Analysis of Public Expenditure Growth on Infrastructure in Lesotho

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ABSTRACT

This study expanded the line of research in evaluating the effect of factors related to the growth of government expenditure on infrastructure with the use of the Engle and Granger (1987) approach using annual time series data from 1980 to 2014 in Lesotho. This approach provides a direct test of the economic theory and enables utilization of the estimated long-run parameters into the estimation of the short-run disequilibrium relation. The residual test showed that there is a stable long-run relationship among the variables. The government revenue, grants and loans play a significant role in determining growth of government spending in Lesotho. There is no evidence of association between growth of government spending on infrastructure and external reserves both in the long –run and short-run. The absence of this trade off can lead to accumulation of reserves above the optimal level. An increase in the allocation of government resources to capital expenditure will boost the country's economic growth and development.

Keywords*: infrastructure, government, grant, revenue, cointegration*

1. Introduction

The investment in infrastructure is considerably important in the context of planning and economic development as it throws light to the capital base of an economy and subsequent changes in the modes and capacity of production. For growth potential of the economy, adequate policy measures are required for resources mobilization and allocation (Barro 1991). Several studies have ascertained that investment in infrastructure is a major determinant of economic growth (see Dogan and Tang 2006, Alm and Embaye 2010, Durevall and Henrekson 2011 and Agenor and Dodson 2006). This makes public expenditure, particularly on infrastructure, a significant apparatus in the development agenda which has gained attention in economic literature in recent time. Public expenditure continues to be a fundamental subject in economic development, especially in developing countries in Sub-Saharan Africa, whose economies are characterized by structural rigidities, weak support services and institutional framework, declining productivity, high levels of corruption and policy instability. Spending on infrastructure refers to government acquisition of goods and services intended to create future benefits, such as infrastructure investment or research spending, and also it is classed as government investment (government gross capital formation).

The Lesotho's economy presents a gloomy picture in relation to public expenditure on infrastructure. Overall Government expenditures remain comparatively high. Government expenditures have amounted to about 60 percent of GDP or more in recent years, with spending becoming increasingly slanted toward recurrent expenditures. The government wage bill rose to 21.5 percent of GDP in 2014 which was the highest in sub-Saharan Africa. Central Bank of Lesotho (2016) mentioned that Lesotho relies heavily on grants revenues from the development partners such as World Bank (WB) and International Development Association (IDA) for financing infrastructure projects.

However, the Central Bank of Lesotho (2016) outlined that the average execution rate of budget for infrastructural activities amounted to 85 percent between 2011 and 2013 which the International Monetary Fund (IMF) deemed unacceptable for small developing country like Lesotho with infrastructural deficit. Several studies have analysed the impact of public spending on economic

growth in general in the short and long-run, (see Landau 1983 and Edame 2009). Others considered the effect of public expenditure on infrastructure (specifically) on economic growth in most developed and developing countries including Lesotho (see Thamae 2013, Masenyetse and Motelle 2012, and Thabane and Lebina 2016). While these studies provide valuable insides about the economy, they fail to isolate analysis on infrastructure and its determinants.

The inadequacy of empirical information on the trend analysis of public expenditure on infrastructure in Lesotho makes it justifiable to carry out this study, given the importance of investment in infrastructure on the overall development of the economy. Fundamentally, the broad objective of this study is to analyse the factors behind the dynamics of public expenditure on infrastructure growth in Lesotho using the Engle-Granger techniques to analyse trends on public expenditure on infrastructure and its determinants using available time series data from 1980 to 2014. This approach provides a direct test of the economic theory and enables utilization of the estimated long-run parameters into the estimation of the short-run disequilibrium relation. The study correctly avoids estimating a vector because the OLS estimator can be badly biased in small sample due to correlations. The study contributes to the empirical literature of the determinants of public spending growth on infrastructure in a developing country.

The remainder of this paper is organized as follows: section two provides a brief overview of infrastructure spending in Lesotho. Section three outlines the literature review on public expenditure on infrastructure growth and section four presents the model and estimation procedures. The results and discussion are reported in section five while the last section concludes the study.

