FOREWORD

The Central Bank of Swaziland welcomes you to yet another rendition of its Research Bulletin. This publication forms part of the Bank’s endeavor to provide voice to research work conducted within the institution. We hope that a reading of this document ignites new discussions, revives unfinished deliberations and reorganizes existing policies in Swaziland. Encompassed in this document is the research work that has been undertaken during the 2017/2018 financial year.

It has to be amplified that whilst care has been given to ensure accuracy in terms of methodological application and use of analytical tools available, errors and omissions are those of authors. As such should a reader identify such an error and/or an omission, please forward these to the General Manager, Economic Policy Research and Statistics Department who is reachable at sikhumbuzod@centralbank.org.sz. Further, each of the published material contains contact details of the authors. Readers are encouraged to interact with authors to enable the Bank to improve the quality of its research work.

Disclaimer: The ideas expressed in the papers should not be reported as representing the views of the Central Bank of Swaziland. The views expressed in this papers are those of the authors and do not necessarily represent those of the Central Bank of Swaziland and Central Bank Policy.
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Determination of an Optimal Public Debt Threshold Level for Economic Growth in Swaziland

Patrick Ndzinisa¹ and Majozi V. Sithole²

Abstract

This paper determines an optimal public debt threshold level above which increasing debt reduces economic growth in Swaziland. Theoretical literature suggest that debt initially causes growth to rise by increasing aggregate expenditure. However, as debt increases to unsustainable levels tends to reduce growth by reducing aggregate expenditure as resources are channeled towards servicing debt. This suggests a nonlinear relationship of a quadratic form between debt and growth. As such, the study estimates an aggregate demand nonlinear quadratic threshold model including public debt. We control for the possibility of endogeneity by employing the Generalized Method of Moments (GMM) estimation technique.

The results confirm the existence of a nonlinear hump-shaped relation between public debt and economic growth. The optimal level of public debt-to-GDP above which increasing debt reduces economic growth is estimated at about 46 per cent of GDP. A retrospective examination of the country’s total public debt-to-GDP profile indicates that the estimated threshold level has not been exceeded in the past and not even the 35 per cent public debt limit set by government and the 40 per cent proposed by the World Bank for developing countries.

The estimated optimal debt limit is also in line with the SADC convergence criteria of public debt as a percentage of GDP of less than 60 per cent. We recommend for debt-management policies that will gradually bring public debt towards the threshold level to support growth while also ensuring debt sustainability.

Key words: public debt threshold, economic growth, GMM, Swaziland

1.0 INTRODUCTION

The paper empirically determines an optimal threshold level of the public debt beyond which rising debt becomes deterrent to economic growth in Swaziland. The existence of an optimal public debt threshold implies a nonlinear quadratic relation between economic growth and public debt. As suggested by existing theoretical studies, the nonlinearity effect of debt to economic growth is most likely to be transmitted through the investment channel (Pattillo et al., 2002). According to Palley (1994) and Athanassiou (2012) debt initially increases growth by increasing aggregate expenditure. However, as debt becomes excessively high it dampens growth as government revenue is channeled towards servicing debt at the expense of low aggregate expenditure. This suggests that debt has two opposing effects on growth and that the relationship between the two variables is nonlinear of the quadratic form.

The global economic meltdown prompted many countries to pursue expansionary fiscal policies to prevent their economies from collapsing. While these policies helped to resuscitate growths, they led to high public debt-to-GDP ratios. This became evident in countries including Greece which recorded a debt-to-GDP ratio of over 100 per cent (Bawa et al., 2016). In Swaziland, the crisis led to a sharp fall in the Southern African Custom Union (SACU) revenue prompting a rapid increase in public debt particularly in public domestic debt. Public domestic debt

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increased from a low of 1.5 per cent of GDP in 2009 to 10.0 per cent of GDP in 2016. As noted by Semmler and Sieveking (2000), an increase in debt above a critical level can result to unsustainable debt and insolvency. Consequently, creditworthiness may be lost leading to capital outflows causing a currency and financial crisis and a huge decline in output.

Against this background, the purpose of this study is to establish an optimal level of public debt given the growth rate for Swaziland using both quantitative and qualitative analysis. More specifically, the study intends to achieve the following objectives. Firstly, to ascertain if there is evidence in support of a non-linear quadratic relationship between the public debt-to-GDP ratio and growth in Swaziland. Secondly, to determine the optimal debt-to-GDP ratio for Swaziland above which increases in public debt has a negative effect on growth. Thirdly, to find out if there are significant differences between the estimated optimal debt-to-GDP ratio for Swaziland and the 35 per cent of GDP debt limit set by the Swaziland government in its debt strategy and the 40 per cent of GDP debt limit set by the World Bank for developing countries respectively. Lastly, we intend to verify if the estimated optimal debt threshold is in line with the SADC debt limit of less than 60 per cent of GDP.

The significance of the study is that the public debt threshold will guide policy makers in designing appropriate optimal public debt strategies for the country. In this regard, the debt threshold acts as a debt ceiling to ensure positive economic growth rates and debt sustainability. Pattillo et al. (2011) argue that for high level of debt it is a challenge to know if debt has reached levels that are suppressing to growth. The debt threshold therefore provides a quantifiable level at which additional debt lowers growth by channeling resources to debt repayment. Unlike the critical debt ratios set by the World Bank, the study determines a country-specific debt threshold supported by econometric models. For example, the 40 per cent to GDP debt critical ratio for developing countries may not be applicable in Swaziland.

To the best of our knowledge, no study has been done in relation to the determination of an optimal public debt threshold beyond which additional debt impedes economic growth in Swaziland. Unlike existing studies which investigate the relation between debt and growth within growth models, this study examines this relation using the aggregate demand specification. In this regard, we build on the work by Moron and Winkelried (2005), who formulate an aggregate demand function for Latin American countries. By adding the linear term and squared term of the public debt-to-GDP to the aggregate demand equation, we formulate a non-linear debt-growth nexus. This formulation allows us to investigate whether public debt has a positive short-run and a negative long-run effects on economic growth.

The remainder of the paper is organized as follows: In section 2, we review previous related literature on the relationship between public debt and economic growth, and on the determination of threshold levels. Section 3 presents developments of the public debt and growth in Swaziland in relation to its counterparts in the SACU region. In section 4, we present the theoretical public debt threshold models. Data analysis and the estimation technique are presented in section 5. In section 6, the empirical results are presented and analyzed. Section 7 concludes with some policy recommendations.
2.0 LITERATURE REVIEW

The global recession and sovereign debt crisis in Europe have intensified studies on the relationship between debt and economic growth. As noted by Eberhardt and Presbitero (2015), many studies examine this relationship by investigating the possibility of a nonlinear debt-growth nexus; and the extent to which debt accumulation has a short-run positive and a long-run negative effects on economic growth. In this regard, a strand of literature concludes that there is a nonlinear effect of debt on economic growth. These studies further argue that debt initially promotes growth and that higher debt levels beyond a threshold level tend to significantly and negatively affect growth in the long-run. The general theoretical assumption is that the impact on economic growth is positive at low levels of public debt, and that beyond a certain debt level a negative effect on growth prevails.

Many studies examine the relationship between public debt and growth by augmenting the standard overlapping generation models of growth (Blanchard, 1985) and the endogenous growth models (Saint-Paul, 1992) with public debt. The positive short-run effects of debt on growth is supported by Keynesian economists who argue that the accumulation of public debt induced by a fiscal deficit will improve the level of income, the transaction demand for money and prices, all of which will enhance economic growth. In line with this theory, Bakar and Hassan (2008) and Cohen (1991) have found a significant positive relationship between debt and economic growth.

On the other hand, Checherita and Rother (2010) argue that public debt negatively affects growth in the long-run through the long-term interest rates channel. As such, higher long-term interest rates, prompted by increased public debt to finance fiscal deficits, can crowd-out private investment, leading to low output growth. Codogno et al. (2003) also note that higher public debt may imply higher sovereign yield spreads. This according to Laubach (2009) could lead to higher real interest rate, hence lowering private investment and growth.

The nonlinear relationship between debt and growth can also be theoretically motivated from the demand side of the economy. As noted by Palley (1994), a rise in debt initially increases aggregate demand leading to output growth. However, as debt accumulation becomes excessive debt service burden increases which in turn reduces aggregate demand and therefore hampering output growth. Alternatively, the increased aggregate demand causes the interest rate to rise putting pressure on output to fall. Similarly, Athanassiou (2012) argues that debt has an expansionary effect on aggregate demand emanating from the increase in the debt and a contractionary effect resulting from the debt service on outstanding and new debts. The nonlinear aggregate demand relationship between debt and growth can be explored by augmenting the aggregate demand function proposed by Morón and Winkelried (2005) with public debt.

Turning to empirics, amongst the authors that have investigated the relationship between public debt and economic growth is Reinhart and Rogoff (2010). Using simple descriptive statistics, they find that an increase in the public debt-to-GDP ratio to above 90 per cent has a negative effect on growth for advanced and emerging economies. This result is later confirmed by econometric studies by Cecchetti et al. (2011) and Padoan et al. (2012) for OECD countries; and Checherita and Rother (2012) and Baum et al. (2013) for euro area countries. Employing an instrumental variable approach, Mupunga and le Roux (2015) find an optimal growth-maximising public debt threshold of between 45 and 50 per cent for Zimbabwe. The result confirms the existence of a nonlinear hump-shaped relationship between public debt and economic growth in Zimbabwe.
Pattillo et al. (2011) use a quadratic function to examine the nonlinear linkage between public external debt and growth for 93 developing countries. Their findings confirm the existence of a nonlinear and a hump-shaped relationship between debt and growth. The results indicate debt-to-GDP threshold levels ranging from 35 to 40 per cent for these countries. Similarly, Wright and Grenade (2014) examine the relationship between public debt and growth and the nonlinearity issue using panel dynamic OLS and threshold dynamics in 13 Caribbean countries. Their findings indicate that beyond the debt-to-GDP ratio of 61 per cent, debt negatively affects investment and economic growth. For Nigeria, Bawa et al. (2016) find a total public debt-to-GDP ratio of 73.7 per cent, an external debt ratio of 49.4 per cent and a domestic debt ratio of 30.9 per cent above which growth begins to fall, respectively.

3.0 PUBLIC DEBT AND ECONOMIC GROWTH IN SWAZILAND

Tables 1a and 1b show SACU revenue growth rates, GDP growth rates and public debts as percentage of GDP in SACU countries. Compared to its counterparts in the SACU region, Swaziland’s public debt as percentage of GDP remains low over the period 2006 to 2016. The current debt-to-GDP ratio is about 20 per cent and below the 35 per cent limit set by government. The debt limit set by government is within the convergence criteria set by SADC, which stipulates a public debt as percentage of GDP of less than 60 per cent. Over the period under review, Swaziland’s public debt averaged 14 per cent of GDP. This is lower than the averages of 15 per cent recorded in Botswana, 42 per cent in Lesotho, 24 per cent in Namibia and 38 per cent in South Africa. For Swaziland, public debt started growing at a faster pace during and after the global financial crisis. This was due to the crisis induced decline in SACU revenue, which was reflected in trends in fiscal deficits.

As shown in Table 1b economic growth in Swaziland considerably slowed down in 2008 to 0.8 per cent. On average, Swaziland’s economic growth remains relatively low at 3.4 per cent compared to 4.6 per cent in Botswana, 4.5 per cent in Lesotho and 4.7 per cent in Namibia over the period under review.

<table>
<thead>
<tr>
<th>Table 1a: SACU Revenue Growth (SR), GDP Growth (GDP) and Public Debt as % of GDP (PD) in SACU Countries 2006-2016</th>
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<tbody>
<tr>
<td><strong>Botswana</strong></td>
</tr>
<tr>
<td><strong>SR</strong></td>
</tr>
<tr>
<td>2006</td>
</tr>
<tr>
<td>2007</td>
</tr>
<tr>
<td>2008</td>
</tr>
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<td>2009</td>
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<td>2012</td>
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<td>2013</td>
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<tr>
<td>2014</td>
</tr>
<tr>
<td>2015</td>
</tr>
<tr>
<td>2016</td>
</tr>
<tr>
<td><strong>Avg.</strong></td>
</tr>
</tbody>
</table>

Sources: Central banks of SACU members and Swaziland Revenue Authority
Table 1b: SACU Revenue Growth (SR), GDP Growth (GDP) and Public Debt as % of GDP (PD) in SACU Countries 2006-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>RSA SR</th>
<th>RSA GDP</th>
<th>RSA PD</th>
<th>Swaziland SR</th>
<th>Swaziland GDP</th>
<th>Swaziland PD</th>
<th>Swaziland DD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>41</td>
<td>5.6</td>
<td>26</td>
<td>105</td>
<td>6.0</td>
<td>16</td>
<td>2.6</td>
</tr>
<tr>
<td>2007</td>
<td>16</td>
<td>5.4</td>
<td>24</td>
<td>-13</td>
<td>4.4</td>
<td>18</td>
<td>2.0</td>
</tr>
<tr>
<td>2008</td>
<td>14</td>
<td>3.2</td>
<td>26</td>
<td>20</td>
<td>0.8</td>
<td>16</td>
<td>1.6</td>
</tr>
<tr>
<td>2009</td>
<td>-9.4</td>
<td>-1.5</td>
<td>31</td>
<td>-37</td>
<td>1.6</td>
<td>12</td>
<td>1.5</td>
</tr>
<tr>
<td>2010</td>
<td>6.3</td>
<td>3.0</td>
<td>35</td>
<td>-48</td>
<td>3.8</td>
<td>12</td>
<td>4.7</td>
</tr>
<tr>
<td>2011</td>
<td>1.0</td>
<td>3.3</td>
<td>38</td>
<td>46</td>
<td>2.2</td>
<td>11</td>
<td>4.8</td>
</tr>
<tr>
<td>2012</td>
<td>30</td>
<td>2.2</td>
<td>41</td>
<td>145</td>
<td>4.7</td>
<td>12</td>
<td>5.5</td>
</tr>
<tr>
<td>2013</td>
<td>10</td>
<td>2.5</td>
<td>44</td>
<td>1.3</td>
<td>6.9</td>
<td>13</td>
<td>5.8</td>
</tr>
<tr>
<td>2014</td>
<td>9.4</td>
<td>1.7</td>
<td>47</td>
<td>6.3</td>
<td>4.2</td>
<td>13</td>
<td>5.8</td>
</tr>
<tr>
<td>2015</td>
<td>4.8</td>
<td>1.3</td>
<td>49</td>
<td>-10</td>
<td>1.9</td>
<td>15</td>
<td>5.9</td>
</tr>
<tr>
<td>2016</td>
<td>13</td>
<td>0.3</td>
<td>52</td>
<td>4.3</td>
<td>0.6</td>
<td>19</td>
<td>10.0</td>
</tr>
<tr>
<td>Avg.</td>
<td>13</td>
<td>2.4</td>
<td>38</td>
<td>20</td>
<td>3.4</td>
<td>14</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Swaziland’s SACU revenue declined significantly by 37 per cent in 2009 and 48 per cent in 2010 compared to those of the other SACU members. As indicated by Mafusire (2015), the sharp decline in SACU revenue inflows coupled with limited expenditure adjustments led to extreme fiscal stress. This is evident in Figure 1 where fiscal balances deteriorated from surpluses recorded prior to the global financial crisis to register high deficits in 2009 and 2010 in line with a significant decline in SACU revenues. The situation was further exacerbated by Swaziland’s failure to secure international funding to close the financing gap. Domestic payments arrears accumulated to more than 5 per cent of GDP in 2011 due to the government’s inability to pay suppliers in time. The fiscal deficit also increased to almost 13 per cent of GDP in 2011/12. Without adjustments to expenditure to match the declined revenue flows, public debt, particularly domestic debt rose on the back of high fiscal deficits. Domestic debt continued rising since 2010 to register 10 per cent in 2016.

Mafusire (2015) further notes that the higher interest costs associated with high borrowing requirements spilled over into the private sector. The increase in the government borrowing from the domestic markets caused the lending rates to rise, hence crowding out the private sector. The increase in the borrowing costs coupled with the non-payments to suppliers negatively affected private sector activities. Given that the public sector contributes about 40 per cent of GDP, economic growth slowed even further down during and after the global economic crisis.
4.0 THEORETICAL MODEL

To determine the potential nonlinear relationship between public debt and economic growth, hence the optimal debt threshold, the study employs a threshold type nonlinear model. This model allows the existence of two policy regimes according to whether public debt is above or below a threshold value. This framework has been applied in a number of studies. For instance, Proano et al. (2014) estimate a threshold level of the debt-to-GDP ratio beyond which a rise in debt reduces output growth. Similarly, Wright and Grenade (2014) examine the relationship between public debt and growth using threshold dynamics. The general empirical threshold model is specified as follows:

\[ y_t = \alpha_0 + \alpha_1 x_t + \alpha_2 d(x_t - k) + \beta' Z_t + \varepsilon_t \]  

(1)

\[ d = \begin{cases} 1, & \text{if } (x_t > k) \\ 0, & \text{otherwise} \end{cases} \]

Where \( y_t \) is the dependent variable, \( x_t \) is the threshold variable and \( k \) is a given threshold value. \( d \) is a dummy variable that assumes a value of one for observed values of the threshold variable greater than the given threshold level values and zero otherwise. \( Z_t \) is a vector which contains control explanatory variables. \( \beta' \) is the corresponding vector of coefficients of the explanatory variables. \( \varepsilon_t \) is a random disturbance term with zero mean and a constant variance. Estimating eq. (1) repeatedly with different values of \( k \), chosen in ascending order, the optimal value of \( k \) is obtained by finding the value that minimizes the residual sum of squares (RSS).

However, some studies employ a quadratic model to obtain the threshold level. For example, Pattillo et al. (2011) examine a nonlinear and hump-shaped linkage between external debt and growth by using a quadratic function model. The non-linear model assumes a quadratic form of the following:

\[ y_t = \alpha_0 + \alpha_1 x_t + \alpha_2 x_t^2 + \beta' Z_t + \varepsilon_t \]  

(2)

The variables \( y_t, x_t \) and \( z_t \) are as explained in eq. (1). However, \( x_t \) and \( x^2 \) are now interpreted as linear and nonlinear terms of the threshold variable. Eq. (2) indicates that the relationship between \( y_t \) and \( x_t \) is nonlinear of an inverted U-shape. Hence, the coefficient of \( x_t \) is expected to be positive and that of the squared variable to be negative. Differentiating eq. (2) with respect to the threshold variable and equating to zero yields the following:

\[ \frac{\partial y_t}{\partial x_t} = \alpha_1 - 2\alpha_2 x_t = 0 \]  

(3)

The optimal threshold level \( x^* \) is obtained by solving eq. (3) as follows:

\[ x^* = \frac{\alpha_1}{2\alpha_2} \]  

(4)

Graphically the above relation between \( y_t \) and \( x_t \) can be represented as follows:

**Figure 2. A quadratic relation between y and x**

Where \( x^* \) is the threshold level beyond which increasing \( x_t \) reduces \( y_t \). On the other hand, if \( x_t \) is below \( x^* \) the increase in \( x_t \) is expected to increase \( y_t \).
4.1 Public Debt Threshold Model

Whilst the two approaches are equally important, our study adopts the nonlinear model of the quadratic form in line with Pattillo et al. (2011). This approach is preferred compared to the other approach as represented in Eq. (1) because of its simplicity. However, unlike in Pattillo et al. (2011) who employ a panel data set of 93 developing countries, our study estimates a quadratic equation for one country, which is Swaziland. While a number of studies investigate the nonlinearity of the relationship between public debt and growth by augmenting growth models with public debt, our study examines this relationship from the demand side of the economy. Hence, the study uses the aggregate demand equation as in Morón and Winkelried (2005) for Latin American countries. The proposed aggregate demand relates the output gap $y_t$, as a function of the one-period lagged output gap $y_{t-1}$, the real interest rate $r_t$, the foreign output gap $y^*_t$ and the real exchange rate $q_t$.

The nonlinearity relationship between output growth and public debt is introduced in the above aggregate demand model by including the squared term of the public debt $d_t^2$ and the linear term of the public debt $d_t$. The combination of the linear and nonlinear terms of the public debt implies a hump-shaped relationship between public debt and growth. The turning point of the quadratic equation determines the optimal threshold level of the public debt above which debt is deterrent to economic growth. Consequently, the nonlinear quadratic relationship between public debt and economic growth can be represented as follows;

$$
\hat{y}_t = \theta \hat{y}_{t-1} + \varphi \hat{q}_t + \alpha \hat{r}_t + \delta \hat{y}^*_t + \rho \hat{d}_t + \sigma \hat{d}_t^2 + \mu_t \tag{5}
$$

Where $y_t$, $q_t$, $r_t$ and $y^*_t$ are control explanatory variables, which are explained above. The public debt variable $d_t$ is the threshold variable and a crucial variable in our analysis. The following $\theta$, $\varphi$, $\alpha$, $\delta$, $\rho$ and $\sigma$ are parameters to be estimated and $\mu_t$ is the error term and is assumed to have a zero mean and a constant variance. The parameter $\theta$ of the one-period lagged output gap is expected to be positive indicating output persistence. The real exchange rate parameter $\varphi$ is expected to be positive. This is the case because an increase in the real exchange rate, a real depreciation, improves the external competitiveness of domestic exports leading to an increase in output growth.

The coefficient $\alpha$ of the real interest rate is expected to assume a negative sign implying that a rise in the real interest rate reduces investment, hence a reduction in economic growth. The sign of the coefficient $\delta$ of the foreign output gap is expected to be positive. An increase in the foreign output gap leads to an increase in demand for domestic goods and services, which in turn causes domestic output to increase. For a nonlinear relationship to exist between the public debt and growth, hence an optimal threshold debt level, the signs of the parameters of the linear debt variable and the squared term variable of the public debt must be positive and negative, respectively. The hat above the variables denotes percentage deviation from the steady state.
5.0 ESTIMATION TECHNIQUES AND DATA ANALYSIS

The study estimates eq. (5) and subjects our estimation results to intensive array of robustness tests. In particular, we control for the possibility of endogeneity of debt so that the impact of debt on growth is robust and not affected by omitted variables or simultaneity bias (Pattillo et al., 2011). In this regard, we use the Generalized Method of Moments (GMM), an estimation technique, which gives us estimates that are corrected for endogeneity, heteroskedasticity and autocorrelation. Lagged values of the endogenous variables are used as instruments. Using the GMM estimation also enables us to test the specification of the proposed model for over-identification through the Hansen J test. The GMM estimation technique has been used in a number of threshold models such as in Pattillo et al. (2011).

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The estimation is based on annual data for the period spanning from 1980 to 2016. The study uses the following data; short-term interest rate, domestic output gap, foreign output gap, real exchange rate and total public debt as a percentage of GDP. For short-term interest rates we use the treasury bill rate because it is market determined. The output gaps are generated by applying a Hodrick-Prescott filter with a smoothing parameter settled on the standard value of 1600 on seasonally adjusted real GDP. The foreign output gap is proxied by the South African GDP given that more than 60 per cent of the country’s exports are destined to South African markets. All variables are presented as deviations from their steady state, hence we work with stationary data. Data come from the Central Bank of Swaziland quarterly bulletins except for the South African GDP, which is sourced from the IMF.

6.0 EMPIRICAL RESULTS

Table 2 presents results for eq. (5), which describes the dynamics of the nonlinear aggregate demand of a small open economy that also takes into consideration of public debt. As indicated by the high adjusted $R^2$ of 0.99, the explanatory variables including debt play an important role in explaining the variations in the output gap in Swaziland. The parameters of the explanatory variables are all statistically significant at 1 per cent. The J-statistic suggests that the model passes the test for over-identification. This suggests that there are no identification problems in our specification.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
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<td>$y_{t-1}$</td>
<td>0.81</td>
<td>0.02</td>
<td>36.8</td>
<td>0.00</td>
</tr>
<tr>
<td>$q_t$</td>
<td>0.03</td>
<td>0.00</td>
<td>6.57</td>
<td>0.00</td>
</tr>
<tr>
<td>$r_t$</td>
<td>-0.35</td>
<td>0.06</td>
<td>-5.41</td>
<td>0.00</td>
</tr>
<tr>
<td>$y_t$</td>
<td>0.12</td>
<td>0.01</td>
<td>8.96</td>
<td>0.00</td>
</tr>
<tr>
<td>$d_t$</td>
<td>0.22</td>
<td>0.07</td>
<td>2.99</td>
<td>0.01</td>
</tr>
<tr>
<td>$R_t$</td>
<td>-0.24</td>
<td>0.08</td>
<td>-3.05</td>
<td>0.01</td>
</tr>
<tr>
<td>$d_t^2$</td>
<td>0.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J-Stat.</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The parameter $\theta$ of the one-period lagged output gap $\gamma_{t-1}$ carries the positive sign in line with expectations. This means that the current output gap is positively related to its past indicating a 0.81 per cent degree of output persistence. The coefficient $\varphi$ which measures the elasticity of the output gap with respect to changes in the exchange rate is positive and consistent with theory. This suggests that a 1 per cent depreciation in the exchange rate renders domestic exports more competitive in foreign markets. Consequently, this leads to an increase in domestic aggregate demand, hence raises output by 0.03 per cent. As expected, the exchange rate affects the output gap with a lag in Swaziland indicating that it takes time for output to respond to the exchange rate.

The effect of the exchange rate on the output gap is relatively small. This is more so because a small proportion of the total domestic exports are destined to markets outside the CMA and respond to the exchange rate between the Lilangeni and the US Dollar used in this study. Otherwise, a large proportion of the total domestic exports are destined to the CMA, particularly in South Africa, which do not respond to the Lilangeni/US Dollar exchange rate because of the exchange rate parity between the Lilangeni and the South African Rand.

The coefficient $\alpha$ of the interest rate $r_t$, exhibits the theoretical expected negative sign. This means that a 1 per cent increase in the interest rate, which reduces aggregate demand, causes output to shrink by 0.35 per cent in the following period. The sign of the parameter $\delta$ of the South African output gap $\gamma_t$ is positive. This implies that a 1 per cent rise in the foreign output increases demand for domestic goods and services, and consequently causes domestic output to increase by 0.12 per cent. The sign of the parameter $\rho$ of the linear variable of the public debt $d_t$ is positive. The parameter $\sigma$ of the nonlinear term of the public debt $d^2_t$ is negative. This confirms the existence of a hump-shaped relation between output and public debt in Swaziland.

To obtain the public debt threshold level we first express the estimated equation as:

$$\dot{y}_t = 0.81\dot{y}_{t-1} + 0.03\dot{q}_t - 0.35\dot{r}_t + 0.12\dot{y}_t^2 + 0.22\dot{d}_t - 0.24\dot{d}_t^2 \quad (6)$$

Secondly, we differentiate eq. (6) with respect to the debt variable $d_t$ and equate the resultant expression to zero. By solving for $d$ from the resulting equation we obtain a public debt threshold level of about 46 per cent of GDP for Swaziland. This suggests that for public debt as percentage of GDP lower than 46 per cent of GDP, increasing debt yields positive growth rates. However, beyond the threshold level of 46 per cent of GDP, increasing debt reduces economic growth. The results indicate that a 1 per cent increase in the public debt as percentage of GDP leads to a 0.22 per cent increase in output when debt is below the 46 per cent of GDP. On the other hand, if public debt is above the 46 per cent of GDP, a 1 per cent rise in public debt is expected to reduce output by 0.24 per cent. The estimated debt-to-GDP ratio is above the 35 per cent limit set by government in its debt strategy and the World Bank’s 40 per cent critical debt for developing countries. It is also in line with the SADC convergence criteria of a public debt-to-GDP ratio of less than 60 per cent.

### 7.0 CONCLUSIONS

This paper determines an optimal public debt threshold level above which increasing debt reduces economic growth in Swaziland. The study builds on theoretical literature, which suggest that debt initially causes growth to rise by increasing aggregate expenditure. However, as debt increases to higher levels tends to reduce growth by reducing aggregate expenditure as public revenues are channeled towards servicing debt. This suggests a nonlinear relationship of a
quadratic form between debt and growth. In this regard, we extend the aggregate demand function by Moron and Winkelried (2005) for Latin American countries by adding the linear and squared terms of the public debt-to-GDP. This formulation allows us to investigate the existence of a quadratic nonlinear relationship between public debt and economic growth. Hence, the study employs a quadratic nonlinear threshold model as in Pattillo et al. (2011). To control for the possibility of endogeneity, the paper uses the Generalized Method of Moments (GMM) estimation technique.

The GMM results confirm the existence of a nonlinear hump-shaped relation between public debt and economic growth in Swaziland. This is consistent with the findings of Pattillo et al. (2011) for 93 developing countries and Bawa et al. (2016) for Nigeria. Our empirical results suggest that a 1 per cent increase in public debt-to-GDP has a short-run positive impact of 0.22 per cent and a long-run negative effect of 0.24 per cent on growth. The optimal level of public debt above which an increase in debt reduces economic growth is estimated at about 46 per cent of GDP. This threshold is higher than the 35 per cent limit set by government and the World Bank debt critical ratio of 40 per cent for developing countries. The estimated debt threshold for Swaziland is also within the SADC convergence criteria of a public debt limit of less than 60 per cent of GDP. Using the quadratic form relation, Mupunga and le Roux (2015) find an optimal growth-maximising public debt threshold of about 48 per cent of GDP for Zimbabwe.

The coefficients of the control variables exhibit the correct signs in line with theory and highly statistically significant. The parameter of the one-period lagged output is positive indicating a 0.81 per cent degree of output persistence. The exchange rate coefficient has a positive value of 0.03. The results show that a 1 per cent of a one-period lagged depreciation increases exports leading to a 0.03 per cent increase in output. The coefficient of the interest rate is negative at 0.35. This suggests that a 1 per cent rise in the interest rate reduces aggregate demand, which causes output to fall by 0.35 per cent in the following period. The parameter of the foreign output as proxied by South Africa’s output has a positive value of 0.12. This means that a 1 per cent increase in the foreign output causes a 0.12 percent rise in the domestic output by increasing demand for domestic exports.

Our findings, particularly with respect to the optimal public debt threshold level, suggests that Swaziland needs to adopt debt-management policies that will allow the country to gradually move its public debt level towards the estimated debt threshold to support growth while also ensuring debt sustainability. However, this will yield positive results provided that the debt funds are used to fund viable capital projects. The preferred capital projects are those that will have greater growth multiplier effects through usage of mainly local inputs, or at worst imports from SACU countries in order to earn the country higher SACU receipts. This would call upon government to identify such projects in consultation with relevant stakeholders.

We therefore recommend that government put in place policies that will ensure that debt accumulation, be it external or domestic, is consistent with the country’s growth objectives. The recently established debt management unit, which is highly commendable, should spearhead and expedite the formulation of such policies. Sound communication and cooperation between the ministry of finance and the central bank should be maintained in managing public debt. In this regard, the central bank may have to maintain a positive interest rate differential with its
Common Monetary Area (CMA) counterparts, particularly with South Africa in order to increase the competitiveness of government securities. Although keeping the interest rate relatively high may constrain the private sector, such policy stance helps to achieve both the objectives of public debt management and price stability.

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Discount Rate Differential Monetary Policy Decisions in the CMA and Portfolio Investment Assets: The Efficacy of Namibia and Swaziland Monetary Policy

Simiso F. Mkhonta

Abstract

A Panel regression model for Namibia and Swaziland with data from 2010 Q1 to 2015 Q4 is employed with stationary data to allow for country specific effects in the estimation of the impact of the discount rate differential with South Africa on portfolio investment assets. Serial correlation, heteroscedasticity and normality are corrected using the generalised least squares cross-section weights method of estimation. The Fixed Effects and Random Effects models are rejected using the Likelihood ratio and Hausman tests respectively in favour of a panel regression model. Namibia and Swaziland monetary policy differential with South Africa is found to be statistically insignificant in influencing portfolio investment assets with a p-value of 0.7011. Financial development is found to reduce statistically significantly portfolio investment assets in the economies of Namibia and Swaziland with a p-value of 0.0125. Higher GDP growth rates lagged two quarters in Namibia and Swaziland are strongly related to higher levels of portfolio investment assets inflows with a p-value of 0.0647. A higher fiscal deficit is also strongly correlated to a reduction in portfolio investment assets inflows with a p-value of 0.0148. The low level of development in the financial sectors in Namibia and Swaziland in particular in the depth of availability in the variety of financial assets. According to literature in sub-Sahara (Gelard and Leite, 1999) the ratio of sub-Saharan countries financial development is associated with increased importance of deposits and thus a lower ratio of narrow to broad money. The resultant liquidity tends to be invested outside the country due to the lack of a diversified and sophisticated development of the financial sectors in Namibia and Swaziland particularly in comparison to South Africa. The fund managers in Namibia and Swaziland do respond positively to higher domestic rates but are limited by the low level of development of their financial sectors and the risk of higher taxes being imposed in future due to high levels of fiscal deficits. The nature of development of the financial sector is therefore pertinent for the efficacy of monetary policy in Namibia and Swaziland.

Keywords: Discount rate Differential, Capital Flight, Portfolio Investment Assets, CMA.

1.0 INTRODUCTION

Monetary Policy is regarded as essential in driving macroeconomic variables to the desirable macroeconomic outcome. Countries in a monetary union focus their monetary policy in stabilising capital outflows by maintaining their interest rates at par to the country pegged to and in the process anchor inflation expectations to foster economic growth. The pegging countries in a monetary union have independent monetary policies.

South Africa, Lesotho, Namibia and Swaziland belong to a Common Monetary Area (CMA). Namibia and Swaziland peg their discount rates to South Africa to stabilise capital outflows anchoring the peg of their
currencies to the South African Rand. Lesotho phased out the discount rate and adopted the Lombard rate pricing it above the 91-day TB rate and the lending rates in Lesotho respond very strongly to changes in the repo rate in South Africa (Sylvanus Ikhide, 2010). Lesotho central bank has just recently reverted back to setting interest rates with reference to South Africa’s repo rate. Thus due to the lack of data where monetary policy is actively set by the central bank of Lesotho, Lesotho is not included in the study.

Sylvanus Ikhide, (2010) observed that lending rates, level of prices and money supply in the monetary union respond instantaneously to changes in the discount rate by the South African reserve bank with Namibia’s repo rate responding sharply compared to Swaziland’s as their central banks actively set interest rates. He confirms that South Africa discount rate is the relevant policy instrument for the LNS countries. He concludes that due to the asymmetry of shocks the LNS countries might be able to undertake independent monetary policy by setting their central bank discount rate lower than South Africa’s to stimulate the economy.

The question that this study will therefore address is whether the discount rate differential pursued by Namibia and Swaziland in their conduct of monetary policy do impact on international flow of portfolio investment assets. Many studies in literature have supported the inflow of capital as a pre-requisite for economic growth with Lisa M. Schineller (1997) extending the concerns to the degree of economic, social and political fracture. Most researchers address the importance of capital inflows for economic growth under studies on capital flight. The current research therefore borrows most of its literature review from studies on capital flight in developing countries. The balance of payments approach popularised by Cuddington (1987) define capital flight as the sum of private short-term capital outflows and errors and omissions.

Section1 is the brief introduction, section 2 is the literature review, section 3 is the model, data and methodology. Section 4 are the empirical results and section 5 is the conclusion.

2.0 LITERATURE REVIEW

Reviewed literature suggest that interest rates are an important determinant of capital flight which is often measured as portfolio investment assets Puah etl. (2012), Folorunso S. Ayadi (2008) and Dooley (1998). The are many determinants of capital outflows in literature and the following critical factors will be discussed for the cases of Namibia and Swaziland: (1) the GDP growth rate differential (2) the fiscal deficit (3) financial development (4) interest rate differential.

The following authors discuss these factors in the context of capital flight; where capital flight is measured by portfolio investment assets as obtained in the balance of payments statistics.

Puah and et al (2012) employed a vector error correction model (VECM) to measure capital flight on macroeconomic variables for Malaysia using time series data from first quarter of 1991 to the fourth quarter of 2008. He explained capital flight as errors and omissions and short-term capital outflows. The results showed that capital flight is determined by real GDP, the budget deficit, the treasury bill rate, foreign direct investment and the stock market. All the variables were found to have the right signs and statistically significant. The treasury bill rate was found to be negatively related to capital flight. He concluded that capital is expected to flow to developing countries in being attracted by a positive rate of return on capital. His paper also finds that improvements of in the real GDP and budget...
deficit stemmed capital flight. He linked real GDP growth to investors’ confidence and the improvement in the budget deficit to less distortion in the economy as a conditions to stall capital. The study shows that the financial markets liberalization and the deregulation of the international movement of capital in Malaysia resulted in an improved stock market causing capital flight.

