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# Testing the J Curve and the Marshall-Lerner Condition: Evidence from Southern African Development Community Countries

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**Abstract:** This study seeks to establish if there is empirical evidence in support of a currency devaluation or depreciation by testing the validity of the J-curve and the Marshall-Lerner condition using evidence from SADC member countries. The study objective is twofold; to test if a depreciation or devaluation worsens the trade balance in the short run and to test if a depreciation or devaluation improves the trade balance in the long run. The study adopts Autoregressive Distributed Lagged (ARDL) cointegration technique on a period from 1980 to 2018 for SADC countries using data from the World Development Indicators and the Trade Map. The study finds that the theory holds for Angola at 1.0 percent level of significance; at 5.0 percent level of significance, it holds for Comoros and Seychelles; and at 10.0 percent level of significance, it holds for Madagascar, Eswatini and South Africa. Lastly, the theory does not hold for Botswana, the Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, Tanzania and Zambia. For economies whose results are not consistent with the J curve phenomenon, the study suggests that authorities need not to exclusively rely on the exchange rate policy. Deliberate policies toward export diversification and fiscal policies have to be employed to resolve the financial challenges faced by in the export sector.

**Keywords:** Cointegration, J Curve, Trade Balance, Real Effective Exchange Rate, Depreciation

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## 1. Introduction

Southern African Development Community (SADC) countries experienced extraordinary growth in the 1970s. On average, annual economic growth stood at 3.2 percent. This period was followed by years of decline in economic growth. In the early 1980s, the average annual growth declined to 1.4 percent. Consequently, SADC countries quickly found themselves in economic turmoil. The economies had huge debt, ever increasing trade deficits, overvalued exchange rates, and excessive government involvement in running economic affairs. In a quest to restore economic stability, economies turned to multilateral organizations like the International Monetary Fund (IMF) and the World Bank (WB) for funding to support the current account balances [1]. One of the policy recommendations proposed to improve the trade balance and balance of payments, was to either devalue or to depreciate exchange rates. This recommendation came with strict terms and conditions. Failure to adhere to the terms and conditions

led to withholding of the funds or a complete abandonment of the program whenever deemed off track [2]. The plausibility of the recommendation of currency depreciation, devaluation or a complete shift from fixed regimes to flexible regimes has been a debatable topic.

This stance faced serious criticisms by scholars. For instance, Killick (1993) argues that the fund programs were inappropriate and preoccupied with the control of demand. The recommendations are little concerned about the balance of payments (BoP) weaknesses arising from the supply side. To make matters worse, the changes further impoverished the already poor. That notwithstanding, the IMF maintains the view that the programs strengthen the trade balance by swinging import cuts and improving export performance [3]. It is argued that in practice, it takes time for these improvements to show up and are usually sustained into the medium-term. These policy adjustments are pre-conditions for the loans and serve to ensure that the country is credit worthy [4]. As a way of ensuring strict adherence to the set conditions,

the finances are paid out in installments and linked to evident policy actions [5].

This study, therefore, seeks to establish if indeed there is empirical evidence for currency devaluation or depreciation by testing the validity of the J-curve phenomenon using evidence from SADC member countries.

### 1.1. Study Objectives

The overall objective of this study is to test the applicability of the J curve by testing if a devaluation or depreciation worsens the trade balance in the short run and an improvement of the same in the long run. The study was guided by the following objectives;

- 1) To test if a depreciation or devaluation worsens the trade balance in the short run.
- 2) To test if a depreciation or devaluation improves the trade balance in the long run.

In line with the overall study objective above, the following null hypotheses were tested;

- 1) Depreciation or devaluation does not worsen the trade balance in the short run.
- 2) Depreciation or devaluation does not improve the trade balance in the long run.

### 1.2. Southern African Development Community

Southern African Development Community (SADC), formerly known as the Southern African Development Coordination Conference (SADCC), is a regional block that was established in 1980 to strengthen socio-economic cooperation, integration and political and security cooperation of southern African economies. SADC membership comprises of sixteen countries namely; Angola, Botswana, Comoros, Democratic Republic of Congo (DRC), Eswatini (formerly Swaziland), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, United Republic of Tanzania, Zambia and Zimbabwe. Zimbabwe faced one of the world's worst economic crises from the late 1990s to 2009. The crisis encompassed a financial sector crisis, hyperinflation reached some of the highest levels ever seen, leading to a total disruption of the marketplace. For instance, inflation increased from 47 percent in 1998 to 7,982 percent in 2007, thereon it rose to 231,150,889 percent in July 2008 [6]. For this reason, Zimbabwe was not included in the study.