2. Economic context

For several years, the Lesotho economy attained solid economic growth with only moderate inflation; however, this growth lacked inclusiveness and poverty has remained widespread (IMF 2012). Real GDP growth averaged about 4 percent a year from 1980 to 2014, led by the mining and construction sectors. The cyclical variations in the Lesotho's economic activities have led to the periodical surge in the country's unemployment and inflation rates along with the external sector disequilibrium. The Lesotho's economy has witnessed many shocks and turbulences both internally and externally from

1980 to early 2014. Internally, there were aspects such as social and political factors, technological development, capital formation, natural resources, human resources, consumption patterns, and improper implementation of public policies as well as fiscal insatiability. The external factors included technological transfer, changes in the Foreign Direct Investment (FDI) in addition to the degree of openness.

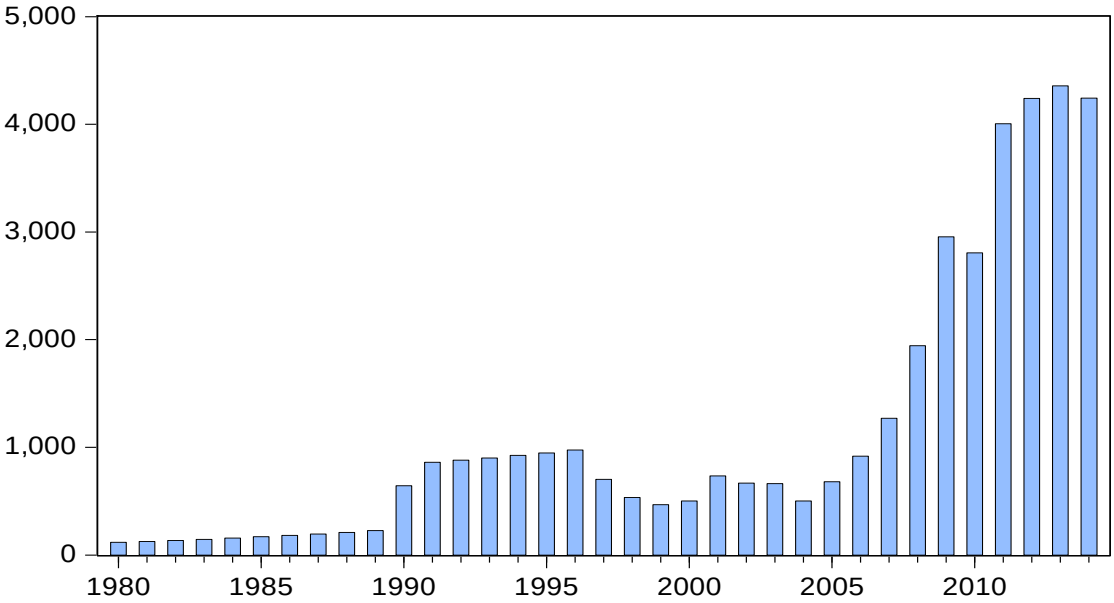
Fiscal policy had been a major economic stabilisation weapon, which involved the use of government spending, taxation and borrowing to influence the pattern of economic activities and also the level and growth of aggregate demand, output and employment. Fiscal policy entails government's management of the economy through the manipulation of its income and spending power to achieve certain desired macroeconomic objectives amongst which is economic growth. In principle, fiscal dominance in Lesotho occurred when fiscal policy was set exogenously to monetary policy in an environment where there is a limit to flexibility of monetary policy due to exchange rate policy arrangement between Lesotho and South Africa.

To finance large government expenditures particularly infrastructure, Lesotho relies heavily on revenues from the Southern African Customs Union (SACU) which accounts for more than 50 percent of the total revenue. However these revenues are highly volatile and pro cyclical. The national budget experienced a severe pressure as a result of 2008 economic and financial crisis, which led to SACU revenues to decline severely. In 2010/12 and 2011/12 the SACU revenues plummeted to an average of about 15 percent of GDP and the overall fiscal deficit jumped to more than 10 percent of GDP on average. However, fiscal policy remained expansionary with government expenditures totalling to about 60 percent of GDP or more between those years. In addition, spending has become increasingly skewed towards recurrent expenditures.