Boyce and Ndikumana (2012) also measures capital for 30 sub-Saharan African countries, including 24 countries classified as severely indebted low-income countries for the period 1970-1976. He finds that the difference between domestic interest rates and US interest rates to have the expected negative sign in both a pooled and cross-sectional regression but in neither cases was it significant at 10 per cent. Higher interest rates in the sub-Saharan African countries than in the US curb capital flight. He found the fiscal position to have an ambiguous relationship with capital flight. Citing the lack of accurate fiscal position statistics, he could therefore not reach any firm conclusions. Boyce and Ndikumana (2010) found that an unfavourable foreign and fiscal position are among causes of capital flight. FitzGerald (1997) also argues that panic sets in when foreign exchange reserves levels fall in periods of high fiscal deficits and investments move to countries with better fiscal and foreign exchange reserves positions.

Folorunso S. Ayadi (2008) when employing ordinary least squares (OLS) and error correction model (ECM) for Nigeria supports the argument that higher domestic interest rates than foreign interest rates reduce the outflows of portfolio investment assets. In fact, he finds interest rate differential to be the most significant determinant of capital flight in Nigeria. The other explanatory variables he uses in the estimation of capital flight are the total debt stock, exchange rate, real GDP growth, the trade balance, inflation and political stability. He finds the Real GDP to be negatively related to capital flight and GDP growth to significantly reduce capital flight both in the short and long run. High economic growth brings about opportunities for investment that discourage capital flight.

3.0 MODEL, DATA, AND METHODOLOGY

The time-series data used in this study are from 2010 Q1 to 2015 Q4 and sourced from the Central bank of Swaziland Quarterly Bulletin and the Bank of Namibia Quarterly Bulletin. Because the time-series is short the data is pooled to solve the problem of a few degrees of freedom and to also allow for the analysis of lagged values (Leonce Ndikumana, 2010). Quarterly GDP data are not available and are obtained by interpolating the yearly GDP data.

The generalised least squares cross section weights is used to estimate the parameters of the model in order to solves the problem of heteroscedasticity, serial correlation and normality in the data to avoid obtaining parameters that are not best linear and unbiased (BLUE) (Marius Ooms, 2007; Ruppert D and Carrol R, 1998; Wooldridge, 2002).

The foregoing literature review measures capital flight as portfolio investment assets. Most of the variables used in the literature to explain capital flight are used in this study to explain portfolio investment assets. The variables to use in the model are; (i) the GDP growth differential (ii) the discount rate differential (iii) financial development and (iv) the fiscal position. Portfolio investment assets are expressed as a proportion of GDP. The GDP growth differential and the discount rate differential is expressed in per cent form, financial development is defined as M2 divided by GDP and the fiscal deficit is expressed as a per cent of GDP. The following is the model:
Central Bank of Swaziland © 2018

The foregoing literature review measures capital and capital flight. The variables are tested for stationarity using the pool unit root test and the null hypothesis of unit root is rejected by the Im, Pesaran Shin W-stat, ADF-Fischer Chi-square, PP-Fischer Chi-square, and the Levin, Lin & Chnt to test. The stationarity of the variables is important as it allows for country-specific effects in the estimation.

A stepwise approach of adding explanatory variables one by one and retaining those that are significant in panel data regression estimation is used (Ndikumana and Boyce, 2002). Namibia and Swaziland being different countries could have unique country characteristics that are usually evident in the behaviour of the data. The fixed effects model is used to capture the unique characteristics of entities in a panel data set up by creating cross-sectional dummy variables. The interrelationship of the unique characteristics of the individual entities in cross-sectional data makes the fixed effects model unable estimates and unreliable because the effects of the unique characteristics of counterpart entities will not be captured. The across entities relationship of the uniqueness of the entity is captured by the estimation of random effects model. The fixed and random effects models are estimated and rejected according to the redundant fixed effects and hausman tests respectively.

Serial correlation of the error term is tested using the residual/panel cross-section dependence test; Breusch-Pagan (1980) LM; Pesaran scaled (2004) LM, Bias-corrected scaled (2012) LM, and Pesaran (2004) CD. The Breusch-Pagan LM test is also used to detect for the presence of heteroscedasticity. The tests show that there is a presence of serial correlation and heteroscedasticity. The error terms for Namibia is found not be normally distributed.

The stepwise approach is applied to the variables in the model and the significant variables remain, which are the GDP growth differential, financial development and the fiscal position. The final robust model is the following:

$$GDP_{it} = C + \alpha_1 GDP_{gri, t-2} + \alpha_2 LFD_{it} + \alpha_3 DEF_{it} + \epsilon \text{ ... ... ... (2)}$$

Only the fiscal deficit is found to be significant and when the model is corrected for heteroscedasticity, autocorrelation and normality of the error term, financial development and GDP growth rate differential becomes significant (see table 2 below).

### 4.0 EMPIRICAL RESULTS

The following equation is obtained from estimation using panel regression:

<table>
<thead>
<tr>
<th>Table 1. Panel Regression Model Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable: GDP</td>
</tr>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>GDPgri(-2)</td>
</tr>
<tr>
<td>DD(-1)</td>
</tr>
<tr>
<td>LFD</td>
</tr>
<tr>
<td>DEF</td>
</tr>
<tr>
<td>Observation; balanced panel</td>
</tr>
<tr>
<td>R squared</td>
</tr>
<tr>
<td>DW</td>
</tr>
<tr>
<td>F-statistics</td>
</tr>
</tbody>
</table>
Table 2. Panel Regression Model Results/Corrected for Heteroscedasticity and Autocorrelation

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coefficients</th>
<th>t-Statistics</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.000138</td>
<td>-0.035593</td>
<td>0.9718</td>
</tr>
<tr>
<td>GDP growth (-2)</td>
<td>-0.002296</td>
<td>1.82193</td>
<td>0.0659</td>
</tr>
<tr>
<td>Discount rate differential</td>
<td>-0.00390</td>
<td>0.386676</td>
<td>0.7011</td>
</tr>
<tr>
<td>Financial development</td>
<td>-0.027398</td>
<td>-2.068415</td>
<td>0.0453</td>
</tr>
<tr>
<td>Deficit</td>
<td>-0.001073</td>
<td>-2.514358</td>
<td>0.0162</td>
</tr>
<tr>
<td>Observations; balanced panel</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R squared</td>
<td>0.22386</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DW</td>
<td>1.547792</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>2.804493</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 presents the final model arrived at by dropping the insignificant discount rate differential which is shown in table 2. The chances of the discount rate differential to influence portfolio investment assets is merely 30 per cent or rather 3 out of 10 chances.

Table 3. Panel Regression Model without the Discount Rate Differential

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coefficients</th>
<th>t-Statistics</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.000798</td>
<td>-0.232295</td>
<td>0.8175</td>
</tr>
<tr>
<td>GDP growth rate (-2)</td>
<td>0.002136</td>
<td>1.899524</td>
<td>0.0647</td>
</tr>
<tr>
<td>Financial development</td>
<td>-0.023741</td>
<td>-2.615909</td>
<td>0.0125</td>
</tr>
<tr>
<td>Deficit</td>
<td>-0.001024</td>
<td>-2.547399</td>
<td>0.0148</td>
</tr>
<tr>
<td>Observations; balanced panel</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R squared</td>
<td>0.221093</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DW</td>
<td>1.512939</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>3.784663</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Most of the independent variables significance improves under the panel regression model. The final model in table 3 with a larger F-statistics is selected (Kadane and Lazar, 2004) after the correction of serial correlation, heteroscedasticity, normality and the dropping of the insignificant variables to remain with the final specification of the model in table 3. As opposed to the discount rate differential the GDP growth rate differential, financial development and the fiscal position are found to be statistically significant. The GDP growth rates for Namibia and Swaziland increase above that of South Africa leads to an improvement in the level of portfolio investment assets in the respective economies. Low GDP growth encourages portfolio investment assets outflows (Ndikumana and Boyce 2000; Pastor 1990; Nyoni, 2000).

The discount rate differential increase i.e. when the Namibia and Swaziland discount rates are higher than South Africa’s discount rate the level of portfolio investment assets outflows reduces but insignificantly. In 10 attempts only 3 are likely to attract portfolio investment assets in a sample of 44 observations. Investors are assumed to seek to maximise profits and would allocate funds between domestic and foreign financial markets, placing the funds to where the returns are high. Risks and returns to investment based on portfolio choice determine the outflow of funds. The higher the discount rate as a proxy for the returns on financial assets should attract more investment.

The low level of development of the financial sector in particular in terms of diversification in the choice of financial products compared to South Africa in both Namibia and Swaziland discourages portfolio investment in two countries vis-à-vis South Africa. Risk aversion has driven portfolio investment assets in Namibia and Swaziland with fund managers indicating that the discount rate differential has somewhat affected their decision to either place the funds locally or internationally particularly in South Africa. This happens within the confines of the local compliance with legislation by fund managers, the pension fund managers and other financial institutions. The insurance companies such as the Swaziland Royal Insurance Corporation, Aon and Metropolitan mostly engage fund managers for the investment of their funds.
Commercial banks besides interest rate risks which they manage within defined risk limits while integrating the impact of liquidity risk maintain current accounts in South Africa for the purpose of facilitating customer demand for South African Rands. The commercial banks have been influenced by the discount rate differential between South Africa and Swaziland and excess funds are naturally placed in the accounts giving better yields while taking into account the need to meet daily customer obligations. The money market portfolio consists mainly of Swaziland Treasury Bills for both compliance and investment purposes and the balanced fund is then split between the Rand current account and central bank call account. The fund managers and commercial banks also prefer to invest in in South Africa because the market has a variety of highly liquid financial products which can be readily tapped into when the need arises. These allocation needs shroud the effect of the discount rate differential on portfolio investment assets.

Financial development is found to encourage portfolio investment assets outflows, which could be least expected. The development of the financial sector has to present expanded and varied opportunities for domestic portfolio diversification (Puah and Liew, 2012). The financial development in Namibia and Swaziland are not diversified enough to withstand the attraction of funds to the South African financial sector. Collier, Hoeffler and Pattillo (2001) found that financial development is not statistically significant in driving portfolio investment assets when using M2/GDP. They also find financial development to have an incorrect expected sign hence they drop it out of the model specification. But due to the ambiguities of the influence of financial development on portfolio investment assets flows the variable is not dropped but defended in the spirit of Gelbard and Leite (1999).

The effects of financial development in literature has been mainly found to be mixed owing to the challenged definition of financial development. Gelbard and Leite (1999) in a study on measuring financial development in 38 Sub-Saharan Africa, found that even though there has been improvement in financial development in Sub-Saharan Africa, in many countries the range of financial products remains extremely limited. Interest rate spread are wide, capital adequacy ratios are insufficient, judicial loan recovery is a problem, and the share of nonperforming loans in large. The composition of M2 is critical in determining the influence of financial development when it is measured as M2/GDP. In the same study Gelbard and Leite (1999) further note that financial development is associated with increased importance of term deposits and the ratio proportion of cash in M2 is dominant which assets are susceptible to be invested across the border. The commercial banks naturally place excess funds in better yielding accounts and to meet daily customer obligations.

The fiscal deficit is found to encourage portfolio investment assets like in the studies by Puah and Lewis (2012) and Leonce and Boyce (2002) as earlier mentioned. A percentage point improvement in the fiscal deficit results in an outflow of 0.102 per cent of GDP in portfolio investment assets and a per cent improvement in financial development leads to an outflow of 0.024 per cent of GDP in portfolio investment asset. For fear of future taxation due to the central government running successive deficits economic agents change their holding of local financial assets to foreign exchange denominated financial assets by transferring their funds to South Africa.
CONCLUSION
The objective of the study is to ascertain the impact of higher or lower discount rates, the monetary policy tool for Namibia and Swaziland, than that of South Africa on portfolio investment assets is found that the impact is statistically insignificant due to the low development of the respective countries financial sector. If Namibia and Swaziland’s intention of setting the discount rate higher than that of South Africa is to attract portfolio inflow they should accelerate the development of their financial sectors. Swaziland has embarked on the financial sector development implementation plan (FISDIP) which would go a long way in improving the efficacy of monetary policy. The nature of the development of the financial sector is critical to broaden the lower ratio of narrow to broad money. Diversification and sophistication of products in the financial sector are seen as key to the development of a financial sector for the discount rate differential to attract or deflect portfolio investment assets for Namibia and Swaziland.

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An Assessment of the Impact of Fiscal Policy on Output in Swaziland: A Determination of the Size of Fiscal Multipliers in Recessions and Expansions

Bongani P. Dlamini

Abstract

This paper seeks to estimate and assess fiscal multipliers in recessions and expansions in Swaziland, more specifically to evaluate how government spending impacts output during those times. The study used annual data spanning from 1980 to 2016. Following Blanchard and Perotti (2002), the study applied the structural vector autoregression (SVAR) model to estimate linear multipliers. To estimate non-linear multipliers (during expansions and recessions), the study employed the multivariate threshold autoregression (MTAR) by Tsay, (1998). The multipliers were estimated for both aggregated and disaggregated expenditure data. Cointegration was tested using the Johansen approach, where a long run relationship among the variables was found to exist. Impulse response analysis shows that the response of GDP is not significant for revenue but significant to expenditure. When expenditure was disaggregated to capital and recurrent, the results show that GDP response is significant for capital than recurrent expenditure. The impulse response functions were then used to estimate linear multipliers, where it was found that for the accumulated multipliers, a positive Lilangeni change in expenditure brings 20 cents to GDP in the 10-year horizon compared to 11 cents for a Lilangeni change in revenue. Disaggregating expenditure further to capital and recurrent, it was found that capital expenditure multipliers are higher at E2.00, compared to 32 cents for recurrent expenditure in the 10-year horizon. The results for the non-linear multipliers show that multipliers are higher during times of recession than expansion, with a Lilangeni increase in expenditure bringing 89 cents to GDP in recessions compared to 39 cents in expansions. Therefore, the results show that authorities should direct much of the expenditure to capital projects, particularly during recessions.

Key words: Fiscal Multipliers, Government Spending, Output, SVAR, Swaziland.

1.0 INTRODUCTION

Swaziland experienced a fiscal revenue boom when the Southern African Customs Union (SACU) receipts more than tripled during 2004 - 2009 period after the introduction of a new revenue sharing formula. SACU receipts finances over 50 per cent of the country’s national budget. The extra revenues financed mostly wages, which are almost 50 percent of revenues and about 17 percent of gross domestic product (GDP) since the 2009/10 financial year. The public wage bill is one of the highest in Sub-Saharan Africa (SSA) making the country vulnerable to a decline in SACU revenues. The high wage bill also crowded out capital expenditures so that investment as a share of GDP fell to almost half of the average for SSA in 2014 - estimated to reach about 11 percent of GDP. Capital expenditure had not exceeded 25 per cent of total expenditure since 2006, which spell doom for economic growth. The decline in SACU receipts from E7.49 billion in 2014/15 fiscal year to E5.25 billion in 2016/17 spells doom for the country, hence the need for more fiscal prudent measures. Data shows that the estimated budget outturn for 2016/17 is E14.4 billion while

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expenditure is at E21.2 billion, leading to a budget deficit of E6.8 billion, equivalent to 12.3 per cent of GDP (CBS Annual Report, 2015/16).

During the period between 1980 and 1989, GDP growth in Swaziland averaged 6.1 percent, with a high of over 10 per cent in 1987. That was during the times of political unrest in the country’s neighbours, making the country a perfect investment destination. However, that picture changed in the 90’s when those unrests subsided, resulting to the growth rates to average 3.8 per cent between 1990 and 1999. The poor performance of the economy continued into the turn of the millennium, with growth rates averaging 2.4 percent between 2000 and 2016, and reached a high of over 3.5 per cent in 2007. This growth was driven by the manufacturing sector, which is the main growth engine and in turn encouraged rapid growth in supporting sectors such as construction. Manufacturing entities range from small factories engaged in light industry to large ones endowed with the latest technology and producing highly sophisticated goods which, given the small size of the domestic market, are destined mainly for the export market. The sector’s contribution to export earnings has improved recently, currently standing above 60 percent of total exports (CBS Quarterly, December 2016).

Going forward, real GDP growth is expected to shrink by 0.6 per cent in 2016 from a revised estimate of 1.9 per cent in 2015 (previously 1.7 per cent). Decreases are expected mainly in the primary and secondary sectors. The projected deceleration in output is mainly informed by the drastic effects of the drought experienced by the country in 2016, which had devastating effects on agriculture, agro-processing, power generation and water supply. This is projected to be further compounded by lower SACU inflows for the 2016/2017 fiscal year which compromises government activity in the short to medium term, particularly in financing capital projects, which are known to drive the economy (CBS Quarterly, December 2016).

Capital expenditure, however, has always been lower than recurrent expenditure over the years, and has never exceeded 40 per cent, as shown in the figure below.

Just like other countries, Swaziland experienced a severe financial crisis in 2009/10, which had been looming since 2008 with massive declines in SACU revenues...
after the global financial crisis. To date the country has not fully recovered from the crisis. At the onset of the financial crisis in 2010 when SACU revenue declined by over 60 percent the country has had to undertake some major reforms (both structural and institutional) to ensure financial stability. These reforms have been stipulated in the Fiscal Adjustment Roadmap (FAR, 2010) document which was produced by the International Monetary Fund (IMF) in consultation with the Government of the Kingdom of Swaziland.

Amongst others, reforms on the expenditure side included a wage freeze, a slowdown in the implementation of capital (investment) projects, the Voluntary Exit Strategy to reduce the wage bill, and the introduction of the value added tax (VAT). These reforms were for the short to medium term and were intended to reduce government expenditure and bring the budget deficit to levels of about 3 percent of GDP from 2014/15. Although a budget of 1.2 per cent was reached in 2014/15, the challenge remains as the budget deficits are spiralling in the later years. This therefore means that there is still a huge financing gap for the government budget.

1.1 The effect of fiscal policy on output

Generally, a country’s fiscal policy is expected to have a positive effect on output. In the utilization of the scarce resources (revenue), a major concern is where exactly the resources should be channelled to achieve the desired output, and by which variations. In the country’s budget system there are three broad categories where resources are channelled, which are general, economic, and social services. Each of these categories has subcategories as shown in the figure below.

There is currently no general consensus on the share of the budget which can be directed to each of the sub-sectors, save for bits and pieces of declarations which were signed at regional and international levels which were meant to guide budgeting in some components of the sub-categories. An example is the Maputo declaration, which states that at least 10 per cent of a country’s national budget should be allocated to agricultural activities. As a result, budgeting in Swaziland is based on needs basis, with the general public services getting a fair share of the budget. It should be noted at this point that this category also caters for the wage bill, which is the largest stand-alone component of the budget.

Figure 4 shows the allocations to the three components over the years, for both capital and recurrent expenditure. From the figure, during the times of economic boom in the 1980s, general public services has always been the lowest, at less than 30 per cent of total expenditure. That scenario has changed since the 90s, with the component topping the others at over 40 per cent.
Expenditure on social and economic services has been on the declining trend over the years, in line with the fall in economic growth rates. The question that arises then is how fiscal policy should be shaped to enhance economic growth, and whether issues like fiscal stimulus can enhance growth.

According to Auerbach and Gorodnichenko, (2012), this debate has long been a central part of fiscal policy analysis. It was made clear by the debate over the likely effects of a fiscal stimulus in the US after the 2008/09 financial crises, and elsewhere, economists are a long way from reaching a consensus. Indeed economists remain divided over areas such as:

- the strength of fiscal policy’s macroeconomic effects,
- the channels through which these effects are transmitted, and
- the variations in these effects and channels with respect to economic conditions.

Basically the issue at the centre of this debate is the size of fiscal multipliers, particularly when the economy is in recession or expansion.

### 1.2 Fiscal Multipliers

In general, fiscal multipliers measure the effect that fiscal shocks (whether positive or negative) have on output and are usually defined as the percentage change in real GDP that follows a fiscal shock totalling to one per cent of GDP. Given that multipliers may be higher during crisis times, the question of whether fiscal consolidation might even be self-defeating, in the sense of putting the public debt ratio on an unfavourable path, has become central to the debate (Warmedinger, et al., 2015). Critics of fiscal austerity have argued that consolidation suppresses demand further and thus leads to an even deeper recession. If the negative impact on short-term economic growth is sufficiently large, frontloading fiscal consolidation may prove to be self-defeating and result in higher public debt-to-GDP ratios. The counterarguments typically focus on the necessity of consolidation to ensure fiscal sustainability; any self-defeating effects are seen at most as a short-term phenomenon (Warmedinger et al., 2015).

According to Mitra and Poghosyan (2015), fiscal consolidation measures are considered to have a large impact on growth when the spending multiplier or the revenue multiplier (in absolute value) exceeds one. A spending multiplier greater than one indicates that public spending cuts harm economic activity and produce a reduction in output larger than the initial drop in public spending. Similarly, a revenue multiplier less than negative 1 implies that raising one unit of taxes causes a decline in economic activity of more than one unit. A spending multiplier less than one, or even negative, reflects a reversal of the initial decline in aggregate demand due to confidence effects, the crowding-in of productive private sector activities, and reduced leakage through imports. Distortions in private investment incentives, households’ anticipation of future tax declines (or spending increases), or changes in inflation and imports caused by a change in tax policy could result in revenue multipliers that are larger than one.
and even positive in some cases.

At its simplest level, fiscal multiplier is the change in output arising from a change in a fiscal policy instrument. For instance;

$$\frac{dY_t}{dZ_t}$$

where $Y_t$ is output (or some other activity variable) and $Z_t$ is a fiscal instrument, either government spending on goods and services, on government transfers, or taxes or tax rates. Since there are typically lags in the effects, one should distinguish between impact multipliers (above) and the cumulative multiplier:

$$\sum_{j=0}^{n} dY_{t+j} \quad \sum_{j=0}^{n} dZ_{t+j}$$

The interpretation of the fiscal multiplier is complicated by the fact that it is not a structural parameter. Rather, in most relevant contexts, the multiplier is a function of structural parameters and policy reaction parameters (Chinn, 2013). However, over the years, this simple estimation of fiscal multipliers has shifted to the use of econometric models, resulting in varying multipliers across countries. For example, Barro and Redlick (2009) find a multiplier of 0.6 to 0.8 when using data on US defence spending while Almunia et al. (2009) find a multiplier of greater than one when looking at the Great Depression. Theoretical work by Christiano et al. (2009), Woodford (2010), and others emphasise that government spending may have a large multiplier in the US when the nominal interest rate is at the zero bound, which occurs rarely and only in recessions.

These novel theoretical findings for market-clearing models echo earlier Keynesian arguments that government spending is likely to have larger expansionary effects in recessions than in expansions. Intuitively, when the economy has slack, expansionary government spending shocks are less likely to crowd out private consumption or investment. To the extent that discretionary fiscal policy is heavily used in recessions to stimulate aggregate demand, the key empirical question is how the effects of fiscal shocks vary over the business cycle. The answer to this question is not only interesting to policymakers in designing stabilisation strategies but it can also help the economics profession to reconcile conflicting predictions about the effects of fiscal shocks across different types of macroeconomic models (Auerbach and Gorodnichenko, 2012).

1.3 The Business Cycle

The changing states of the economy during times of recession and expansion is referred to as the business cycle. Many variables are used to measure the business cycle, which can be capacity utilization, unemployment gap, output gap, etc. This study limits itself to the output gap as a measure of the business cycle. Output gap can be defined as potential output and its corresponding deviations from actual output. The most common measure of output gap which is also used in this paper is the Hodrick-Prescott (HP) filter.

**Figure 5: US and Japan Recession Shadings with Swaziland’s Output Gap**

Source: Central Statistical Office and NBER

Figure 5 shows Swaziland’s business cycle as measured by the HP filter as well as US
recession shadings from the National Bureau of Economic Research (NBER). The figure shows that most recessions in the country follow those of the US, just like most countries in the world. This figure also incorporates Japan recession shadings.

The Fiscal Multiplier over the Business Cycle Despite these important theoretical insights and strong demand by the policy process for estimates of fiscal multipliers, no empirical research trying to assess how the size of fiscal multiplies varies over the business cycle has been carried out in Swaziland, but elsewhere in the world. Most of empirical research in this area is based on linear structural vector autoregressions (SVARs) or linearised dynamic stochastic general equilibrium (DSGE) models, which by construction rule out state-dependent multipliers.

In their work, Auerbach and Gorodnichenko, (2010) addressed this issue by providing estimates of state-dependent fiscal multipliers. Building on Blanchard and Perotti (2002) and subsequent studies, their paper extends the existing literature in three ways. First, using regime-switching SVAR models, they estimated effects of tax and spending policies that can vary over the business cycle. They found large differences in the size of fiscal multipliers in recessions and expansions, with fiscal policy being considerably more effective in recessions than in expansions.

The rest of the paper is organised as follows; section 2 is the review of literature, section 3 presents the methodology, section 4 presents the models results, multipliers for aggregated and disaggregated data, as well as multipliers in expansions and recessions, while section 5 concludes.

2.0 LITERATURE REVIEW
Keynes advocated a fiscal stimulus during the Great Depression, and since then governments have at times implemented fiscal expansions during recessions as a means of stimulating economic activity. However, modern business cycle models, and most empirical evidence suggests that these policies are ineffective. The theoretical argument is that an increase in government spending raises consumers’ expected tax burden, and this negative wealth effect largely curtails the expansion of aggregate demand. The multipliers generated by these models are small, hovering at most around one. Moreover, their size does not vary over the business cycle, which implies that fiscal policy is ineffective even during very severe downturns.

Traditional Keynesian (IS-LM-AS) models usually have large multipliers since the size of the multiplier (when accommodating monetary policy keeps the interest rate from rising) is given by

$$\frac{1}{1 - MPC}$$

where $MPC$ is the marginal propensity to consume which is typically quite large (about 0.5–0.9). To that extent, the AS curve in the IS-LM-AS model is upward sloping. Therefore the multiplier can vary from relatively large (the AS curve is flat and there is a great deal of slack in the economy; i.e., in a recession) to relatively small (the AS curve is steeply upward sloping and the economy operates at full capacity; i.e., in an expansion). In contrast, an increase in government spending in modern business cycle models usually leads to a large crowding out of private consumption in recessions and expansions and correspondingly the typical magnitude for the multiplier is less than 0.5 (Auerbach and Gorodnichenko, 2012).

The majority of studies on fiscal multipliers have focused on the advanced economies. A comprehensive literature review on fiscal multipliers in advanced economies can
be found in Baunsgaard et al. (2012), who extended and updated work undertaken by Spilimbergo, Symansky, and Schindler (2009). Baunsgaard et al. (2012) review a total of 37 studies including both model based (DSGE) and vector autoregressive (VAR) approaches. For those studies government spending multipliers range between 0 and 2.0, with a mean of 0.8 during the first year after fiscal measures are taken. Government revenue multipliers range from about -1.5 to 1.4, with a mean of 0.3. Coenen et al. (2012) compared seven models used at policy making institutions, and found that most models (of which six are DSGE models, including GIMF) have similar short run multipliers for temporary changes in government spending (roughly 0.6 to 1.5 under the normal conduct of monetary policy) and revenues (roughly 0.1 to 0.5 under the normal conduct of monetary policy).

In spite of an extensive literature, there is still no consensus regarding the size of fiscal multipliers, even in advanced economies. They tend to be smaller in more open economies and in countries with larger automatic stabilizers, but as the theoretical and empirical literature suggest, they differ widely across countries. For the advanced economies, Spilimbergo et al., (2009) suggest that as a rule of thumb, government consumption multipliers are 0.5 or less in small open economies, with smaller values for revenue and transfers and slightly larger ones for investment. Moreover, recent studies have concluded that multipliers are significantly larger when the economy is undergoing a recession than when it is in an expansion (Auerbach and Gorodnichenko, 2012, Batini and others, 2012, Baum and others, 2012).

Some findings from DSGE models with some Keynesian features (e.g., Christiano, Eichenbaum, and Rebelo 2011; Eggertsson 2008; and Woodford 2011), however, suggest that the government spending multiplier in periods with a binding zero lower bound (ZLB) on nominal interest rates (which are recessionary times) could be somewhere between 3 and 5. Intuitively, with the binding zero lower bound, increases in government spending have no effect on interest rates and thus there is no crowding out of investment or consumption, which leads to large multipliers. A key issue coming out of recent economic events is the size of fiscal multipliers when the economy is in recession.

In a paper by Auerbach and Gorodnichenko (2011), they extended the standard Structural Vector Autoregression (SVAR) methodology in three ways to shed light on this issue. First, using regime-switching models, they estimated effects of fiscal policies that can vary over the business cycle, and found large differences in the size of spending multipliers in recessions and expansions with fiscal policy being considerably more effective in recessions than in expansions. Second, they estimated multipliers for more disaggregated spending variables that behave differently in relation to aggregate fiscal policy shocks, with military spending having the largest multiplier. Third, they showed that controlling for real-time predictions of fiscal variables tends to increase the size of the multipliers in recessions.

Blanchard and Perotti (2002), estimated multipliers for government purchases and taxes on quarterly US data. They applied four identifying assumptions; (i) discretionary policy does not respond to output within a quarter, (ii) nondiscretionary policy responses to output are consistent with auxiliary estimates of fiscal output elasticities, (iii) innovations in fiscal variables not predicted within the VAR constitute unexpected fiscal policy innovations, and (iv) fiscal multipliers do not vary over the business cycle. These multipliers are still commonly cited, although subsequent research has questioned whether the innovations in these
SVARs really represent unanticipated changes in fiscal policy, the challenge relating both to expectations and to whether the changes in fiscal variables, notably taxes, represent actual changes in policy, rather than other changes in the relationship between fiscal variables and the included SVAR variables. The few empirical studies, which generally employ a panel data approach to estimate multipliers across emerging economies, tend to validate the hypothesis that multipliers are indeed lower in emerging economies (IMF, 2008, Mendoza et al., 2011 and Ilzetzki, 2011). Some studies even conclude that multipliers are generally negative, particularly in the longer term (IMF, 2008) and when public debt is high (Ghosh and Rahman, 2008). Revenue-based stimulus measures seem to be more effective at boosting output in the short-term than expenditure-based measures, in contrast to advanced economies, perhaps reflecting concerns that, once implemented, increased expenditures are difficult to remove. Ilzetzki et al. (2011) and Ilzetzki (2011) find that while spending multipliers are very small and not generally significant, revenue multipliers are positive and significant and lie around 0.3 in the short term. According to Mendoza et al. (2010), the low overall spending multiplier in emerging economies could be due to the combination of a negative government consumption multiplier and a positive response of output to government investment with a multiplier of around 0.6 in the short-term. DSGE simulations and SVAR models, developed since the early 1990s, suggest that first year multipliers generally lie between 0 and 1 in “normal times.” This literature also finds that spending multipliers tend to be larger than revenue multipliers.

Based on a survey of 41 such studies, Mineshima et al. (2014) show that first-year multipliers amount on average to 0.75 for government spending and 0.25 for government revenues in advanced economies. Assuming, in line with recent fiscal adjustment plans, that two thirds of the adjustment falls on expenditure measures, this would yield an overall “normal times” multiplier of about 0.6. However, these standard results have been challenged by the more recent literature. First, a number of studies have shown that multipliers can exceed 1 in “abnormal” circumstances — in particular when the economy is in a severe downturn or if the use and/or the transmission of monetary policy are impaired. Second, some papers, which use a new “narrative” approach to identify exogenous fiscal shocks, find larger tax multipliers than conventional VAR models do.

### 3.0 METHODOLOGY

There are various approaches to estimating fiscal multipliers as noted in the review of literature. In line with Blanchard and Perotti (2002), this study employs the structural vector Autoregression (SVAR), which consists of three variables, namely real GDP, real net revenue and real net expenditure. Revenue is defined as total revenues excluding transfers, subsidies, and interest payments. Expenditure is defined as government consumption and investment. Cointegration tests, using the Johansen test were carried out before the estimations. Its purpose was to establish the long run relationship between the three variables. Using data from 1980 to 2016, and based on the Cholesky decomposition of the reduced form VAR, the following structural VAR was estimated:

\[
\begin{bmatrix}
    e_G^t \\
    e_T^t \\
    e_Y^t
\end{bmatrix} = 
\begin{bmatrix}
    1 & 0 & 0 \\
    a_{21} & 1 & 0 \\
    a_{21} & a_{21} & 1
\end{bmatrix} \times 
\begin{bmatrix}
    
\end{bmatrix}
\]

Where the left hand side of the equation contains a vector of residuals in the reduced form, and in the right hand side is the squared matrix \(A_0\) of coefficients associated with lagged variables and structural shocks through the column vector \(\varepsilon\)
The assumption is that fiscal variables impact GDP contemporaneously but GDP impacts fiscal policy decisions with a lag. The identification is the same as in Blanchard and Perotti (2002), where unexpected movements in taxes can be due to the response to unexpected movements in GDP, response to structural shocks to spending, and to structural shocks to taxes. A similar interpretation applies to unexpected movements in spending in the second equation. The third equation states that unexpected movements in output can be due to unexpected movements in taxes, unexpected movements in spending, or to other unexpected shock in output. In order to test the robustness of the results, we then estimated the same model with disaggregated data for government expenditure.

The impulse response analysis was carried out to determine the effects of various shocks in the estimated model. The impulse response function in a VAR analyses dynamic effects on the system when the model received the impulse of say one standard deviation shock. Given that the multipliers can differ given the state of the economy, various approaches has been undertaken in literature to estimate multipliers in different states of the economy. Auerbach and Gorodnichenko (2012) used the regime switching SVAR to show that output multipliers are countercyclical. Other studies use a threshold VAR (TVAR), which is a simple method to model changing dynamics of a set of variables over two or more distinct regimes. In this study, Tsay (1998) multivariate threshold autoregression (MTAR) approach will be utilised. To specify the MTAR model, we begin by the specification of the general autoregressive model for a variable \( y_t \) that takes the form:

\[
    y_t = \theta_0 + \theta_0 y_{t-1} + \ldots + \theta_p y_{t-p} + \epsilon_t.
\]

Where \( \epsilon_t \) is the error term. This is a univariate linear model; however, some data is known to exhibit some non-linear trends. That leads to the introduction of the threshold variables to separate the estimations into two or more regimes. A two-regime threshold autoregression (TAR) model is presented as follows:

\[
    y_t = \begin{cases} 
        \theta_0 + \theta_0 y_{t-1} + \ldots + \theta_p y_{t-p} + \epsilon_t, & \text{for } z_{t-d} \leq r \\
        \theta_0 + \theta_0 y_{t-1} + \ldots + \theta_p y_{t-p} + \epsilon_t, & \text{for } z_{t-d} \geq r
    \end{cases}
\]

Where \( z_{t-d} \) is a threshold variable and \( r \) is the transition variable which separates the two regimes. The transition variable is either endogenous or exogenous (Hansen 1996, 1997, and Tsay 1998). In general, it is possible to obtain more than one critical threshold values, but for simplicity this study will focus on a model with only two regimes, recession and expansion. In this paper, the MTAR model for \( y_t \) that may also depend on some exogenous variables \( x_t \), can be presented as follows:

\[
    y_t = c_j + \sum_{i=1}^{p} \alpha_i^{(j)} y_{t-i} + \sum_{i=1}^{q} \beta_i^{(j)} x_{t-i} + \epsilon_t^{(j)}
\]

\[
    \text{if } r_{j-1} < z_{t-d} \leq r_j
\]

where \( j = 1, \ldots, s \), \( c \) are constant vectors and \( p \) and \( q \) are nonnegative integers. The threshold variable \( z_t \) is assumed to be stationary and have a continuous distribution. The model has \( s \) regimes and is a piecewise linear model in the threshold space \( z_{t-d} \), but it is nonlinear in time when \( s > 1 \). The model assumes that the threshold variable \( z_{t-d} \) is known, but the delay \( d \), is unknown (Tsay, 1998).

In this study, the output gap is chosen as the threshold variable to determine whether the economy is undergoing an expansion or downturn. The reasons to employ the output gap instead of other variables are manifold. The output gap is the measure most commonly used to identify economic cycles, as it is seen not only as reliable ex-post but also as a reliable real-time indicator for policymakers. More importantly, one argument
for fiscal policy being more effective in downturns than in expansions is that under a negative output gap, excess capacities are available in the economy, making the crowding out of private investment lower. This argument is expected to hold as long as the output gap is negative, which can hardly be captured by other variables. These equation specifications will be estimated in two fold; aggregated and disaggregated components of spending. This study used annual data from 1980 to 2016 to examine the effect of fiscal multipliers both in times of recession and expansion in Swaziland. Data was collected from the Central Bank of Swaziland, the Central Statistics Office, and the Ministry of Finance.