## 2. Literature Review

### 2.1. Real Effective Exchange Rate

Quite often, economists are interested in making a distinction between real and nominal variables, in this case, the real exchange rates. Nominal variables are adjusted for inflation to become real variables. As such, the real exchange rate describes the fluctuations in the price of foreign currency after considering domestic and foreign rates of inflation. The real effective exchange rate refers a measure of the value of a currency against a weighted average of several foreign

currencies divided by a price deflator or index of costs. The real effective exchange rate is calculated as follows;

$$RER = NER * \frac{\text{Domestic Price Index}}{\text{Foreign Price Index}} \quad (1)$$

$$REER_i = \sum_{j=1}^k W_j * RER_j \quad (2)$$

Where country  $j = 1, 2, \dots, k$  are country  $i$ 's trading partners and  $W_j$  represents the weight assigned to the RER of a trade partner based on the value of transactions.

### 2.2. Trade Balance

Trade Balance refers to the difference between the value of a country's imports and exports for a given period. It measures the relative strength of a country's economy. The trade balance formula is the total value of imports minus the total value of exports. A country that imports more goods and services than it exports in terms of value has a trade deficit. On the other hand, a country that exports more goods and services than it imports has a trade surplus. Trade balance is a component of the balance of payments (BoP) [7].

The balance of payments measures a nation's total receipts from and the total payments to the rest of the world. It provides a summary of all the transactions of the residents of a nation with the residents of all other nations recorded during a particular period, usually a calendar year [8]. The main purpose of the balance of payments is to inform the government of the international position of the nation. This information is very crucial in the formulation of monetary, fiscal, and trade policies. Government officials frequently consult the balance of payments of important trade partners in making policy decisions. As a summary statement, the balance of payments aggregates all merchandise trade into major categories.

### 2.3. Relationship Between Exchange Rate and Trade Balance

A depreciation of the domestic currency stimulates export demand and lower imports, thereby improving the trade balance. In contrast, an appreciation in the currency reduces exports demand and increases the demand for imports, consequently, adversely affect the trade balance. However, there is a lag period that elapses before imports and exports begin to respond to particular changes arising from the foreign exchange rate market. This has implications in the short and long term eventually gives rise to the J-curve effect and the Marshall-Lerner condition respectively [9].

### 2.4. The Marshall-Lerner Condition

The conventional concept that domestic currency devaluation improves the trade balance is rooted in a static and partial equilibrium approach to the balance of payments, called the elasticity approach. In particular, domestic currency devaluation makes domestic goods attractive on the foreign market – resulting in an increase in exports while foreign goods expensive on the domestic market – resulting into a

reduction in imports. Both effects lead to an improvement in the domestic country's trade balance. The Marshall-Lerner (ML) condition states that for a positive effect of devaluation on the trade balance to occur, the sum of the exchange rate elasticities of exports and imports must exceed one in absolute value terms [10]. When the ML condition holds, the exchange market is implicitly stable since there will be excess foreign exchange when the exchange rate is above the equilibrium, and vice versa. The ML condition is a long-run (equilibrium) condition empirically investigated by understanding the response of the imports and exports in level variables to changes in exchange rate [11].

### 2.5. The J-Curve Phenomenon

The effects of devaluation on the trade balance occur with a time lag. Magee (1973), observed that imports and exports adjust to changes with time lags which arise from recognition lag, decision lag, production lag, replacement lag and delivery lag. Importantly, it is argued that the trade balance deteriorates in the short-run in response to a currency devaluation, but improves over time towards the ML condition. Hsing (1999) argues that the degree of foreign and domestic producer's price pass-through to consumers and the scale of supply and demand elasticities of exports and imports determine the value of the exchange rate effect, and these tend to improve with time. Consequently, there is a short-run deviation which gradually gets corrected through an adjustment process in each period as the economy progresses towards the equilibrium [12]. The time path of the effects of devaluation on the trade balance, therefore, traces the so-called J-curve. While the ML condition merely explains the long-run phenomenon, the J-curve is a more recent phenomenon and goes further to explain the short-run post devaluation behavior of the relationship.

### 2.6. Empirical Literature Review

Kamoto (2006) investigated the effects of devaluation on the trade balance in Malawi and South Africa using a vector error correction model (VECM). The study used generalized impulse response functions to trace the response of the trade balance to the shocks in the exchange rate. The vector error correction model suggested the existence of a long-run equilibrium relationship among the variables for both Malawi and South Africa. The study found evidence of the J-curve on the South African trade balance, suggesting that following a real depreciation, the South African trade balance initially deteriorated but improved in the long run. However, Malawi did not exhibit a statistically significant J-curve phenomenon.

Mangani (2011) examined the effects of the exchange rate on foreign trade in Malawi. Separate export value and import value models were estimated using the single equation error correction modeling framework proposed by Pesaran et al. (2001). Apart from the real effective exchange rate, the aggregate GDP of Malawi's key trading partners was included in the export value function, while Malawi's GDP was allowed to explain the value of imports. The study showed that foreign trade in Malawi was not responsive to the real

effective exchange rate, both in the long-run and in the short-run.

Botha (2012) examined the existence of the J-curve effect to ascertain if the Marshall-Lerner condition holds in the South African manufacturing sector or not. The study used quarterly data from 1995 to 2010, applying the vector error correction modelling technique and impulse response functions to attain the research objectives. Overall, the results showed that a depreciation in the domestic currency results in a deterioration in the manufacturing trade balance in the short run followed by an improvement in the long run.

