first of the simple panel cointegration statistics is a type of non-parametric variance ratio statistics. The second is a panel version of a non-parametric statistics that is analogous to the familiar Phillips Perron rho- statistics. The third statistics is also non-parametric and is analogous to the Phillips and Perron *t*-Statistics. The fourth statistics is the simple panel cointegration statistics which is corresponding to augmented Dickey-Fuller *t*-statistics" (Pedroni, 1999, p 658). "The rest of the statistics are based on a group mean approach. The first of these is analogous to the Phillips and Perron rho-statistics, and the last two analogous to the Phillips and Perron *t*-statistics and the augmented Dickey-Fuller *t*-statistics respectively" (Pedroni, 1999, p 658). The study also used the Fisher panel cointegration test. Maddala and Wu (1999) propose a Fisher cointegration test based on the multivariate framework of Johansen (1988). They suggest combining the p-values of the individual (system based) cointegration tests in order to obtain a panel test statistic (Martins, 2011).

3.4.3. Fully modified least squares (FMOLS)

According to Pedroni (2000) in the presence of cointegration, OLS estimates do not give efficient results because OLS cannot solve the problems of endogeneity and serial correlations. Endogeneity bias and serial correlations are corrected by FMOLS and DOLS techniques and these estimators allow for standard normal inference (Carlsson, Lyhagen and Osterholm, 2007). This study employed the panel group FMOLS test from Pedroni (2000). Pedroni (2000) and Bispham (2005) find FMOLS estimators more robust and excelling in panels where there is considerable hetero-geneity. The FMOLS was preferred than the panel DOLS because in order "to ensure the Panel DOLS regression is carried out effectively, there are certain necessary conditions it needs to satisfy. The first amongst these conditions is that the level data of all variables under study must be in a non-stationary form, while the other condition states that, the variables must be stationary at first difference" (Stock and Watson, cited in Dursun, 2016). Results from the panel unit root tests showed that INT, INF and FDI were stationary at levels. This then made it inappropriate to use the DOLS method and the study opted to adopt the FMOLS technique. Therefore, FMOLS presented by Pedroni (2000, 2001) is applied to estimate long-run coefficients (Asghar & Nasreen, 2011). A simple panel regression model is presented as follows:

$$y_{it} = \alpha_i + \beta_i x_{it} + \varepsilon_{it} \tag{i}$$

The coefficient of FMOLS can be obtained based on the following equation:

$$\beta_{FMOLS} = \left[\sum_{i=1} N \sum_{t=1} T(x_{it} - \overline{x_{it}})\right]^{-1} \left[\sum_{i=1}\left(N \sum_{t=1} T(x_{it} - \overline{x_{it}})\right)y_{it}^+ + Ty_i^{\wedge}\right] \tag{ii}$$

$y_i^{\wedge}$ represents the serial correlation term. For overcoming the endogeneity, y_{it} changes into y_{it}^+.

3.4.4. Panel Mean Group Estimator

The study also used a Pooled Mean Group Estimator (PMG). This model takes the cointegration form of the simple ARDL model and adapts it for a panel setting by allowing the intercepts, short-run coefficients and cointegrating terms to differ across cross-sections. The estimation of the PMG requires reparameterization into the error correction system. The model can be reparametrized as a VECM system:

$$\Delta y_{it} = \theta_i\left(y_{i,t-1} - \beta_i' x_{i,t-1}\right) + \sum_{j=1}^{p-1} \lambda_{ij}\Delta y_{i,t-j} + \sum_{j=1}^{q-1} y_{ij}'\Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{iii}$$

where the β_i are the long-run parameters and θ_i are the equilibrium (or error)-correction parameters (Chu & Sek, 2015). In the PMG, the long-run coefficients on the explanatory variables (xit) are the same across units:

$$\Delta y_{it} = \theta_i\left(y_{i,t-1} - \beta' x_{i,t-1}\right) + \sum_{j=1}^{p-1} \lambda_{ij}\Delta y_{i,t-j} + \sum_{j=1}^{q-1} y_{ij}'\Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{iv}$$

All the dynamics and the ECM terms are free to vary in PMG. PMG technique is pooling the long-run parameters while avoiding the inconsistency problem flowing from the heterogeneous short-run dynamic relationships. Plus, the PMG relax the restriction on the common coefficient of short run while maintain the assumption on the homogeneity of long-run slope (Masih & Majid, 2013).