4.0 FINDINGS AND DISCUSSIONS
Stationarity tests are the pre-tests for avoiding spurious regressions. They are the starting point in any cointegration analysis as well as regression analysis. In non-stationary series, the order of integration is therefore determined by the number of times it has to be differenced to attain stationarity. All the variables were found to be nonstationary at their levels, and had to be differenced. The ADF test results for the first differences are presented in the table below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intercept</th>
<th>Trend and Intercept</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log RGDP</td>
<td>-4.239***</td>
<td>-3.693**</td>
<td>-2.933***</td>
</tr>
<tr>
<td>Log Revenue</td>
<td>-6.065***</td>
<td>-4.498***</td>
<td>-3.660***</td>
</tr>
<tr>
<td>Log Expend</td>
<td>-6.145***</td>
<td>-6.012***</td>
<td>-0.612***</td>
</tr>
</tbody>
</table>

Note: ***,**,* = significant at the 1%, 5%, 10% level.

A variable is stationary if the ADF statistic is greater than the MacKinnon critical values for the rejection of hypothesis for a unit root. From the table above, all the variables were previously not stationary at their levels because the ADF statistic is smaller than the MacKinnon critical values for the rejection of hypothesis for unit roots and therefore had to be differenced to induce stationarity. This means that the null hypothesis for unit root is not rejected for these variables.

4.1 Cointegration Results
After determining the order of integration of the variables, the next step is to determine whether there is cointegration between the variables. This is to establish if the linear relationship of the variables is stationary. If the null hypothesis of no cointegration is rejected then the linear combination of the variables is stationary, hence a non-spurious long-run relationship exists between the variables and as such, consistent estimates of the long run relationship is evident. To test for cointegration between these variables, the Johansen approach was employed. Using the lag length selection criteria, a lag length of 3 was selected. The results, it is evident that the variables are cointegrated (there is a long-run relationship amongst the variables), as there are cointegrating equations in both the trace statistic and maximum eigenvalue statistic. In that regard, we proceed to estimate the SVAR for both aggregated and disaggregated data. Diagnostic tests were carried out and the model passed all the diagnostic tests as shown in the table below, where a rule of thumb is that the probability should be greater than 0.05.

<table>
<thead>
<tr>
<th>Significance</th>
<th>$X^2$ statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breusch-Godfrey serial correlation LM test</td>
<td>2.98</td>
<td>0.24</td>
</tr>
<tr>
<td>White Heteroskedasticity test</td>
<td>0.53</td>
<td>0.63</td>
</tr>
<tr>
<td>Jarque-Bera test</td>
<td>0.65</td>
<td>0.56</td>
</tr>
<tr>
<td>Ramsey RESET test (log likelihood ratio)</td>
<td>0.14</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Source: Own estimations
4.2 Impulse Response Analysis for the Effects of Revenue and Expenditure on Output

4.2.1 Response of GDP and expenditure to a revenue shock

The paper begins by considering the effects of revenue in the SVAR linear model with no regime shifts, following the basic specification of Blanchard and Perotti (2002), but ordering taxes (T) first, followed by expenditure (G) and output (Y). Figure 6 displays a summary of the impulse response from the SVAR of GDP and expenditure to a shock on revenue. The impulse responses of GDP and government spending to a shock in revenue yields different results, with a pronounced significant effect on expenditure compared to almost insignificant effect to GDP. A positive shock in revenue (taxes) results to an increase in government spending as depicted in the first diagram, but is not generally significant to GDP, revealing that the revenue has been generated by the economy, hence a downward trend. However, the impact is felt in the later years as an upward trajectory is observed in GDP.

4.2.2 Response of GDP and revenue to an expenditure shock

Figure 7 displays the responses of revenue and GDP to an increase in government spending. The response of revenue to an increase in spending is generally insignificant in the ten-year horizon. Although it starts on a negative trajectory, positive effects are observed after the third year, showing that the government starts reaping expenditure benefits after about three years in the form of taxes. GDP on the other hand also responds to the increase in spending after three years as shown in the second diagram of Figure 7. This is in line with the Keynesian theory that an increase in spending may accelerate economic growth in the long run.

4.3 Effects of revenue and components of expenditure (capital and recurrent) on output

4.3.1 Shock on revenue

In this section, expenditure was disaggregated into capital (investment) and recurrent (consumption) to ascertain their impacts to revenue and GDP. As shown in Figure 8, whenever there is a positive shock in revenue, capital expenditure responds positively, however to a lesser extent than recurrent expenditure where the positive shock is largely pronounced. GDP on the other hand does not respond significantly to the revenue shock in the ten-year horizon.
4.3.2 Shock on Capital Expenditure
Whenever there is a positive shock on capital expenditure, there is no immediate significant impact on revenue and recurrent expenditure, although a fall in recurrent expenditure is observed in Figure 9 as expected. Notable is the positive response in GDP, which is significant after three years. That shows that expenditure in investment by the government has an impact on GDP, compared to consumption expenditure.

Figure 9: Response of the Variables on Capital Expenditure

4.3.3 Shock on recurrent expenditure
A positive shock to recurrent expenditure results in a positive response to revenue, although not very significant, as shown in Figure 10. That could be a result of taxes to the government employees as a sizable component of recurrent expenditure goes towards the compensation of employees. The positive shock on recurrent expenditure does not result in a significant response to investment and GDP. That is because a positive shock to recurrent expenditure crowds out investment and leads to reduced economic growth.

Figure 10: Response of the Variables on Recurrent Expenditure

4.4 Response of disaggregated expenditure (economic, social, and general) on a revenue shock
Government spending was further disaggregated to three components; general services (general administration, public order and safety), social services (education and health), and economic services (agriculture, industry, and mining). The idea is to identify the impact of each component to revenue and GDP. First to be examined are the response of the expenditure components to a positive shock on revenue. The results in Figure 11 shows that the response is not very significant in all the three components, however social and economic services show a positive response in the first years, which shows that they do get positive spill overs from the improved revenue.

Figure 11: Response of Expenditure Components to Revenue

4.4.1 Response of GDP to components of expenditure
Whenever there is a positive shock in each of the three components of expenditure, it does not have a significant impact to GDP. However, it is observable in Figure 12 that there is a positive response to GDP arising from a positive shock in economic services expenditure, albeit insignificant. That shows the need for the government to increase its expenditure in economic services.

Figure 12: Response of the Variables on Economic Services Expenditure

Source: Authors Calculations
4.5 Fiscal Multipliers

Fiscal multipliers in this study are different from impulse response functions in the sense that impulse responses measure a percentage change compared to a unit change measured by fiscal multipliers. When put simply, fiscal multipliers measure the change in output arising from a Lilangeni change in expenditure or revenue. The fiscal multipliers can be categorised into three: (i) impact multipliers, (which show the contemporaneous effect of one unit increase in the respective fiscal variable on output), (ii) the interim multipliers (show the effect of one unit increase in the respective fiscal variable on output in the medium-term). Finally, the cumulative multipliers is defined as the sum of fiscal multipliers through a horizon (shows the total effect of fiscal policy changes to output over a pre-defined period).

For estimation purposes, given that the endogenous variables used in the estimations are measured in logarithms, the obtained impulse response functions are elasticities measuring the percentage change in output in response to one percentage point change in the fiscal variables. To convert these elasticities to multiplier units, we correct impulse response functions by the average ratios of the respective fiscal variable and GDP over the estimation period. It is known that elasticity $\beta$ can be defined as

$$\frac{X_t \Delta Y_t}{Y_t \Delta X_t} = \beta$$

Where $\beta$ is a percentage. Hence

$$\frac{\Delta Y_t}{\Delta X_t} = \beta + \frac{X_t}{Y_t}$$

Where $\frac{X_t}{Y_t}$ is expressed as a constant and it is the average proportion of variable $X_t$ to output $Y_t$. These averages for revenue and expenditure (including expenditure components) for the estimation period from 1980 to 2016 are shown in table 5.

**Table 5: Ratio of Each Component to GDP in the Estimating Horizon (1980 to 2016)**

<table>
<thead>
<tr>
<th>REV</th>
<th>EXP</th>
<th>CAP_EXP</th>
<th>REC_EXP</th>
<th>ECON_SERV</th>
<th>GEN_SERV</th>
<th>LSOC_SERV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.180</td>
<td>0.199</td>
<td>0.043</td>
<td>0.156</td>
<td>0.0847</td>
<td>0.066</td>
<td>0.034</td>
</tr>
</tbody>
</table>

*Source: Own calculations*

For example, the ratio of average revenue to average GDP for the period 1980 to 2016 is 0.18 as shown in Table 5. Dividing the impulse response value of 0.0019 in Table 6 by this ratio gives an impact multiplier (first year) of 0.01055 in the interim multiplier column. Summing the interim multipliers cumulatively gives the accumulated multipliers as shown in the fourth column.

**Table 6: Revenue and Expenditure Multipliers to GDP**

<table>
<thead>
<tr>
<th>Period (Yr)</th>
<th>IMPULSE</th>
<th>INTERIM</th>
<th>ACCM MLTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00190</td>
<td>0.01055</td>
<td>0.01053</td>
</tr>
<tr>
<td>2</td>
<td>0.00097</td>
<td>0.00537</td>
<td>0.01591</td>
</tr>
<tr>
<td>3</td>
<td>0.00189</td>
<td>0.01047</td>
<td>0.02638</td>
</tr>
<tr>
<td>4</td>
<td>-0.00368</td>
<td>-0.02041</td>
<td>0.00597</td>
</tr>
<tr>
<td>5</td>
<td>-0.00254</td>
<td>-0.01407</td>
<td>-0.00810</td>
</tr>
<tr>
<td>6</td>
<td>0.00013</td>
<td>0.00070</td>
<td>-0.00740</td>
</tr>
<tr>
<td>7</td>
<td>0.00300</td>
<td>0.01662</td>
<td>0.00922</td>
</tr>
<tr>
<td>8</td>
<td>0.00530</td>
<td>0.02938</td>
<td>0.03860</td>
</tr>
<tr>
<td>9</td>
<td>0.00703</td>
<td>0.03898</td>
<td>0.07758</td>
</tr>
<tr>
<td>10</td>
<td>0.00614</td>
<td>0.03401</td>
<td>0.11160</td>
</tr>
</tbody>
</table>
Taking these multipliers into perspective, the impact multiplier (year one) is 0.01055 for revenue while it is -0.023 for expenditure. That means for every additional Lilangeni used by the government today, that result to a fall in GDP of about 2 cents (-0.02325 x 100). Similarly, for every additional Lilangeni of revenue generated today, leads to a 1 cent rise in GDP (0.01053 x 100). On the cumulative multipliers, an additional Lilangeni used today will result to an 11 cents (0.11160 x 100) and 20 cents (0.20094 x 100) rise in GDP in year 10, arising from revenue and expenditure respectively.

Figure 13 shows graphically the cumulative multipliers for revenue and expenditure. The figure shows that expenditure multipliers starts on the negative, which is true in the sense that when the government spends, it runs down GDP, but the multipliers starts being positive after the third year.

**Figure 13: Revenue and Expenditure Accumulated Multipliers to GDP**

However, it can be noted from the table that the multipliers for capital expenditure becomes positive after year 3, which is the estimated duration of most capital projects, compared to year 2 for recurrent expenditure. Furthermore, the returns from capital expenditure are more pronounced than recurrent expenditure as shown in Figure 14.
The figure shows that an additional Lilangeni used in capital expenditure today will result to E2 emalangeni increase in GDP after 10 years. On the other hand, an additional lilangeni used in recurrent expenditure today will result to 32 cents increase in GDP after 10 years. These results show the importance of spending in capital projects in increasing the country’s GDP. Hence, the next section further breaks down capital expenditure to the three sectors (economic, social, and general services), to identify the one which drives the capital expenditure multipliers.

From the table, it is evident that the most driver of the capital expenditure multiplier are the economic services whereby an additional Lilangeni used today will result to an increase of E1.55 in GDP after 10 years. Closely following the economic services are the general services at E1.14 cents increase to GDP after 10 years, with the lowest being social services at 66 cents as shown in the figure below.

It should be noted at this stage that general public service consist of general administration, public order, safety and defence. Social services consist of education, health, and other community services. Economic services on the other
4.6 Fiscal Multipliers in times of recessions and expansions

One of the major objectives of the study is to find the size of fiscal multipliers in times of recessions and expansions. In doing so, the study adopted an MTAR model of Tsay (1998) and estimated it using the Threshold Regression (TR) approach, with output gap being the threshold variable. This model is estimated for both aggregated and disaggregated government expenditure. The results of the aggregated model with lag 3 are shown below. These results show the elasticities which will then be converted to multipliers using the previously stated approach.

Table 8: Threshold Regression Results for Aggregated Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LREV(-3)</td>
<td>0.044898</td>
<td>0.014208</td>
<td>3.160071</td>
<td>0.0039</td>
</tr>
<tr>
<td>LEXP(-3)</td>
<td>0.076368</td>
<td>0.014194</td>
<td>5.380471</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>1.815667</td>
<td>0.323710</td>
<td>5.608933</td>
<td>0.0000</td>
</tr>
<tr>
<td>OUTPUT_GAP &lt;= 0.01515 =&gt; 7 obs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LREV(-3)</td>
<td>0.144190</td>
<td>0.041287</td>
<td>3.492352</td>
<td>0.0017</td>
</tr>
<tr>
<td>LEXP(-3)</td>
<td>0.176916</td>
<td>0.041935</td>
<td>4.218776</td>
<td>0.0002</td>
</tr>
<tr>
<td>C</td>
<td>1.809452</td>
<td>0.333203</td>
<td>5.430483</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Source: Own estimations

After estimating the model, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests are applied to assess parameter stability (Pesaran and Shin, 1997). The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. The figure below plots the results for CUSUM and CUSUMSQ tests. The results indicate the absence of any instability of the coefficients because the plot of the CUSUM and CUSUMSQ statistic fall inside the critical bands of the 5 percent confidence interval for parameter stability.

Since the model passes the stability test, it can be used for further analysis. From the results all the coefficients are significant, and there are twenty seven observations below the output gap threshold of 0.01515, against seven above the threshold. That means about 79 per cent of the time between 1980 and 2016 the economy is in recession compared to 21 per cent when it is in expansion. The table below shows the multipliers obtained from these elasticities using the previously stated approach.

Table 9: Fiscal Multipliers in Times of Recessions and Expansions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Expansion</th>
<th>Recession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>0.2489</td>
<td>0.7994</td>
</tr>
<tr>
<td>Expenditure</td>
<td>0.3854</td>
<td>0.8928</td>
</tr>
</tbody>
</table>

Source: Authors Calculations

These results shows that multipliers are higher during times of recession than expansion, with a Lilangeni increase in expenditure bringing 89 cents to GDP in recessions compared to 39 cents in
expansions. These results are in line with recent studies that have concluded that multipliers are significantly larger when the economy is undergoing a recession than when it is in an expansion (Auerbach and Gorodnichenko, 2012, Batini at al. 2012, Baum at al. 2012).

The nice point to emerge out of this exercise is that during recessions policymakers are trying to stimulate the economy in order to raise output and employment. The policy implication is that increasing government spending in periods of recessions (as Keynesian considerations would call for) would stimulate output whereas increasing it in times of expansion would have essentially no effects. Further, since we have made no distinction between increases and decreases in government spending, it would also follow that reducing government spending in recessions, as many developing countries have historically done would be quite contractionary whereas reducing spending in good times would have little effect. Since the study has found that it is wiser to increase spending during recessions, the issue is financing the budget, whereby the country might find itself with a high debt to GDP ratio. Thus, policy makers should be careful on the magnitude in which the spending should be increased. The results are further confirmed when expenditure is disaggregated into capital and recurrent as shown in the table below.

The results shows that expenditure on capital projects far exceed one during recessions, which shows that the magnitude of the gains on government investment is huge. From the results, an additional Lilangeni used in capital expenditure results to £1.60 increase in GDP during recessions, compared to 51 cents during expansions. Therefore, since it has been found that increasing government spending in periods of recessions would stimulate output, much of the expenditure should be directed to capital projects.

5.0 CONCLUSION AND RECOMMENDATIONS

The major objective of this study was to assess the impact of fiscal policy on output in Swaziland, with emphasis on the size of the fiscal multipliers, including times of recessions and expansions. The SVAR modelling approach was used to determine linear multipliers, while MTAR was applied for non-linear multipliers (recessions and expansions). The first step therefore was to test for stationarity of the variables. Results of the ADF stationarity test show that the variables are not stationary. The Johansen and Juselius cointegration test was performed to establish the existence of a long run relationship among the variables, results of which show the existence of such a relationship.

Once cointegration was established, the SVAR model was estimated and the impulse response analysis was undertaken. The results shows that the response of GDP is not significant for revenue but significant to expenditure. When expenditure was disaggregated to capital and recurrent, the results shows that GDP response is significant for capital than recurrent expenditure. On further disaggregation of capital expenditure, the results show that economic services followed by general services expenditure drives capital expenditure.

Table 10: Fiscal Multipliers in Times of Recessions and Expansions for Capital and Recurrent Expenditure

<table>
<thead>
<tr>
<th>Variable</th>
<th>Expansion</th>
<th>Recession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>0.2645</td>
<td>0.7487</td>
</tr>
<tr>
<td>Capital Expenditure</td>
<td>0.5129</td>
<td>1.6154</td>
</tr>
<tr>
<td>Recurrent Expenditure</td>
<td>0.3394</td>
<td>0.6058</td>
</tr>
</tbody>
</table>

Source: Authors Calculations
The impulse response functions were then used to estimate linear multipliers, where it was found that the accumulated multipliers are higher at 20 cents for expenditure in the 10 year horizon compared to 11 cents for revenue multipliers. Disaggregating expenditure further to capital and recurrent, it was found that capital expenditure multipliers are higher at E2.00, compared to 32 cents for recurrent expenditure. On the components of capital expenditure, it was found that economic services expenditure has a higher multiplier, at E1.55, followed by general services multiplier at E1.14.

The results for the non-linear multipliers show that multipliers are higher during times of recession than expansion, with a Lilangeni increase in expenditure bringing 89 cents to GDP in recessions compared to 39 cents in expansions. These results are in line with recent studies which have concluded that multipliers are significantly larger when the economy is undergoing a recession than when it is in an expansion (Auerbach and Gorodnichenko, 2012, Batini et al. 2012, Baum et. al. 2012). The results are further confirmed when expenditure is disaggregated into capital and recurrent, where capital expenditure is found to have a multiplier of E1.62 during times of recession compared to 51 cents in times of expansions.

In light of the findings in the study, the following policy recommendations are offered:

- The government should continue increasing government spending in periods of recessions (as Keynesian considerations would call for) in order to stimulate output whereas increasing it in times of expansion would have essentially no effects.

- The study has found that it is wiser to increase spending during recessions, the issue is financing the budget, whereby the country might find itself with a high debt to GDP ratio. Thus, policy makers should be careful on the magnitude in which the spending should be increased. Therefore, a study needs to be undertaken to ascertain the magnitude of this budget expansion to avoid situations whereby the debt to GDP ratios reach unsustainable levels.

- Since the results show that the returns from capital expenditure are more pronounced than recurrent expenditure, efforts should be made towards spending more on capital projects, with more emphasis on the economic services component of capital expenditure.

- The results further shows that expenditure on capital projects far exceed one during times of recessions, with an additional Lilangeni used in capital expenditure results to a E1.60 increase in GDP during recessions, compared to 51 cents during expansions. Therefore, much of the expenditure should be directed to capital projects during recessions.
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The Efficacy and Potency or Paralysis of Monetary Policy in Swaziland under the Common Monetary Union

Sikhumbuzo S. Dlamini\textsuperscript{7}, Ntobeko S. Dlamini\textsuperscript{8} and Sive Kunene\textsuperscript{9}

Abstract

This paper is a twofold analysis of the effectiveness of monetary policy in Swaziland and an assessment of the Common Monetary Area (CMA) as an optimal currency area (OCA) using structural vector autoregression (VAR) models. In assessing the optimality, the paper identifies the underlying shocks and correlation in the shocks to real gross domestic product, consumer price index and real exchange rate. The results indicated that demand shocks proxied through the consumer price index are less correlated among the CMA member states; instead, they have converged around the South Africa as an anchor economy. The results therefore support the Central Bank of Swaziland's drive to align policy rates with that of South Africa, but dependent on data outcomes. The impulse response results revealed that a shock on the discount rate only has a negative significant effect on the real gross domestic product (GDP), inflation and money supply (M2), indicating the efficacy of monetary policy in Swaziland.

Key Words: CMA, Optimum Currency Area, Macroeconomic Convergence, Monetary Policy, Structural VAR.

1. INTRODUCTION

The paper argues that Swaziland’s membership to the Common Monetary Area (CMA) together with Lesotho, Namibia and South Africa has paid huge dividends for the country over the years. With macroeconomic stability the principal outcome over the years the country has achieved a stable currency with the Lilangeni pegged one-to-one with the South African Rand. Under this arrangement, the economy has also been stable. The interlinkages between fiscal and monetary policies have been strong. Monetary policy implementation has yielded positive reviews over the years. The country has maintained relatively stable levels of increase in prices (inflation) as well as a stable financial sector.

Monetary policy has had a measurable and foreseeable impact on demand and inflation over time. Within the confines of lose of monetary policy autonomy in a currency union, monetary policy may not always be effective. This requires central banks to continuously innovate in areas such as risk management and developing analytical tools to deal with adverse developments, including the inherent costs of monetary policies, especially those applied in quasi-currency unions such as the CMA.

The paper argues that whilst monetary integration within the CMA has over time strengthened, the Central Bank of Swaziland still retains autonomy to implement monetary policy as economic fundamentals allow. This bestows potency of monetary policy to adjust the levels of money supply to curb inflation and restore financial stability. It renders the rhetoric of ‘monetary policy decision taker’ which many believe about monetary policy decisions in Swaziland as flawed. The paper argues that Swaziland’s monetary policy

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independence or autonomy is inherent by jurisdiction or national sovereignty. Remaining within the CMA is one such conscious decision in the implementation of the country’s monetary policy strategy. It notes various developments in South Africa that had devastating effects to the other economies in the CMA, especially those associated with the collapse of the exchange rate.

1.1 Stylised Facts about the Swazi Economy

1.1.1 Economic Growth

During the 1980s Swaziland recorded high economic growth rates, driven by an influx of foreign direct investment (FDI) arising from sanctions imposed on South Africa, which propelled the relocations of enterprises into Swaziland. The high levels of foreign direct investment caused an economic upturn in the manufacturing sector, which became the main growth engine, which in turn encouraged rapid growth in supporting sectors such as construction. This also generated additional revenue which permitted the consequent expansion of government services. Apart from the inflows into the manufacturing sector, the growth performance was also aided by more conventional external stimuli, such as improved export prices for sugar, reinforced by the real depreciation of the Lilangeni. However, in recent years, that growth stimulus subsided.

Swaziland has suffered sluggish growth since the turn of the century, averaging 3.2 per cent between the years 2001 to 2016. Economic growth has been slowing down since 2013, falling from 4.6 per cent to 1.3 per cent in 2016, averaging 2.5 per cent over this period. The slowdown is due to continued drought and a difficult external environment, especially from South Africa, leading to a sharp decrease in South African Customs Union (SACU) revenues. Such a decrease in revenue, combined with increased public spending, has generated higher fiscal deficits and a growing public debt.

1.1.2 Inflation Developments

The Central Bank of Swaziland has as its ultimate goal price stability to create an environment conducive for economic growth. The monetary authorities in the country basically uses monetary policy tools (namely; the discount rate, reserve ratio and liquidity requirement) to control the level of money supply and consequently inflation. The Bank mainly uses the discount rate which largely moves in harmony with the movements in the repurchase rate in South Africa. This is mainly done to curb capital flight as there is free flow of capital in the CMA. The graph below shows the time series data for the discount rate and inflation from 2006 to 2017.

South African prices are the dominant factor...
determining the inflation level in Swaziland (Ndzinisa, 2008). With free flow of goods between South Africa and Swaziland, as well as through close proximity, the two countries have extremely strong trade and investment links. Further, the two countries enjoy strong investment links with South African retailers and financial institutions established in Swaziland. These are responsible for transferring the price and monetary policy effects to Swaziland.

Imported inflation effects are transmitted through the fixed exchange rate. The Lilangeni is at par with Rand. As such, components contributing significantly to the consumer price index are imported from South Africa, especially fuel, electricity and food. With fuel having the strongest import inflation effect. Swaziland imports over 80 per cent of its electricity from South Africa. Electricity tariff increases have mirrored or surpassed those in South Africa. Other food items such as cereals are all imported. Such imports therefore transmit the effects of price changes in South Africa to Swaziland’s inflation developments over time. Generally inflation rates in the CMA moves in tandem, with Swaziland among the highest and Namibia with the lowest rates.

Following the 2007/2008 global financial crisis which led to the first recession in recent years and the decade of undeterred growth, the level of inflation increased drastically and recorded double digits. In the year 2008, inflation in South Africa and Swaziland recorded 11.5 and 12.5 per cent respectively. Between the period 2011 and 2017, the inflation trajectory for the CMA countries remained subdued. Swaziland, however, registered the highest inflation rates and deviated by a large margin from the rest of the CMA in 2012 mainly due to the introduction of the value added tax (VAT) which added pressure on prices to increase on goods and services that attracted the VAT and this had a once-off effect especially during the period in which it was introduced.

Figure 3: Inflation Movements in the CMA

1.1.3 Exchange Rate Developments
Maintaining a healthy export sector over a long period requires maintaining an appropriately stable, competitive and sustainable exchange rate. Swaziland has achieved a sustainable exchange rate through the peg with the South African Rand. This has offered certainty to economic agents, especially exporters. It is however not possible for Swaziland to adjust (manipulate) the exchange rate to promote export competitiveness. Generally, a depreciation boosts export receipts and as such makes Swazi products competitive in export markets outside of the CMA. Figure 3 illustrates the movement in nominal exchange rates from 2006 to 2017. During the period under review the exchange rate of Lilangeni to US dollar was consistently depreciating, from an average of around E7.00 in 2006 to an average of around E13.20 in 2017. This was due to various factors ranging from the effects of global financial crisis on capital flows to emerging countries to political factors in South Africa and globally.
The influence of exchange rate towards inflation itself depends on the level of imports denominated in foreign currencies. As the Lilangeni/Rand freely floats, it has over time been extremely volatile, on the weaker side. A depreciation (devaluation) of the domestic currency can affect the price level directly through imported goods that domestic consumers pay. However, this condition occurs if the country is the recipient of international prices. This is more pronounced for fuel and some food items, such cereals linked to wheat prices. That is on the demand side. On the supply side, the transmission of the effects of the exchange rate is through intermediate goods, which are inputs to the production process. With trade liberalization, and global interconnectedness, it has become easy to source products globally. However, the depreciation of the currency would tend to increase production costs and such be inflationary as manufacturers will transfer costs increases to consumers.

**Figure 4: Exchange Rates Movements in the CMA**

<table>
<thead>
<tr>
<th>Year</th>
<th>US Dollar</th>
<th>Pound Sterling</th>
<th>Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2007</td>
<td>55</td>
<td>55</td>
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<tr>
<td>2008</td>
<td>58</td>
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<tr>
<td>2009</td>
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<td>2010</td>
<td>62</td>
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</tr>
<tr>
<td>2017</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

*Source: Central Bank of Swaziland*

1.2 The importance of the Paper

Monetary integration, to varying degrees has become an increasingly important phenomenon within the modern global political economy. The global political economy is characterized by regions developed into building blocks to develop economies of scale to take advantage of trade agreements as well as policy harmonisation for quasi-homogeneous economies. Such homogeneity is mainly on the structure of the economies and historical political links, such as is the case for the Southern African Customs Union (formed in 1969). Due to such demand, the countries agreed that in order to foster stronger trade ties, a currency union, CMA, was an imperative. The CMA offers the opportunity for countries such as Swaziland to enjoy macroeconomic stability as well as price and financial sector stability through exchange rate stability. The Lilangeni is pegged one to one to the South African Rand. This allows the country to “import some” price stability as well as any ailments into the domestic economy. This was evident in Rand crises in 1985, 1998 and 2002.

Recently, the efficacy of the country’s monetary policy especially on curbing inflationary pressures has been put on the spotlight as the country battled high inflation in 2016. Questions have also been raised on whether the CMA is still an optimum currency area or not. It is therefore against this backdrop that this study is conducted. The rest of the paper is organised as follows; section 2 is the review of literature, section 3 is the methodology, section 4 are the results and discussions, while section 5 presents the conclusion and policy recommendation.

**2.0 LITERATURE REVIEW**

2.1 The impact of monetary policy changes on macroeconomic variables

Using monthly data spanning from 1990 to 2015, Dlamini and Skosana (2017) applied...
the structural vector autoregressive (SVAR) model approach to investigate the impact of monetary policy changes on macroeconomic variables in Swaziland. The results revealed that a shock on the discount rate had a negative impact on inflation, even though the response was not statistically significant. The results further revealed that a positive shock on the discount rate had a negative effect on business credit and GDP. These variables respond to the shock with different lags.

Results by Simatele (2003), revealed that in Zambia bank lending is not driven by monetary policy but rather by demand. The results further revealed that a contractionary monetary policy had a negative and significant effect on inflation and GDP. Kalikeka and Sheefeni (2013) investigated monetary policy transmission in Zambia focusing on the interest rate channel using data from the year 1980 to 2011. The granger causality results showed a bidirectional causality relationship between inflation and interest rate, and a unidirectional causality from GDP to interest rates. The impulse response results were similar to those of Simatele (2003) in which a positive shock on monetary policy had a negative impact on GDP and inflation. On the overall, the results provided evidence of a functional interest rate channel existence in the Zambian economy.

Ikhide and Uanguta (2010) used a vector autoregressive (VAR) approach to study the impact of South Africa’s monetary policy impact on Lesotho, Namibia and Swaziland (LNS) and found that monetary policy in the LNS responded instantaneously to changes in monetary policy in South Africa. Ikhide and Uanguta (2010) concluded that the South African repo rate was the most relevant policy instrument than the bank rates for the LNS countries. Onyeiwu (2012) employed the Ordinary Least Squares (OLS) method to examine the impact of monetary policy on the Nigerian economy using data spanning from 1981 to 2008. The results revealed that monetary policy represented by money supply had a positive impact on GDP growth and Balance of Payments (BOP), but had a negative impact on inflation.

Peersman and Smets (2003) applied a standard VAR for the Euro area using data spanning from 1980 to 1998 to investigate the response of main macroeconomic variables to an unexpected monetary policy shock. The results revealed that a positive shock to the interest rate was followed by a fall in output and a real appreciation of the exchange rate. The results also revealed that prices appear to be stickier and therefore respond with a lag and a decline several quarters later. Popescu (2012) employed a VAR approach to analyse the effects of monetary policy in Romania using quarterly data spanning from 2005 quarter three to 2012 quarter one. The results revealed a negative response of inflation, GDP and Money supply, and a positive response by the nominal exchange rate.

Cheng (2006) applied both recursive and non-recursive SVAR to monthly data in Kenya for 1997-2005. The results revealed that an increase in interest rate led to an increase in the price level followed by a falling price level that was statistically significant for about two years following the shock. In response to a contractionary monetary policy, output rises initially but falls eventually, though the decline was not statistically significant.

Maturu, Maana and Kisinguh (2010) applied the use of a SVAR and a VAR to study monetary policy transmission in Kenya using quarterly data from 2000 to 2010. Maturu, Maana, and Kisinguh (2010) used M3 as the monetary policy instrument and the results revealed that a positive shock on M3 had no effect on real output but had a statistically significant positive effect on prices for almost 18 months. A positive shock on the
interest rates had a negative effect on prices but this effect was not statistically significant. Buigut (2009) applied structural VAR methods to annual data for Tanzania in 1984-2005, and found evidence that interest rate shocks had weak and insignificant effects on output and inflation.

2.2 The Optimal Currency Area Theory
Paolo (2002) asserts that one of the requisites for optimum currency area (OCA) boarders around the geographic domain as there should be close proximity between countries for it to work optimally. The individual currencies of the lesser countries are pegged to the currency of the hegemony, the dominant economy. For the case of the CMA, currencies of Lesotho, Namibia and Swaziland (LNS) are pegged one to one to the South African Rand. The Rand floats freely against other world currencies.

The optimality of an economic zone is among other properties defined in terms of the similarity (symmetry) of external shocks to which the different currencies found in that geographic domain are exposed (Paolo, 2002). Coco and Silvestrini (2017) explain that not only is the measuring of the degree of symmetry of shocks across countries an important indicator to assess the viability of forming a currency union, but it is also important in assessing the sustainability of a common currency area. The authors further point out that in a currency union, the size and persistence of asymmetric shocks should be as low as possible, given that member countries forego their own monetary and exchange rate policies.

The Optimum Currency Area (OCA) models adopts tenets from Dornbusch, Fischer and Samuelson (1977) and from Blanchard and Kiyotaki (1987) with an addition of:
(a) Non-traded goods
(b) Random Cobb-Douglas preference in goods and money,
(c) Exchange rates,
(d) Trade costs,
(e) Authorities loss function and,
(f) Nominal rigidities to a two-country two-good Ricardian trade model.

Ijssenagger (undated) includes the generally regarded features determining an OCA which are:
(a) Degree of Trade; the percentage of intra-area trade as plotted by Ijssenagger (undated) gives an idea as to whether the OCA is appropriate.
(b) Similarity of Shocks and Cycles; the divergence and synchronisation of shocks among countries considering to enter into a currency union where the more synchronised the shocks the more appropriate are the countries to form an OCA.
(c) Degree of labour Mobility where the higher the level of labour mobility the more suitable are countries to form an OCA.
(d) System of Risk-sharing; are the countries in a position to share and assist each other in smoothening out the shocks.

The theory of optimum currency areas provides several criteria and econometric tools for analysing a prospective monetary union. Building on these considerations, some studies aim at assessing the suitability of membership to the currency union and by evaluating the related macroeconomic costs. The structural vector autoregressive (SVAR) model approach is one of the most commonly used methods in examining correlation and symmetry of macroeconomic shocks to determine the feasibility or sustainability of a common currency area. As a rule of thumb, it is expected that in order for countries to meet the OCA criteria, the correlations of structural shocks should be positive which implies a prevailing symmetric component. On the other hand, if the correlation is found to be negative and/or insignificant, the structural shocks are considered asymmetric (Zhang et al., 2003).
Zhang, Sato and McAleer (2003) examined the viability of an OCA for the East Asian region by testing the symmetry of the underlying structural shocks through a SVAR model. The results indicated that some sub-regions were potential candidates for the OCA as their shocks were correlated. More recently, Lee and Azali (2012) employed the same model to assess the possibility of a common monetary area among East Asian economies by examining the symmetry of demand and supply shocks. The result indicated that establishing a common currency area among the economies was feasible. Omotor and Niringiye (2011) employed a two variable model (real GDP and GDP deflator) and assessed the feasibility of forming an OCA in the West African Monetary zone using a SVAR model. The results suggested that there was a possibility of the West African Monetary zone to establish an common monetary area.

Kazerooni and Razzaghi (2014) used a three-variable SVAR model (gross domestic product, real exchange rate and consumer price index) to examine the symmetry of structural shocks among D-8 member countries in order to ascertain the feasibility of a common monetary area. The results revealed that structural shocks were positively correlated and symmetric between these countries hence establishing a common currency area would be possible. Coco and Silvestrini (2017) on the other hand, investigated the nature and propagation of macroeconomic shocks hitting the Euro area, in order to draw conclusions on the functioning, sustainability and viability of the European monetary area since inception. The results showed that the European Monetary Union, by favouring trade and integration of financial markets, had induced more similarity and synchronization of shocks in the euro area.

3.0 METHODOLOGY

3.1 Introduction
This study employs the use of two structural vector autoregressive (SVAR) models, one for determining the efficacy of monetary policy in Swaziland and another one for assessing the optimum currency area theory in the CMA. This chapter is divided into two main sections, namely; the efficacy of monetary policy in Swaziland and the CMA as an optimum currency area. Other subtopics include diagnostic checks, and data and data sources.

3.2 Efficacy of Monetary Policy in Swaziland
One of the major objectives of the study is to determine the efficacy of monetary policy in Swaziland, especially on inflation. Therefore, this section of the study presents the methodology employed in determining the link between monetary policy actions and selected macroeconomic variables including inflation. For this particular model, monthly data spanning from 1990 to 2016 is used. Below is the estimation procedure which was followed when investigating the effects of monetary policy shocks on macroeconomic variables in Swaziland.