The economy has been characterised by periods of economic transformation, economic recoveries and stability in relation to government expenditure on infrastructure between 1980 and 2014. The main objective has been to alleviate underdevelopment and eliminate poverty to raise the overall quality of life of the citizens (Molapo and Damane, 2015). From 1980 to 1988, government’s capital spending has been fairly low. Thamae (2013) outlined that the economic progress in Lesotho depends mainly on the developments in the neighbouring Republic of South Africa (RSA), which surrounds it entirely,

through the remittances of workers employed in the RSA mines as well as the sale of water resources to RSA. From 1989, the economy was boosted by a boom in infrastructure investment related to the Lesotho Highlands Water Project (LHWP). This was a joint project between the government of Lesotho and the Republic of South Africa (RSA) which consisted of the construction of two dams whose main aim was to transfer water from the catchment of the Orange River to Gauteng Province in South Africa and construction of a Muela hydropower station for Lesotho.

Figure 1: *Government Expenditure on Infrastructure in Lesotho*



Source: *Central Bank of Lesotho and own computation*

From 2008 to late 2015, the government expenditure on infrastructure in Lesotho was boosted by grants from the Millennium Challenge Account (MCA). Besides the construction of the Metolong dam for the supply of water in urban areas, the MCA grant also included building of schools and hospitals in the country. The second phase of the LHWP project was expected to commence in 2016. The government of Lesotho also doubled its efforts to allocate more funds to capital budget from 2012/13 fiscal year in order to implement National Strategic Development Plan (NSDP). The NSDP was developed to serve as an implementation strategy for the National Vision 2020 of which pursuing high shared employment, economic growth and developing key infrastructure were amongst the plan's strategic goals.

3. Literature Review

Boopen and Khadaroo (2009) empirically examined the dynamic link between transportation capital and private investment for the case of Mauritius over the period 1950-2000 using rigorous dynamic time series analysis. They employed a neoclassical investment model in an error correction framework to overcome the endogeneity and dynamics; an often ignored element in private investment modelling. They engaged a cointegrating Vector Autoregressive framework to analyse short run dynamics as well. The results from the analysis showed that transport capital is complementary to private investment and thus consistent with the crowding in hypothesis in both short and long run. Adhikary (2011) also found that there is a strong long-run equilibrium relationship between Gross Domestic Product (GDP) growth rates and between Foreign Direct Investment, trade openness and capital formation with unidirectional casual flows. The results also supported the study of Kormendi & Meguire (1985) and Barro (1991) which reported positive influence between the rate of physical capital formation and the rate of a country's economic growth.

Mehta mentioned that Capital Formation, also termed as 'investment', is an important macroeconomic variable in any economy. The paper showed that capital formation and economic growth variables are considered for analysis wherein the short-run and long-run relationship between these variables in India was empirically tested with the help of co integration technique and vector error correction technique. The study revealed a long-run relationship between capital formation and economic growth.

Shuaib and Dania (2015) examined the capital formation: impact on the economic development of Nigeria, using time series data from 1960 to 2013. They applied Harrod-Domar model to Nigerian economic development model and tested if it had a significant relationship with Nigerian economy. They found that their results corroborated with the Harrod-Domar model which proved that the growth rate of national income is directly related to saving ratio and/or capital formation. Ray (2013) outlined that, the causal connection among different macroeconomic variables and stock prices are crucial in the formulation of a country's macroeconomic policy and have long been a debatable issue. The effect of Gross Fixed Capita Formation (GFCF) on Stock Prices (SP) as well as causal connection between gross fixed capital formation and stock prices were confirmed, in addition to the finding that

gross fixed capital formation and stock prices were cointegrated indicating an existence of long run equilibrium relationship between the two.

4. Methodology

4.1 The model

In an attempt to determine the determinants of government expenditure growth on infrastructure in Lesotho, it is ideal to develop a model to justify the relationship that exists between the variables. The finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time series analysis. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables. The method used in this paper trail Chakraborty and Mazumdar (2003) and Fedderke et al. (2003). It takes into account the following cointegrating and regressor equations to be estimated using Ordinary Least Squares (OLS) based on the specific characteristics of the Lesotho economy.

$$GP_t = F\,(\,REV_t,\ ER_t\,,\ G_t,\ L_t, RS_t) \qquad (1)$$

Where:

GP_t is growth of government expenditure on infrastructure; REV_t is total government revenue without grants; ER_t is external Reserves; G_t is grants received; L_t is public debt; RS_t is recurrent expenditure; and **t** is time period.