Bahmani-Oskooee (2012) tested the j-curve hypothesis for nine African countries namely; Burundi, Egypt, Kenya, Mauritius, Morocco, Nigeria, Sierra Leone, South Africa, and Tanzania for which quarterly trade data were available. Using the bounds testing approach to co-integration and error-correction modeling the study found no evidence to support the j-curve hypothesis.

Scholars have used methodologies ranging from Vector Error Correction Model VECM is an appropriate modeling strategy when the variables are cointegrated. It is useful when long-run forecast is desired [13, 14], the Error Correction Model ECM integrates the short-run dynamics with the long-run equilibrium without losing long-run information and avoids problems such as spurious relationship resulting from non-stationary time series data. This model takes sufficient numbers of lags to capture the data generating process in a general to specific modeling framework [15, 16].

The theoretical basis of the J-curve, suggests the existence of both short run and long run relationship to endogenous and exogenous variables. Relationships of this nature are best handled by the autoregressive distributed lagged models (ARDL). The j-curve proposes that a real exchange rate devaluation initially leads to worsening of the trade balance in the short run, and it is followed by an improvement of the trade balance in the long run. According to Rose and Yellen (1989), the trade balance behavior of a country is modelled as a function of the real exchange rate, the real domestic income and foreign income. The study makes the following assumptions; import prices rise immediately, export prices remain stable, import volumes begin to decline after some lags, and export volumes begin to increase, after some lags.

Letting  $X$  to denote exports,  $E$  to denote exchange rate and  $Y^f$  to denote foreign income; the export function is therefore expressed as follows;

$$X = X(E, Y^f) \quad (3)$$

Letting  $Y^d$  to denote domestic income, the import function is expressed as follows;

$$M = M(E, Y^d) \quad (4)$$

The trade balance is expressed as follows;

$$TB = X - M \quad (5)$$

$= X(E, Y^f) - M(E, Y^d)$  ...substituting (3) and (4) in equation (5).

$$TB = TB(E, Y^f, Y^d) \tag{6}$$

Following Bahmani-Oskooee & Brooks (1999), Gupta-Kapoor & Ramakrishnan (1999), and Onafowora (2003), trade balance is defined as the ratio of exports to imports. This definition makes trade balance insensitive to units of measurement and allows logarithmic transformation since trade deficits are not associated with negative signs (Boyd *et al.*, 2001). Given this definition, therefore, trade balance can be expressed as follows:

$$\ln\left(\frac{X}{M}\right) = fn(REER, Y^d, Y^f) \tag{7}$$

### 3. Methodology and Results

#### 3.1. Model Specification

This study employs the ARDL model. According to

$$dlnTB_{it} = \beta_{i0} + \sum_{k=1}^n \beta_{i1} lnTB_{it-k} + \sum_{k=0}^n \beta_{i2} lnY_{it-k}^d + \sum_{k=0}^n \beta_{i3} lnY_{it-k}^f + \sum_{k=0}^n \beta_{i4} lnREER_{it-k} + \sum_{k=0}^n \beta_{i5} dlnTB_{it-k} + \sum_{k=0}^n \beta_{i6} dlnY_{it-k}^d + \sum_{k=0}^n \beta_{i7} lnY_{it-k}^f + \sum_{k=0}^n \beta_{i8} lnREER_{it-k} + ECT_{it} + \varepsilon_{it} \tag{8}$$

TB is the dependent variable denoting the trade balance. The variable is defined as a ratio of exports to imports.

Yd denotes domestic income. This is the gross domestic product that represents the total market value of the goods and services produced within a specific nation over a selected period. The coefficient is expected to be negative. A rise in domestic income levels would make foreign goods more desirable to domestic consumers, hence, an increase in import demand. In turn, this is expected to worsen the trade balance.

Yf denotes foreign income. This is the foreign gross domestic product that represents the total market value of the goods and services produced within a specific nation over a selected period. The foreign GDP is a weighted GDP of a country’s major trading partners. A rise in foreign income levels would make locally produced goods more desirable to foreign consumers, hence an increase in exports. In turn, this is expected to improve the trade balance.

REER denotes real effective exchange rate. The real effective exchange rate is a direct quotation such that an increase in the REER index is equivalent to a depreciation of the local currency and a decrease in the REER index is considered as an appreciation of the domestic currency. The real effective exchange rate is computed as the weighted sum of the real effective exchange rates of a country’s major trading partners. As such,  $\beta_{i4}$  is expected to be positive indicating an improvement of the trade balance in the long run while  $\beta_{i8}$  is expected to be negative in the short run indication a deterioration of the trade balance in the short run.

The study used annual time series data over the period 1970-2018. The data on exports, imports, consumer price indices, gross domestic product and the exchange rates were World Bank Indicators prepared by the World Bank. The country trading partner were selected from the Trade Map prepared by the International Trade Center. The statistical analysis was performed using Stata 13.0.