3.2.1 Unit Root tests
The study starts by testing for unit roots for each of the variables under consideration. According to Gujarati and Porter (2009), it is important to test for stationarity when using time series because failure to do so can result in spurious regression. A stationary series can be defined as one with a constant mean, constant variance and constant auto covariance for each given lag. In stationary time series, shocks are temporary and overtime their effects will be eliminated as the series revert to their long run mean values (Gujarati and Porter, 2009). Acknowledging the existence of many tests for stationarity, this study will limit itself to the Augmented Dicky Fuller (ADF) test.
3.2.2 The Structural Vector Autoregression Model (SVAR) for Efficacy of Monetary Policy

Fry-McKibbin and Zheng (2012) and Naceur, Boughrara and Ghazouani (2009) assert that empirical analysis of the effects of monetary policy have been largely investigated through the use of Vector Autoregressive (VAR) models. A review of studies on monetary policy transmissions by Mishra, Montiel, and Spilimbergo (2010) revealed that most of the studies of this nature have used VARs, especially recursive VARS. On this basis, this study uses the standard recursive structural VAR. The basic structural VAR model in this study contains five endogenous variables. The matrix form of the equation of the VAR model is selected as follows:

\[ AY_t = \sum_{i=1}^{p} B_i Y_{t-i} + \varepsilon_t \]

Where; \( Y \) is the vector containing the five endogenous variables. \( A \) is a square matrix of coefficients to be estimated. \( (\varepsilon) \) is a vector of serially uncorrelated, and mutually orthogonal structural disturbances and \( p \) is the number of lags.

The structural model represented by the above system must be identified for the purpose of policy analysis and must be given economic interpretation (Leeper et al, 1996). A reduced form of the model, which is obtained by multiplying both sides by \( A^{-1} \) is specified as follows;

\[ Y_t = A^{-1} \sum_{i=1}^{p} B_i Y_{t-i} + \varepsilon_t \]

where \( \varepsilon \) is a vector of serially uncorrelated, but not necessarily orthogonal, reduced form disturbances. In that regard, the relationship between the reduced form VAR residuals \((\varepsilon_t)\) and structural shocks \((\tilde{\varepsilon}_t)\) can be expressed as follows:

\[ \varepsilon_t = A_0 \tilde{\varepsilon}_t. \]

Based on the Cholesky decomposition of the reduced form VAR, the study imposes constraints that define matrix \( A_0 \) as a lower triangular matrix. The identification scheme follows the original paper by Sims (1980), whereby the Cholesky decomposition is applied to the contemporaneous parameter matrix \( A \). Thus, the order of the variables is similar to many studies used in the context of VARs in advanced economies, including Sims (1992), and is as follows; output (GDP), inflation rate (CPI), money supply (M2), private sector credit (PSCR) and the policy rate (DR). The matrix form of the SVAR model can be expressed as follows:

\[
\begin{bmatrix}
\varepsilon^{GDP}_{t} \\
\varepsilon^{CPI}_{t} \\
\varepsilon^{M2}_{t} \\
\varepsilon^{PSCR}_{t} \\
\varepsilon^{DR}_{t}
\end{bmatrix} =
\begin{bmatrix}
a_{11} & 1 & 0 & 0 & 0 \\
a_{21} & a_{22} & 1 & 0 & 0 \\
a_{31} & a_{32} & a_{33} & 1 & 0 \\
a_{41} & a_{42} & a_{43} & a_{44} & 1 \\
a_{51} & a_{52} & a_{53} & a_{54} & a_{55}
\end{bmatrix}
\begin{bmatrix}
\varepsilon^{GDP}_{t-1} \\
\varepsilon^{CPI}_{t-1} \\
\varepsilon^{M2}_{t-1} \\
\varepsilon^{PSCR}_{t-1} \\
\varepsilon^{DR}_{t-1}
\end{bmatrix}
\]

Where the left hand side of the equation contains a vector of residuals in the reduced form, and on the right hand side is the squared matrix \( (A_0) \) of coefficients associated with lagged variables and structural shocks through the column vector \( (\varepsilon) \).

The econometric identification of monetary policy shocks is crucial to any model specification, including SVARs. The SVAR identification exercise followed in this paper is explained as follows;

- The ordering of output and price level at the beginning is because they react to an innovation in the monetary policy rate with a lag due to their slow movement in nature.
- Economic activities determine the demand for money in an economy thus affecting money supply and private sector credit. The study therefore orders money supply third whiles private sector credit is ordered fourth.
Amongst other things, the Central Bank of Swaziland before deciding on its monetary policy stance considers developments in the domestic economy and this include output, inflation, money supply and private sector credit. In this regard, the study orders the discount rate last since its level is, in part, influence by the above mentioned factors.

The impulse response and variance decomposition analysis are carried out to determine the effects of the discount rate shocks in the estimated model. The impulse response function in a VAR analyses dynamic affects on the system when the model received the impulse of say one standard deviation shock. The variance decomposition reveals some amount of vital information and explanation of the contribution of each variable to other variables in the system.

3.3 Is the CMA an Optimum Currency Area?
The second objective of the study is to determine whether the CMA is an optimum currency area or not and the study uses the OCA criteria to assess such.

3.3.1 OCA Criteria
The paper builds on the two-country model developed by Ricci (1997). Ricci (1997) asserts that converging to the anchor economy accrued certain costs to the smaller economy. Any volatility of the exchange rate (of the anchor economy) would be transferred fully to the smaller countries. Generally, the OCA analysis focuses on how various macroeconomic variables such as GDP growth, inflation, exchange rates, interest rates and stock prices are correlated across economies or regions. Among the first to identify the fundamental structural shocks were Bayoumi and Eichengreen (1992), and Bayoumi and Eichengreen (1994) who used a structural vector autoregression (SVAR) identification scheme and identified a series of demand and supply shocks for economies in different regions to examine whether forming an optimum currency area was viable.

These authors tested for symmetry (correlation) of the underlying structural shocks between countries in Western Europe, East Asia and the Americas. Coco and Silvestrini (2017) also used a SVAR model approach to determine the viability of the European Monetary Union, after its long existence. As in Coco and Silvestrini (2017), this study adopts a SVAR representation to investigate whether the CMA is an optimum currency area or not. The study uses three variables (consumer price index, real GDP and real exchange rate) to construct the VAR model required to examine the shocks according to the OCA criteria and to establish whether countries in the CMA do exhibit some level of convergence or not.

Following Fielding and Shields (1999), the estimated innovations in the SVAR model are referred to as the macroeconomic shocks wherein conclusions about the degree of similarity of shocks between countries, are based on the pairwise correlation of the innovations in their respective models. This paper thus focuses on shocks to real gross domestic product (q), consumer price index (p) and the foreign price (xr) shock common to all member countries.

3.3.2 The Structural Vector Autoregression (SVAR) for OCA
In this paper’s SVAR OCA criteria, we let
\[ \Delta y_t = [\Delta q_t, \Delta p_t, \Delta x_{rt}] \text{and } \varepsilon_t = [\varepsilon_{qt}, \varepsilon_{pt}, \varepsilon_{x_{rt}}] \]
where \( \Delta \) represents the first difference operator, \( y \) is the vector of the endogenous variables and \( \varepsilon_{qt}, \varepsilon_{pt}, \varepsilon_{x_{rt}} \) denote the orthogonal shocks of supply, demand and exchange rate, respectively. The structural VAR model is thus presented as follows;
\[ \Delta y_t = A_0 \varepsilon_t + A_0 \varepsilon_{t-1} + A_0 \varepsilon_{t-2} + \ldots + A_k \varepsilon_{t-k} = A^*(L) \varepsilon_t \]

where \( \varepsilon_t \) is a 3x1 vector of observable endogenous variables as indicated above. \( A^*(L) = A_1 + A_2 L + A_3 L^2 + \ldots \) is a polynomial function of the lag operator, L.

\[
A^*(L) = \begin{bmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) \\ A_{21}(L) & A_{22}(L) & A_{23}(L) \\ A_{31}(L) & A_{32}(L) & A_{33}(L) \end{bmatrix}
\]

The methodology employed by this paper assumes that the structural shocks are uncorrelated and have a covariance matrix normalized to the identity matrix. The conditional requirement for the restrictions sufficient to identify the structural Ai matrix and time series of structural shocks is that \( A_{12}(1) = A_{13}(1) = A_{22}(1) = 0 \).

A reduced-form VAR is constructed as follows:

\[
\Delta y_t = B(L) \Delta y_{t-1} + u_t
\]

where \( u_t \) is a vector reduced-form disturbance and \( B(L) \) is a 3 x 3 matrix of lag polynomial. A moving average representation of equation (2) is specified as:

\[
\Delta y_t = B(L) \Delta y_{t-1} + u_t
\]

where \( C(L) = (1 - B(L)L)^{-1} \) and the lead matrix of \( C(L) \) is by specification, \( C_0 = I \). By comparison of the above equations the relationship between the structural and reduced form disturbances: \( u_t = A_0 \varepsilon_t \) is obtained. In order to recover the structural shocks of \( \varepsilon_t \) it is imperative that estimates of \( A_0 \) be obtained. As the structural shocks are mutually orthogonal and each shock has unit variance, the following relationship between the covariance matrices is obtained:

\[
C(1) \Sigma C(1) = A(1) A(1)'
\]

where \( \Sigma = E \varepsilon_t \varepsilon_t' \) and \( A_0 = A_0' = H \) denotes the lower triangular Choleski decomposition of \( C(1) \Sigma C(1)' \), then \( A(1) = H \) as the long run restriction imply that \( A(1) \) is also lower triangular. As a result,

\[
A_0 = C(1)^{-1} A(1) = C(1)^{-1} H.
\]

### 3.6 Diagnostic checks
Once the models have been estimated, they were subjected to various diagnostic tests, which assess their stochastic properties, such as residual autocorrelation, normality and model stability.

### 3.7 Data
Data used in the study was obtained from the Central Bank of Swaziland, Central Statistical Office, and the World Bank. Since GDP data is of low frequency, it was interpolated into monthly series using e-views software.

### 4.0 RESULTS AND DISCUSSIONS

#### 4.1 Efficacy of monetary policy in Swaziland

##### 4.1.1 Stationary
The ADF stationarity test results shows that all the variables were not stationary at their levels but had to be differenced once to attain stationarity, meaning all the variables are I(1). The Akaike’s information criterion (AIC) and the final prediction error (FPE) selection criteria selected an optimal lag length of 4 whiles the Schwarz Criterion (SC) and the Hannan-Quinn criterion (HQ) selected a lag length of 3. Thus the study selects 4 as an optimum lag length.

##### 4.1.2 Inverse roots of characteristic polynomials for Model 1
The inverse roots of characteristic polynomials for Model 1 indicates that the model is stable as all the unit roots lie within the circle.
The impulse response results presented on Figure 4.1.3 Impulse Response Functions indicate that a shock on the discount rate only has a negative significant effect on the real gross domestic product (GDP), inflation and money supply (M2). Inflation responded with a lag and starts decreasing after 6 months whiles real GDP responds significantly after 18 months. The results also revealed that private sector credit (PSCR) responds negatively to a shock on the discount and slightly trends down over time.

### 4.1.4 Variance Decomposition Analysis

Table 1 shows the variance decomposition analysis for real GDP, inflation, money supply, and the private sector credit in response to shocks in the monetary policy rate (discount rate). The results reveal that shocks on the discount rate account for a 4.4 per cent and 6.96 per cent variation in inflation in 6 months and 36 months, respectively. This indicates that inflation dynamics in the country are largely explained by other variables and not the discount rate as it accounts for a smaller portion of the variation in inflation. A variation in money supply is explained by 1.6 per cent of variation in the discount rate in 6 months and 1.47 per cent in 36 months whiles private sector credit variation is explained 0.2 per cent and 2.58 per cent variation in the discount rate in 6 and 36 months, respectively. Lastly, the results indicate that discount rate shocks account for about 0.15 per cent and 15.18 per cent variation in real GDP in 6 and 36 months, respectively.

### Table 1: The Variance Decomposition Results

<table>
<thead>
<tr>
<th>Period</th>
<th>DR to GDP</th>
<th>DR to CPI</th>
<th>DR to LM2</th>
<th>DR to LPSCR</th>
<th>DR to DR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>93.03</td>
</tr>
<tr>
<td>6</td>
<td>0.15</td>
<td>4.44</td>
<td>1.611</td>
<td>0.20</td>
<td>78.36</td>
</tr>
<tr>
<td>12</td>
<td>1.53</td>
<td>6.048</td>
<td>1.57</td>
<td>0.58</td>
<td>58.05</td>
</tr>
<tr>
<td>18</td>
<td>4.72</td>
<td>5.72</td>
<td>1.43</td>
<td>0.85</td>
<td>46.89</td>
</tr>
<tr>
<td>24</td>
<td>8.85</td>
<td>5.89</td>
<td>1.51</td>
<td>1.17</td>
<td>42.76</td>
</tr>
<tr>
<td>30</td>
<td>12.62</td>
<td>6.52</td>
<td>1.44</td>
<td>1.73</td>
<td>41.52</td>
</tr>
<tr>
<td>36</td>
<td>15.18</td>
<td>6.97</td>
<td>1.47</td>
<td>2.58</td>
<td>40.54</td>
</tr>
</tbody>
</table>

### 4.2 Optimal Currency Area (OCA) Model

#### 4.2.1 Pairwise Correlation

The pairwise correlation coefficients measuring the correlation of demand shocks across the CMA countries are presented in Table 2. The results revealed that demand shocks are less correlated among the CMA member countries; instead, they have converged around the South African economy.
The results reflect the effect of South Africa as an anchor economy on CMA monetary policy implementation and how developments in this economy filter through to the other member states. Even though the structural shocks are insignificant between Swaziland and Namibia, and Lesotho and Namibia, the correlation coefficients of the shocks are positive, indicating that they are symmetric.

Table 2: Correlation of Structural Demand Shocks across CMA countries, 2002Q1-2016Q4

<table>
<thead>
<tr>
<th>Country</th>
<th>SA</th>
<th>SD</th>
<th>NAM</th>
<th>LES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>0.76*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAM</td>
<td>3.70**</td>
<td>0.26</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>LES</td>
<td>1.03*</td>
<td>0.63*</td>
<td>0.004</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: SA: South Africa, SD: Swaziland, NAM: Namibia, LES: Lesotho. Painted figures denote significance of correlation. *, ** denote statistical significance at 1 and 5 per cent level.

Table 3 shows a contrasting pattern of the pairwise correlation of supply shocks as compared with the demand shocks. The results indicate that supply shocks in the CMA over the period 2002Q1-2016Q4 have mixed effects and all were insignificant. Asymmetric shocks were observed between South Africa and Namibia, South Africa and Lesotho, and Swaziland and Namibia. Symmetry shocks observed between South Africa and Swaziland, Swaziland and Lesotho, and Namibia and Lesotho. Even though the correlation coefficients between Swaziland and Namibia, and Lesotho and Namibia are insignificant, worth noting is that the coefficients carry a positive sign, indicating that the structural shocks are symmetric.

Table 4 presents the results of the pairwise correlation of exchange rate shocks across the CMA countries. As shown in the table, the correlation of real exchange rate shocks exhibit some level of symmetry, which prevails between Swaziland, South Africa and Namibia. The significant correlations are synonymous with the pegged exchange rate policy as well as the close coordination of monetary policy implementation in the CMA.

Table 3: Correlation of Structural Supply Shocks across CMA countries, 2002Q1-2016Q4

<table>
<thead>
<tr>
<th>Country</th>
<th>SA</th>
<th>SD</th>
<th>NAM</th>
<th>LES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>0.05</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAM</td>
<td>-0.85</td>
<td>-0.46</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>LES</td>
<td>-1.56</td>
<td>0.12</td>
<td>0.17</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: SA: South Africa, SD: Swaziland, NAM: Namibia, LES: Lesotho.

Table 4: Correlation of Structural Real Exchange Rate Shocks across CMA countries, 2002Q1-2016Q4

<table>
<thead>
<tr>
<th>Country</th>
<th>SA</th>
<th>SD</th>
<th>NAM</th>
<th>LES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>0.39*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAM</td>
<td>-0.39</td>
<td>1.25*</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>LES</td>
<td>0.09***</td>
<td>0.25*</td>
<td>0.03</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: SA: South Africa, SD: Swaziland, NAM: Namibia, LES: Lesotho. Painted figures denote significance of correlation. *, ** denote statistical significance at 1 and 10 per cent level.

While the results favour the existence of the CMA as an optimal currency area based on the significance of the demand and real exchange rate shocks correlation, the OCA theory asserts that supply shocks are a more informative indicator for evaluating the symmetry of shocks. This is because unlike supply shocks, demand and monetary shocks using the structural VAR approach tend to include the effects of macroeconomic...
policies as well as purely stochastic disturbances (Bayoumi & Eichengreen, 1994). It thus becomes a consequent outcome that the more (less) the symmetry of shocks, the more (lesser) the possibility and justification for economies to establish an OCA.

4.2.2 Variance Decomposition Analysis
The variance decomposition analysis measures the proportions of forecast error variance in a variable that is explained by impulses in it and by the other variables in the system. In a statistical sense, if a variable explains most of its own shock, then it does not allow variances of other variables to contribute to it being explained and is therefore said to be relatively exogenous. Kazerooni and Razzaghi (2014) asserts that if the variability of the forecast error variance is different between countries then those countries would have to follow different policy strategies and the chance of establishing a common currency area should be put on hold.

The results for the variance decomposition analysis of real GDP, the consumer price index and real exchange rate at the 12th quarter are presented on Table 4. The supply and demand shocks were found to be the most predominant accounting for a larger variability in their own variables in all the CMA economies. At most, the own shocks to the consumer price index (demand shocks) and real GDP (supply shocks) account for almost 70 per cent of total variation in the last quarter of the sample period in all four countries of the CMA. The similarities in these shocks accounting for larger variations in these economies indicate that the countries can pursue similar policy strategies and therefore are in support of the formation of the OCA. An own shock to the real effective exchange rate accounts for a combined 50 per cent of total variation on average over the 12th quarter period.

### Table 5: Variance Decomposition of Changes in Real GDP, Consumer Price Index and Real Exchange Rate

<table>
<thead>
<tr>
<th></th>
<th>Real GDP/Output</th>
<th>Consumer Price Index</th>
<th>Real Exchange Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>76.2</td>
<td>14.0</td>
<td>9.8</td>
</tr>
<tr>
<td>SD</td>
<td>77.3</td>
<td>3.43</td>
<td>19.0</td>
</tr>
<tr>
<td>NAM</td>
<td>73.1</td>
<td>18.6</td>
<td>8.3</td>
</tr>
<tr>
<td>LES</td>
<td>69.1</td>
<td>26.3</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Source: own calculations

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion
The study had two main objectives, namely; to determine the efficacy of the monetary policy in Swaziland and secondly, to determine if the CMA is an optimal currency area. The study employed the use of two SVAR models, one to determine the impact of monetary policy on selected macroeconomic variables, including inflation and the other to determine optimality of the CMA.

The impulse response results on the efficacy of monetary policy in Swaziland indicate that a shock on the discount rate has negative effect on real GDP, inflation and private sector credit. The variance decomposition results indicate that the variability in GDP, CPI, money supply and private sector credit was explained by marginal variation of the discount rate in the sixth month. The results revealed that the effect of a shock on the discount rate on the other variables increases with time. In 36 months, a shock on the discount rate accounts for 6.97 per cent, 1.47 per cent and 2.58 per cent in variation in inflation, money supply and private sector credit, respectively.
For the SVAR model the study considered three variables, namely; GDP as a supply shock, real effective exchange rate as monetary policy shock and the CPI as a demand shock. In this model, the study used quarterly secondary data spanning from 2002 to 2016. All variables were non-stationary at levels and were transformed and differenced once to achieve stationarity. The pairwise correlation coefficients results for the demand shocks across the CMA countries revealed that demand shocks are less correlated among the CMA member states; instead, they have converged around the South African economy. These results reflect the effect of South Africa as an anchor economy in the CMA and how developments in this economy affect the other member states. Even though the structural shocks are insignificant between Swaziland and Namibia, and Lesotho and Namibia, the correlation coefficients of the shocks are positive, indicating that they are symmetric.

Mixed effects were observed for the supply shocks correlation coefficients but all were insignificant. Asymmetric shocks were observed between South Africa and Namibia, South Africa and Lesotho, and Swaziland and Namibia whilst South Africa and Swaziland, Swaziland and Lesotho, and Namibia and Lesotho exhibited symmetric shocks. The results for the pairwise correlation of real effective exchange rate shocks across the CMA countries exhibit some level of symmetry between Swaziland, South Africa and Namibia. The significant correlations are synonymous with the pegged exchange rate policy as well as the close coordination of the monetary policy in the CMA. Generally, the overall OCA criteria results are in favour of the existence of the CMA as an optimal currency area.

5.2 Recommendations
The findings of the study supports the Central Bank of Swaziland’s drive to align policy rates with that of South Africa, but dependent on data outcomes. Since the shocks of the LNS country are mainly symmetric with that of the anchor economy (South Africa), the country’s membership to the CMA is therefore justified. Swaziland should therefore remain within the CMA.
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The Impact of Monetary Policy Changes on Macroeconomic Variables in Swaziland: A special focus on Fiscal Variables

Sive Kunene\textsuperscript{10} and Thandeka Mdladla\textsuperscript{11}

Abstract

The study investigates the impact of monetary policy changes on budget deficit, tax revenue and domestic public debt in Swaziland. Time series data obtained from the Central Bank of Swaziland and the Ministry of Finance was used to run three Structural Vector Autoregressive (SVAR) models where the discount rate, liquidity requirement and reserve requirement were used as policy rates. In all three models, impulse response functions as well as variance decompositions were obtained. The impulse response results revealed that all the policy rates did not have a significant effect on the fiscal variables over a 24-months period. The variance decomposition results indicate that a shock on the discount rate can cause a 2.9, 1.4 and 1.5 per cent variation on government deficit, tax revenues and domestic public debt over a period of 24 months, respectively. A shock on the reserve requirement would cause a 0.4, 0.5 and 0.1 per cent variation on government budget deficit, tax revenues and domestic public debt in twenty-four months, respectively. A shock on the liquidity requirement would cause variation of 0.5 per cent on government budget deficit, 0.4 per cent on tax revenues and 0.1 per cent on domestic public debt over twenty-four months. The insignificant effect of the reserve requirement and the liquidity requirement on the fiscal variables, specifically domestic public debt, suggest minimum monetary and fiscal policy coordination between authorities. The study therefore recommends that the two monetary policy instruments be reviewed more regularly to enhance coordination between monetary and fiscal policies.

Key words: Monetary policy, fiscal variables, Structural VAR

1.0 INTRODUCTION

The 2008/2009 financial crisis inspired debates on the role of central banks and their ability to efficiently manage the economy. Generally, there is consensus in literature on price stability being the primary objective of monetary policy (Hilbers, 2005); however, arguments are being raised on whether Central Banks should focus on price stability as their only objective (Bhattacharyya, 2012). Reis (2016) asserts that one of the common discussions surrounding central banks is their ability to ease the fiscal burden for a country. After investigating ways through which central banks can alleviate fiscal burdens, Reis (2016) concluded that there is limited scope for the central bank to lower or ease the fiscal burden.

Kaplan (2016) argues that even though monetary policy is highly important, by itself it is not meant to address key structural issues. Kaplan further warns that monetary policy should not be treated as a substitute for actions, which should address structural issues and other economic challenges. Hilbers (2005) and Reis (2016) posit that while different bodies implement monetary and fiscal policies, the two policies are not independent of each other. A change in one policy affects the effectiveness of the other and hence the overall impact of any policy change.

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The Southern African Customs Union (SACU) receipts, which have become the most important source of revenue for the Swazi economy, averaging 48.6 per cent of Swazi Government’s total expenditure between the years 1999/2000 and 2016/2017, have become increasing volatile (MoF, 2017). The percentage of the SACU receipts contribution to government expenditure has decreased from 66.9 per cent in 2012/13 down to 24.8 per cent in 2016/17 as shown on Figure 1. The volatility in SACU receipts over recent years has put a strain on the fiscus (MoF, 2017), resulting in the government running budget deficits since 2014, which are above the 3 per cent recommendation of the Protocol on Finance and Development for SADC which was stipulated in 2012. From a budget surplus of 3.7 per cent in 2012/13, the government ran a deficit of 1.2 per cent in 2014/15, shooting up to 12.4 per cent in 2016/17 in pursuit of an expansionary stance. This has led to an increase in public debt levels.

Figure 1: SACU receipts as a Percentage of Total Expenditure and the Budget Surplus as a Percentage of GDP

On average, total public external debt for Swaziland averaged about 15.1 per cent of GDP for the period 2000 to 2016, whilst public domestic debt averaged 3.7 per cent of GDP for the same period. Even though these figures are below the 60 per cent debt-to-GDP ratio threshold stipulated in the Protocol on Finance and Development for SADC members, the country’s ability to service its debts has come under serious scrutiny, as the most important element of debt management is the ability to service the incurred debts to the satisfaction of the creditors.

The year 2016/17 and the first two quarters of the year 2017/18 saw the government facing serious cash flow challenges and questions were raised on the role of the Central Bank in ameliorating the situation. In light of these concerns, the departure point would be to empirically establish how monetary policy changes affect macroeconomic fiscal variables, hence this study. To the best knowledge of the authors and information available, there is no published study in the country, which has tried to establish the relationship between monetary policy changes and fiscal variables. Specifically, the study seeks to determine the effects of monetary policy shocks on macroeconomic fluctuations with a special focus on fiscal variables, namely; budget deficit, tax revenue and domestic debt.

The significance of the study is that a relationship between monetary policy changes and its effects on fiscal variables will be established and hence add to the body of knowledge, which will assist policy makers to better engage especially during tough economic times.

The rest of the study is subdivided into four sections. In section 2, the paper presents the review of literature between monetary policy shocks and its effects on fiscal variables whiles the methodology of the study is presented in section 3. The results and analysis are presented in section 4 and section 5 constitutes the conclusion together with policy recommendations.
2.0 REVIEW OF LITERATURE

Rosoiu (2015), Fry-McKibbin and Zheng (2012), Belviso and Milani (2003) and Bernake, Boivin and Eliasz (2003; 2005) assert that Vector Autoregressive (VAR) models have been largely used in measuring the transmission of monetary policy to the economy and has delivered plausible information. Even though the VAR approach has delivered useful information in measuring the effects of monetary policy, it is said to have limitations in its implementation. One major limitation of the VAR, which has been widely cited in a number of papers, is that it is a low dimensional model since it can incorporate only about six to eight variables yet there are numerous underlying factors affecting the economy (Bernake, Boivin & Eliasz, 2005).

Bernake, Boivin and Eliasz (2005) developed a Factor Augmented Vector Autoregression (FAVAR) model in order to minimize the limitations of the VAR which have been widely raised in most papers. The FAVAR combines the structural VAR and factor analysis for large data sets and was found to be more efficient in the analysis of the monetary transmission mechanism than a simple structural VAR. Indeed, a number of recent studies like Rosoiu (2015), Jushan, Lina and Kunpeng (2014) and Fry-McKibbin and Zheng (2012) have used the FAVAR given its properties. The FAVAR has been heralded as one of the most plausible methodological approach which is more inclusive in terms of economic data to depict underlying economic factors. A FAVAR model needs large data sets and is more appropriate in data rich countries and hence this study could not use it. The Structural Vector Autoregressive (SVAR) approach was used instead, which remains one of the mostly used models in determining the effects of monetary policy using a few variables.

Fry-McKibbin and Zheng (2012) used the Factor Augmented Vector Auto Regression (FAVAR) framework to investigate the impact of monetary and fiscal policy shocks on US macroeconomic fluctuations. These authors defined monetary policy shocks as temporally shocks in the short-term interest rates such as the Federal fund rate. The monetary policy shock results revealed that the US Federal budget (government taxation less government expenditure) responds with a surplus for the first quarter followed by a deficit for the next 27 quarters before the economy returns to a budget surplus. The shock also had an immediate significant negative impact on output and absorption. Government taxation also declined as a result of the decrease in consumption. The debt-to-GDP ratio also increased after 16 quarters, which is a result of an increase in the budget deficit.

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Muscateli et al. (2004) reported results similar to Fry-McKibbin and Zheng (2012) for the US and further stated that fiscal variables adjust with a lag to the output effects caused by a contractionary monetary policy. Fry-McKibbin and Zheng (2012) reported that monetary policy also moves other interest rates like the treasury bills in the same direction. Using a FAVAR, results by Dungey and Fry (2010) revealed that in Australia, a contractionary monetary policy results in reduced government revenue and is also associated with reduced debt-to-GDP ratios.

Haug, Jedrzejowisz and Sznajderska (2013) combined the monetary and fiscal policy in a Structural Vector Auto Regression (SVAR) and found that a positive shock on monetary policy (interest rate) had a significant negative effect on GDP. This effect was significant for more than 12 months. However, the shock did not have a significant effect on inflation, government expenditure and revenue. The ordering of the variables by Haug, Jedrzejowisz and Sznajderska (2013) was different from that of Fry-McKibbin and Zheng (2012) with the fiscal variables.
ordered last whiles Fry-McKibbin and Zheng (2012) ordered them first.

Investigating the implications of monetary policy shocks on government debt management in Barbados, Moore and Skeete (2010) reported that there is a positive relationship between the bank rate and treasury bills’ interest rate. An increase in the bank rate was found to be positively correlated with rises in treasury interest rate. Moore and Skeete (2010) also found a positive relationship between treasury bills and the minimum savings rate which is another monetary policy tool used by the Bank and this relationship was even stronger than that of the Bank rate. Using a SVAR, Dlamini and Skosana (2016) also found a positive relationship between the discount rate and the treasury bills interest rates in Swaziland.

Jannsen, Potjagailo and Wolters (2015) assert that monetary policy effects differ between crisis and non-crisis times as the monetary transmission mechanisms might be different due to credit constraints and additional effects of increases in uncertainty. They found that in emerging economies and Organisation for Economic Co-operation and Development (OECD) countries, expansionary monetary policy is more effective on increasing GDP during a recession period of a financial crisis than in none-crisis times. Monetary policy was found to be having a negligible effect on GDP during the recovery period. Findings by Saliba (2013) revealed that monetary and fiscal policy had a positive and significant effect on growth of small economies post-recession period. Saliba (2013) also found monetary measures to be more important than fiscal measures in mitigating the effects of a recession.

Alp and Elekdag (2011) investigated the impact of the monetary policy in Turkey during the financial crisis of 2007/2009 and the results revealed that, had Turkey not undertaken counter cyclical and discretionary interest rate cuts, the economy would have shrunk by -6.2 per cent instead of the -4.8 per cent that was realized. The Bank of the Republic of Turkey reduced the policy rate by 1025 basis point between November 2008 and November 2009. During the financial crisis period, Turkey also adopted a floating exchange rate system and the results revealed that if this exchange rate system was not adopted, the economy would have shrunk by 8 per cent in 2009. In the US, Mishkin (2009) argues that the accommodative monetary policy stance adopted by the Federal Reserve Bank during the financial crisis played an important role in ameliorating the effects of the recent financial crisis.

Greenlaw et al. (2013) argue that monetary policy can play a significant role in ensuring a sustainable outcome if the fiscal position is moving in a positive direction from an unsustainable path to a sustainable path. Greenlaw et al. (2013) further state that since fiscal consolidation is contractionary, the standard prescription for monetary policy is to ease during fiscal consolidation. Results by Hellebrandt, Posen and Tolle (2012) after examining historical records of fiscal consolidation in advanced economies between the years 1978 and 2009 revealed that successful consolidations tend to be accompanied by higher monetary easing as measured by the interest rate. The authors further note that the easing has to start at the onset of the consolidation programme.

Greenlaw et al. (2013) note that in a case of fiscal dominance, a central bank has got no power to avoid the consequences of an unsustainable fiscal policy. Similarly, Hellebrandt, Posen and Tolle (2012) posit that monetary policy cannot be effective when fiscal policies are unsustainable. They further state that there is an argument that any monetary loosening should be preceded
by fiscal commitment and central bank’s toughness is important for inducing fiscal consolidation.

Investigating the impact of monetary policy in 24 countries, results by Bech, Gambacorta and Kharrroubi (2012) revealed that an easy monetary policy during a “normal” downturn leads to a stronger recovery afterwards. However, an accommodative monetary policy was found to be having reduced effects in a case of a down turn associated with a financial crisis. Deleveraging was found to be instrumental for subsequent recovery in the case of a financial crisis. Explaining the reduced effectiveness of monetary policy during the financial crisis, Bech, Gambacorta and Kharrroubi (2012) stated that this might be a function of the impairment of the transmission channel.

Adam and Billi (2008) analyzed a non-cooperative monetary and fiscal policy game within a standard stochastic general equilibrium model without capital and established that when fiscal policy is determined before monetary policy each period, the monetary authority should focus exclusively on stabilizing inflation. They argue that since too much inflation is generated by lack of monetary commitment, an endogenous fiscal policy requires an inflation conservative central banker.

3.0 METHODOLOGY

3.1 The Structural Vector Autoregression Model (SVAR)

Fry-McKibbin and Zheng (2012) and Naceur, Boughrara and Ghazouani (2009) assert that empirical analysis of the effects of monetary policy have been largely investigated with Vector Autoregressive (VAR) models. As alluded to in the limitations of the study and the literature review, the most ideal methodology for the study would have been a FAVAR model as cited in Rosoiu (2015), Jushan, Lina and Kunpeng (2014) and Fry-McKibbin and Zheng (2012). However, this method necessitates the use of a large set of data which is not available in the country hence the study used a Structural Vector Autoregressive (SVAR) model.

The SVAR in this study’s model contains seven endogenous variables. The matrix form of the equation of the VAR is specified as follows;

\[ AY_t = \sum_{i=1}^{p} B_i Y_{t-i} + \varepsilon_t \]  

Where; \( Y \) is the vector containing the 7 endogenous variables. \( A \) is a square matrix of coefficients to be estimated. \( \varepsilon \) is a vector of serially uncorrelated, and mutually orthogonal structural disturbances and \( p \) is the number of lags.

A reduced form of the model is obtained by multiplying both sides by \( A^{-1} \) and it is specified as follows;

\[ Y_t = A^{-1} \sum_{i=1}^{p} B_i Y_{t-i} + \varepsilon_t \]  

where \( \varepsilon_t \) is a vector of serially uncorrelated, but not necessarily orthogonal, reduced form disturbances. In that regard, the relationship between the reduced form VAR residuals \( (\varepsilon_t) \) and structural shocks \( (\varepsilon_t) \) can be expressed as follows:

\[ \varepsilon_t = A_0 \varepsilon_t \]

Based on the Cholesky decomposition of the reduced form VAR, the study imposes constraints that define matrix \( A_0 \) as a lower triangular matrix. The identification scheme follows the original paper by Sims (1980), whereby the Choleski decomposition is applied to the contemporaneous parameter matrix \( A_0 \).

Estimating the impact of monetary policy shock (interest rate), Fry-McKibbin and Zheng (2012) recursively ordered the
variables from first to last as follows; total government expenditure (Gt), total taxation revenue (Tt), real gross national expenditure (GNEt), the ratio held by the public to GDP (Debt), real GDP, inflation (Inf), augmented factors (C) and the interest rate (r_t). This study adopts an ordering similar to that of Fry-Mckibbin and Zheng (2012) but without the augmented factors and the inflation rate. This study also adds private sector credit as a variable after real GDP and the last variable to be ordered is the discount rate (Dt). The matrix form of the structural VAR is specified as follows;

\[
[\begin{bmatrix}
\epsilon^G \\
\epsilon^N \\
\epsilon^E \\
\epsilon^D \\
\epsilon^P \\
\epsilon^C \\
\epsilon^D \\
\end{bmatrix} =
[\begin{bmatrix}
a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} & a_{27} & a_{28} & a_{29} & a_{30} & a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} & a_{37} & a_{38} & a_{39} & a_{40} & a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} & a_{47} & a_{48} & a_{49} & a_{50} & a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & a_{56} & a_{57} & a_{58} & a_{59} & a_{60} & a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & a_{67} & a_{68} & a_{69} & a_{70} & a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76}
\end{bmatrix}
[\begin{bmatrix}
\epsilon^G \\
\epsilon^N \\
\epsilon^E \\
\epsilon^D \\
\epsilon^P \\
\epsilon^C \\
\epsilon^D \\
\end{bmatrix}^\prime]] + [\begin{bmatrix}
\epsilon^G \\
\epsilon^N \\
\epsilon^E \\
\epsilon^D \\
\epsilon^P \\
\epsilon^C \\
\epsilon^D \\
\end{bmatrix}^\prime]
\]

Where the left hand side of the equation contains a vector of residuals in the reduced form, and on the right hand side is the squared matrix (A0) of coefficients associated with lagged variables and structural shocks through the column vector (\epsilon).