4. Presentation of results

4.1. Descriptive statistics
Table 1 shows the descriptive statistics of the variables used in this study.

Table 1. Descriptive statistics						
	EXCH	**EXP**	**FDI**	**INT**	**INF**	**MNF**
Mean	7.1471	45.801	1.1324	6.5390	6.7461	9.3249
Median	7.0453	46.471	3.9157	7.8423	6.5478	9.4065
Maximum	12.750	84.444	9.8945	4.1645	12.702	5.0012
Minimum	0.3782	22.135	0.6019	1.4289	−0.6920	2.5280
Std. Dev.	2.4506	13.500	2.1268	1.1578	2.5445	1.5701
Skewness	−0.0865	0.2724	2.5268	1.7694	0.2453	1.4461
Kurtosis	3.9578	2.7898	8.4853	4.7629	3.3573	3.4153

   The results show that the mean value of EXP (45.801) was higher than all other mean values and the FDI (1.1324) variable had the lowest mean value. Results also further reveal that the EXP variable had the highest variability as shown by the high standard deviation value (13.5). This was the highest of all the variables. The INT variable had the lowest variability (1.157). EXP also has the highest point on maximum values and EXCH had the lowest value on minimum values (0.3782). FDI (2.526), INT (1.769) and MNF (1.446) showed some deviation from the standard skewness of 0 as for kurtosis, FDI (8.485), and INT (4.762) had values that were above the kurtosis of 3.

4.2. Unit root tests and cointegration tests

The importance of a priori check of the existence of unit roots in the panel data comes from the already known effect that the presence of unit roots in time series may cause a misinterpretation of estimated results (Barreira & Rodrigues, 2005). In light of this, this study conducted some stationarity tests to check if the statistical properties of a time series do not vary with time. The Levin, Lin and Chu, Lm, Pesaran and Shin and ADF Fischer test were used. The results are shown in Table 2.

Table 2. Stationarity tests						
Variable	**Levin, Lin & Chu t***		**Lm, Pesaran and Shin W-stat**		**ADF—Fischer Chi-square**	
	Stat.	**Prob.**	**Stat.**	**Prob.**	**Stat.**	**Prob.**
MNF	0.8080	0.2095	−0.6180	0.2683	−11.9609	0.2877
INT	−2.5619	0.0052	−2.6601	0.0039	25.1483	0.0051
INF	−2.9372	0.0017	−2.4278	0.0076	23.9301	0.0078
IMP	0.2462	0.5973	1.4822	0.9309	3.5014	0.9670
FDI	−3.13476	0.0009	−3.3087	0.0005	28.8807	0.0013
EXP	−1.2946	0.0977	−0.9464	0.1720	13.2835	0.2082
EXCH	−1.4855	0.9313	0.6272	0.7347	5.4320	0.8606

Results in Table 2 show that all tests reveal that INT, INF and FDI were stationary at levels. Results also show that MNF, IMP, EXP and EXCH have unit root. The presence of stationary in the data implies that there might be an existence of a long-run relationship. To test whether there is a long-run relationship between variables in the data, the Pedroni Panel Cointegration Test and the Fisher panel cointegration test were used to determine the result.

Table 3. Pedroni cointegration test		
Cointegration test	**Intercept**	**Intercept and trend**
Test statistics	**Prob.**	**Prob.**
Panel v-statistic	0.4337	0.5927
Panel rho-statistic	0.7199	0.9645
Panel PP-statistic	0.0000	0.0000
Panel ADF-statistic	0.0004	0.0000
Group Panel rho-statistic	0.9240	0.9906
Group PP-statistic	0.0000	0.0000
Group ADF-statistic	0.0000	0.0000

Results show that among the seven statistics of the Pedroni cointegration test, four of the tests (the two PP statistics, and two ADF statistics) show that there is evidence of a long-run equilibrium relationship among the variables. Their *p*-values are below 0.05 and it implies that the study rejects the null hypothesis of no cointegration. The Fischer Test was used to supplement the Pedroni test. Table 3 shows the results from the Fisher Panel cointegration test.

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Table 4. Fisher panel cointegration test				
Hypothesised no. of CEs	Fisher statistic (from Trace test)	Prob.	Fisher statistic (from Max-eigen test)	Prob.
None	0.000	1.0000	0.000	1.000
At most 1	267.6	0.0000	208.6	0.000
At most 2	28.4	0.6452	22.3	0.4563

The Fisher panel cointegration test confirmed the existence of one cointegrating relationship among the variables. This corroborates with the Pedroni test results and upholds that there is a long-run association amongst the variables. The next step was to estimate the long-run estimates.