Granger (1981) and Engle and Granger (1987), ARDL cointegration or bounds test techniques have become the solution to determining the long run relationship between series that are non-stationary, as well as reparameterizing them to the Error Correction Model (ECM) (Pesaran and Shin 1999 and Pesaran *et al.* 2001) and, Johansen and Juselius (1990). The reparameterized result gives the short-run dynamics and long run relationship of the underlying variables (Uko, 2016). This approach is applicable irrespective of the order of integration whether the variables under consideration are purely I(0) (i.e. the variables are stationary at level form) or purely I(1) (i.e. the variables become stationary at first difference). ARDL is superior in consideration regardless of sample size, which can be either small or finite and consist of 30 to 80 observations (Ghatak and Siddiki 2001) (Qamruzzaman & Jianguo, 2018). The ARDL model is estimated as follows;

#### 3.2. Unit Root Tests

The unit root test was conducted to establish the stationarity of the time series variables. Stationary series are those whose mean and variance are constant over time and the value of the covariance between the two time periods depends only on the lag between the two time periods and not the actual time at which the covariance is computed. Such a time series tends to return to its mean and fluctuations are around the mean. Stationarity makes generalization and forecasting possible [17]. On the other hand, any analysis on non-stationary series becomes misleading as the usual standard tests of significance are all invalid. Stationarity is a desirable property. The Phillips-Perron tests confirmed the presence of unit root.

Table 1. Cointegration Results.

(TB Yd, Yf, REER)	F-Statistic	Decision
Angola	5.707	Cointegration
Botswana	7.111	Cointegration
Comoros	7.677	Cointegration
Congo D R	4.930	Cointegration
Lesotho	6.256	Cointegration
Eswatini	5.761	Cointegration
Madagascar	4.915	Cointegration
Mauritius	3.941	Cointegration
Malawi	12.835	Cointegration
Mozambique	5.583	Cointegration
Namibia	7.401	Cointegration
Seychelles	7.341	Cointegration
South Africa	5.564	Cointegration
Tanzania	4.180	Cointegration
Zambia	5.479	Cointegration
Lower-bound critical value at 5.0%	3.160	
Upper-bound critical value at 5.0%	4.160	
Lower & Upper-bound critical values (Pesaran <i>et al.</i> (2001), Table CI(ii) Case II)		

### 3.3. Cointegration Analysis

Although two or more variables are individually non-stationary, their linear combination can be stationary [18]. The existence of a cointegrating relationship implies that the regression of non-stationary series in their levels yields meaningful results. Cointegration enables separation of the short and long run relationships among variables higher accuracy in long-run forecasting. The results in the Table 1 indicates presence of cointegration for all the countries under consideration.

### 3.4. Test for Structural Breaks and Stability

In the period under study, the economies may have experienced some shocks caused structural breaks between the regressand and the regressors in the function. A structural break means that the values of the parameters of the model do not remain the same throughout the period. The commonly used test for structural breaks is the Chow test [17]. The chow test results in Table 2 suggested the presence of a structural break in all the countries.

Tables 2. Structural Breaks Results.

	Point of Structural Break
Angola	1999
Botswana	1988
Comoros	1998
Congo Dem. Rep.	1988
Eswatini	1988
Lesotho	2000
Mauritius	1987
Madagascar	2010
Mozambique	2008
Malawi	1995
Namibia	2007
South Africa	1988
Seychelles	1996
Tanzania	2003
Zambia	2002

### 3.5. ARDL Results

Table 3 below shows the results after specifying the ARDL model followed by a discussion of the same.

Table 3. ARDL Results.

	Adj.	Long Run			Short Run				Cons.	R <sup>2</sup>
	lnTB	lnYd	lnYf	lnREER	dITB	dYd	dYf	dIREER		
Angola	-0.655***	0.007***	-0.233***	0.086***	0.522***	0.031	-1.110	-0.153***	-0.027	0.71
lag 1								-0.144***		
lag 1								-0.140***		
lag 3								-0.099***		
Botswana	-0.383***	-2.188	3.546***	-0.186*	0.255	1.753***	0.940	0.023	0.232***	0.61
lag 1								0.013		
Comoros	-0.945***	0.447	-0.039	0.044**		-0.354	0.032	-0.035**	0.307***	0.58
lag 1						-0.184	0.092	-0.017**		
Congo D. R.	-0.317	0.563*	0.256*	0.040	-0.266			-0.014*	-1.301*	0.47
lag 1							0.347	-0.022***		
Eswatini	-0.935***	0.555	0.625	0.104*	0.079	-0.431	0.277	-0.077***	-0.039	0.6
lag 1						-0.431	0.267			
Lesotho	-0.173**	-3.406*	-0.053	-0.004		0.471***	0.199	-0.002	0.063**	0.43
lag 1						0.226***				
Mauritius	-0.285**	-1.127**	-0.158	0.071		0.251**	-0.008	-0.030*	0.293*	0.36
lag 1						0.189		-0.011		
Madagascar	-0.588***	0.295	-0.435	0.102*	-0.051	-0.454	5.476***	-0.044*	1.335	0.58
lag 1					0.368**					
lag 2					0.390**					
Malawi	-0.677***	0.887**	-1.307**	0.108		0.834	0.152	-0.046	7.080*	0.51
lag 1							1.725	-0.041		
Mozambique	-0.375**	2.020**	-1.637*	0.057		0.888*	4.081	-0.03	3.264	0.37
Namibia	-0.985***	-0.400***	8.775**	-0.088*	0.388*	-0.133	-3.783	0.062*	0.318**	0.53
lag 1							-3.489			
Seychelles	-0.623***	-1.487**	4.818***	0.353***	0.087	0.233	3.097	-0.128**	-27.545***	0.47
lag 1							2.351	-0.072		
South Africa	-0.874***	-1.157*	2.036	0.042*	0.034	-0.97	-0.602	-0.042**	-0.057	0.76
lag 1							-0.577	-0.025*		
Tanzania	-0.979***	-0.311	-1.261	-0.172**		0.653	1.442	0.139**	0.082	0.63
lag 1								0.076**		
Zambia	-0.347**	0.136	-0.133	0.026		-0.139*	0.554	-0.019	-0.055	0.39
lag 1								-0.012		