The identification of the SVAR model followed in this study is largely informed by literature. Analyzing the effects of fiscal policy on business cycles, Fatas and Mihov (2001) ordered government spending first on the assumption that other variables like output, cannot affect government spending contemporaneously. Fry-Mckibbin and Zheng (2012) also ordered government expenditure first on the same bases hence this study also orders government expenditure first in the model. Results by Nxumalo and Hlophe (2016) revealed that the Swazi Government follows a spend and tax approach hence this study orders tax revenues second after government expenditure. Fry-Mckibbin and Zheng (2012) ordered tax second since government expenditure is likely to affect taxes.

Impulse response and variance decomposition analysis were carried out to determine the effects of policy rate shocks in the estimated model. The impulse response function in a VAR analyses traces the effects on the system when the model receives a shock of say one standard deviation. The variance decomposition reveals the amount of contribution of each variable to other variables in the system. In essence, it shows the amount of the forecast error variance of each of the variables that can be explained by exogenous shocks to the other variables in the system.

The study uses monthly data spanning from 2000M01 to 2015M12 to examine the impact of
monetary policy changes on macroeconomic variables with a special focus on fiscal variables. Secondary data were sourced from the Central Bank of Swaziland, Ministry of Finance and the Central Statistics Office using annual reports.

4.0 STRUCTURAL VAR RESULTS

4.1. Unit Root Tests
The unit root test results indicate that all variables save for the government budget deficit (as percentage of GDP) were non-stationary at levels and hence needed to be differenced once in order to be stationary. The variables are therefore integrated of order one while the government budget deficit was integrated of order zero. All variables were in logs except for the government budget deficit, which was modelled at levels since it had negative figures but was stationary.

4.2. Cointegration Tests
Before conducting the Johansen test, the study starts by estimating the optimal lag length. The Schwartz Bayesian Criterion (SC) and the Hannan-Quinn (HQ) suggest an optimal lag order of 1 whilst the Akaike Information Creterion (AIC) and the Final Prediction Error (FPE) suggest a lag of order 2. Given the different suggested lag orders, the study uses the AIC and the FPE, which suggested a lag order of 2.

The study then selects the appropriate model, which involves the estimation of the three most relevant models. All three models indicated the presence of cointegration and the trace statistic results revealed that model 3 is the most appropriate with at most five cointegrating vectors. The Maximum Eigenvalue results indicate that there are at most two cointegrating vectors in model 2 and 3. Based on the trace statistic results, model 3 was selected as the best model for this study, and the variables were confirmed to be cointegrated.

4.3. Diagnostics Tests
In all three models the results of the Portmanteau Test for serial autocorrelation indicate that there is no serial autocorrelation whilst the LM test indicates that there is no serial correlation. However, all three models failed the normality test, indicating that the residuals are not normally distributed. The inverse roots of the autoregressive polynomials of the models are presented on Figure 2 and they indicate that all three models are stable. Lutkepol (1991) and Baum (2013) assert that a model is stable if all the roots have modulus less than one and therefore lie within the circle.

Figure 2: Inverse Roots of Characteristic Polynomials

4.4. Impulse Response Functions and the Variance Decomposition

4.4.1. The Impulse Response for a Shock on the Discount Rate
The impulse response results presented on Figure 3 indicate that a one standard deviation shock to the discount rate does not have a significant effect on all the
variables under consideration over a 24 months’ period, including the fiscal variables (government budget deficit, tax revenue and the public domestic debt).

Figure 3: Impulse Response for the Shock on the Discount Rate

Source: Own calculations

4.4.2. Impulse Response for a Shock on Reserve Requirement

Similarly, to the response of a shock on the discount rate, the impulse response results indicate that a shock on the reserve requirement has no significant effect on the fiscal variables. The results also indicate that the shock has an insignificant effect on gross national expenditure, GDP and private sector credit.

Figure 4: Impulse Response for the Shock on the Reserve Requirement

Source: Own calculations

4.4.3. Impulse Response for a Shock on Liquidity Requirement

The results on Figure 5 indicate that a one standard deviation shock to the liquidity requirement does not have a significant effect on the fiscal variables, just like the reserve requirement and the discount rate shocks. The shock also does not have a significant effect on the other variables except for private sector credit, which has a negative and significant response.

Figure 5: Impulse Response for a Shock Liquidity Requirement

Source: Own calculations

4.4.4. Variance Decomposition for the Discount Rate

The variance decomposition results presented in Table 1 indicate that a one standard deviation shock to the discount has a minimal effect on the fiscal variables. A shock on the discount rate causes a 2.9 per cent, 1.4 per cent and 1.5 per cent variation on government budget deficit, tax revenues and domestic public debt over a 24 months’ period, respectively. Over the same period, the shock would cause a variation of 0.5 per cent to the gross national expenditure, 0.4 per cent to GDP and 3.8 per cent to private sector credit. These results indicate that the discount rate largely affects private sector credit hence it is an effective monetary policy instrument.
4.4.5. Variance Decomposition for the Reserve Requirement

The results presented in the table below indicate that a one standard deviation shock on the reserve requirement causes a variation of 0.4 per cent on government budget deficit, 0.5 per cent on tax revenues and 0.1 per cent on domestic public debt over a 24-month period. Over the same period, the shock causes a variation of 0.4 per cent, 0.1 per cent and 0.1 per cent to the private sector credit, gross national expenditure and GDP, respectively.

Table 2: Variance Decomposition for the Reserve Requirement

<table>
<thead>
<tr>
<th>Period</th>
<th>Reserve Req.</th>
<th>Gov. Deficit</th>
<th>Tax</th>
<th>GNE</th>
<th>Debt</th>
<th>GDP</th>
<th>PSCR</th>
</tr>
</thead>
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<td>1</td>
<td>100.00</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>97.82</td>
<td>0.45</td>
<td>0.37</td>
<td>0.17</td>
<td>0.06</td>
<td>0.01</td>
<td>1.12</td>
</tr>
<tr>
<td>8</td>
<td>97.69</td>
<td>0.48</td>
<td>0.40</td>
<td>0.21</td>
<td>0.06</td>
<td>0.01</td>
<td>1.14</td>
</tr>
<tr>
<td>12</td>
<td>97.68</td>
<td>0.48</td>
<td>0.40</td>
<td>0.21</td>
<td>0.06</td>
<td>0.01</td>
<td>1.13</td>
</tr>
<tr>
<td>16</td>
<td>97.68</td>
<td>0.48</td>
<td>0.40</td>
<td>0.21</td>
<td>0.06</td>
<td>0.01</td>
<td>1.14</td>
</tr>
<tr>
<td>20</td>
<td>97.68</td>
<td>0.48</td>
<td>0.40</td>
<td>0.21</td>
<td>0.06</td>
<td>0.01</td>
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</tr>
<tr>
<td>24</td>
<td>97.67</td>
<td>0.49</td>
<td>0.40</td>
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<td>0.06</td>
<td>0.02</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Source: own calculations

5.0 CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The main purpose of this study was to determine the effects of monetary policy changes on fiscal macroeconomic variables; however, other variables were included for model specification and stability purposes. The study considers shocks on all three monetary policy rates employed by the Bank, namely; the discount rate, liquidity requirement and the reserve requirement. Other variables considered include government budget deficit, tax revenues, gross national expenditure, public domestic debt, GDP and private sector credit.

All the variables were found to be integrated of order one, except for government budget deficit, which was integrated of order zero. The lag length selection criteria chose 2 as the optimal lag length and the Johansen Test revealed that there are at most 5 cointegrating vectors. Three SVAR models were estimated using the three policy rates and they all passed the diagnostics checks, namely; LM test, Portmanteau test and the stability test.

The impulse response results for the shock on the discount rate indicate that a one standard deviation shock does not have a...
significant effect to the variables under consideration over a 24 months’ period, including the fiscal variables. A shock on the reserve requirement and the liquidity requirement also did not have a significant effect on all the variables.

The variance decomposition for all three policy rates indicates that the policy rates do not have a significant effect on the fiscal variables. A one standard deviation positive shock on the discount rate causes a 2.9 per cent, 0.4 per cent and 1.5 per cent variation on, government budget deficit, tax revenue and public domestic debt over a 24 months’ period, respectively. Over the same period, the shock causes a variation of 0.5 per cent to gross national expenditure, 0.4 per cent to GDP and 3.8 per cent on private sector credit.

The variance decomposition results indicate that a shock on reserve requirement would cause a 0.4 per cent, 0.5 per cent and 0.1 per cent variation on government budget deficit, tax revenues and domestic public debt in twenty-four months, respectively. The results also revealed that a shock on the liquidity requirement would cause a variation of 0.5 per cent on government budget deficit, 0.4 per cent on tax revenues and 0.1 per cent on domestic public debt over twenty-four months.

5.2. Recommendations
Although there is limited space for monetary policy to influence fiscal variables in literature, the insignificant effect of monetary policy especially the liquidity requirement and reserve requirement on public domestic debt suggest minimum monetary and fiscal policy coordination between the monetary and fiscal authorities. We therefore recommend maximum coordination of these policies to ensure their effectiveness in achieving macroeconomic objectives. There is need to revise the liquidity requirements and the reserve ratio more frequently to enhance the coordination.

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The Relationship between Household Debt and Economic Growth in Swaziland

Ntobeko S. Dlamini\textsuperscript{12} and Zana S. Mabuza\textsuperscript{13}

Abstract

This paper explores the relationship between credit extended to households and economic growth in Swaziland, by employing the ARDL-bounds testing procedure to long run cointegration. Using quarterly time series data over the period 2006 to 2015, the study found that household credit had a long run negative impact on economic growth in Swaziland. The study further found that consumer price index, population growth and residential building plans approved were key determinants of household credit in the long run with coefficients of 0.70, -1.74 and 0.23, respectively. The error correctional terms for the models relating to GDP and household credit were -0.07 and -0.83, respectively, implying that about 7 per cent and 81 per cent of disequilibria in the short run converges back to long run equilibrium in the long run. The study recommends for close monitoring of household credit market and the control of excessive households’ exposure to credit.

Key words: ARDL, Household credit, GDP

1. INTRODUCTION

Since the dawn of the 2007/2008 financial crisis researchers and policymakers all over the world have become cautious of the levels of household debt. The increased household indebtedness which continues to be heightened by the growing demand for loans is exacerbated by commercial banks’ obvious drive to make excessive profits. Irrespective of the fact that household debt has caused a stir in the global economy, it is still considered as an important factor towards economic growth through its contribution to consumption expenditure. The reality that confronts many countries, however, is that enormous household debt levels are not an ideal factor to economic activity, instead, they may signal a looming financial bubble which would eventually bring a negative effect on the performance of the economy (Hammad et al, 2016).

Even though the global financial crisis caught many by surprise, it must have prompted policymakers to draw lessons that would have prevented the repeat of the episodes that emerged thereafter and the spillover effects on the global economy. Disappointingly, data from the International Monetary Fund (IMF) indicates that household debt is still on a rise for both developed and developing countries. This shows that financial intermediaries still require a significant level of monitoring in light of the chaos that erupted in 2007. Wildauer (2016) clarifies that the chaos did not only demonstrate that credit is an important macroeconomic aggregate but it also made a difference which sectors are taking on debt and that a highly indebted household sector ultimately triggers a recession.

While debt accumulation may be seen as a problem, its importance towards household consumption and economic growth should not be ignored. The availability of credit not only makes it easier for households to advance their expenditure objectively,
but it also helps cash strapped consumers to quicken payments for present needs than to prolong purchases into the future. Nevertheless, increased borrowing that escalates to unsustainable levels raises concerns about an individual’s ability to repay what they owe, especially in the event of an unexpected change in the economic environment (Tudela & Young, 2005). Martinez-Carrascal and Del Rio (2004) states that high debt levels imply a higher debt service burden which can restrict the household’s access to additional external fund hence leaving a household defenseless against unexpected shock to their income, assets or interest rates.

To a number of countries household consumption expenditure accounts for a larger share of their gross domestic product (GDP). According to the World Bank (2016), among high income countries final household consumption expenditure contribution to gross domestic product between the year 2000 and 2015, averaged an estimated 59.9 per cent while heavily indebted poor countries recorded an estimated 74.2 per cent contribution. In the same period, the Sub-Saharan African region’s consumption of households grew slightly above that of high income countries to eventually close at 66.3 per cent of GDP.

Following the onset of the 2007/2008 financial crisis it transpired that in the United States and United Kingdom, extreme easing of lending conditions created an insatiable level of demand for mortgage loans which led to unsustainable growth in household debt and further fueled higher debt-service burdens and increases in house prices. Thus the condition presented by the financial crisis provided a unique opportunity for countries to continuously examine developments in their household debt and to have a deeper understanding of what causes household debt to rise or fall in any existing debt business cycle.

Prinsloo (2002) claims that household debt ratios are an important analytical tool which allows policymakers and economic researchers to evaluate a household’s financial situation and to predict the outcome of final consumption expenditure. In Swaziland, the household consumption expenditure currently represents about 76 per cent of the gross domestic product (Central Statistics Office, 2015).

1.1 Household Debt in Swaziland

Total household debt in Swaziland comprises of three components which include; credit extended to the housing sector, motor vehicles, and other unsecured loans. As shown in Figure 1, credit extended to the housing market contributes the largest share of total household credit followed by loans extended for other unsecured loans such as education and personal. Credit extended for the acquisition of motor vehicles remains the least in terms of contribution to the total household sector credit.

As shown in Figure 2, household credit has been rapidly increasing and is considered as one of the largest components of private sector credit. By analyzing the evolution of private sector credit over the last decade, we observe an upward trajectory in household credit, in which the sector contributed between 30-45 per cent between 2005 and 2015. The major attributing factors towards
the substantial growth in household credit include a decline in prime lending rates from a high of 9 per cent in 2006 to a low of 5.8 per cent in 2015 combined with the competitive credit products aggressively offered by commercial banks to the household sector. According to Khan et al (2016), recent trends also show that the cost of living has increased significantly especially due to rising food prices which put upward pressure on household consumption especially among low and middle income population. Such increases restrict household consumption and may compel a household to acquire credit in order to maintain or enhance consumption. However, increased household borrowing relative to household income raises concerns about a household’s ability to service the loan, and has economic implications.

Figure 2: Share of Private Sector Credit

Source: Central Bank of Swaziland.

Figure 3 shows the ratio of credit extended to households to GDP between the period 2006 and 2015. Household credit started the period 2006 at a 7.1 per cent ratio to GDP, climbing steadily over the years. The 2007/2008 recession saw the Central Bank of Swaziland adopting restrictive monetary policies to discourage household liquidity. The period after the crisis marked an easing of monetary policy stance with the Bank reducing the discount rate from 11 per cent in 2008 to 5.75 per cent in 2015 in order to induce growth in the domestic economy. The result was an increase in household credit as shown by the household credit to GDP ratio increasing from around 7% in 2006 peaking at 9.5% in the third quarter of 2011, before declining to around 8.2% in 2013 before rising again to around 9.4% in 2015. This accommodative monetary policy stance favoured household credit as it generally accelerated during this period.

The expansion in lending to households requires the Central Bank to respond appropriately through restrictive monetary policies to contain unwarranted increases in credit extended to the household sector which safeguards the sustainability of the country’s financial system. The Bank does this conscious of the fact that its focus is not limited to the dynamics in the household sector but the economy as a whole. The Central Bank of Swaziland is ultimately tasked with the responsibility of ensuring price stability and sound financial systems that ensures a long-term viable growth path. However, notwithstanding the Bank’s presence, household credit remains elevated.

Figure 3: Household Credit to GDP Ratio

Source: Central Bank of Swaziland.

The remainder of this paper is organized as follows: section 2 presents the theoretical and empirical literature, section 3 discusses the methodology which is divided into several sections of data type and model specification. Section 4 provides an in-depth analysis of the estimation results obtained by applying the ARDL model. Finally, section
5 concludes the research by providing appropriate recommendations for policy and further research.

2.0 LITERATURE REVIEW
This section provides a theoretical and an empirical review of literature behind household debt, its determinants and the relationship that exists between household debt and economic growth. Empirical literature on the study of household debt and its attributes is still scanty for most African countries, non-existent in Swaziland which underscores the need to bridge the existing gap. The approach adopted and the variables selected for this study are based on some of the studies that estimate the relationship in question.

2.1 Theoretical Literature
The theories explaining the study of consumption and household debt can be traced back to the marginalist school of thought which saw consumers as individual utility maximizing agents (Santos et al, 2014). Given a set of tastes or preferences, income and price of goods and services, the problem facing the consumer is that of selecting a combination of commodities that would maximize or satisfy their needs. Consumers are therefore expected in theory to be rational thinkers and produce an option that maximizes their utility. This decision-making problem, as Santos et al (2014) puts it, is not distinguished from other economic problems, namely decisions made by producers who, given particular prices for raw materials, outputs, level of technology and a budget constraint, come up with a combination of inputs and prices that will enable profits to be maximized. A decision concerning credit and long-term consumption is also approached from the problem of individual utility maximization.

The theoretical clarification on the effect of macroeconomic variables on household debt and its implication is found in the Hyman Minsky’s financial instability hypothesis. The hypothesis according to Rahman and Masih (2014) argues that a financial crisis is rampant in a capitalist society because periods of economic prosperity encourages borrowers and lending institutions to be more certain about the prospect of financial sustainability which compels a reckless kind of behavior in the financial system. This excess optimism creates a financial bubble which at a later stage is highly likely to burst. Minsky’s theory asserts that a key apparatus that pushes an economy towards a crisis is the accumulation of debt by the private sector. The theory identifies three types of borrowers that contribute towards insolvent debt and these include: hedge borrowers, speculative borrowers and Ponzi borrowers. Given that financial markets frequently acquire excess liquidity, the hypothesis gives emphasis to the importance of a central bank or government as a lender of last resort.

The life cycle hypothesis as developed by Irving Fisher, Rod Harrod, Albert Ando and Francis Modigliani who furthers the argument of debt accumulation by assuming that consumers are rational and forward looking. The founding prescript of this theory is embedded on the general observation that consumption needs and income are often unequal at various points in the life cycle. According to the theory, some households are priority driven and mainly go for large amount of debt to smoothen their consumption to acquire long lasting commodities such as houses, cars among the many durables. The model thus foresees that household consumption in each period is dependent on expectations about life time income. As a result, households will inevitably enter into debt during these periods when their incomes are extremely low, mainly because they need to finance their existing consumption and will then pay back these loans in periods when their income is relatively high. In essence,
the model assumes that a household can maximize utility over its lifetime subject to a budget constraint.

Another theory called the permanent income hypothesis, developed by Milton Friedman in 1957, also weighed in on the subject of household credit and consumption. Friedman in this theory argued that consumption should not depend on current disposable income alone but on expectations relating to the total income which individuals expect to earn during their lifetime. The model emphasized that consumers utilize the saving and borrowing option to smoothen their consumption pattern in response to random and temporary changes in their income from year to year. From this perspective, indebtedness is the result of a rational decision aimed at maximizing intertemporal utility, now based on the wealth and income expected during the life cycle (Santos et al, 2014).

Although rising household debt can be attributed to the rationales advanced by the assertions highlighted above, there are many other important economic factors and reasons why household debt continues to rise. One of the reasons relates to a drop in real and nominal interest rates. The Bank of Canada (2012) claims that the upward trend in household debt in recent years, especially mortgage credit, is consistent with the growth in population and ownership coupled with improved mortgage affordability. Although house prices may have risen, mortgage demand and financing has benefited from other factors such as income gains and lower interest rates.

2.2 Empirical Literature
The discussion of the related literature is provided in this section and mainly focuses on the main factors that influence household debt among the developing economies including the Southern African region and the developed world.

A study in Australia which was conducted by Meng et al (2011) explored the determinants of household debt by employing a Vector Autoregressive (VAR) model. Findings of the study revealed a positive and significant impact of GDP, followed by house prices and the number of new dwellings on household debt in Australia. Over and above that, interest rates, unemployment rate and inflation were found to have a negative effect on Australia’s household debt. From the results, it was recommended that given the large negative effect of uncontrolled debt levels regulating and standardizing the practice of mortgage financing could limit the irresponsible behavior of financial institutions.

Rahman and Masih (2014) studied the relationship between household debt and GDP, interest rate and house price in Malaysia using a Johansen test for cointegration. The results showed that there was a long run positive relationship between house prices and household debt. In the short run, changes in GDP, lending rates and house prices according to the study findings could not influence household debt.

Khan et al. (2016) further explored the determinants of household debt in Malaysia by disaggregating the household sector into specific components of mortgage and consumer debt. By utilizing the bound test for cointegration through the ARDL modelling approach, the study revealed that in the long run, a change in income level, housing price and population had a positive impact on mortgage debt while a rise in interest rates and cost of living (consumer price inflation) would exert a negative impact.

Mutezo (2014) examined the relationship between household debt and consumption spending in South Africa. Using the ARDL bounds testing approach the results revealed that there was a significant deterministic
relationship between household debt and disposable income, net wealth and inflation. The results further indicated that there was a long run relationship between household debt and income, interest rates and inflation implying that low interest rates and a general increase in household income during the period 2004-2011 supported high household indebtedness.

Cross country evidence from a study conducted by Coletta et al. (2014) of 32 countries which included 26 members of the European Union plus Japan, South Korea, Canada, Australia, New Zealand and the U.S. over the period 1995 to 2011 revealed that household debt was highest in countries that had higher per capita GDP and household wealth. The coefficient of GDP growth rate on the other hand was found to be negative and statistically significant, implying that household debt is at its highest when economic activity (growth rate) is at its lowest.

Mah et al. (2013) studied the household debt and how it responded to shocks from several macroeconomic variables over the period 1985 quarter one to 2012 quarter two. Using the Variance Decomposition and Generalized Impulse Response Function analyses the study found that distortions in the level of household debt in South Africa were explained by the contributions in house prices, household income, gross domestic product and the real prime rate. Based on the study findings, the authors recommended that government should intervene by closely monitoring and properly managing the housing market to guard against excessive credit to the housing sector.

Zimunya and Raboloko (2015) studied the factors behind the growth of household debt in Botswana. Using quarterly data from the first quarter of 1994 to the second quarter 2012, the study employed the Vector Error Correction Model to analyze the effect gross domestic product per capita, interest rates, inflation, household consumption and money supply had on household debt. Results from this study showed that in the long run GDP per capita, interest rates and money supply determined changes in household debt in Botswana.

Panic (2010) in Sweden examined the underlying factors that were responsible for the developments in the household debt to disposable income ratio which had remained relatively high for almost 30 years. Using the Engel-Granger two-step modelling approach to cointegration, the results indicated that household debt to disposable income ratio was determined by debt to assets, interest payments to disposable income and real estate price index in the long run. Inflation was found to be a significant determinant only in the short run.

Tu (2008) employed the multivariate regression model to examine the lagged effect of house prices and interest rates on household debt to disposable income ratio in New Zealand. Using data spanning the period from the first quarter of 1991 to first quarter 2008, the study observed that the 1980s financial deregulation and the consequent drops in interest rates and the increase in house prices were the main causes of the increased household debt in New Zealand.

A study by Hong (2011) explored the determining factors of household indebtedness in the U.S. using quarterly data over the period of 1980-2010. The result from a simple regression analysis showed that the unemployment rate, interest rate, disposable personal income per capita, share of retiring population and educational attainment were negatively related to the household debt in the U.S. while housing prices, consumer confidence and share of working-age population were positively related to the household borrowing.
More recently, Wildar (2016) clarifies why households in the U.S. were deeply indebted in the last three decades. In his explanation, the author first acknowledged that private households in the U.S. took on large amount of debt over the last three decades hence understanding the forces behind the household debt trends is crucial in order to design monetary and fiscal policies aimed at reducing the prospect of another financial crisis. Through an in-depth descriptive analysis of the borrowing patterns in the U.S. the study concluded that real estate related borrowing explained a large part of the increase in household debt over the period 1989 to 2007.

Kim (2016) investigated the effect of the aggregated and disaggregated household debt components on economic growth in the U.S over the period 1951Q4 to 2009Q1. Using the vector error correction model the study revealed that both household debt and consumer debt had a negative relationship with the level of output in the long run which implied that debt accumulation depressed economic activity in the U.S.

Using data on 54 economies, Shim et al (2017) established that household debt boosts consumption and GDP growth in the short run, with the bulk of the impact of increased indebtedness passing through the real economy in the space of one year. However, the long-run negative effects of debt eventually outweighed their short-term positive effects, with household debt accumulation ultimately proving to be a drag on growth.

Kilman (2016) investigated the effect of household, corporate and government debt on economic growth using panel data for 20 advanced economies between 1980-2014. Through a dynamic panel data model, the study concluded that there is a relationship between household debt and economic growth in the long run.

### 3.0 METHODOLOGY AND DATA DESCRIPTION

#### 3.1 Model Specification

The primary focus of this study is to investigate the factors behind the rising household debt and its impact on economic growth in Swaziland using the Autoregressive Distributed Lag (ARDL) model. This methodology is similar to studies by Kan et al (2016) and Mutezo (2014). Studies presented in the literature review section suggest that household debt as an independent variable is a function of a varying set of macroeconomic variables. These variables as revealed by the empirical literature (in Hong, 2011; Tu, 2008; Zimunya and Raboloko, 2015; Khan et al., 2016 and Meng et al., 2011) include among others: consumer price index, interest or lending rates, gross domestic product, house or mortgage prices, population statistics, GDP per capita, money supply, working-age population among the numerous variables.

For the purpose of this study and considering that data for this type of analysis is limited in Swaziland, this study will focus on quarterly time series data of consumer price index, prime lending rate, gross domestic product, building plans approved, population and household credit. The period of the study covers 2006Q1 to 2015Q4.

In order to analyse the relationship between household debt and economic growth in Swaziland, the following regression equations are used:

\[
\log {HD} = \beta_0 + \beta_1 \log {CPI} + \beta_2 \log {PR} + \beta_3 \log {GDP} + \mu
\]

(1)

\[
\log {GDP} = \beta_0 + \beta_1 \log {CPI} + \beta_2 \log {PR} + \beta_3 \log {HD} + \beta_4 \log {POP} + \beta_5 \log {BPA} + \mu
\]

(2)
3.2 Econometric Estimation Procedure
The study invokes three steps of estimation procedures which seek to examine the determinants of household debt in Swaziland and its impact on economic growth. The first step considers examining the nature of the data or order of integration (stationarity). If variables are non-stationary we may have spurious regression. Thus in order to avoid such cases, stationarity tests of the variables are performed. For this purpose, the Augmented Dickey-Fuller test (ADF) is employed.

After the order of integration has been established and it is found that all the variables are integrated of order zero I(0) or order one I(1), the second step is to check for the presence of long run cointegration using the bounds test method through the Autoregressive Distributed Lag (ARDL) estimation procedure which was developed by Pesaran et al. (2001). This method has several advantages over other frequently employed cointegration approaches such as the Johansen and Juselius and Engel-Granger Two Step method. The Engel-Granger, for example, is limited to bivariate testing of typical runs. It identifies only a single cointegration relationship among what might have been many relations and it is also limited to one regression. Similarly, the Johansen and Juselius approach, unlike the bounds cointegration method, fails to consider the mixture of regressors which are not integrated of same order, that is, I (0) and I (1). As opposed to the other multivariate co-integration methods the ARDL is applicable whether the regressors are not integrated of same order or mutually co-integrated but as long as the order of integration is not higher than one, there can still be a long run relationship between the explanatory and dependent variable provided that they are co-integrated (Sultan, 2012). Fundamentally, this approach is suitable for smaller sample observations of between 30-80.

For long run relationships, the ARDL normally involves two steps of estimation. The first step is to examine the existence of a long-run cointegration relationship among the variables in the equations in question using the bounds test. On condition that there exists long run cointegration among the variables, the long-run coefficients and short-run coefficients are thereafter estimated via a parsimonious ARDL model which is developed using Hendry’s general-to-specific modelling approach. The selection of the parsimonious model is done using the built-in ARDL operator in EViews 9. To test for long run cointegration in model 1 and 2, the following Unrestricted Error Correction Models (UECM), are constructed:

\[ \Delta \text{log } HD_t = \]
\[ \beta_0 + \Sigma^p_{i=1} \beta_{1i} \Delta \text{log } HD_{t-i} + \Sigma^p_{i=0} \beta_{2i} \Delta \text{log } CPI_{t-i} + \]
\[ \Sigma^p_{i=0} \beta_{3i} \Delta \text{log } PR_{t-i} + \Sigma^p_{i=0} \beta_{4i} \Delta \text{log } POP_{t-i} + \]
\[ \Sigma^p_{i=0} \beta_{5i} \Delta \text{log } GDP_{t-i} + \Sigma^p_{i=0} \beta_{6i} \Delta \text{log } BPA_{t-i} + \]
\[ \phi_1 \text{log } HD_{t-1} + \phi_2 \text{log } CPI_{t-1} + \phi_3 \text{log } PR_{t-1} + \]
\[ \phi_4 \text{log } GDP_{t-1} + \phi_5 \text{log } BPA_{t-1} + \]
\[ \phi_6 \text{log } POP_{t-1} \epsilon_t \]  

(3)

\[ \Delta \text{log } GDP_t = \]
\[ \beta_0 + \Sigma^p_{i=1} \beta_{1i} \Delta \text{log } HD_{t-i} + \Sigma^p_{i=0} \beta_{2i} \Delta \text{log } CPI_{t-i} + \]
\[ \Sigma^p_{i=0} \beta_{3i} \Delta \text{log } PR_{t-i} + \Sigma^p_{i=0} \beta_{4i} \Delta \text{log } POP_{t-i} + \]
\[ \Sigma^p_{i=0} \beta_{5i} \Delta \text{log } GDP_{t-i} + \Sigma^p_{i=0} \beta_{6i} \Delta \text{log } BPA_{t-i} + \]
\[ \phi_1 \text{log } HD_{t-1} + \phi_2 \text{log } CPI_{t-1} + \phi_3 \text{log } PR_{t-1} + \]
\[ \phi_4 \text{log } GDP_{t-1} + \phi_5 \text{log } BPA_{t-1} + \]
\[ \phi_6 \text{log } POP_{t-1} \epsilon_t \]  

(4)

where HD, GDP, refers to the dependent variables corresponding to equation (3) and (4), \( \beta \) and \( \epsilon \). coefficients are considered as column vectors of the parameters, while \( \Delta \) is the first difference operator and \( \epsilon \) is the error term.

Once the estimation of equation (3) and (4) is completed, the F-statistic will be computed to test whether the independent variables
have a long-run relationship with household debt and economic growth. This will be done by estimating the Wald or F-test for the joint significance of the coefficients of the lagged variables at their levels and comparing it to the critical bounds values computed by Pesaran et al. (2001).

The null hypothesis (Ho) of non-existence of long-run effect (no cointegration): $H_0: (\varepsilon)1 = (\varepsilon)2 = (\varepsilon)3 = (\varepsilon)4 = (\varepsilon)5$ is tested against the alternate hypothesis (H1) that there exist a long-run effect (existence of cointegration 1: $(\varepsilon)1 \neq (\varepsilon)2 \neq (\varepsilon)3 \neq (\varepsilon)4 \neq (\varepsilon)5$.

Should the F-statistics exceed the upper bound of the critical values, I(1), then we may reject the null hypothesis of no long run cointegration, concluding that the variables contained in the models share meaningful long run relationships. However, if the F-statistics are inferior to the lower bounds of the critical values, I(0), we fail to reject the null hypothesis of no long run cointegration among the variables and conclude that the variables being tested do not share a significant long run relationship.

4.0 EMPIRICAL FINDINGS

4.1 Stationarity Test
The stationarity test was done in order to determine if each time series contains unit root or non-stationary and to determine the order of integration. This was necessary to confirm the study’s validity in using the ARDL Bounds testing methodology; this methodology requires variables to be integrated of order I(0) or I(1) to make the model valid (Pesaran et el (2001). In this study, the variables were first tested at levels and were found to be none stationary. The same test was conducted after differencing, and all the variables were found I(1).

4.2 Bounds Test
From the stationarity results it has been established that none of the variables are integrated of order two I(2) hence the next step is to proceed with the three ARDL estimation procedures. The first step which involves the test for long run cointegration is presented in Table 1. In the ARDL model, the existence of long run cointegration among the variables for equations 4 and 5 are tested using the bounds F-test which checks the joint significance of the coefficients of the lagged variables at their initial levels. Accordingly, the F-statistic tests the null hypothesis that: the coefficients of the lagged level variables are jointly equal to zero (that is, there is no cointegration or long-run relationship), which is tested against the alternative hypothesis that; there exists a long run relationship between the variables.

<table>
<thead>
<tr>
<th>Models</th>
<th>Estimated F-Value</th>
<th>Critical Value</th>
<th>Lower Bound I(0)</th>
<th>Upper Bound I(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (1)</td>
<td>10.235</td>
<td>1%</td>
<td>3.41</td>
<td>4.68</td>
</tr>
<tr>
<td>Model (2)</td>
<td>4.2380</td>
<td>5%</td>
<td>2.62</td>
<td>3.79</td>
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<tr>
<td></td>
<td></td>
<td>10%</td>
<td>2.26</td>
<td>3.35</td>
</tr>
</tbody>
</table>

The bounds test results for long run cointegration are presented in Table 1. The F-statistics in this case has been calculated for two models in order to clearly explain the relationship between household debt and economic growth in Swaziland. Model 1 in this regard is based on household debt as a dependent variable while model 2 shows how household debt as an independent variable explains variations in economic growth.

Using Pesaran et al (2001) critical bounds value, the study finds that the estimated F-values for model 1 F(HD/GDP, CPI, BPA, POP, PR) and model 2 F(GDP/HD,CPI, BPA, POP, PR) is 10.24 and 4.24, respectively. From the results we see that the estimated F-values are greater than the upper bound...
critical values at 1 and 5 per cent level of significance hence we reject the null hypothesis of no long run cointegration and conclude that there is long run cointegration relationship between the variables specified in all the models and their dependent variables.

4.3 Long Run and Short Run Relationship Analysis

After generating a more parsimonious model which is traditionally found by gradually deleting the insignificant variables. Table 2 presents the long-run estimation results of the Model 1 based on the ARDL (1,3,0,2,1,1) lag length while Model 2 is based on ARDL (1,1,2,0,1,2) lag length. The number of lags of both models were selected using the Akaike Information Criterion (AIC). From the results of Model 1, the coefficients of Consumer Price Index, Building Plans Approved and Population were found to be significant determinants of household debt. The estimated coefficients (Model 1), suggest that a 1 % increase in the Consumer Price Index will result in a 0.70% increase in household debt in the long run implying that as the cost of living rises they pose a burden to household disposable income hence forcing households to acquire more loans. Khan et al (2016) further points out that households may use debt to supplement their wages in order to meet their daily living expenses.

On the other hand, a 1% increase in building plans approved translates into a 0.23 % in household debt. The positive coefficient of building plans approved could mean that the desire for households to own urban residential properties is facilitated through the acquisition of mortgage which translates into an increase in household debt. The results further indicate that a 1% increase in population is expected to reduce household debt by 1.7 %. Consequently, population growth was found to be contradicting theoretical expectations where it is expected to increase household debt. However, in this study, population growth discourages growth in household debt and this could be due to the high poverty and unemployment levels which hinders households from acquiring loans with commercial banks. Meng et al (2012) purports that lower income or the absence of income due to high unemployment casts doubt on future income. As a result, regular unemployment of a household discourages household debt because of concerns about the ability to repay an existing loan hence this discourages household demand for loans and constraints growth of household debt.

Even though the coefficients of GDP and prime lending rates were found to be insignificant determinants of household debt, they do bear the correct signs which are in line with theoretical expectations. The results as presented in Table 2 imply that growth in GDP and lending rates discourage or retard household borrowing. The signs of these parameters confirm the findings by Hong (2011), Khan et al (2011) and Cletta et al (2014) who also found a negative relationship between interest rates, GDP and household debt in the respective countries.