4.3. FMOLS and PMG Results

When all variables are cointegrated, the next step is to calculate the long-run estimates. This was done by employing an FMOLS and the PMG technique. Results from the FMOLS tests are presented in Table 5.
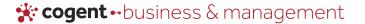
Table 5. FMOLS results				
Variable	Coefficient	Std Error	t-statistic	Prob
INT	0.0093	0.0315	0.2958	0.7680
INF	0.1310	0.0331	3.9524	0.0002***
IMP	−8.0600	3.7400	−2.1545	0.0339**
FDI	−0.0722	0.0315	−2.2885	0.0245**
EXP	0.0509	0.0220	2.3085	0.0233**
EXCH	−0.1901	0.0819	−2.3202	0.0226**

Note: *** 1% level; ** 5% level.

Results show that interest rates (INT) have a positive but insignificant relationship with manufacturing. This implies that interest rates do not affect the manufacturing sector. Results also show that inflation has a statistically positive relationship with manufacturing. This implies that an increase in inflation increases manufacturing performance. The findings are consistent with the empirical literature. Sergii as cited in Modebe and Chijindu (2016) states that there are theoretical arguments for a positive link between inflation and growth for low levels of inflation and a negative relation for high levels. This may explain the results of this study. SACU states have low and single-digit inflation figures. For instance, in 2018 Lesotho had 5.4%, Eswatini at 5.2%, Namibia (5.1%), South Africa (4.5%), and Botswana (3.5%) (SACU, 2018).

Results show that imports have a negative statistically significant relationship with manufacturing performance. This implies that an increase in imports reduces the performance of the manufacturing sector. This finding is supported by the literature. The common perception in South Africa is that the effects of the growth of trade with China have been negative for manufacturing, with several industries, most notably textiles and clothing, demanding increased protection from Chinese imports (Morris and Einhorn, 2008 cited in Edwards and Jenkins, 2013 and Bhorat, 2017).

Results show that foreign direct investment has a negative relationship with manufacturing performance. This implies that when foreign direct investment increases, manufacturing performance declines. This is surprising because foreign direct investment is supposed to promote

investment and this may boost the manufacturing industry. Emmanuel (2016) and Pulstova (2016) did some studies in Nigeria and Uzbekistan, respectively. Results from their studies showed that FDI was positively related to manufacturing performance. However, earlier studies had shown a negative relationship as found in this study. For instance, Mencinger (2003) as cited in Wang (2005) finds a negative growth effect of FDI in eight transitional economies over the period of 1994 to 2001. The author proposes several reasons for a negative growth effect of FDI such as the form of FDI, including majority as Mergers and Acquisitions (M&A) in these eight economies, and the proceeds of M&A are spent on imports which then causes current account deficits.

Results show that exports have a statistically significant relationship with manufacturing performance. This implies that when exports increase, manufacturing performance also increases. This is consistent with theoretical literature. The manufacturing sector contributes directly to GDP, employment, exports and human capital development (DTI, 2017). The results of a study conducted by Malan and Steenkamp (2015) who revealed that when exports declined, as a result of the 2008 global financial crisis, the performance of the manufacturing industry also declined.

Results show that there is a negative relationship between the exchange rate and manufacturing performance. This implies that when the rand exchange rate is depreciating manufacturing performance decline. This result seems to be consistent with the literature that investigates the rand manufacturing behaviour in SACU states such as South Africa and Namibia. For example, Saville (2014) analyses the weakening rand between 2011 and 2014 and finds no evidence of improved manufacturing performance. The author also fails to see any discernible relationship between currency and manufacturing output from 1980 to 2013. A report commissioned by the Department of Trade and Industry revealed that weakening rand has not led to an improvement in SA's export performance, but has resulted in local manufacturing firms cutting back on domestic investment (Maqutu, 2014) and SACU (2014). It can, therefore, be concluded that in South Africa weaker exchange rate does not translate into an improving trade balance and a stronger exchange rate does not necessarily lead to a poorer trade balance (South African Market Insights, 2019). In Namibia, there was a trade deficit in 2017 despite the real effective exchange rate depreciation (SACU, 2017). Table 6 shows the results from the PMG.

Findings from the MG estimation technique reveal that INT and INF have an insignificant impact on manufacturing while IMP is significant at 10% all in the long run. IMP has a negative impact on manufacturing performance. The long-run result also shows that EXP and FDI have a positive impact on manufacturing. There is also a negative between exchange rate and manufacturing performance. This implies that when the rand exchange rate is depreciating manufacturing performance decline. This result is in line with the result that was found in the FMOLS model. In the short run, only EXP and EXCH are significant at 5%. EXP has a positive relationship with manufacturing performance and EXCH has a negative relationship with manufacturing performance. This implies that when the rand exchange rate is depreciating manufacturing performance decline. This result is in line with the result that was found in the FMOLS model. INT shows a negative impact on manufacturing performance but it is significant at a 10% significance level. INF, IMP and FDI proved to be insignificant in explaining the changes in manufacturing performance.