\*\*\*-Significant at 1 percent, \*\*-Significant at 5 percent, \*-Significant at 10 percent

#### Angola

In the long run, on average, a one percent increase in domestic output leads to an improvement of 0.007 percent of the trade balance; a one percent increase in the global output leads to a 0.233 percent worsening in the trade balance; while

a one percent depreciation of the Angolan Kwana leads to a 0.086 percent improvement in the trade balance. The short run deviations are corrected at 65.4 percent. In the short run, on average, a one percent increase in the first lag of the trade balance leads to a 0.52 percent improvement in the trade

balance; a one percent increase in the domestic output leads to a 0.03 percent improvement of the trade balance, a one percent increase in the foreign output leads to a 1.10 percent worsening of the trade balance; while a one percent depreciation of the Angolan Kwanza leads to a 0.153 percent worsening of the trade balance. The j curve phenomenon holds for the Angolan economy at 5.0 percent significance level. Angola's exports are largely dominated by oil exports, which accounted for about 20.0 percent of the exports [19]. A depreciation shock leads to an increase in demand for oil, producers adjust by increasing production [20]. Eventually, there is an improvement in the trade balance.

#### *Botswana*

In the long run, on average, a one percent increase in domestic output leads to a worsening of 2.18 percent of the trade balance; a one percent increase in the global output leads to an improvement of 3.54 percent in the trade balance; while a one percent depreciation of the Botswana Pula leads to a 0.186 percent worsening in the trade balance. The short run deviations are corrected at 38.3 percent. In the short run, on average, a one percent increase in the first lag of the trade balance leads to a 0.255 percent improvement in the trade balance; a one percent increase in the domestic output leads to a 1.753 percent improvement of the trade balance, a one percent increase in the foreign output leads to a 0.94 percent improvement of the trade balance; while a one percent depreciation of the Botswana Pula leads to a 0.023 percent improvement of the trade balance. In the long run, domestic output, foreign output and the real effective exchange rate are insignificant at 5.0 percent. In the short run, the domestic output is significant, while foreign output and the real effective exchange rate are insignificant at 5.0 percent. Therefore, the j curve phenomenon does not hold for the Botswana economy at 5.0 percent significance level. In the long run, a depreciation of the Botswana Pula leads to a worsening trade balance while in the short run a depreciation of the Botswana Pula leads to an improvement of the trade balance. To a large extent, this is due to Botswana's heavy reliance on diamonds. Depreciation of the Pula creates a strong global demand for diamonds in the short run. Results indicate that in the long-run there is no trade-off between export competitiveness and devaluation. In the long run, the depreciation leads to inflationary pressures which result in loss of competitiveness hence worsening the trade balance.

#### *Comoros*

In the long run, on average, a one percent increase in domestic output leads to an improvement of 0.447 percent of the trade balance; a one percent increase in the global output leads to a worsening of 0.039 percent in the trade balance; while a one percent depreciation of the Comorian Franc leads to a 0.044 percent improvement in the trade balance. The short run deviations are corrected at 94.50 percent. In the short run, on average, a one percent increase in the domestic output leads to a worsening of 0.354 percent in the trade balance, a one percent increase in the foreign output leads to a 0.032 percent improvement of the trade balance; while a one percent depreciation of the Comorian Franc leads to a 0.035 percent

worsening of the trade balance. In both long run and short run, domestic output and foreign output are significant at 5.0 percent while the real effective exchange rate coefficients are significant. The j curve phenomenon holds for the Comorian economy at 5.0 percent significance level. The analysis shows that the real effective exchange rate was broadly in line with economic fundamentals. A real depreciation of the exchange rate is consistent with the j curve. The economy exhibits a strong sensitivity of the current account to changes in the real effective exchange rate [21].