The goodness of fit of Model 1 as shown by R-squared and Adjusted R-squared are 0.75 and 0.61, respectively. These results imply that 61 per cent of total variation in household debt is explained by the specified explanatory variables in the model, which is a fairly good fit.
Table 2: Estimated long run coefficients using ARDL

<table>
<thead>
<tr>
<th>Model (1) Selected ARDL (1, 3, 0, 2, 1, 1)</th>
<th>Model (2) Selected ARDL (1, 1, 2, 0, 1, 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable (LogHD)</td>
<td>Dependent Variable (LogGDP)</td>
</tr>
<tr>
<td>Explanatory Variables</td>
<td>Explanatory Variables</td>
</tr>
<tr>
<td>LogGDP(-1)</td>
<td>LogGDP(-1)</td>
</tr>
<tr>
<td>-0.433943</td>
<td>-0.417741***</td>
</tr>
<tr>
<td>LogCPI(-1)</td>
<td>LogBPA(-1)</td>
</tr>
<tr>
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<td>0.417741**</td>
</tr>
<tr>
<td>LogBPA(-1)</td>
<td>LogHD(-1)</td>
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<td>0.704221***</td>
<td>-0.968235**</td>
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<tr>
<td>LogPOP(-1)</td>
<td>LogPOP(-1)</td>
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<tr>
<td>-0.968235**</td>
<td>-1.678399***</td>
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<tr>
<td>PR(-1)</td>
<td>PR(-1)</td>
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<tr>
<td>-0.003505</td>
<td>-0.017081</td>
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<tr>
<td>C</td>
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</tr>
<tr>
<td>29.811409</td>
<td>0.020199</td>
</tr>
</tbody>
</table>

R-squared 0.749528
Adjusted R-squared 0.607956
S.E. of regression 0.024871
F-statistic 5.294348
Prob(F-statistic) 0.000262

R-squared 0.749528
Adjusted R-squared 0.607956
S.E. of regression 0.024871
F-statistic 5.294348
Prob(F-statistic) 0.000262

Table 3: Error Correction Model

<table>
<thead>
<tr>
<th>Model (1)</th>
<th>Model (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable (LogHD)</td>
<td>Dependent Variable (LogGDP)</td>
</tr>
<tr>
<td>Explanatory Variables</td>
<td>Explanatory Variables</td>
</tr>
<tr>
<td>Δ(LogGDP)</td>
<td>Δ(LogCPI)</td>
</tr>
<tr>
<td>-2.69936***</td>
<td>-0.699360*</td>
</tr>
<tr>
<td>Δ(LogGDP(-1))</td>
<td>Δ(LogBPA)</td>
</tr>
</tbody>
</table>
| -1.670036  | 1.670036*
| Δ(LogGDP(-2)) | Δ(LogBPA(-1)) |
| -1.899906  | -0.587505* |
| Δ(LogCPI) | Δ(LogHD) |
| 0.587505**  | 0.042557** |
| Δ(LogBPA) | Δ(LogPOP) |
| 0.042557***  | 0.071250** |
| Δ(LogBPA(-1)) | Δ(PR) |
| -0.081417*  | -0.172338* |
| Δ(LogPOP) | Δ(PR(-1)) |
| -0.172338  | 0.019775* |
| Δ(PR) | ECM1(-1) |
| -0.019775***  | -0.065668** |
| ECM2(-1) | -0.834261* |

*, ** & *** denotes significance at 1%, 5% & 10% statistical level.

In the case of Model 2, the coefficients of the consumer price index, building plans approved and population were found to be significant determinants of GDP at 1%, 5% and 10%, respectively. Compared to model 1, model 2 results reveal that there exists a negative and significant relationship between household debt and economic growth in the long run in Swaziland. This result is consistent with existing empirical findings of Kim (2016) who found that debt accumulation depresses economic growth in the long run. Verner et al (2015) also found that rising household debt was associated with a decline in GDP growth.

The estimated coefficients further show that a 1% increase in the consumer price index and in building plans approved will result in 1.2 per cent and 0.42% increase in GDP respectively. Also, a 1% increase in household debt and population rates individually, will result in a decrease of 0.97 %, 1.68 % and 0., respectively.

Having established that there exists long run cointegration among the variables the next step is to investigate the short run dynamic of the two models through an error correction representation of the ARDL model. As shown in Table 3, the speed of adjustment towards long run equilibrium for Model 1 is -0.83 which suggests that 83% of any deviations towards long run equilibrium between household debt and its determining factors is corrected within one quarter. Denoted as ECM1, it is also interesting to note that the coefficient of the error correction term is quite high suggesting that restoration to a steady state level is much faster, should the model be confronted with any disturbances.

From the findings presented in Table 3, it is also evident that the results do not concur with the long run results of household debt determinants shown in Table 2. Contrary to the long run, the short run impact of GDP on household debt was found to be negative and statistically significant at 10 per cent level. This therefore suggests that economic growth in the long run is not a significant determinant of household debt in Swaziland.

Table 3 also shows that a 1% increase in prime lending rates in the same quarter decreases
household debt by 0.02%. This result is found to be consistent with the long run result which found that there exists a negative but insignificant relationship between the two variables. The main reason for this is that interest rate hikes in general discourage loan demand because it raises the cost of borrowing, which discourages household from borrowing or at least reduce credit demand.

On the other hand, a 1% increase in the consumer price index and building plans approved in the immediate short run results in household debt increasing by a 0.59 and 0.04%, respectively, indicating that these variables have a positive impact in short run as well. However, this paper takes exception that once a quarter elapses, building plan approved begin to generate a negative impact leading to a 0.08% reduction in household debt.

In terms of Model 2, the analysis also provides a contrasting picture to what was found in the long run results. According to the results, there exists a positive and significant short run relationship between household debt and economic growth. Specifically, the result indicates that a one per cent increase household debt results in 0.04% increase in economic growth in Swaziland.

The error correction term also reflects the required negative sign which is statistically significant. Thus, it can be concluded that any short run deviations are highly likely to converge towards long run equilibrium. The coefficient of the error correction term (ecm2) is -0.066 which implies that about 6.6% of disequilibrium between GDP and its determining factors is corrected within one quarter. This shows a very slow speed of adjustment towards long run equilibrium.

### 4.4 Diagnostic tests
To ensure that the results are robust and appropriate, several diagnostic tests were conducted, these include, tests for serial correlation and homoscedasticity. The Ramsey RESET test for model specification was also conducted to check whether the models non-linear combinations of the fitted values help explain the dependent variable or not.

<table>
<thead>
<tr>
<th>Diagnostic Tests</th>
<th>Model 1(HD)</th>
<th>Model 2(GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Statistic</td>
<td>p-value</td>
<td>Test Statistic</td>
</tr>
<tr>
<td>Jarque-Bera (normality)</td>
<td>0.6045</td>
<td>0.7391</td>
</tr>
<tr>
<td>Breusch-Godfrey (serial correlation)</td>
<td>1.3316</td>
<td>0.5139</td>
</tr>
<tr>
<td>Breusch-Pagan-Godfrey (heteroscedasticity)</td>
<td>6.2471</td>
<td>0.9367</td>
</tr>
<tr>
<td>Ramsey RESET</td>
<td>0.3681</td>
<td>0.7163</td>
</tr>
</tbody>
</table>

Table 4 presents the diagnostic test results which indicate that all the models do not suffer from problems of serial correlation, heteroscedasticity and model misspecification as shown by the insignificance of the probability values of the Jarque-Bera, Breusch-Godfrey, Breusch-Pagan-Godfrey and Ramsey RESET tests.

### 4.5 Parameter Stability Test
In order to confirm the stability of the estimated coefficients given that the model is said to be correctly specified, Pesaran (1997) proposed that the cumulative sum of recursive residuals (CUSUM) and the CUSUM of squares tests be applied to assess the stability of the estimated parameters. As a result, the plots of the cumulative sums are expected to fall within the 5% critical lines of statistical significance where we shall conclude that the coefficients are stable and reliable.
Figure 4 and 5 reflect the plots of CUSUM and CUSUMQ tests of the two models. The results from the two figures reflect the reliability and stability of all the estimated parameters as all the residuals were found to be falling within the critical bounds of 5% level of significance.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This paper investigates the relationship between household debt and economic growth in Swaziland by employing the Autoregressive Distributed Lag modelling approach using quarterly data from 2006 to 2015. Using the bounds test for long-run cointegration, the study found evidence of a long run relationship between household credit and economic growth.

The results revealed that household credit had a long-run negative and significant impact on economic growth, while the economic growth had an insignificant negative impact on household credit in Swaziland. Such findings imply that an increase in household debt in the long run deters economic growth. More importantly, this finding is in line with the earlier assertion that excessive growth in household debt, if left unchecked, may bring a negative effect on the performance of the economy (Hammad et al, 2016). This calls for close monitoring of the household
credit market and the control of excessive households’ exposure to credit. This can be achieved by setting a household credit threshold that promotes economic growth. The study further explored the impact of prime lending rate, population growth, residential building plans approved and consumer price index on household credit and economic growth. The study established that the consumer price index, population growth and the residential building plan approved had significant influence on household credit in the long run.

Based on the aforementioned, the findings of this study indicated that an increase in residential building plans approved leads to an increase in household credit in the long run. This implies that the housing market plays a significant role in the accumulation of household credit in Swaziland which is a cause for concern. In this regard, government needs to intervene and impose polices that require further scrutiny of the credit extended towards residential development.

Furthermore, the study revealed that an increase in population leads to a decrease in household debt in Swaziland in the long run. This finding implies it is possible for household debt to fall as a result of an increase in population. Aligned with this negative relationship could be the high level of unemployment and poverty which shows that a number of households could be unbanked and highly incapable of acquiring loans with commercial banks. According to Zimunya and Raboloko (2015), it is possible to reduce household debt by creating more jobs. This study thus reiterates the need for more job creation opportunities in both private and public sectors which would increase productivity in the economy and enhance household income hence raising households’ ability to acquire credit.

The consumer price index was found to lead to an increase in household debt. This finding of the study implies that an increase in consumer prices encourages an increase in household debt in Swaziland. As prices go up, households are expected to increase their credit in order to smoothen their consumption. Though the central bank expertly controls the interest rates when inflation increases, the households will have more loans to maintain and defaulting risks will also increase. Dercon (2012) explains that in most cases, households in developing countries often lack risk management tools to meet adverse shocks. Thus encouraging financial literacy among consumers would help households to manage their spending pattern and help them make informed decisions.

The ECMs for both models were found to be statistically significant with the expected signs. In the case of the household debt model, the estimated value was 0.83 implying that approximately 83 per cent of disequilibria in the long run is corrected within one quarter while in the case of the GDP model the ECM implies that 6.6 per cent of disequilibrium is corrected within one quarter.

5.1 Recommendations for further research
For future research, we recommend that further studies be conducted to determine the household credit threshold that sustains economic growth in Swaziland. This would help policymakers to make informed policy decisions. Though the study found a long run relationship between household debt and economic growth, the causal relationship has not been explained in this study hence the granger causality is recommended for further research.
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Modelling and Forecasting Inflation Dynamics in Swaziland

Bongani P. Dlamini

Abstract

The purpose of this study was to identify a suitable inflation forecasting model ideal for small economies like Swaziland, eight quarters ahead. This was to be attained through evaluating the Vector Error Correction Model (VECM), the Bayesian Vector Autoregressive (BVAR), two variants of the Phillips curve model (ARDL & Triangle model) and two types of naïve benchmarks (Autoregressive Moving Average (ARMA)) and the random-walk model proposed by Atkeson-Ohanian (2001) using quarterly data between 1990Q1 and 2013Q4 for parameter estimation and 2014Q1 to 2015Q4 for forecasting. The quality of the obtained forecasts was evaluated using four classical statistical loss functions: Mean Absolute Error (MAE), Mean Absolute Percent Error (MAPE), the Root Mean Squared Error (RMSE), and the Thiel’s Coefficient. Results show that the AO model proved to be the best model both in-sample and out-of-sample. Generally, all the models failed to beat the AO naïve benchmark, even combined models. The BVAR was the only model which challenged the AO, hence can be ideal for forecasting inflation in Swaziland.

Key words: Inflation, forecasting models, forecast evaluation, forecast combination, Swaziland.

1.0 INTRODUCTION

The importance of a clear understanding of the determinants of inflation is undisputed given its role in economic policy, and yet there are a plethora of theories regarding its determination. Hence, there is an obvious role for model selection techniques in ascertaining the most relevant causes of inflation. Like many Central Banks, the Central Bank of Swaziland has the ultimate goal of attaining price stability, stable and sound financial systems that will ensure sustainable economic growth. This can be achieved through a sound monetary policy formulated and implemented by the Central Bank. This can be done by basically influencing the monetary variables to achieve the ultimate macroeconomic goals of the nation, particularly low inflation. However, Swaziland’s inflation has experienced many structural breaks and regime changes over the past years. The key determinants of inflation are the pressures arising from excess demands in all sectors of the economy and so measures of excess demand for both goods and labour are crucial, with the output gap, as a proxy for excess demand for goods and services, being widely used.

In general terms, monetary policy can be defined as the manipulation of monetary variables such as money supply, interest rates, and credit availability, to achieve the ultimate national macroeconomic objectives of price stability, low unemployment, stable exchange rate, and economic growth (Dlamini, 2014). Faure (2005) defines monetary policy as the formulation and execution of policies by the central bank, in the form of open market operations to render repo rate effective. It is aimed at guiding bank lending rates to levels where credit and money demand are at a level with aggregate supply elasticity, all of which are premeditated on the attainment of low inflation (usually targeted) and high and sustainable economic output. However,

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Central banks define monetary policy in various ways. In practice there are many instruments which can be used by the central banks in formulating their monetary policies. They include controlling the level of money supply, the reserve and liquidity requirements, open market operations, and the discount rate among others. The discount or bank rate is the most popular in most central banks. These banks target a certain level of inflation which guides them whether to increase or decrease the discount rate. Central banks in most advanced economies now operate with some form of either explicit or implicit inflation target. However, several emerging markets and developing economies have adopted inflation targeting since the 1990s, including South Africa in 2000.

Therefore, understanding the dynamics of inflation is very crucial in predicting the future course of inflation in a precise manner to achieve the goal of price stability. A number of efforts have been undertaken in different countries to identify suitable models for this analysis and has resulted into a large number of different models for inflation, which vary in terms of scale, and in terms of the variables assumed to drive inflation. According to Aron and Muellbauer (2011), forecasting inflation in emerging markets is particularly challenging compared to the US and the Eurozone, due to the volatility in food prices, exchange rates, as well as structural changes, hence a range of approaches are used for forecasting inflation. These efforts have resulted in a large number of different models for inflation, which vary in terms of scale, and in terms of the variables assumed to drive inflation (including the output gap, unemployment rate or unit labour costs). This paper therefore seeks to identify a suitable model for forecasting inflation for Swaziland. As noted by Langa (2001), Swaziland’s monetary policy framework is to a greater extent influenced (determined) by her membership to the quasi-currency board, the Common Monetary Area (CMA), where South Africa is a dominant member.

1.1 Monetary Policy in Swaziland

The Central Bank of Swaziland has at its disposal a variety of monetary policy instruments to achieve price stability. However the country’s membership to a CMA coupled with full economic integration and a fixed exchange regime precludes discretion monetary policy or independence. Therefore Swaziland has no formal role in the formulation of the monetary and exchange rate policies. Therefore given the parity of the currency of Swaziland to the Rand and the free mobility of capital, the scope of monetary policies in Swaziland is limited and less independent to those of South Africa. The exchange rate peg has to be fully supported by well-coordinated monetary policy and discipline fiscal policies. Expansionary fiscal policy in Swaziland tends to undermine the exchange rate peg by exerting pressure on external outflows reducing reserves and threatening the peg, (Nxumalo, 2014).

In that regard, keeping the exchange rate peg serves as an intermediate goal for monetary policy in Swaziland. To support this exchange rate policy of the currency board, Swaziland has to keep high levels of reserves equivalent to the conventional international standard of 3 months of imports cover.

Generally, Swaziland’s discount rate moves in tandem to that of South Africa, however based on domestic economic fundamentals, Swaziland sometimes deviate from the South African Reserve Bank (SARB) repo rate usually by 50 basis points.
1.1 Monetary Policy in Swaziland

Monetary policy is a central component of the central bank’s overall policy of the currency board, Swaziland has to serve as an intermediate goal for monetary well-coordinated monetary policy and discipline exchange rate peg has to be fully supported by independent to those of South Africa. The role in the formulation of the monetary and independence. Therefore Swaziland has no formal achievement price stabil.

1.2 Theoretical Framework on Inflation Dynamics

Different schools of thought articulate to dynamics of inflation trends especially in relation to economic growth. Central to inflation dynamics is the issue of neutrality of money and labour markets adjustment to price changes. The traditional route to analyzing inflation is that of isolating demand pull pressures and cost push pressures. According to the Keynesian model, demand pull inflation arises from factors that lead to excess demand in an economy (i.e. increased in investment, rise in money supply or government financing spending through borrowing). Cost push inflation, on the other hand, links inflation to supply factors - predominantly rising production costs. Structuralists believe that structural bottlenecks such as distortionary government policies, government budget constraint, inelastic supply of essential commodities and conflicts in income distribution are key determinants towards inflation outcomes.

1.3 Swaziland and South Africa Inflation Trends

Inflation movements in Swaziland are often linked with those of South Africa with the notion that there is high imported-inflation pass-through effect from South Africa to Swaziland since Swaziland sources more than 90 percent of its imports via South Africa. In the long-run the relative purchasing parity hypothesis holds for these countries’ price movements. More than 70 percent of the inflation movements in Swaziland are explained by exogenous factors mainly through imported inflation (Nxumalo and Mabuza, 2013).

1.4 Swaziland Inflation Composition and Weights

The composition of the consumer prices index (whose changes are used to measure inflation) has changed over time predominately informed by household and income and expenditure surveys (HIES) carried out in the country. These surveys provide data for evaluation of the weighting structure of the items in the consumption basket. The latest survey used is the 2001 Swaziland Household

![Figure 1: Swaziland and South Africa Discount Rates](source: Central Bank of Swaziland)

![Figure 2: Swaziland and South Africa inflation rates](source: Central Bank of Swaziland & STATS SA)
Income and Expenditure surveys (SHIES 2001). The breakdown of the subcomponents is based on the international classification standard COICOP (classification of Individual consumption by purpose). Given the high poverty rates noted in the SHIES 2001, food dominates the consumption basket.

**Figure 3: Comparative Inflation Rate Trends**

![Inflation Rate Trends](image)

Source: Swaziland Central Statistics Office

CPI Weights may become out of date and less representative of current consumption patterns. This inaccuracy increases the further the length of time from the reference period. At some point, it becomes necessary to use the weights of a more recent period to ensure that the index is weighting appropriately the price changes currently faced by consumers. The recommended frequency for updating CPI weights is once in every 5 years. However, the frequency of updating weights depends on the availability of household income and expenditure surveys (HIES) as they always provide not only a snapshot of the levels of income and expenditure for households during a specified reference period, but also provide a comparative analysis to subsequent surveys on changes in household consumption patterns and income distribution. The last update of CPI weights in Swaziland was in April 2007 based on the SHIES 2001. Another SHIES was conducted in 2010 and based on its results new weights have been compiled. Table 2 below shows the new weights that came into effect in 2013 and they are compared with the previously used weights.

**Table 1: A Comparison of Old and the New CPI Weights**

<table>
<thead>
<tr>
<th>Code</th>
<th>COICOP Category Classification</th>
<th>Weight Based on SHIES 2001</th>
<th>Weight Based on SHIES 2010</th>
<th>Percentage point change</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Food &amp; non-alcoholic beverages</td>
<td>37.73</td>
<td>28.31</td>
<td>-9.4</td>
<td>-25.0</td>
</tr>
<tr>
<td>02</td>
<td>Alcoholic beverages &amp; tobacco</td>
<td>0.96</td>
<td>0.41</td>
<td>-0.6</td>
<td>-57.3</td>
</tr>
<tr>
<td>03</td>
<td>Clothing &amp; footwear</td>
<td>6.16</td>
<td>3.76</td>
<td>-2.4</td>
<td>-39.0</td>
</tr>
<tr>
<td>04</td>
<td>Housing &amp; Utilities</td>
<td>14.33</td>
<td>29.24</td>
<td>14.9</td>
<td>104.1</td>
</tr>
<tr>
<td>05</td>
<td>Furnishing &amp; household equipment</td>
<td>11.88</td>
<td>5.08</td>
<td>-6.8</td>
<td>-57.2</td>
</tr>
<tr>
<td>06</td>
<td>Health</td>
<td>3.58</td>
<td>3.46</td>
<td>-0.1</td>
<td>-3.4</td>
</tr>
<tr>
<td>07</td>
<td>Transport</td>
<td>8.6</td>
<td>9.95</td>
<td>1.4</td>
<td>15.7</td>
</tr>
<tr>
<td>08</td>
<td>Communications</td>
<td>1.43</td>
<td>3.17</td>
<td>1.7</td>
<td>121.7</td>
</tr>
<tr>
<td>09</td>
<td>Recreation &amp; culture</td>
<td>4.62</td>
<td>1.17</td>
<td>-3.5</td>
<td>-74.7</td>
</tr>
<tr>
<td>10</td>
<td>Education</td>
<td>5.38</td>
<td>8.77</td>
<td>3.4</td>
<td>63.0</td>
</tr>
<tr>
<td>11</td>
<td>Restaurants &amp; hotels</td>
<td>0.72</td>
<td>1.91</td>
<td>1.2</td>
<td>165.3</td>
</tr>
<tr>
<td>12</td>
<td>Miscellaneous goods &amp; services</td>
<td>4.67</td>
<td>4.78</td>
<td>0.1</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>All Items</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SHIES 2000/1 and SHIES 2009/10, Central Statistics Office

The results from SHIES 2010 indicate that there has been a notable shift in the consumption patterns between the two survey periods. The major change in the SHIES 2001 is the share (weight) of ‘food and non-alcoholic beverages’ component which fell by 9.4 percentage points from 37.73 percent in the current weights to 28.31 percent in the new weights. The share of the ‘housing and utilities’ component increased by 14.9 percentage points to a share (weight) of 29.2 percent, replacing ‘food and non-alcoholic beverages’ as the component with the largest weight in the consumption basket. Another significant shift was noted in the weightings of durable and semi-durable products. Components that saw their shares (weights) declining by notable margins are ‘furnishing and household equipment’ (6.8
percentage points), ‘clothing and footwear’ (2.4 percentage points) and ‘recreation and culture’ (3.5 percentage points). Meanwhile items that recorded notable increases in their weights are ‘communication’ (from 1.43 percent to 3.17 percent) and ‘education’ (from 5.38 percent to 8.77 percent). The different composition of Consumer Price Indices (CPI) weighting structure across countries is one of the often cited reasons why inflation differential may persist across countries.

The rest of the paper is organised as follows; section 2 is the review of literature, section 3 presents the methodology, section 4 presents the models results, forecasting performance, as well as forecast combinations, while section 5 concludes.

2.0 LITERATURE REVIEW
This chapter presents various theories and empirical studies on the choice of inflation forecasting models for various economies. In spite of the abundant literature on the comparison of forecasting models worldwide, studies that specifically focus on Swaziland are scanty. However, this paper will make use of other empirical studies that have been undertaken worldwide.

2.1 Theoretical Literature

2.1.1 The traditional Phillips curve
In 1958, A.W. Phillips introduced the Phillips Curve, which postulates a trade-off between inflation and unemployment. The Phillips curve representation states that a lower inflation rate will tend to be associated with a higher level of unemployment, and vice-versa. The econometric specification of this relationship can be written as:

$$\pi_t = \alpha \pi_{t-1} + \beta (U_t - U^*) + \varepsilon_t$$

where \( \pi_t \) denotes the inflation rate, \( U_t \) is the log of unemployment or output, \( U^* \) is the steady-state value of unemployment or output, and \( \varepsilon_t \) is a random disturbance term.

The traditional Phillips curve may be subject to the Lucas critique. Estimated parameters are likely to change as the policy regime varies. This led to the introduction of the so-called Friedman-Phelps Accelerationist Phillips Curve (APC) where there is no long-run trade-off between inflation and unemployment as presented below:

$$\pi_t = \gamma (U_t - U^*) + \pi^e_t$$

Where inflation, \( \pi_t \), is negatively correlated with deviations of the unemployment rate from its natural rate \( U^* \), and where the entire curve is shifted up or down one-for-one with changes in \( \pi^e_t \) (the expected rate of inflation). However, expectations of inflation were modelled as some function of past inflation (e.g. adaptive expectations), at its simplest just one lag of inflation. Therefore in practice inflation depended on lagged inflation and the output gap, hence the above equation becomes:

$$\pi_t = \gamma (U_t - U^*) + \pi_{t-1},$$

where all the variables are as previously determined.

2.1.2 The New Keynesian Phillips Curve
Different authors have augmented the univariate Phillips curve relationship with inflation expectations, thereby avoiding the implication that there is a long-run trade-off between lower unemployment and higher inflation (Norman and Richards, 2010). Gali and Gertler (1999) were among authors who introduced the New Keynesian Phillips Curve (NKPC), which had current inflation depending on some measure of the output or unemployment gap and the expected value of inflation in the next period. Hence the resulting inflation equation (NKPC) then makes the inflation rate, \( \pi_t \), to depend on either the output gap or unemployment gap and expected future inflation, \( E_t \pi_{t+1} \). Thus the NKPC is presented as follows:
\[ \pi_t = \alpha E_t \pi_{t+1} + \beta (U_t - U^*_{t}) + \epsilon_t \]

where \( U \) is the unemployment rate. The only difference between the formulation of the new and the traditional Phillips curve lies in the fact that the former relies on expectation of the future, rather than past inflation to determine current inflation.

### 2.1.3 The Hybrid Phillips curve

The explanatory power of the NKPC was improved drastically when Galí and Gertler (1999) introduced additional features in the pure forward looking NKPC. They added the past values of inflation as an explanatory variable, and further used real unit labor cost other than the output gap to proxy for marginal cost. The resulting formulation was referred to as the hybrid NKPC, as it displays features of both the traditional and the new Phillips curve of the form:

\[ \pi_t = \alpha E_t \pi_{t+1} + \beta (U_t - U^*_{t}) + \mu \pi_{t-1} + \epsilon_t \]

Where the variables are as explained before. The major difference in this hybrid NKPC is the addition of the term \( \mu \pi_{t-1} \), which are the lagged values of current inflation. Furthermore there must be the restriction that \( \alpha + \mu = 0 \) to rule out a long run trade-off between the past and expected inflation variables.

### 2.1.4 The triangle Model

According to the new Keynesian theories, one of the drawbacks of the standard Phillips curve was identified as the failure to explain the behavior of inflation in some eras. In light of this dilemma, Gordon (1982) developed the empirical triangle model. That was after the US experienced the first oil shock between 1973-1975 which caused inflation and unemployment to be positively correlated. This model was in reference to the three basic determinants of the inflation rate: inertia, demand, and supply. The general specification of this model can be written as:

\[ \pi_t = a(L)\pi_{t-1} + b(L)D_t + c(L)z_t + \epsilon_t \]

where lower-case letters designate first differences of logarithms, upper-case letters designate logarithms of levels, and \( L \) is a polynomial in the lag operator. The dependent variable is the inflation rate and a series of lags on the inflation rate \( \pi_{t-1} \) conveys inertia. \( D_t \) is an index of normalized excess demand, \( z_t \) is a vector of normalized supply shock variables, and \( \epsilon_t \) is a serially uncorrelated error term. Stock and Watson (2008) presented the The Auto-regressive Distributed Lag (ADL) Phillips Curve Phillips curve as the version of the Gordon (1982) triangle model without the supply shock variables and presented it as:

\[ \pi_t = a(L)\pi_{t-1} + b(L)U_t + \epsilon_t, \]

where all the variables are as explained before.

### 2.2 Empirical Literature

Stock and Watson (2006) could not have put it any better when they stated that inflation has become both harder and easier to forecast. They state that it's easier because inflation has become less volatile than it was in the 1970's and the root mean squared error (RMSE) of naïve inflation forecasts has declined. They further state that it is hard to forecast due to less improvement in percentage terms of standard multivariate forecasting models over univariate benchmarks, hence it has become much difficult for inflation forecasters to provide value added beyond a univariate model. Although this assertion was based on the US data, it is quite true to the rest of the world. It is for that reason that forecasters have persistently tried different models in forecasting inflation, deriving mixed results.

Several authors have tried different approaches in forecasting inflation. Engert and Hendry (1998) improved the M1-based vector error-correction model (VECM)
developed by Hendry (2008), by imposing a set of equilibrium conditions to better anchor the long run behavior of interest rates, the exchange rate and the output gap in the model. They found that this extended-VECM provide considerable leading information about forecasting the eight-quarter inflation rate with relatively small errors.

Alturki and Vtyurina (2010) explained the short and long term dynamics and inflation forecasts in Tajikistan using the VECM and autoregressive moving average (ARMA). Their results show that the ARMA model out-of-sample forecast clearly outperforms the forecasts of the VECM, possibly due to the limited sample used in the VECM. Engert and Hendry (1998) improved the M1-based vector error-correction model (VECM) developed by Hendry (2008), by imposing a set of equilibrium conditions to better anchor the long run behavior of interest rates, the exchange rate and the output gap in the model. They found that this extended-VECM provide considerable leading information about forecasting the eight-quarter inflation rate with relatively small errors. Alturki and Vtyurina (2010) explained the short and long term dynamics and inflation forecasts in Tajikistan using the VECM and autoregressive moving average (ARMA). Their results show that the ARMA model out-of-sample forecast clearly outperforms the forecasts of the VECM, possibly due to the limited sample used in the VECM.

Biswa et al. (2010) developed a forecasting model for inflation as well as Index of Industrial Production (IIP) growth in a multivariate time series Bayesian framework, known as Bayesian Vector Autoregressive (BVAR) Model. They argued that the main advantage of using this model is the incorporation of prior information which may boost the forecasting performance of the model. Using the quarterly data on wholesale price index (WPI), narrow money (M1) and IIP during the period of first quarter of 1994-95 (Q1: 1994-95) to last quarter of 2007-08 (Q4: 2007-08), a VAR was developed and subsequently using Minnesota prior or Litterman’s prior proposed by Litterman in 1980, a BVAR model was developed. Based on the comparison of forecasting performance of a VAR and BVAR model, measured in terms of out-of-sample percentage root mean square error (RMSE), they found that BVAR model performed better than VAR model in the case of inflation as well as IIP growth forecast.

Other authors who assessed the performance of the BVAR against other models includes Kenny et al. (2008), Giannone et al. (2010), Cuaresma et al. (2009) and Huang (2012). Kenny et al. (2008), focused on the development of multiple time series models for forecasting Irish Inflation. They employed the BVAR, which allows the estimated models to combine the evidence in the data with any prior information which may also be available. A large selection of inflation indicators were assessed as potential candidates for inclusion in a BVAR. The results confirm the significant improvement in forecasting performance which can be obtained by the use of Bayesian techniques over the other forecasting models.

Giannone et al. (2010) constructed a large Bayesian Vector Autoregressive model (BVAR) for the Euro Area that captures the complex dynamic inter-relationships between the main components of the Harmonized Index of Consumer Price (HICP) and their determinants. They evaluated the model in real time and found that it produces accurate forecasts than other multivariate models.

Akdogan et al. (2012) produced short-term forecasts for inflation in Turkey, using a large number of econometric models such as the univariate ARIMA models, decomposition based models, a Phillips curve motivated time varying parameter model, a suit of VAR and Bayesian VAR models and dynamic factor models. Their result suggests that the
models which incorporate more economic information outperformed the random walk model at least up to two quarters ahead.

3.0 METHODOLOGY

3.1 Overview
The review of literature on the various models for inflation forecasting has shed some light on the ideal approach on which family of models to analyze and come out with the best model for forecasting inflation in Swaziland. From the literature review, this study draws up four models to be analysed for their forecasting performance against two benchmarks.

3.2.1 The Vector Autoregression Model (VAR)
The first model under this category is the Vector Autoregression Model (VECM), which is from the vector autoregression (VAR) family of models introduced by Sims (1980). The mathematical representation of a VAR is:

\[ y_t = \beta_1 y_{t-1} + \beta_2 y_{t-2} + \cdots + \beta_k y_{t-k} + \gamma x_t + \epsilon_t \]

where \( y_t \) is a vector of endogenous variables, \( x_t \) is a vector of exogenous variables, \( \beta_1, \ldots, \beta_k \) and \( \gamma \) are matrices of coefficients to be estimated, and \( \epsilon_t \) is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables. A VECM therefore is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. Therefore the first step consists of testing for cointegration among the variables which requires pretesting of the stationarity property of the time series.

3.2.2 Unit root tests and Cointegration
There are various tests for identifying nonstationarity or the presence of unit roots in time series data, however this study limited itself to the Augmented Dickey-Fuller (1979) and Phillips-Perron (1988) tests. Gujarati (2003) suggests that cointegration of two or more times series indicates the presence of a long-run or equilibrium relationship between them. Acknowledging the existence of different approaches, the Johansen approach was used to test for cointegration. Lag length selection criterions used are the Schwartz Information Criterion (SIC) and the Akaike Information Criterion (AIC).

3.2.3 The Vector Error Correction Model (VECM)
When cointegration is found to exist among the variables in a VAR, then a vector error-correction model (VECM) can be estimated. The VECM has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The VECM therefore can be specified as:

\[
\Delta y_t = \Pi y_{t-k} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + \cdots + \Gamma_{k-1} \Delta y_{t-(k-1)} + \epsilon_t
\]

where \( \Pi = (\sum_{i=1}^{k} \beta_i) - I_n \) and \( \Gamma_i = (\Sigma_{j=i}^{k} \beta_i) - I_n \), \( I \) is the identity matrix, \( \Pi \) is the long run coefficient matrix, and \( \Gamma \) is the short run dynamic.

3.2.4 The Bayesian Vector Autoregression Model (BVAR)
The BVAR is in the family of the VAR models; however it differs by imposing restrictions on the parameters of the VAR. This ideology of imposing restrictions in econometric estimations is available in Bayesian Statistics by the way of prior information on parameters of interest. Hence the idea behind the BVAR is to impose restrictions (shrinkage) by the way of prior information
on coefficients of the VAR. Therefore in BVAR model, the coefficients are considered as variables with some known distribution called prior distributions.

In this study a BVAR model for Swaziland will be developed which will allow for interactions between the major macroeconomic variables and further produce inflation forecasts which will be compared with results from other forecasting models.

Despite the abundance of the priories in literature, many authors found that the Litterman prior outperforms the other priories. For example Huang (2012) found that the Minnesota prior of Litterman (1986) is the best among all priors considered when forecasting Chinese inflation and output. Furthermore the Minnesota prior is fine-tuned to most macroeconomic data in particular something that shows why Bayesian VARS can provide more freedom to modelers by allowing subjective as well as objective fine tuning (Litterman, 1986). In that regard, this study will use only the Litterman or Minnesota prior in estimating the BVAR.

3.2.5 The Autoregressive Distributed Lag (ARDL) Phillips Curve

The ARDL model can be used to empirically analyse the long-run relationships and dynamic interactions among the variables of interest in a model. The model can be estimated by using the ARDL bounds test cointegration procedure, developed by Pesaran et al. (2001). The ARDL bounds test is based on the assumption that the variables are I(0) or I(1). So, before applying this test, we determine the order of integration of all variables using the unit root tests. The objective is to ensure that the variables are not I(2) so as to avoid spurious results. In the presence of variables integrated of order two, we cannot interpret the values of F statistics provided by Pesaran et al. (2001).

The ARDL Phillips curve model used in this study will follow that in Stock and Watson (2008) and be presented as follows:

\[
\Delta \text{log } CPI_t = a_0 + b_1 \text{log } CPI_{t-1} + b_2 \text{OPG}_t + \sum_{i=1}^{p} c_i \Delta \text{log } CPI_{t-i} + \sum_{i=1}^{p} d_i \Delta \text{OPG}_{t-i} + \epsilon_t
\]

Where \(\Delta\) is the difference operator, \(\text{log } CPI_t\) is the logarithm of Swaziland CPI and \(\text{OPG}_t\) is the logarithm of output minus the logarithm of potential output, and \(\epsilon_t\) is the error term. The first step in the ARDL bounds approach is to estimate the above equation by ordinary least squares (OLS). This would test for the existence of a long-run relationship among the variables by conducting an F test for the joint significance of the coefficients of the lagged levels of the variables. The null hypothesis to be tested is \(b_1 = b_2 = 0\) against the alternative \(H_1: c_i = d_i = 0\). Two sets of critical values for a given significance level can be determined (Pesaran et al., 2001). The first level is calculated on the assumption that all variables included in the ARDL model are integrated of order zero, while the second one is calculated on the assumption that the variables are integrated of order one. The null hypothesis of no cointegration is rejected when the value of the test statistic exceeds the upper critical bounds value, while it is accepted if the F-statistic is lower than the lower bounds value. Otherwise, the cointegration test is inconclusive.