The average speed of adjustment coefficient (error correction coefficient) is negative (0.53) and statistically significant (0.0000), indicating the existence of a long-run relationship between exchange rate and manufacturing. The magnitude of the error correction coefficient reveals the speed of adjustment to the long-run equilibrium (Kinkyo et al., 2016). In this case, approximately 53% of the disequilibrium adjusts during the year interval.

4.4. Robustness checks
Two diagnostic tests were applied to test the robustness of the model. These were the normality test and the Wald test. The normality test was used to test the normality of the series. The p-value

Table 6. Pooled mean group results				
Variable	**Coefficient**	**Std. error**	**_t_-Statistic**	**Prob.**
Long-run coefficients				
INT	0.1010	0.3717	0.2718	0.7858
INF	0.2744	0.2740	1.0013	0.3204
IMP	−0.3161	0.1903	−1.6607	0.0968*
FDI	0.0495	0.0169	2.2928	0.0047***
EXP	0.1110	0.0062	17.8931	0.0000***
EXCH	−0.3658	0.0798	−4.5794	0.0000***
Error correction coefficient				
Error correction	−0.5315	0.0538	−9.8716	0.0000***
Short-run coefficients				
ΔINT	−0.2810	0.1625	−1.7284	0.0887*
ΔINF	0.0647	0.0444	1.4587	0.1495
ΔIMP	0.4093	0.3836	1.0670	0.2860
ΔFDI	−0.0089	0.0271	−0.3278	0.7441
ΔEXP	0.4460	0.0611	7.2950	0.0000***
ΔEXCH	−0.5329	0.0549	−9.6990	0.0000***

Note: *** 1% level; * 10%.

of the Jarque-Bera statistic was 0.1225. This shows that we fail to reject the hypothesis of normal distribution at the 5% level. The Wald test was used to test for whether the cointegrating vector is (1, −1). The test was also applied to "further validate the estimated linkage by applying the Wald restriction tests to the empirical models which are estimated by FMOLS" (Sharma, 2015). The *t*-statistic and Chi-square *p*-values are both around 0.1239, indicating that we cannot reject the null hypothesis that the cointegrating regressor coefficient value is equal to 1. Furthermore, the results validate the estimated linkage between exchange rate and manufacturing performance.

5. Conclusions

The purpose of this study was to examine the relationship between exchange rate and manufacturing by applying panel techniques in SACU states for the period 1995–2015. The study drew from the fact that several stakeholders in the business circles, trade unions and analysts, particularly in South Africa, have been worried about the exchange rate and manufacturing relationship. The empirical results showed that there was a long-run relationship between the variables in the panel of five countries. Results showed that there is a negative relationship between the rand exchange rate and manufacturing performance. This implies that when the rand exchange rate is depreciating manufacturing performance decline. Results further showed that Results show that exports have a statistically significant positive relationship with manufacturing performance. This implies that when exports increase, manufacturing performance also increases. Inflation was seen to be having a positive relationship with manufacturing performance and imports and FDI were seen to be having a negative relationship with manufacturing performance.

Based on the findings of the study, it is recommended that SACU countries need to formulate informed policies that align the exchange rate to the actual needs of the manufacturing sector. The policy must be grounded in a complete understanding of the diverse industry segments as well as the wider trends affecting them. Conventional wisdom suggests that exchange rate devaluations are typically a development strategy. Given the traded environment of the manufacturing industry, a depreciation of a currency is usually seen as a solution that remedies the poor performance of the manufacturing sector through an increase in exports. This may not be the case (as revealed by this study) if the ripple effects (imported inflation and many other problems

that may come along with a weak currency) of an exchange rate depreciation are greater than the direct effects (increase in exports). For example, depreciation can cause inflation which may increase the prices of goods and services. This may hurt the manufacturing sector on the domestic market. In this regard, policymakers need to know which subsectors of the manufacturing sector will be affected by an exchange rate change and they also need to know the magnitude of the impact so that they can make informed decisions. In the absence of correct information of how the exchange rate affects the manufacturing sector and which sectors are affected by exchange rate changes, policy intervention leads to inefficiently low manufacturing performance.

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Note
1. Schussler (2014) maintained that the period between 2011 and 2014 has been a whole 36-month non-event because exports did not respond to the weakening rand over that period.

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