#### *Democratic Republic of Congo*

In the long run, on average, a one percent increase in domestic output leads to an improvement of 0.563 percent of the trade balance; a one percent increase in the global output leads to a 0.25 percent improvement in the trade balance; while a one percent depreciation of the Congolese Franc leads to a 0.04 percent improvement in the trade balance. The short run deviations are corrected at 31.65 percent. In the short run, on average, a one percent increase in the foreign output leads to a 0.266 percent worsening of the trade balance; while a one percent depreciation of the Congolese Franc leads to a 0.014 percent worsening of the trade balance. The j curve phenomenon does not hold for the Congolese economy at 5.0 percent significance level. Depreciation of the real effective exchange rate makes the exports competitive in short run. The study found that the competitiveness is insignificant in the long run. This is attributable to the fact that the exports are not diversified by sectors. Diversification is limited to mining products such as diamonds, cobalt, copper and offshore oil.

#### *Eswatini*

In the long run, on average, a one percent increase in domestic output leads to an improvement of 0.555 percent of the trade balance; a one percent increase in the global output leads to a 0.625 percent improvement in the trade balance; while a one percent depreciation of the Swazi Lilangeni leads to a 0.104 percent improvement in the trade balance. The short run deviations are corrected at 93.5 percent. In the short run, on average a one percent increase in the first lag of the trade balance leads to a 0.079 percent improvement in the trade balance; a one percent increase in the domestic output leads to a 0.431 percent worsening of the trade balance, a one percent increase in the foreign output leads to a 0.27 percent improvement of the trade balance; while a one percent depreciation of the Swazi Lilangeni leads to a 0.077 percent deterioration of the trade balance. In the long run, domestic output, foreign output and the real effective exchange rate are insignificant at 5 percent. However, the domestic output and real effective exchange rate are significant at 10 percent. In the short run, only real effective exchange rate is significant at 5.0 percent. The J-curve phenomenon holds for the Eswatini economy at 10.0 percent significance level. The results demonstrate the extent to which the structure of Swaziland's economy has evolved; moving away from reliance on primary sectors to developing a sizable industrial base. A depreciation of the Lilangeni leads worsens the trade balance in the short run. Producers respond by increasing production to exploit the demand that follows in the long run.

*Lesotho*

In the long run, on average, a one percent increase in domestic output leads to a worsening of 3.406 percent of the trade balance; a one percent increase in the global output leads to a 0.053 percent worsening in the trade balance; while a one percent depreciation of the Lesotho Loti leads to a 0.004 percent worsening in the trade balance. The short run deviations are corrected at 17.3 percent. In the short run, on average, a one percent increase in the domestic output leads to an improvement of 0.471 percent in the trade balance, a one percent increase in the foreign output leads to a 0.002 percent worsening of the trade balance; while a one percent depreciation of the Lesotho Loti leads to a 0.063 percent improvement of the trade balance. In the long run, the domestic output is significant, while foreign output and the real effective exchange rate are insignificant at 5.0 percent. In the short run, domestic output, foreign output and the real effective exchange rate are insignificant at 5.0 percent. Real exchange rate was found statistically insignificant. Lesotho belongs to the Common Monetary Area of Southern Africa, such that its currency is pegged to the South African currency, the rand. Consequently, movements in the rand-exchange rate have got a direct and significant impact on Lesotho's external competitiveness as opposed to the Loti [21].

*Madagascar*

In the long run, on average, a one percent increase in domestic output leads to an improvement of 0.295 percent of the trade balance; a one percent increase in the global output leads to a worsening of 0.435 percent in the trade balance; while a one percent depreciation of the Malagasy Ariary leads to a 0.102 percent improvement in the trade balance. The short run deviations are corrected at 58.8 percent. In the short run, on average a one percent increase in the first lag of the trade balance leads to a worsening of 0.051 percent in the trade balance; a one percent increase in the domestic output leads to a worsening of 0.454 percent in the trade balance, a one percent increase in the foreign output leads to a 5.476 percent improvement of the trade balance; while a one percent depreciation of the Malagasy Ariary leads to a 0.044 percent worsening of the trade balance. In the long run domestic output, foreign output and the real effective exchange rate are insignificant at 5.0 percent. In the short run, domestic output and foreign output are insignificant at 5.0 percent while real effective exchange rate is significant. The j curve phenomenon holds for the Malagasy economy at 10.0 percent significance level. In the short run, exchange rate depreciation worsens the trade balance and creates demand which stimulates export growth. In long run, the exports become competitive.

*Malawi*

In the long run, on average, a one percent increase in domestic output leads to an improvement of 0.887 percent of the trade balance; a one percent increase in the global output leads to a 1.307 percent worsening in the trade balance; while a one percent depreciation of the Malawi Kwacha leads to a 0.107 percent improvement in the trade balance. The short run deviations are corrected at 67.7 percent. In the short run, on average, a one percent increase in the domestic output leads to

a 0.834 percent worsening of the trade balance, a one percent increase in the foreign output leads to a 0.152 percent improvement of the trade balance; while a one percent depreciation of the Malawi Kwacha leads to a 0.046 percent deterioration of the trade balance. The j-curve phenomenon does not hold for the Malawian economy. The lack of responsiveness of Malawi's trade balance to changes in foreign income is attributable unmanufactured nature of Malawi's export commodities and the relatively unfavorable market conditions for these exports in the major importing western countries [22, 23].