Whenever the existence of a long-run relationship is found, the short-run dynamic parameters can be obtained by estimating an error correction model associated with the long-run estimates. Thus, an error correction
model will be specified as follows:

$$\Delta \text{log} \text{CPI}_t = \sum_{i=1}^{p} b_i \Delta \text{log} \text{CPI}_{t-i} + \sum_{i=1}^{p} c_i \Delta \text{log} \text{OPG}_{t-i} + \sum_{i=1}^{p} d_i \Delta \text{log} \text{OIL}_{t_i} + \epsilon_t$$

Where $ci$ and $di$ are the short run dynamic coefficients of the model’s convergence to equilibrium and $\alpha$ is the speed of adjustment. Once the ECM model has been estimated, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests are applied to assess the parameter stability (Pesaran et al., 1997).

3.2.6 The Triangle Model Phillips Curve
The fourth and last model under the theory based models whose forecasting ability will be tested is the Triangle model Phillips curve which was developed by Gordon (1982), which is based on three basic determinants of inflation rate, namely; inertia, demand, and supply. The major difference with the ADRL Phillips curve is that the latter includes only the demand shock, whereas the triangle model also includes supply shock variables. Following Gordon (1997) the specification of the triangle model which will be used in this paper is as follows:

$$\Delta \text{log} \text{CPI}_t = \sum_{i=1}^{p} b_i \Delta \text{log} \text{CPI}_{t-i} + \sum_{i=1}^{p} c_i \Delta \text{log} \text{OPG}_{t-i} + \sum_{i=1}^{p} d_i \Delta \text{log} \text{OIL}_{t_i} + \epsilon_t$$

Where the lagged rate of inflation $\text{CPI}_{t-i}$ conveys inertia, $\text{OPG}_{t-i}$ are the lags of the logarithm of output minus the logarithm of potential output, which is the proxy for excess demand, $\text{OIL}_{t-i}$ are the lags of oil prices, which is a proxy for the supply shock variable. This specification predicts steady inflation when the output gap and the supply shock terms are all zero, and hence it is always estimated without a constant term (Gordon, 2009). This model will be estimated by ordinary least squares (OLS).

3.3 The naive benchmark models

3.3.1 The Autoregressive Moving Average (ARMA)
The first benchmark model to be used in the study is the Autoregressive Moving Average (ARMA). This model combines both autoregressive (AR) and moving average (MA) terms. It basically states that the time series behavior of a variable is largely determined by its own value in the preceding period and the value of the immediate past error. The general form of the ARMA model as presented in Asteriou and Hall (2007) is an ARMA $(p, q)$ model of the form;

$$y_t = \mu + \sum_{i=1}^{p} y_i y_{t-1} + \epsilon_t + \sum_{i=1}^{q} \theta_i \epsilon_{t-1}$$

Where $\mu$ is a constant, $\gamma_i$ is the coefficient for the lagged autoregressive term, $\theta_i$ and is the coefficient of the lagged moving average term. Whenever the data for $y_t$ is non-stationary and integrated of order one, the model becomes an ARIMA model, where the $I$ denotes integration. For the Swaziland model, $y_t$ refers to the CPI inflation.

3.3.2 The random-walk model proposed by Atkeson-Ohanian (2001)
The second benchmark is the Atkeson-Ohanian (2001) random walk model, in which the forecast of the four-quarter rate of inflation is the average rate of inflation over the previous four quarters. The Atkeson-Ohanian model thus is presented as:

$$\pi_{t+4} = \pi_t + \epsilon_{t+4}$$

Where $\pi_{t+4}$ is the four quarter ahead rate of inflation.
3.4 Pseudo out-of-sample forecast methodology.
All forecasts will be computed using the pseudo out-of-sample forecast methodology, that is, for a forecast made at date $t$, all estimation, lag length selection, etc, will be performed using only data available through date $t$. The forecasts in this section will be recursive, so that forecasts at date $t$ are based on all available data from the initial period, which is 1990:Q1 in this study through date $t$, which is 2013:Q4. This period will be used for parameter estimation. The forecast horizon will be 2014:Q1 to 2015:Q4, which is eight quarters ahead.

3.5 Forecast Evaluation
Pseudo out-of-sample forecast evaluation captures model specification uncertainty, model instability, and estimation uncertainty, in addition to the usual uncertainty of future events (Stock and Watson, 2008). Therefore the performance evaluation of the competing models is to determine which of them are more precise and reliable for forecasting headline inflation over the eight quarter forecast horizon. The quality of the obtained forecasts will be tested using four classical statistical loss functions: Mean Absolute Error (MAE), Mean Absolute Percent Error (MAPE), the Root Mean Squared Error (RMSE), and the Thiel's Coefficient.

3.6 Forecast Combination
Bates and Granger (1969) introduced the idea that a combination of forecasts outperforms any individual forecast, as different models have their own merits. Acknowledging the existence of different approaches to combine forecasts, in this study the Combination Test of Chong and Hendry (1986) and refined by Timmermann (2006) will be used. The idea underlying this test is that if a single forecast contains all information contained in the other individual forecasts. The forecasts will be combined in pairs to produce three forecast combinations. The forecasts from the VECM will be combined with those of the BVAR, and the benchmarks combined together.

3.8 Data
All the data to be used in this study are secondary data which will be sourced from the Central Bank of Swaziland (CBS) and the Central Statistical Office (CSO). Data transformation will be carried out where necessary. Since the study will use quarterly data, annual data like GDP will be disaggregated to quarterly while monthly data like inflation will be aggregated to quarterly.

4.0 FINDINGS AND DISCUSSIONS
4.1 Unit Root Tests
According to Granger (1969), stationarity tests are the pre-tests for avoiding spurious regressions. They are the starting point in any cointegration analysis as well as regression analysis. A series is said to be nonstationary if it contains a unit root, hence testing for stationarity is simple testing for the presence of a unit root in a series. In nonstationary series, the order of integration is determined by the number of times it has to be differenced to attain stationarity. One way of testing for stationarity or otherwise is through graphical inspection of the series to be used in the estimations. The graphical analysis serves as a benchmark for the formal measure of unit root. The figure below shows the graphs of the variables to be used in this paper.
The graphs on Figure 4 show that it is apparent that the series are non-stationary at levels. The conclusion of non-stationarity is arrived at after observing that none of the graphs fluctuate around a zero mean, an indication of stationarity. The other characteristic of the series is that most of the variables show a sign of a trend. The problem with the visual inspection technique is that the approach is very subjective, hence the need to use statistical techniques to reach a proper conclusion.

4.1.1 Augmented Dicky Fuller (ADF) and Phillips-Perron (PP) Unit Root Tests
Acknowledging the existence of different types of unit root tests, this paper utilizes the ADF and the PP unit root tests. The reason for that is that they are very popular in literature and very easy to apply and understand, and to further compare the results.

The number of lags included in the tests is based on the Akaike Information Criterion (AIC) automatic selection. The test results show that all the variables, save for the 3 months deposit rate and output gap whose stationarity was found to be I(0), were found to be nonstationary at levels and had to be differenced once to attain stationarity.

4.2 Cointegration
After determining the order of integration of the variables, the next step is to determine whether there is cointegration between the variables. This is to establish if the linear relationship of the variables is stationary. If the null hypothesis of no cointegration is rejected then the linear combination of the variables is stationary, hence a non-spurious long-run relationship exists between the variables and as such, consistent estimates of the long run relationship is evident. To test for cointegration between these variables, the Johansen test is applied. The first step in conducting the test was to identify the optimal lag length, where results chose 2 as the optimal lag length. From literature and the structure of the Swaziland economy, the most preferred variables which will be used as the predictors of inflation in the VAR are the US dollar, the three months deposit rate, private sector credit, crude oil prices, money supply, South Africa CPI and Swaziland CPI. Cointegration results conclude the existence of a long run relationship among the variables, and we go on to estimate the Vector Error Correction Model (VECM).

4.2.1 The Vector Error Correction Model (VECM)
Given that the variables are co-integrated, one can proceed to estimate the VECM model. The VECM contains information on both the long run and short run relationships between the variables. The cointegrated variables must have an error correction representation in which an error correction term (ECT) must be incorporated into the model. Accordingly, a VECM is formulated to reintroduce the information lost in the differencing process, thereby allowing for long-run equilibrium as well as short-run dynamics (Ang and McKibbin, 2006). The results from the best model, which involves only four variables of the ECM (Swaziland CPI, RSA CPI, credit extension, and money supply), are shown below. The results show that money supply, credit extension, and
Swaziland CPI affects the direction of local CPI after 2 lags, whereas RSA CPI affects it after 1 lag in the short run. Furthermore, the speed of adjustment towards equilibrium is 30 per cent as shown by the coefficient of the ECM. That means about 30 per cent of any disturbance from equilibrium is corrected every quarter.

Table 2: ECM Model Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(LSDCPI(-1))</td>
<td>0.038855</td>
<td>0.10020</td>
<td>0.38776</td>
</tr>
<tr>
<td>D(LSDCPI(-2))</td>
<td>0.281508</td>
<td>0.09856</td>
<td>2.85615</td>
</tr>
<tr>
<td>D(LSACPI(-1))</td>
<td>0.57484</td>
<td>0.14720</td>
<td>3.90512</td>
</tr>
<tr>
<td>D(LSACPI(-2))</td>
<td>-0.137704</td>
<td>0.15622</td>
<td>-0.88147</td>
</tr>
</tbody>
</table>

Table 3: Results of diagnostic tests

<table>
<thead>
<tr>
<th>Significance</th>
<th>X2 statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breusch-Godfrey serial correlation LM test</td>
<td>17.34</td>
<td>0.36</td>
</tr>
<tr>
<td>White Heteroskedasticity test</td>
<td>578</td>
<td>0.12</td>
</tr>
<tr>
<td>Jarque-Bera test</td>
<td>5.55</td>
<td>0.70</td>
</tr>
<tr>
<td>Ramsey RESET test (log likelihood ratio)</td>
<td>0.14</td>
<td>0.72</td>
</tr>
</tbody>
</table>

4.3 The Bayesian VAR
The BVAR used in this paper arise from the same variables which were used in the VECM. Furthermore since cointegration was found to exist among the variables, we proceed to estimate the BVAR, by applying the Litterman/Minnesota prior as explained in the methodology that they are the most common in literature. A key issue in the estimation of Bayesian VARs is the choice of hyper-parameters which determine overall tightness, the tightness on the prior mean of zero on cross lags in each equation, and the decay parameter. A complete search over all possible hyper-parameters is not justifiable as it merely transfers the problem of over-parameterization to one of two many hyper parameters to estimate. For the purpose of this study, the decay parameter was therefore set equal cross-variable weight to 0.99; which are commensurate with the Minnesota prior. The results are in the table below.

Table 4: BVAR Model results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(LSDCPI(-1))</td>
<td>0.619348</td>
<td>0.05644</td>
<td>10.9744</td>
</tr>
<tr>
<td>D(LSDCPI(-2))</td>
<td>0.100586</td>
<td>0.04251</td>
<td>2.36605</td>
</tr>
<tr>
<td>D(LSACPI(-1))</td>
<td>0.319830</td>
<td>0.07675</td>
<td>4.16703</td>
</tr>
<tr>
<td>D(LSACPI(-2))</td>
<td>-0.034866</td>
<td>0.06319</td>
<td>-0.55172</td>
</tr>
<tr>
<td>D(LPSCR(-1))</td>
<td>0.022807</td>
<td>0.01082</td>
<td>2.10754</td>
</tr>
<tr>
<td>D(LPSCR(-2))</td>
<td>-0.000331</td>
<td>0.00881</td>
<td>-0.03754</td>
</tr>
<tr>
<td>D(LM2(-1))</td>
<td>-0.007342</td>
<td>0.01352</td>
<td>-0.54297</td>
</tr>
<tr>
<td>D(LM2(-2))</td>
<td>0.000390</td>
<td>0.01218</td>
<td>0.03204</td>
</tr>
</tbody>
</table>

4.4 The Autoregressive Distributed Lag (ARDL) Phillips Curve
The ARDL Phillips curve model can be estimated by using the ARDL bounds test...
The ARDL bounds test is based on the assumption that the variables are I(0) or I(1), but not I(2). The variables which were used in this model are inflation and output gap. From the unit roots tests previously performed, both these variables were found to be I(0). From literature, it is believed that there is a positive relationship between inflation and some lags of output gap, meaning a rise in inflation is associated with lagged rise in output although with some lags. The AIC lag length selection criterion was used and the model estimated is an ARDL (5, 1). The bounds test for cointegration results are shown below.

Table 5: Bounds test for cointegration

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>k</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>8.046502</td>
<td>1</td>
</tr>
</tbody>
</table>

Critical Value Bounds

<table>
<thead>
<tr>
<th>Significance</th>
<th>I0 Bound</th>
<th>I1 Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>4.04</td>
<td>4.78</td>
</tr>
<tr>
<td>5%</td>
<td>4.94</td>
<td>5.73</td>
</tr>
<tr>
<td>2.5%</td>
<td>5.77</td>
<td>6.68</td>
</tr>
<tr>
<td>1%</td>
<td>6.84</td>
<td>7.84</td>
</tr>
</tbody>
</table>

Table 7: Short Run Model Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(INFL(-1))</td>
<td>0.013989</td>
<td>0.1017</td>
<td>0.137435</td>
<td>0.8910</td>
</tr>
<tr>
<td>D(INFL(-2))</td>
<td>0.238988</td>
<td>0.1006</td>
<td>2.374740</td>
<td>0.0199</td>
</tr>
<tr>
<td>D(INFL(-3))</td>
<td>0.143380</td>
<td>0.1017</td>
<td>1.408644</td>
<td>0.1627</td>
</tr>
<tr>
<td>D(INFL(-4))</td>
<td>-0.226114</td>
<td>0.1034</td>
<td>-2.185729</td>
<td>0.0317</td>
</tr>
<tr>
<td>D(GGGAP)</td>
<td>0.004322</td>
<td>0.0019</td>
<td>2.264026</td>
<td>0.0262</td>
</tr>
</tbody>
</table>

It is interesting to note that from these results, the Phillips curve could exist in the short run in Swaziland data as the coefficient of the output gap carries the correct sign and is significant. That contradicts the results of the long run equation that the Phillips curve does not exists in the Swaziland data. On the other hand the speed of adjustment was found to be significant and carries the correct sign, meaning that about 14 per cent of any disequilibrium is corrected every quarter. For the purpose of this paper, this model was then subjected to various diagnostic tests to assess its suitability for forecasting. Results of these tests are shown in the table below.

Table 8: Results of diagnostic tests

<table>
<thead>
<tr>
<th>Significance</th>
<th>X2 statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breusch-Godfrey serial correlation LM test</td>
<td>0.828</td>
<td>0.51</td>
</tr>
<tr>
<td>White Heteroskedasticity test</td>
<td>2.14</td>
<td>0.04</td>
</tr>
<tr>
<td>Jarque-Bera test</td>
<td>31.98</td>
<td>0.00</td>
</tr>
<tr>
<td>Ramsey RESET test (log likelihood ratio)</td>
<td>0.367</td>
<td>0.55</td>
</tr>
</tbody>
</table>
From these results, it was observed that the model could not pass all the tests, as it fails the normality and heteroskedasticity tests, as shown by the probabilities of 0.00 and 0.04, respectively, in the table. Regardless of that, the model stability was tested for stability by the CUSUM and CUSUM of squares as shown in the figures below.

![CUSUM and CUSUM of squares](image)

The results indicate the absence of any instability of the coefficients because the plot of the CUSUM and CUSUMSQ statistic generally fall inside the critical bands of the 5 percent confidence interval of parameter stability, indicating the stability of the model.

4.5 The Triangle model Phillips Curve

The Triangle model Phillips curve was developed by Gordon (1982), and is based on three basic determinants of inflation rate, namely; inertia, demand, and supply. The major difference with the ADRL Phillips curve is that the latter includes only the demand shock, whereas the triangle model also includes supply shock variable, which in this case are commodity prices, proxied by oil prices. Cointegration in this model was tested through the Engel and Granger (1969) two step approach. Cointegration in this case are commodity prices, proxied by oil prices. Cointegration in this model was tested for stability by the CUSUM and CUSUM of squares as shown in the figures below.

![CUSUM and CUSUM of squares](image)

From the results above, it was observed that both the demand shock and supply shock variables were insignificant and carried the wrong signs. This was expected due to the non-existent of the Phillips curve in the Swazi data. Testing for cointegration shows that the variables are cointegrated as the residuals from this equation were found to be stationary at levels. Performing diagnostic tests shows that the model suffers from serial correlation and the residuals are not normally distributed, however the model passes heteroskedasticity and stability tests.

![CUSUM and CUSUM of squares](image)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFL(-1)</td>
<td>0.8869</td>
<td>0.0506</td>
<td>17.49505</td>
<td>0.0000</td>
</tr>
<tr>
<td>GGAP(-1)</td>
<td>-0.0135</td>
<td>29.114</td>
<td>-0.137856</td>
<td>0.8907</td>
</tr>
<tr>
<td>DLOIL</td>
<td>-0.2173</td>
<td>0.9577</td>
<td>-0.226994</td>
<td>0.8209</td>
</tr>
<tr>
<td>C</td>
<td>0.8839</td>
<td>0.4481</td>
<td>1.972379</td>
<td>0.0516</td>
</tr>
</tbody>
</table>

4.6 The naive benchmark models

4.6.1 The Autoregressive Moving Average (ARMA)

The first benchmark model which was used in the study is the Autoregressive Moving Average (ARMA). This model combines both autoregressive (AR) and moving average (MA) terms. Whenever the series to be forecasted is not stationary and integrated of, say order one, then the model becomes ARIMA. The Box-Jenkins approach was used in model selection, and the final model selected was the ARIMA (2,1,2), results of which are shown below.
Therefore the performance evaluation of four models against the two benchmarks.

4.7.1 In-sample evaluation (1990Q1 to 2013Q4)
The first step in in-sample evaluation is to visually inspect the movements of all the forecasts against the actuals as shown in the figure below. A closer look at the graph shows that all the forecasts tracks the movements of the actuals in the in-sample period.

4.6.2 The random-walk model proposed by Atkeson-Ohanian (2001)
The second benchmark model is the Atkeson-Ohanian (2001) random walk model, in which the forecast of the four-quarter rate of inflation is the average rate of inflation over the previous four quarters. The Atkeson-Ohanian model results are presented below.

Table 12: Atkeson-Ohanian model results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.705617</td>
<td>0.423296</td>
<td>4.029371</td>
<td>0.0001</td>
</tr>
<tr>
<td>INF(-1)</td>
<td>0.913861</td>
<td>0.101097</td>
<td>9.039407</td>
<td>0.0000</td>
</tr>
<tr>
<td>INF(-2)</td>
<td>0.178800</td>
<td>0.137591</td>
<td>1.299501</td>
<td>0.1969</td>
</tr>
<tr>
<td>INF(-3)</td>
<td>-0.113476</td>
<td>0.137652</td>
<td>-0.824367</td>
<td>0.4118</td>
</tr>
<tr>
<td>INF(-4)</td>
<td>-0.194160</td>
<td>0.100256</td>
<td>-1.936643</td>
<td>0.0558</td>
</tr>
</tbody>
</table>

The lags two and three were found not to be statistically significant in the AO model, however we proceeded to use it for forecasting purposes and the forecasts from this model are compared to the actuals in the graph below.

4.7 Forecasts Evaluation
The major purpose of this paper is to evaluate the forecast performance of the four models against the two benchmarks. Therefore the performance evaluation of the competing models is to determine which of them are more precise and reliable for forecasting headline inflation over the eight quarter forecast horizon. The quality of the obtained forecasts will be tested using the previously stated four classical statistical loss functions: Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), Root Mean Square Error (RMSE), and the Theil’s Coefficient. These evaluations will be categorised into two; in-sample (1990Q1 to 2013Q4), and out-of-sample (2014Q1 to 2015Q4).

The model was then used to forecast inflation eight quarters ahead. The forecasts trace the actuals fairly well in-sample, with some divergence out-of-sample.
Eight quarters ahead out-of-sample (2014Q1 to 2015Q4)

The second step was to evaluate the models forecasting ability eight quarters ahead. Just like in the other evaluations, the first step is to visually inspect the movements of all the forecasts against the actuals in the eight quarter ahead forecasting period as shown in the figure below. A closer look at the graph shows that generally the forecasts track the movements of the actuals in the eight quarter ahead forecasting period, however all the models over-predicted inflation in the last four quarters as shown in the graph.

With visual inspection it is not very easy to identify the model which tracks the actuals better eight quarters ahead. In that regard, using the previously stated criterions and the mean square error as an averaging method, the table below shows conflicting results, with the RMSE choosing the BVAR while the other measures chose the AO model. Based on majority, we conclude that the AO model is the best model in forecasting inflation eight quarters ahead.

### Table 13: In-sample Evaluation statistics

<table>
<thead>
<tr>
<th>Forecast</th>
<th>RMSE</th>
<th>MAE</th>
<th>MAPE</th>
<th>Theil</th>
</tr>
</thead>
<tbody>
<tr>
<td>VECM</td>
<td>1.5932</td>
<td>1.217162</td>
<td>16.45786</td>
<td>0.093329</td>
</tr>
<tr>
<td>BVAR</td>
<td>1.7069</td>
<td>1.288774</td>
<td>16.55504</td>
<td>0.100007</td>
</tr>
<tr>
<td>PHILIPS</td>
<td>1.3424</td>
<td>0.996753</td>
<td>13.06176</td>
<td>0.078916</td>
</tr>
<tr>
<td>TRIANGLE</td>
<td>1.2337</td>
<td>0.914317</td>
<td>12.36371</td>
<td>0.072342</td>
</tr>
<tr>
<td>ARIMA</td>
<td>1.4492</td>
<td>1.081336</td>
<td>14.81903</td>
<td>0.084847</td>
</tr>
<tr>
<td>AOM</td>
<td>1.3543</td>
<td>1.009655</td>
<td>13.31094</td>
<td>0.079596</td>
</tr>
<tr>
<td>Mean square error</td>
<td>1.3318</td>
<td>0.995632</td>
<td>12.99070</td>
<td>0.078217</td>
</tr>
</tbody>
</table>

### Table 14: Out-sample Evaluation statistics

<table>
<thead>
<tr>
<th>Forecast</th>
<th>RMSE</th>
<th>MAE</th>
<th>MAPE</th>
<th>Theil</th>
</tr>
</thead>
<tbody>
<tr>
<td>VECM</td>
<td>1.392668</td>
<td>1.307597</td>
<td>25.42017</td>
<td>0.123055</td>
</tr>
<tr>
<td>BVAR</td>
<td>0.809370</td>
<td>0.680443</td>
<td>12.64060</td>
<td>0.074615</td>
</tr>
<tr>
<td>PHILIPS</td>
<td>1.391884</td>
<td>1.123842</td>
<td>20.38211</td>
<td>0.138399</td>
</tr>
<tr>
<td>TRIANGLE</td>
<td>1.525228</td>
<td>1.087103</td>
<td>19.32947</td>
<td>0.153205</td>
</tr>
<tr>
<td>ARIMA</td>
<td>0.931882</td>
<td>0.815626</td>
<td>15.12816</td>
<td>0.087513</td>
</tr>
<tr>
<td>AOM</td>
<td>0.825195</td>
<td>0.599974</td>
<td>11.66610</td>
<td>0.073780</td>
</tr>
<tr>
<td>Mean square error</td>
<td>0.852552</td>
<td>0.786239</td>
<td>14.70940</td>
<td>0.079648</td>
</tr>
</tbody>
</table>

In that regard, this section concludes with the findings that the VECM, BVAR, and Phillip curve models fails to beat the benchmarks, particularly the AO, in forecasting inflation for Swaziland, however the BVAR model did beat the benchmarks in the eight quarters ahead forecasts, albeit with only the RMSE measure. These results show that the BVAR, when correctly specified, can be a suitable model for forecasting inflation in Swaziland.

### 4.7.2 Forecast Combination

Economic forecasters often have a variety of different models and forecasts of the same variable from which to choose. These models and forecasts may differ in the underlying assumptions, or may employ different information. Traditionally the forecasting decision was to pick which single forecast was “best” out of the individual forecasts available. To test whether an average, or combination, of the individual forecasts may perform better than the individual forecasts themselves. Bates and Granger (1969) introduced the idea that a combination of forecasts outperforms any individual forecast, as different models have their own merits. In this study the Combination Test of Chong and Hendry (1986) and refined by Timmermann (2006) was used. The idea underlying this test is that if a single forecast contains all information contained in the other individual forecasts, that forecast will
be just as good as a combination of all of the forecasts.

In this study the forecasts were be combined in pairs to produce three forecast combinations. The forecasts from the VECM were combined with those of the BVAR, those from the ARDL Phillips curve with those from the triangle model Phillips curve, and the benchmarks combined together. The figure below shows the comparison of the forecasts combinations with the actual data in the eight quarters ahead and the graph below shows that the forecasts were tracking the actuals, except for the graph of the triangle and Phillips curve combination in the first four quarters. However by visual inspection, the Phillips curve combination was the best in the last four quarters.

Figure 8: Forecasts Combinations Comparisons

Again with visual inspection it is not very easy to identify the model combinations which tracks the actuals better eight quarters ahead. In that regard, using the previously stated criterions and the mean square error as an averaging method, the table below shows that the benchmark combination is the best model in forecasting inflation eight quarters ahead, as shown by the lowest values of all the measures, followed by the combination of the VECM and BVAR.

Table 15: Forecast Combination Evaluation Statistics

<table>
<thead>
<tr>
<th>Forecast</th>
<th>RMSE</th>
<th>MAE</th>
<th>MAPE</th>
<th>Theil</th>
</tr>
</thead>
<tbody>
<tr>
<td>VECMBVAR</td>
<td>0.9913</td>
<td>0.9147</td>
<td>17.38</td>
<td>0.0897</td>
</tr>
<tr>
<td>TRIANGLEPHILIPS</td>
<td>1.4455</td>
<td>1.1069</td>
<td>19.89</td>
<td>0.1444</td>
</tr>
<tr>
<td>AOARIMA</td>
<td>0.7168</td>
<td>0.6214</td>
<td>11.88</td>
<td>0.0659</td>
</tr>
<tr>
<td>Mean square error</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

From the results it is evident that the entire criterion gives figures which are less than those reported in the VECM, which confirms that the BVAR produces better forecasts than the VECM. These results further shows that while the model is good for forecasting earlier quarters from the RMSE and MAE, the opposite is true for the MAPE and Theil.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to identify a suitable inflation forecasting model ideal for small economies like Swaziland, eight quarters ahead. This was to be attained through evaluating the VECM and BVAR against the ARIMA and AO naïve benchmarks and ascertain which models forecast Swaziland inflation better eight quarters ahead.

The study used quarterly data between 1990Q1 to 2013Q4 to estimate the model coefficients and 2014Q1 to 2015Q4 to conduct forecasting exercises. The quality of the obtained forecasts was evaluated using four classical statistical loss functions: Mean Absolute Error (MAE), Mean Absolute Percent Error (MAPE), the Root Mean Squared Error (RMSE), and the Thiel’s Coefficient. The model which provides the smallest forecast error in the entire forecast horizon by all the performance measures therefore was selected as the best model.

When the models forecasting ability was evaluated in-sample, the AO model was
found to be the best, with lowest values of all the measures. Four quarters ahead forecasts evaluation selected the AO naïve benchmark as the best model. Results for the eight quarter ahead forecasts were mixed, with the RMSE selecting the BVAR while all the other measures selected the AO naïve benchmark. Generally the best model in this category is the AO naïve benchmark, followed by the BVAR.

Forecasts combinations were also performed. The forecasts from the VECM were combined with those of the BVAR, and the benchmarks combined together. Results showed that the best combination in tracking the actuals four quarters ahead were the benchmarks. The results further show that the combination of the VECM and BVAR performs better than each individual model and the AO performs better than its combination with the ARIMA to forecast inflation four quarters ahead.

Secondly, the model combinations forecasting ability was evaluated for eight quarters ahead. The benchmark combination was the best model in forecasting inflation eight quarters ahead, followed by the combination of the VECM and BVAR. Furthermore, the BVAR was found to perform better than its combination with the VECM to forecast inflation eight quarters ahead, while the AO model was found to perform better than its combination with the ARIMA only with the MAE and MAPE statistics. These results therefore suggest that the VECM and BVAR models are not better than the naïve models in forecasting inflation in Swaziland, however with the BVAR correctly specified, it can be a suitable model for forecasting inflation in Swaziland.

These results contradicts those by Akdogan et al. (2012) which suggested that the models which incorporate more economic information outperformed the random walk model at least up to two quarters ahead. This paper therefore suggests that the Central Bank of Swaziland should consider using the BVAR, over and above the naïve benchmarks in forecasting inflation. This conclusion is similar to that of Doan, Litterman, and Sims (1984), who found that BVAR performs better than the unrestricted vector autoregression models.

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Abstract

Inflation differentials within a currency union is a concern for policy makers as it may lead to misalignment of real interest and real exchange rates which can raise questions on the appropriateness of pursuing a common monetary policy and to some great extent it determines the long-run viability of a currency union. This paper studies inflation differential between Swaziland and South Africa mainly focusing on recent differential observed in the year 2016. A test for relative PPP to test for convergence between the two countries’ prices is tested using a Generalized Error Correction model. The results for a sample period of 1993 to 2016 (monthly data) show that relative PPP holds between the two countries with a long-run coefficient of 1.1, a contemporaneous pass-through effect of 51.7 per cent and an adjustment rate of 7.8 per cent. These coefficients are higher for most recent periods.

The paper also studies the selected trends of the CPI components to make inferences from both supply side and demand side inflation. From this analysis it is concluded that even though Swaziland faced a similar supply shock as South Africa in 2015/16, which was the El-nino-induced drought, the results and the adjustment mechanism to this shock were asymmetric. From the demand side, both fiscal and monetary policy were found to be relatively loose relative to South Africa, exerting demand-driven inflationary pressures particularly in the second half of 2016. Cognizant of the trade-off between nominal and real convergence, the paper recommends that inflation differential be incorporated in the Central Bank’s reaction function especially in times of positive inflation differential.

Key words: PPP Theory, inflation differential, B-S Effect

1.0 INTRODUCTION

Theoretically, under an optimum currency area; there is high integration of labour, product and capital markets and there is thus an expectation of equalization of prices within a currency union. According to Braun (2010) the convergence in prices is also expected due to the elimination of exchange rate risks, transaction costs and border effects as well as the pursuit of common monetary policy. In practise, however, such presumptions fail to hold Ridhwan (2015). As a result, understanding causes of inflation differential within a monetary union set-up has been one of the popular research areas particularly in the European Monetary Union (EMU) in recent years (such as; Haan, 2010, Rabanal, 2008 and Braun, 2010). Inflation differentials within a currency union is a concern for policy makers as it may lead to misalignment of real interest and real exchange rates which can raise questions on the appropriateness of pursuing a common monetary policy and to some great extent determines the long-run viability of a currency union.

Swaziland is part of a currency union - the Common Monetary Area (CMA) with tight geographic and economic links between Swaziland and South Africa. It is a general expectation that whatever happens in South Africa spills over to Swaziland especially in terms of economic developments. For
example, when economic growth slows in South Africa, it affects demand for Swazi exports (to South Africa) which are about 65 percent of the total and thus hampers growth in the domestic economy. With about 90 percent of total Swazi imports coming from or through South Africa, price developments in South Africa has a significant impact on domestic inflation developments through what can be termed as ‘high degree of imported inflation’. With the exchange rate, fixed on a one-to-one basis economic theory postulates that, based on a purchasing power parity hypothesis (PPP), Swaziland’s price movements should be similar to those of South Africa and any differential have implications for competitiveness of the country relative to South Africa on the basis of real exchange rate movements.

When the relative PPP holds, it supports harmony in monetary policy formulation and implementation especially for Swaziland within the context of the Common Monetary Area (CMA) wherein Swaziland has limited discretion for her monetary policy as its policy making is linked to that of the monetary union anchor, South Africa. Divergences in inflation outcomes for Swaziland and South Africa can complicate monetary policy for Swaziland. For example, if South African inflation is on a downtrend and Swaziland’s is on an upward trend, then South Africa has space to pursue an accommodative monetary policy but the Swaziland monetary policy would be a bit complicated. That is because even though they would like to pursue a contractionary policy to fight inflation, they need to be mindful of the South African policy whose stance has a stronger barring on Swaziland’s policy given the CMA set up of capital mobility and a fixed exchange rate.

Considering the tight economic links and the implication of inflation differential between Swaziland and South Africa for monetary policy, it is of constant interest to study the differential between Swaziland and South Africa inflation. Inflation developments and its dynamics evolve over time and the implications therefrom vary. The purpose of this paper is to investigate the reason for divergences in inflation trends between Swaziland and South Africa focusing on recent divergences observed in 2016. This would be done at two levels (i) economic theory - mainly testing the purchasing power parity between Swaziland and South Africa’s consumer prices; (ii) Subcomponents analysis covering methodological issues such as the role of weights in calculation of the consumer price index (CPI) and unpacking supply side and demand side inflation movements. Implications of inflation differentials on monetary policy are also unpacked.

2.0 REVIEW OF LITERATURE

According to Haan (2010) there are several factors that explain the size and dynamics of inflation differentials within a currency board. The factors which are not mutually exclusive include: ‘catch-up’ mechanism; business cycle differences, asymmetric demand and supply shocks and or asymmetric adjustment mechanism to common shocks; characteristics of domestic product; labour and other factor markets and wage and price rigidities. This section however covers a brief overview of theories that have been studied extensively in explaining inflation differential among countries. These are; the purchasing power parity hypothesis and the Balassa-Samuelson effect which mainly focuses on ‘catch-up’ mechanism.

2.1. The Purchasing Power Parity Hypothesis

In the post-First World War, the Purchasing Power Parity (PPP) emerged as the first attempt to determine a country’s equilibrium exchange rate with the notion that exchange rates tend to equalize relative price levels in different countries (Dedu & Dumitrescu, 2010). As noted by Taylor & Taylor (2004) the PPP approach emanate from ‘the Law of One Price’ (LOP) which states that any
commodity in a unified market has a single price. The LOP specification can be written as:

\[ P_t = EP^*_t \quad \text{Equation 1} \]

Where \( P_t \) and \( P^*_t \) are the prices of good in the home and foreign economy respectively, and \( E \) is the nominal exchange rate (domestic currency price of foreign currency). If the same basket of goods costs the same when prices are converted to common currency, then absolute purchasing power parity (APPP) prevails. However, the APPP tends to be vested on unrealistic assumptions such as (i) free trade (no barriers to trade), (ii) all goods being tradeable and (iii) that domestic and foreign price indices are composed of same commodities with identical weighting structure across countries. In light of these limitations the relative PPP theory is often used. Relative PPP prevails if the ratio of two broadly defined price indices stays constant after correcting for changes in the exchange rate. This can be presented as follows:

\[
\frac{(\Delta P_t/P_{t-1})}{(\Delta P^*_t/\Delta P^*_{t-1})} = \frac{(\Delta E_t/E_{t-1})}{E_{t-1}} \quad \text{Equation 2}
\]

This states that domestic inflation \((\Delta P/P_{t-1})\) is equal to the sum of foreign inflation \((\Delta P^*_t/\Delta P^*_{t-1})\) and currency depreciation \((\Delta E_t/E_{t-1})\). Equation 2 reflects that in a case of a currency board like the CMA where the exchange rate is pegged on a one to one basis it should be the case that if relative PPP holds then Swaziland’s inflation should move in tandem with that of South Africa. Empirical tests as noted by Wickremasinghe (2004) on relative PPP have yielded weak support especially under floating exchange rate regimes but consistent results have surfaced in cases whereby the adjustment process is depicted in a non-linear form\(^6\).

### 2.2. The Balassa-Samuelson Effect

The Balassa-Samuelson effect is typically used to explain inflation differential for countries facing catch-up process. According to Balassa (1964) and Samuelson (1964) as quoted by Coudert (2004) during the development process, productivity tends to increase more quickly in the tradable goods sector than in the non-tradeable (services) sector. Given that the prices of tradable goods are set by international competition, an increase in productivity in this sector leads to an increase in wages, which is not detrimental to competitiveness. Since this increase in wages spreads across the economy as a whole, there is a rise in relative prices in the non-tradable goods sector, where productivity has not grown at the same pace. Given that the price index is an average of these two sectors, there is an increase in the prices of domestic goods relative to those from abroad.

The B-S model can be formalized by decomposing the aggregate price level to traded and non-traded components for both domestic and abroad (*):

\[
P_t = \alpha p^*_t + (1 - \alpha)p^{NT}_t \quad \text{Equation 3}
\]

\[
p^*_t = \alpha^* p^*_t + (1 - \alpha^*)p^{NT*}_t \quad \text{Equation 4}
\]

\(^6\)Carolina, 2006 shows that evidence for PPP to hold is weaker when a linear relationship is assumed.
Where $p^T_t$ denotes the price of traded goods and $p^{NT}_t$ denotes the price of non-traded goods in each country. The real exchange rate is given by:

$$q_t = (e_t - p^T_t) - p_t \quad \text{Equation 5}$$

Where $e_t$ is the nominal exchange rate expressed in units of domestic currency per unit of foreign currency.

Given the tradeable and non-traded goods an expression of movements in relative prices in terms of productivity differentials between traded and non-traded goods assuming perfect is given as follows:

$$p^{NT} - p^T = c + \left(\frac{\delta}{\gamma}\right) a^T - a^{NT} \quad \text{Equation 6}$$

Where $a^T$ and $a^{NT}$ represents productivity growth for the tradeable and non-tradeable sector. $\delta$ and $\gamma$ represent the share of labour in the non-tradeable and tradable sector respectively. Combining equation 3,4,5 and 6 yields the following inflation differential model.

$$\Delta p_t - \Delta p^*_t = \Delta e_t + (1 - \alpha_t) \left[\left(\frac{\delta}{\gamma}\right) \Delta a^T_t - \Delta a^{NT}_t\right] - (1 - \alpha^*_t) \left[\left(\frac{\delta}{\gamma}\right) \Delta a^T_* - \Delta a^{NT*}_t\right] \quad \text{Equation 7}$$

From a B-S model as noted by Mihaljek (2002) the on the basis of equation 7, inflation differential between domestic country and abroad would be expressed as a sum of the nominal exchange rate depreciation and the weighted average of the productivity growth differentials between the tradeable and non-tradeable goods sector of the domestic country ($\Delta a^T_t - \Delta a^{NT}_t$) and that of the country abroad ($\Delta a^T_* - \Delta a^{NT*}_t$). The Balassa-Samuelson Effect has been widely used to try and explain inflation differentials particularly in the EU (see. Mihaljek, 2002; Coudert, 2004) and Miletic, (2012).

### 3.0 EMPIRICAL STRATEGY

Given the theoretical background on inflation differential particularly in monetary unions, the paper will study price and inflation differential between Swaziland and South Africa from two fronts. First, it tests the purchasing power parity to study the long-term and short term dynamics. Secondly the paper will study the sources of inflation differential focusing on the Consumer Price Indices (CPI) basket composition and their contribution to inflation outcomes. Special interest also goes to studying distinctly the trends and differentials observed in the tradables and non-tradables so as to make inference for cases of inflation differential arising from the Balassa-Samuelson effect.

#### 3.1. Empirical test for the Purchasing Power Parity

The PPP presentation as shown in equation 2 provides a basis for an equilibrating model. As noted by Coakley & Snaith (2004) most literature view the PPP relationship as a long-run equilibrium condition it can be readily tested by applying unit root and or co-integration frameworks. As noted by Wang, et al. (2007), the long-run representation for Swaziland and South Africa’s prices in the basis of a relative PPP can be shown by the following:

$$\log P^{sw} = \alpha + \log P^{sa} \quad \text{Equation 8}$$

Where $P^{sw}$ represents consumer prices for Swaziland and $P^{sa}$ represents South Africa’s consumer prices. This paper adopts the Generalized Error Correction Model (GECM) to estimate the long-run relationship, the disequilibrium and the short-run dynamics. According to Banerjee et al (1993) as quoted by De Boef (2000) a generalized one step error correction model is a transformation and re-parameterization of an Autoregressive Distributed Lag (ARDL) model which allows the model to be used to estimate relationships among stationary and unit root processes. According to Boef (2000)
under the assumption of weak exogeneity, the single equation GECM yields unbiased, consistent and efficient estimators which makes it to be both ‘theoretically appealing and also statistically superior to the Engle and Granger two-step method’ (pg. 83). The GECM model estimated is given by:

\[ \Delta y_t = \alpha_0 + \gamma(y_{t-1} - x_{t-1}) + \tau_1 \Delta x_t + \tau_2 x_{t-1} \]

\[ \text{Equation 9} \]

Where \( y_t \) represents the Swaziland consumer prices logged and \( x_t \) represents the logged South African consumer prices. \( \gamma \) measures the speed at which Swaziland prices adjust to any discrepancy between the two countries’ prices. The term \( (y_{t-1} - x_{t-1}) \) is zero when the countries’ prices are at equilibrium and measures the extent to which the long-run relationship is not satisfied. \( \tau_1 \) captures the short-run dynamics in terms of the contemporaneous effect of the South African prices on Swaziland prices. The long-run multiplier of South African prices on Swaziland prices is then derived from the estimated coefficients as follows:

\[ k_1 = -\frac{\tau_2 - \gamma}{\gamma} \]

\[ \text{Equation 10} \]

\( k_1 \) is the long-run multiplier and captures the long-run effect of South African prices on Swaziland prices.

3.2. Analysing inflation Differential from CPI composition

The second aspect to understanding inflation differential between Swaziland and South Africa focuses on the composition of the CPI baskets and comparison of trends between the two countries so as to understand the similarities/differences in sub-components contribution to the overall CPI for each country. To study these effects, it is first important to ascertain sources of inflation differential by separating the prices to tradables and non-tradables. This can be done by adopting an equation proposed by Rabanal (2009):

\[ \Delta p_t - \Delta p_t^T = \Delta p_t^T - \Delta p_t^{N*} + (1 - \gamma)(\Delta p_t^{N*} - \Delta p_t^{N}) - (1 - \gamma)(\Delta p_t^T - \Delta p_t^{N}) \]

\[ \text{Equation 11} \]

Where \( \Delta \) is the year-on-year difference operator; \( p_t, p_t^T \) and \( p_t^N \), and are natural logarithms of the consumer price index, its tradable component and non-tradable component for Swaziland \( p_t^*, p_t^{T*} \) and \( p_t^{N*} \) are the same variables for South Africa; \( \gamma \) and \( \gamma^* \) are the share of tradable goods in Swaziland and South Africa respectively. According to equation 11, inflation differentials can be explained by (1) deviations from the law of one price \( (\Delta p_t^T - \Delta p_t^{T*}) \) (2) movements of relative prices between tradable and non-tradable goods inside each country \( (i.e. (\Delta p_t^N - \Delta p_t^{N*}) \) and \( (\Delta p_t^T - \Delta p_t^{N}) \)).

The paper would then further explore inflation differential arising from weighting structure of the two countries by subjecting subcomponents growth rate to similar weighting structure and observe overall inflation outcomes. The paper further studies inflation differential from both the supply side and demand side in order to study closely some of the sources for inflation differential at sub-component level.

3.3. Data

The paper uses data on Swaziland consumer prices sourced from the Central Statistics Office (CSO) as well as Central Bank Quarterly bulletins. South African consumer prices data sourced from statistics South African (STATSSA) and complemented with databases from the South African Reserve Bank (SARB). CPI series which is used for testing the PPP model is populated monthly from 1993 - 2016. However reliable series for subcomponents has a shorter series and analysis thus vary depending on data availability of a given chosen series.
4.0 EMPIRICAL RESULTS
This section covers the empirical results from the estimated models as well as graphical analysis of the data on inflation differential that yield policy inferences and recommendations there-of.

4.1. The PPP model results
As highlighted in the empirical strategy the starting point is the results from testing the relative PPP model using a Generalised Error correction model. The estimated results of equation 9 are presented in table 1. The model is estimated on 3 specifications and the difference between the specification is the sample used. Comprehensive results are documented in specification (1) while specification (2) and (3) attempts to capture recent dynamics. According to the results in specification (1), a one percentage point increase in South African inflation results in a 0.52 of a percentage point increase in Swaziland’s inflation contemporaneously on a month on month basis. The adjustment to any disequilibrium is corrected at a slower rate of 7.8 per cent and this is both economic and statistically significant reflecting that there is convergence in the long-run between the prices of the two countries thereby supporting the relative PPP to hold. The long-run multiplier is derived to be 1.14. This means that any permanent one percentage point increase in South Africa’s prices would lead to a 1.14 percentage point permanent increase in the consumer price level for Swaziland.

Specification (2) and (3) which shows recent trends support the notion that in the post 2000’s the estimated coefficients are much bigger. That is partly because the comparability of the data has improved with newer methodologies adopted (such as the use of similar classification COICOP and the review of weights and rebasing of the CPI with a similar base year of December 2012). The contemporaneous effect for example after the rebasing and reweighting of the CPI in 2013 shows that the contemporaneous effect became as high as 0.67 percentage points with a convergence rate of about 22.3 per cent. Thus, any inflation differential is corrected at a faster pace and given the high pass-through effect, the long-run multiplier is slightly lower at 1.11 percentage points.

Table 1: Estimated results of the GECM model

<table>
<thead>
<tr>
<th>Estimated model</th>
<th>Specification</th>
<th>Sample</th>
<th>Constant ($\alpha_0$)</th>
<th>Adjustment ($\gamma$)</th>
<th>Short-run dynamics ($\tau_1$)</th>
<th>Long-run Multiplier ($k_1$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td></td>
<td>(-0.053*** (-2.75))</td>
<td>(-0.078*** (-3.74))</td>
<td>0.517*** (6.72)</td>
<td>1.14</td>
</tr>
<tr>
<td></td>
<td>(2)</td>
<td></td>
<td>(-0.086*** (-3.57))</td>
<td>(-0.117*** (-4.28))</td>
<td>0.586*** (7.10)</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>(3)</td>
<td></td>
<td>(-0.114** (-2.29))</td>
<td>(-0.223** (-2.59))</td>
<td>0.673*** (5.05)</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Notes: $\gamma$ and $x$ represent logged Swaziland CPI and logged South African CPI. * , ** and *** represents statistical significance at 10%,5% and 1% respectively.
The estimated results can also be shown graphically as shown in figure 1. As noted in figure 1, inflation differential does tend to deviate from the long-run boundary (of about -1.1 and 1.1 as per the estimation in Specification 1). For example, a common shock of a rise in international prices particularly oil and food prices for some selected months in 2007 and 2008 resulted in higher inflation differential between Swaziland and South Africa. Towards the end of 2009 the differential fell below the lower bound mainly due to a collapse in commodity prices which was mainly influenced by the second round effects of the global financial crisis. Throughout the year 2012 inflation differential was elevated above 3 percentage points largely due to domestic tax reforms that had inflationary pressures on Swaziland’s consumer prices\(^{17}\). This study takes more interest on the sources of the recent inflation differential observed in 2016. The unpacking of the sources is done in detail in the subsequent section.

4.2. Analysis of CPI Sub-components trends

This sub section presents graphical analysis of the CPI components. Special focus goes into computation of inflation differential between tradables and non-tradables. Due to data limitations, this analysis is only done for the year 2014 - 2016 focusing on recent inflation differential and this is sufficient for this study as the focus is mainly on the recent inflation differential observed in 2016. The CPI for goods is used to proxy tradables while the CPI for services is used to proxy non-tradables. As noted in equation 11, the interest is to study the sources of inflation differential whether they emanate from the tradable differential between the two countries or from respective internal differential between the tradable and non-tradable sector.

Figure 2: Sources of Inflation Differential between Swaziland and South Africa

According to figure 2 the main drivers of the observed inflation differential between Swaziland and South Africa in 2016 was largely due to (i) the differential between tradables for the two countries and (ii) the internal differential between the tradable and non-tradables in Swaziland. The differential between tradables of the two countries reflects a violation of the ‘Law of One Price’ (LOP) and this paper would explore some of the factors that

\(^{17}\)The tax reforms included an Amendment of the Sales Tax in December 2011 and the introduction of VAT in April 2012. Effects of VAT on Swaziland’s prices are well documented by Nxumalo and Mabuza (2013)
might have led to this in 2016. The second aspect of the differential between the local tradables and non-tradables can be inferred to provide some information on what can be termed the internal version of the Balassa-Samuelson effect which according to Dedu and Dumitrescu (2010) can be interpreted as the Baumol-Bowen effect. To unpack this effect further information on productivity in the tradable and non-tradable sectors is required. However, Swaziland does not have good productivity data to support further analysis for this.

4.2.1. The Role of CPI Weights
The different composition of Consumer Price Indices (CPI) weighting structure across countries is one of the often cited reasons why inflation differential may persist across countries. To test this in the case of Swaziland the paper uses a crude method of recalculating South Africa’s inflation using Swaziland’s CPI weights composition and then compares the CPI-weight adjusted series to the Actual for Swaziland. The results of these calculations are shown in figure 3. As noted from figure 3, the CPI weight differential does explain some of the differential observed in 2016. The weights only explain an average of about 0.6 percentage points of the total 1.5 percentage points observed. That is; the weights differential partially explains 40 per cent of the observed differential in 2016.

Notes: SA_inflation_Weight_adj series represents the SA inflation calculated using Swaziland’s CPI weights. The difference between the bars and SA inflation represent the portion of inflation differential that is explained by weights-differential (40 %)and the difference between the bars and Swaziland inflation represent the portion of inflation differential arising from other factors other than the weights-differential.

4.2.2. Supply Side Inflation Pressures
The next step is to investigate some of the reasons apart from weights-differential that explains the 60 per cent differential observed from figure 3. The first stop is looking at the important sub-component which is “Food and non-Alcoholic Beverages” (FNAB). This component accounts for 29.22 per cent in the consumption basket. Food prices are highly linked to food productions and shocks thereof and thus represent a good proxy to understanding supply side factors in the CPI.

Figure 4: Food Inflation Trends

Source: CSO and STATSSA
Box 1: Food Inflation Components Comparison; South Africa versus Swaziland

Source: CSO and StatsSA
As shown in figure 4 Swaziland and South Africa’s food inflation tends to track each other though there were significant differentials in 2007-2008; 2012 and 2016. The differential observed in 2007-2008 and 2016 were driven by common shocks. In 2007-08 there was a significant surge in international oil and food prices but the observed food inflation was notably higher in Swaziland than in South Africa. A similar story was observed in 2016, a common shock from an El’nino induced drought resulted in asymmetric results in the food inflation outcomes for the two countries while the 2012 differentials were mainly informed by domestic factors that were unique to Swaziland at that time.

To analyse the asymmetric results in food inflation especially the most recent ones arising from the negative effects of the drought, food inflation can be unpacked further to its sub-components. Box 1 shows the comparison of major sub-components within food inflation. It can be observed that significant asymmetric trends or levels of price changes come from the price indices for ‘bread and cereals’, ‘sugar and sugar products’ and ‘vegetables’. For further analysis, it is important to investigate the sources of differences in the growth rates of these price indices. As expected the impact of drought on maize weighed heavily on cereals in what could be termed the first round effects of the drought. Prices of ‘bread and cereals’ products particularly mealie meal accelerated significantly early in the year reflecting food supply shortages in both Swaziland and South Africa.

However, the increase was too pronounced in Swaziland cereal prices with a differential of about 10 percentage points. One of the developments that might have contributed to this differential is the bottlenecks in supply mainly the ban on the importation of mealie meal implemented through National Agricultural Marketing Board (NAMBOARD).

The other notable differential is on ‘sugar and sugar related’ products. Like prices of ‘bread and cereals’ the trend is similar but growth rates for Swaziland are significantly higher than those of South Africa. This is surprising from two grounds: first Swaziland is a net exporter of sugar; secondly sugar price setting is harmonized between Swaziland and South Africa amid on a one-month lag basis. In 2016, sugar prices rose twice; by 12.5 per cent in February and 15 per cent in August. However, in the second half of the year after the second sugar price increase (in both countries) Swaziland sugar prices are 10 percentage points higher than those of South Africa. This reflect that the cumulative 27.5 per cent increase went through smoothly whilst for South Africa it might have not been fully implementable arguably because of an increased influx of sugar imports (to the SA market) that might have put pressure on prices not to increase by the full 15 per cent in August 2016. This also reflects differences in demand elasticities for sugar prices in the two countries.

Another worrying divergence within the food components is that of prices of vegetables. Between November 2015 and March 2016 there was a significant acceleration in prices for vegetables in both Swaziland and South Africa. However, for most part of the second half of 2016 South Africa’s vegetable’s prices have been on a downward trend closing the year 2016 at below 5 percent. An opposite trend was observed in the case of Swaziland with vegetable prices reaching 35 per cent year-on-year increase in the last two months of 2016.

Additional pressures on the supply side can also be studied from administered prices. Administered prices broadly relates to the prices that are regulated by some governing body. While administered prices vary from country to country in terms of coverage, the common ones for both Swaziland and South Africa are electricity, water, fuel and public...
transport. Figure 5 shows the trends for the two countries in administered prices.

Though there is no clear relationship between the administered prices for these two countries (as this reflect domestic policies on regulated pricing), it can be observed from figure 5 that administered prices in Swaziland were relatively higher throughout the year 2016. Administered price increases included among others; a 25 per cent increase in public transport fares and an 11.7 per cent increase in electricity.

**Figure 5: Administered Prices**

![Graph showing administered prices for Swaziland and South Africa](image)

*Source: CSO*

In South Africa administered price movements were merely a reflection of petrol price movements in line with international oil prices and exchange rate developments. On the contrary, there was hardly a change in fuel prices in Swaziland. The higher administered prices in Swaziland do also feed into inflation differential in Swaziland.

**4.2.3. Demand Side Inflation Pressures**

To study the demand side, the paper studies inflation differential for selected components that covers semi-durable and durable products. These are ‘clothing and footwear’ and ‘furnishing and household equipment’. Figure 6 depicts the growth rates for the price indices for ‘clothing and footwear’ and ‘furnishing and household equipment’ indices. Swaziland’s prices for these components tend to be higher with an average of 1.7 percentage points reflecting mark-up in prices that incorporate transportation and other retailing costs. The inflation differential for these components rose significantly in the second half of 2016 signalling that there were demand pressures in the economy particularly in the second half of the year.

**Figure 6: Clothing and footwear and furnishing and household equipment**

![Graph showing clothing and footwear index and furnishing equipment index](image)

*Source: CSO and STATSSA*

The demand pressures mainly came from the fiscal side. According to the medium term budget review for 2016/17 delivered by the minister of Finance, Government...
implemented a salary review for the civil service in July 2016. This resulted in a 26 percent increase in the government wage-bill for 2016/17 financial year and stretched the fiscal deficit for the year revised upwards from 13.7 per cent to 16.1 per cent. This meant that public sector wages rose by more than 15 per cent in real terms. Such adjustments also put pressure on private sector wages as employees demanded similar adjustments. This evidently put pressure on prices of semi-durable and durable products and hence the observed increases in these prices in the second half of 2016.

4.3. Monetary Policy Considerations

As highlighted earlier inflation differential has strong implications for monetary policy especially in a currency union. The fact that relative PPP holds between South Africa and Swaziland provides relief that even though inflation differentials emerge from time to time, they are mean reverting thereby they do not threaten the viability and relevancy of the currency union (i.e. CMA). However, the inflation differentials impose some complications in terms of trade-off between nominal convergence and real convergence. As shown in figure 7; regardless of the inflation differential nominal policy rates in Swaziland track closely those of South Africa and in cases where there is a differential in policy rates, Swaziland policy rates fall below those of South Africa amid at narrow margins of not more than 50 basis points. This is expected given the capital arbitrage that comes with the CMA membership.

Of important note though; is the implied policy movements in real terms which takes into account inflation movements. This gives a better view of whether monetary policy is expansionary or contractionary. Policy rates in real terms are shown in figure 8.

As it can be seen in figure 8; whenever there are significant inflation differentials pursuing similar nominal rates to those of South Africa widens the differential in real policy rates and translates to different monetary policy stances.
A case in point is what was noted in 2016, the South African real policy rate was positive throughout the year reflecting a restrictive monetary policy as headline inflation stayed outside the South African Reserve Bank target range of 3-6 per cent. However, Swaziland’s real policy rate was consistently negative reflecting a relatively looser monetary policy stance even in a period of elevated inflation. This can also explain the inflation differentials observed during this period.

On the basis of this analysis it important that the Central Bank factors in inflation differential in its policy reaction function in order to ensure real convergence and harmonize policy stances within the currency union.

CONCLUSION
The analysis of inflation differential remains an important subject of interest for countries in a currency union so as to ensure harmony of monetary policy stances and hence the viability of the union itself. This paper studied inflation differentials between Swaziland and South Africa and implications for monetary policy in Swaziland. The paper studies long-term convergence and short-run dynamics using the PPP model. The results showed that relative PPP holds for Swaziland and South African inflation rates and that there is high contemporaneous pass-through effect from South African prices to Swaziland’s prices. These results support that the currency union remains viable and relevant for Swaziland.

Disaggregating inflation differentials between tradables and non-tradables reflect that recent inflation differentials (in 2016) mainly came from the tradeable sector which reflected the violation of the law of one price between the two countries. From the supply side, the paper noted that; even though Swaziland and South Africa faced similar shocks, the results and adjustment mechanism to the shocks were asymmetric.

In 2016, the common shock was the El’nino induced drought and it affected both countries but for Swaziland it raised food prices by more than 5 percentage points from those of South Africa arguably because of supply bottlenecks in Swaziland. From the demand side, the paper notes that in the second half of the year; the expansionary fiscal policy particularly adjustment in public wages following the implementation of the salary review created inflationary pressures which may have fed through to the widening of inflation differentials between Swaziland and South Africa. This was further worsened by a relatively looser monetary policy when considering real policy rates movements. The traditional culprit in explaining inflation differential - differences in CPI weights - only explained 40 percent of the recent differential. The paper recommends that inflation differential be taken into account in the monetary policy reaction function so as to correct for real convergence in policy rates and thereby harmonize monetary policy stances within the union.

REFERENCES


Rand-Dollar Price Fixing Effect and Policy Recommendation

Ntobeko S. Dlamini

Abstract

This paper provides an analysis of the effect of price fixing of the rand dollar exchange rate by various commercial banks in both the United States and South Africa as cited by the Competition Commission of South Africa. On the basis that the Bank’s inflation model feeds into the country’s monetary policy, this paper sought to establish the relationship and impact of the exchange rate on the domestic inflation over the period in which the said collusions are presumed to have occurred using the ordinary least squares (OLS) regression method. From the results, the paper found that exchange rate had a positive impact on domestic inflation. Therefore, this paper recommends that the proceeds from penalty or fine imposed by the commission on the banks be shared among CMA members using specified formulae of revenue sharing.

Key Words: Price Fixing, Exchange Rate, Inflation, Swaziland, OLS.

1.0 INTRODUCTION

In February 2017, the Competition Commission of South Africa uncovered that a number of banks were fixing the price of the exchange rate between the US dollar and the Rand. The banks, as alleged by the commission, ‘had generally agreed (in 2007) to collude on prices for bids, offers and bid-offer spreads for the spot trades in the currency trade arena’. In the wake of these findings South Africa’s economy had grappled under a volatile rate of exchange between the Rand and the US dollar which when viewed backwards, such an act has far reaching economic implications not only for South Africa but for the satellite economies found in the Common Monetary Area (CMA).

The CMA which is premised on the idea of a coordinated monetary policy in keeping a low and stable level of inflation links South Africa, Swaziland, Namibia and Lesotho into a monetary union (Ikhide and Uanguta, 2010). As such, the monetary policy formulation becomes the product of a country’s membership into the agreement. According to the agreement, a member country’s currency (e.g. Lilangeni, Namibian dollar & Loti) is pegged at par with the South African Rand and further allows for free movement of the Rand in their respective economies. In order to preserve the credibility of the fixed parity an import coverage for a specified period is required from the members.

QUARTZ Africa (2017) reveals that the collusion was a global effort as banks across four continents worked together to distort the currency market. The banks are alleged to have used the Reuters currency trading platform, Bloomberg instant messaging services and telephone calls to organize appropriate trading times, prices and taking turns to transact, hold or pull bills. As a result, these colluded trades would affect anyone buying Rands or using US Dollars to buy Rand (QUARTZ Africa, 2017).

In essence, the act of collusion by the banks can be transmitted through various channels of economic activity which include inflation, foreign debt, trade and gross reserves resulting in a misdirected policy stance by the various policy institutions of the member countries. As a member of the CMA, Swaziland is not spared from the envisaged brunt of these currency distortions. This paper therefore provides a brief review of the relationship between exchange rate movements and the major economic indicators in Swaziland mindful of the date in which the Rand-Dollar manipulation took place.

1.1 Inflation and Exchange Rate
By the dawn of the 2007/2008 financial crisis, Swaziland’s overall rate of inflation had skyrocketed to double digits and maintained an upward trajectory for the first three quarters of 2008. Having averaged a high of 13.9 per cent in the third quarter of 2008, the consumer price inflation thereafter rapidly decelerated in the subsequent years but still averaged around 5 and 9 per cent over the period 2009 and 2014. Up until the fourth quarter of 2014, Swaziland’s overall consumer price inflation had remained at single digits showing that the monetary policy has been effective in curtailting undesirable levels of inflation. Accounting for these developments (inflation) were a combination of domestic and external factors.

The rapid increase in the consumer price inflation in the first half of 2008 was driven by most notably a rise in oil prices, international commodity prices and domestic food prices. The weakening of the Lilangeni/Rand exchange rate aggravated by rising inflation in South Africa also contributed to further increases in the domestic consumer price inflation as imported inflation, given that the country imports over 90 per cent of its goods from South Africa.

Conversely, the downturn in inflation over the subsequent periods can be attributed to reductions in international oil prices and the strengthening of the Lilangeni/Rand exchange rate. The overall inflation is seen to have moderated in line with a moderation in the volatility in the Lilangeni/Rand exchange rate between fourth quarter 2009 and first quarter 2011.

As oil prices increases began to emerge coupled with a depreciation of the Lilangeni/Rand exchange rate against the U.S dollar, petrol prices also rose sharply. This saw transport inflation increasing to almost 15 per cent in the first quarter of 2012. Throughout the remainder of the review period, overall inflation remained relatively low and such developments were largely attributed to lower food and transport prices which minimised the effects of the continued weakening of the local currency.

Exchange rate depreciation(appreciation) by nature may quicken or gradually lead to a rise (fall) in consumer price inflation. The analysis presented by Figure 1 shows stronger historic cases of the relationship between inflation and the exchange rate. For instance, between the first quarter of 2009 and second quarter 2011 the consumer price inflation is found to be decreasing consistent with an appreciation of the local currency. On the other hand, between the fourth quarter of 2013 and fourth quarter 2014 a depreciation coincides with a rise in the rate of inflation.
1.2 Foreign Debt and Exchange Rate

Though expressed in Emalangeni terms, the country’s foreign debt position is a function of exchange rate developments and drawdowns on the existing external loans. For dollar denominated external liabilities, for instance, a depreciation of the local unit against the US dollar would lead to a rise in outstanding foreign debt, and the reverse is true. As seen in the figure below, outstanding external debt over the review period has been mimicking the movements in the exchange rate.

By the end of the fourth quarter of 2010, Swaziland’s gross external outstanding debt had followed a declining trend which closed at E2.5 billion. The downward movement in foreign debt as shown in Figure 2 was mainly driven by the appreciation in the exchange value of the Lilangeni exchange rate.

The downward trajectory (appreciation) in the exchange was thus a benefit for debt servicing obligations given that external debt for central government constitutes the largest share of total loans portfolio. On the other hand, the substantial depreciation of the Lilangeni from June 2011 to December 2014 coupled with increases in drawdowns on existing projects resulted in the drastic increases in external debt.

1.3 Trade and Exchange Rates

Under normal circumstances, a weaker domestic currency boosts growth in export earnings while discouraging imports. In the case of Swaziland, trade activity is almost entirely catered for by the neighbouring South Africa to which the Rand and Lilangeni are fixed on a one-on-one basis. As a result, more than 80 per cent of the country’s imports come from South Africa. On the other hand, more than half of the country’s exports (approximately 60%) are destined for the South African market with the remainder accounted for by the rest of the world. This therefore means that a percentage of the developments in the country’s trade arena would be susceptible to changes in the major trading currencies.
As seen in Figure 3, Swaziland experienced an improved export performance which saw a positive trade balance almost being maintained throughout the period under review. Accounting, in part, for the positive development in the trade account was a depreciation of the local currency when compared to major trading partners and the reduction in oil prices (which reduced the import bill). By the end of December 2014, quarter-on-quarter exports improved substantially to an estimated E5.87 billion, while imports grew considerably above E4.5 billion. Over the same period, the Lilangeni had weakened from E10.87 in the first quarter of 2014 to E11.21 in the fourth quarter of 2014 to the dollar.

1.4 Gross Official Reserves and Exchange Rates
The currency composition of the country’s reserves is kept at approximately 60% ZAR, 25% USD and the rest comprises of the numerous other foreign currencies. Consequently, it is expected that a sizeable share of the country’s gross reserves especially those held in dollars will be affected by either an upward or downward movement of the value of exchange which also reflects on the country’s level of import cover. Between the first quarter of 2009 and second quarter 2011 gross official reserves fell from a high of E7.5 billion and a low of E4.5 billion respectively. Contributing to the decline was partly due to an appreciation in the external value of the Rand/Lilangeni exchange rate to the major currencies most importantly, due to the fact that most of the fluctuations in the reserves emanates from government budgetary obligations especially because of the revenue from the Southern African Customs Union (SACU) which add to reserves yet they are then allocated towards the national fiscus.

Consistent with a sharp decline of the Lilangeni against the dollar in the period between 2012 to 2014, reserves accelerated from a low of E3.8 billion in March 2012 to E8.0 billion in December of 2014. Despite the positive outcome on the country’s reserves, it is important to note that in 2014 the Lilangeni had performed badly in comparison to the major currencies specifically the US dollar.

2.0 Policy Implication: The Inflation Model
Swaziland together with other members of the CMA the LNS countries adopted the fixed exchange rate targeting system to monetary policy implementation. Under this system, government and the Central Bank have tied the official exchange rate at par with the South African Rand. In this regard, the intermediate objective of the monetary policy in Swaziland is to maintain the fixed exchange rate between the Lilangeni and the Rand. This requires that the country’s currency be backed by the international reserve requirement standard of a three months import cover.
Over and above the fixed exchange rate responsibility, the Central Bank of Swaziland is also tasked with the responsibility of maintaining stable and low prices (inflation) and a sound financial system that will ensure sustainable growth in the economy. Informed by a number of macroeconomic variables the Central Bank thus uses the discount rate to influence monetary conditions in the country, which almost mimics the South African Reserve Bank’s repo rate. Ultimately, the Bank monitors developments in inflation and guards against any undesirable rates of inflation by responding with an appropriate and effective monetary policy action that would be in the form of a manipulation of the discount rate.

This section therefore seeks to establish the relationship and impact of the exchange rate over the period in which the alleged collusions are presumed to have occurred. From previous studies that have investigated the determinants of inflation in Swaziland (Ndzinisa, 2008: Dlamini & Dlamini, 2001), the magnitude of the impact of the Rand/Lilangeni exchange rate to the US dollar, South Africa’s consumer price inflation and oil prices on the consumer price inflation(CPI_SD) in Swaziland over the period January 2008 to December 2014.

From the preceding variables, the following Ordinary Least Squares (OLS) model is constructed:

\[
\log CPI_{SD_t} = \beta_0 + \beta_1 \log CPI_{SA_t} + \beta_2 \log EXR_{USD_t} + \beta_3 \log Oil Prices_t + \mu_t
\]

where \(\beta\) denotes the elasticity coefficients, \(\mu_t\) the error term, \(\log CPI_{SA_t}\) is South Africa consumer price index, \(EXR_{USD_t}\) is the local unit against the USD, and \(\log Oil Prices_t\) is the international price of oil. For estimation purposes, the data series is transformed into natural logarithms.

Instead of using a dummy variable which would have helped to capture the difference in time events before and after the alleged collusion, the paper specifically focuses on the period within which the crime is alleged to have been committed. Once the statistical significance of the variables of the Rand/Lilangeni exchange rate is determined we shall analyse the regression outcome under the pretence that the manipulation had an impact on the consumer price inflation in Swaziland but still subject to the enquiry’s outcome in South Africa.

### Table 1: Long-run regression results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOGCPI_SA</td>
<td>0.87243*</td>
<td>0.09826</td>
<td>8.8784</td>
<td>0.000</td>
</tr>
<tr>
<td>LOGEXR_USD</td>
<td>0.620057*</td>
<td>0.04225</td>
<td>14.673</td>
<td>0.000</td>
</tr>
<tr>
<td>LOGOIL_PRIC</td>
<td>0.172665*</td>
<td>0.02431</td>
<td>7.1014</td>
<td>0.000</td>
</tr>
<tr>
<td>C</td>
<td>-1.50135*</td>
<td>0.45176</td>
<td>-3.3276</td>
<td>0.001</td>
</tr>
</tbody>
</table>

R-squared 0.800614  S.E 0.058032

Adjusted R-squared 0.793137

* = 1%, ** = 5%, *** = 10%

The positive coefficient of the exchange rate as depicted by Table 1 is found to be significant a 1 percent level signifying that a depreciation in the Rand/Lilangeni exchange rate against the US dollar over the period in question was inflationary. If there is concrete evidence that these banks infiltrated the currency market by altering the forces of supply and demand, then a depreciation in the Rand which is transferrable to the peripheral economies of the CMA is a cause for concern about the future stability and credibility of the monetary policy stances that have been taken and/or will be pursued by the countries in the union. Hence, imposing a set of restraints against such unscrupulous exploit becomes a relevant necessity.
The results as shown in the Table 1 also indicate that there exists a statistically significant positive link between the consumer price inflation of South Africa, oil prices and the consumer price inflation of Swaziland. The magnitude of the coefficient implies that a percentage point increase in South Africa’s consumer price inflation over the period under review resulted in a 0.87 per cent increase in the dependent variable (inflation). In recognition of this economic fundamental, Swaziland’s inflation is to a large extent influenced by the price developments in South Africa, to which a significant component of the goods procured by the domestic economy comprises imported inflation.

Table 2: Long-run Cointegration

<table>
<thead>
<tr>
<th></th>
<th>intercept &amp; trend</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF test statistic</td>
<td>-2.401</td>
<td>-2.419***</td>
</tr>
<tr>
<td>ADF test critical values</td>
<td>-2.586</td>
<td>-1.614</td>
</tr>
</tbody>
</table>

***-represents statistical significance at 10%.

While the long run regression results in revealed statistical significance of the variable under review, the robustness of the findings is thus confirmed by the significance of the residuals through the long run cointegration.

2.1 The Status of the Investigations

The Competition Commission of South Africa has since referred the matter to the Tribunal where the commission seeks an order declaring that the seventeen banks indeed contravened South Africa’s Competition Act. Upon establishing beyond reasonable doubt that the banks had conspired to influence market forces, the commission will thereafter impose a penalty of 10 per cent on their annual turnover.

3.0 CONCLUSION AND POLICY RECOMMENDATION

The purpose of this paper was to examine the link and/or the relationship between the exchange rate and the different economic indicators in Swaziland with special focus on the time period in which the Rand-Dollar manipulations occurred. It further demonstrated through a simple regression analysis, that prices in South Africa which are informed by the exchange rate and the actual exchange rate itself do become transferred to the domestic economy.

Key towards this discussion, therefore, is that the impact of the manipulations, the outcome and the mitigating action to restore order as it will be instituted by the commission, should not be viewed in isolation of the South African economy but should take cognisant of the fact that the CMA links South Africa with the LNS countries to which their currencies are pegged at parity with the Rand. Hence, given that these peripheral economies are extremely open to trade with South Africa, the transferability of the impact of the distortion is inevitable. Thus pending the outcome of the enquiry this paper will assume the following policy recommendations:

- Other CMA Member countries should conduct studies to examine the extent to which such collusions might have affected the conduct and implementation of their macroeconomic policies.

- That the proceeds from penalty or fine imposed by the commission on the banks be shared among CMA members using a specified formulae of revenue sharing as imposed by the Southern African Customs Union. The funds may also be incorporated as additional payment when seigniorage compensation payments are made to LNS countries.
The CMA should also come up with policies tailored to safeguard the credibility and relevance of the institution and where there are loop-holes the union should be ready to respond appropriately especially if such a case were to present itself again.

REFERENCES