*Mauritius*

In the long run, on average, a one percent increase in domestic output leads to a worsening of 1.127 percent of the trade balance; a one percent increase in the global output leads to a 0.158 percent worsening in the trade balance; while a one percent depreciation of the Mauritian Rupee leads to a 0.071 percent improvement in the trade balance. The short run deviations are corrected at 28.5 percent. In the short run, on average, a one percent increase in the domestic output leads to an improvement of 0.251 percent in the trade balance, a one percent increase in the foreign output leads to a 0.008 percent worsening of the trade balance; while a one percent depreciation of the Mauritian Rupee leads to a 0.03 percent worsening of the trade balance. In the long run and short run, domestic output, foreign output and the real effective exchange rate are insignificant at 5.0 percent. The j-curve phenomenon does not hold for the Mauritian economy at 5.0 percent significance level. Although the results are consistent with the apriori expectations the long run coefficient is insignificant while the short run coefficient is significant at 10.0 percent level. For the Mauritian economy a depreciation worsens the trade balance in the short run. In the long run the improvement in trade balance is not very pronounced. Hence, depreciation is not very effective in improving the trade balance.

*Mozambique*

In the long run, on average, a one percent increase in domestic output leads to an improvement of 2.02 percent of the trade balance; a one percent increase in the global output leads to a 1.637 percent worsening in the trade balance; while a one percent depreciation of the Mozambican Metical leads to a 0.057 percent improvement in the trade balance. The short run deviations are corrected at 37.50 percent. In the short run, on average, a one percent increase in the domestic output leads to a 0.888 percent improvement of the trade balance, a one percent increase in the foreign output leads to a 4.081 percent improvement of the trade balance; while a one percent depreciation of the Mozambican Metical leads to a 0.03 percent worsening of the trade balance. In the long run, foreign output and real effective exchange rate are insignificant. In the short run, domestic output, foreign output and the real effective exchange rate are insignificant at 5.0 percent. Although the results were conformed to the apriori expectations, there was no statistical evidence supporting the j-curve phenomenon. The reasons for this revolve around the composition of the export basket [24]. The economy's main

exports are locked in long term contracts such that the response to depreciation is constrained. On the demand side, the expenditure switching is more pronounced.

#### *Namibia*

In the long run, on average, a one percent increase in domestic output leads to a worsening of 0.40 percent of the trade balance; a one percent increase in the global output leads to an 8.775 percent improvement in the trade balance; while a one percent depreciation of the Namibian dollar leads to a 0.088 percent worsening in the trade balance. The short run deviations are corrected at 98.50 percent. In the short run, on average, a one percent increase in the first lag of the trade balance leads to a 0.388 percent improvement in the trade balance; a one percent increase in the domestic output leads to a 0.133 percent worsening of the trade balance, a one percent increase in the foreign output leads to a 3.783 percent worsening of the trade balance; while a one percent depreciation of the Namibian dollar leads to a 0.062 percent improvement of the trade balance. The real exchange rate is significant at 10.0 percent both in the long run and in the short run. However, the coefficients do not conform to the apriori expectations; the results suggest that a depreciation leads to an improvement of the trade balance in the short run while it leads to a worsening in the long run. Therefore, the j-curve phenomenon does not hold for the Namibian economy at 5.0 percent significance level. The results indicate that a currency depreciation leads to an improvement in the trade balance in the short run and a worsening in the long run. The exchange rate cannot be used to influence the trade balance.

#### *Seychelles*

In the long run, on average, a one percent increase in domestic output leads to a worsening of 1.487 percent of the trade balance; a one percent increase in the global output leads to a 4.818 percent improvement in the trade balance; while a one percent depreciation of the Seychelles Rupee leads to a 0.353 percent improvement in the trade balance. The short run deviations are corrected at 62.30 percent. In the short run, on average, a one percent increase in the first lag of the trade balance leads to a 0.087 percent improvement in the trade balance; a one percent increase in the domestic output leads to a 0.233 percent improvement of the trade balance, a one percent increase in the foreign output leads to a 3.097 percent improvement of the trade balance; while a one percent depreciation of the Seychelles Rupee leads to a 0.128 percent worsening of the trade balance. In the long run, domestic output, foreign output and the real effective exchange rate are significant at 5.0 percent. In the short run, only real effective exchange rate is significant at 5.0 percent significance level, while domestic output and foreign output are insignificant at 5.0 percent. Therefore, the j-curve phenomenon holds for the Seychelles economy at 5.0 percent significance level. Depreciation of the rupee boosts demand for exports in the short run. In the long run the country exports become more competitive.

#### *South Africa*

In the long run, on average, a one percent increase in domestic output leads to a decline of 1.157 percent of the trade

balance; a one percent increase in the global output leads to a 2.036 percent improvement in the trade balance; while a one percent depreciation of the South African Rand leads to a 0.042 percent improvement in the trade balance. The short run deviations are corrected at 117.4 percent. In the short run, on average, a one percent increase in the first lag of the trade balance leads to a 0.034 percent improvement in the trade balance; a one percent increase in the domestic output leads to a 0.97 percent worsening of the trade balance, a one percent increase in the foreign output leads to a 0.6 percent worsening of the trade balance; while a one percent depreciation of the South African Rand leads to a 0.042 percent deterioration of the trade balance. In the long run, domestic output, foreign output and the real effective exchange rate are insignificant at 5.0 percent. However, the domestic output and real exchange rate are significant at 10.0 percent. In the short run, only real effective exchange rate is significant at 5.0 percent. The j-curve phenomenon holds for the South African economy at 10.0 percent significance level. Depreciation in the domestic currency results in a deterioration in the manufacturing trade balance in the short run, followed by an improvement in the long run. The exchange rate adjustment may be used to change the direction of demand between exports and imports.

#### *Tanzania*

In the long run, on average, a one percent increase in domestic output leads to a worsening of 0.31 percent of the trade balance; a one percent increase in the global output leads to a 1.261 percent worsening in the trade balance; while a one percent depreciation of the Tanzanian Shilling leads to a 0.172 percent worsening in the trade balance. The short run deviations are corrected at 97.86 percent. In the short run, on average, a one percent increase in the domestic output leads to a 0.653 percent improvement of the trade balance, a one percent increase in the foreign output leads to a 1.442 percent improvement of the trade balance; while a one percent depreciation of the Tanzanian Shilling leads to a 0.139 percent improvement of the trade balance. In the long run and short run, domestic output, foreign output and the real effective exchange rate are insignificant at 5.0 percent. The j-curve phenomenon does not hold for the Tanzanian economy at 5.0 percent significance level. Although the real effective exchange rate coefficients are significant at 5.0 percent in the long run and short run, they do not conform to the apriori expectations. The long run coefficient is negative and the short run coefficient is positive suggesting that depreciation improve the trade balance in the short run and does not improve the trade balance in the long run. The results are similar to Bahmani-Oskooee (2012) who found was no evidence to support for the j-curve in Tanzania. The results suggest that exchange rate does not make Tanzanian exports more competitive. The country's export revenue to a large extent depends on international commodity prices.

#### *Zambia*

In the long run, on average, a one percent increase in domestic output leads to an improvement of 0.136 percent of the trade balance; a one percent increase in the global

output leads to a 0.133 percent worsening in the trade balance; while a one percent depreciation of the Zambian Kwacha leads to a 0.026 percent improvement in the trade balance. The short run deviations are corrected at 34.7 percent. In the short run, on average, a one percent increase in the domestic output leads to a 0.139 percent worsening of the trade balance, a one percent increase in the foreign output leads to a 0.554 percent improvement of the trade balance; while a one percent depreciation of the Zambian Kwacha leads to a 0.019 percent worsening of the trade balance. In the long run, domestic output, foreign output and the real effective exchange rate are statistically insignificant at 5.0 percent, while in the short run only the domestic output is significant. The j-curve phenomenon does not hold for the Zambian economy at 5.0 percent significance level. The study found that exchange rates in Zambia have no impact on the trade balance in the short run but they have an impact in the long run. Zambian exports base metals of copper, cobalt, cement, sugar and agricultural products. The price of the commodities volatile and insensitive to the exchange rate adjustments. The country's imports are also less sensitive to the exchange rate movements. The imports are mainly comprised of industrial supplies, capital goods, mineral fuels, oil, transport equipment and consumer goods.

#### 4. Conclusion

Overall, the results indicate that there is a plausible relationship between the trade balance movements and exchange rate changes in Angola, Comoros, Seychelles, Madagascar, Eswatini and South Africa. The presence of j curve strongly indicates the presence Marshall-Lerner condition. However, for Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, Tanzania and Zambia the responsiveness of the trade balance to changes in the exchange rate were found to be insignificant and inconsistent with economic theory. These inconsistencies are attributable to the fact that many African countries largely depend on imports, and tend to be unresponsive to exchange rate changes. Hence, a depreciation of their exchange rates may have insignificant effect on imports.

For economies whose results are not consistent with the j-curve phenomenon, authorities need not to solely rely on the exchange rate policy. The study shows that for the economies to leverage on the real currency depreciation, deliberate policies toward export diversification have to be pursued. Substantial attention should also be given to value addition and non-traditional export sectors. There is need for good coordination between monetary and fiscal policies to address the financial challenges of players in the export sectors.

#### 5. Areas for Further Research

The study focused on analyzing the trade balance response to changes in exchange rate, domestic output and foreign

output. The possible areas of further research are; 1) to replicate the study using quarterly data and 2) to investigate if the j-curve phenomenon to specific sectors of the economy.

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