In order to examine the determinants of government expenditure growth on infrastructure in Lesotho, the study uses real annual time series data between 1980 and 2014. The data has been obtained from two sources: the Central Bank of Lesotho (CBL) and the IMF database. The study employs the use of cointegration technique based on Engle and Granger (1987). The Error Correction Method (ECM) representation of a cointegrated system has the following parameters.

$$\Delta Y_t = C + \alpha_0(Y_{t-1} - \beta X_{t-1}) + \sum_{i=1}^{p} \pi_1 \Delta Y_{t-i} + \sum_{i=1}^{p} \pi_2 \Delta X_{t-i} + \varepsilon_t \qquad (2)$$

Where:

β expresses the long-run equilibrium relationship; **α** expresses the speed of adjustment, or how strongly the past disequilibrium affects changes in **Y**. It is also referred to as the Error Correction Term (ECT) and links the long-run equilibrium relationship implied by cointegration with the short-run dynamic adjustment mechanism that describes how the variables react when they move out of long-run equilibrium. **P** is the order of the Auto Regressive (AR) process in **Y** and **X** where **Y** and **X** are dependent and independent variables respectively; $\boldsymbol{\pi_1}$ and $\boldsymbol{\pi_2}$ are the parameters of own dynamics of Y and X (not reflecting disequilibrium conditions); and **ε** is the error term. When customized for the Lesotho's case, equation (2) takes the following form which is estimated using OLS.

$$\Delta lnGP_t = \alpha_0 + \beta_1 ln\mathrm{REV}_{t-1} + \beta_2 lnER_{t-1} + \beta_3 lnG_{t-1} + \beta_4 lnL_{t-1} + \beta_5 lnRS_{t-1} + +\theta W + \varepsilon_t \quad (3)$$

Where:

W is any other exogenous variable affecting growth of government expenditure on infrastructure in Lesotho; and **ln** = log.

The theoretical background underpinning the choice of variables affecting growth of government expenditure on infrastructure follows literature on the subject. In some years, Government Finance Statistics (GFS) data is not available, extrapolation method was used to fill the gaps. Reungsri (2010), Worlu and Nkoro (2012) as well Edogbanya and Sule (2013) indicated that there is a positive and highly statistically significant relationship between growth of government expenditure on infrastructure and government revenue. Revenue is an important tool of the fiscal policy of the government and is the opposite factor of government spending. In this study grants are netted out from total revenue to avoid the problem of multicollinearity which is a phenomenon in which two or more predictor variables in a multiple regression model are highly correlated, meaning that one can be linearly predicted from the other with a substantial degree of accuracy. Molapo (2016) mentioned that there is a trade-off between external reserves and growth of government spending on infrastructure. The coefficient of external reserves represents the opportunity cost of investment in infrastructure. Reserves that are above the adequate level can be invested in assets such as sovereign wealth funds or

as insurance in times of crisis, such as stabilization funds and more so used to close the deficit in infrastructural projects for economic development (Molapo 2016).

Government grant is a non-repayable fund or a public subsidy offered to a recipient to fund a specific project and require some level of compliance and reporting. In the past, Lesotho has received both recurrent (budget support) and capital grant. The coefficient of grants is expected to be highly positive. Public debt is the debt owed by a central government from both domestic and external sources. While considering that IMF (2012) outlined that Lesotho is in moderate risk of debt distress, the relationship between public debt and government expenditure growth on infrastructure is expected to be positive. Recurrent spending includes expenses that occur on a regular basis, be they monthly, quarterly, semi-annually, or annually. Also known as an operational budget, a recurrent spending is expected to aid execution of the capital spending. On the other hand, the recurrent spending may also be viewed to be crowding out capital spending. So β_5 is expected to be ambiguous.

Table 1: *Data Series, Sources and Expected Sign*

Variable	**Descriptor**	**Database/Source**	**Expected Sign**
REV	Real government revenue without grant	IMF / Central Bank of Lesotho	$\beta_1 > 0$
ER	External Reserves	IMF / Central Bank of Lesotho	$\beta_2 < 0$
G	Grants	IMF / Central Bank of Lesotho	$\beta_3 > 0$
L	Public Debt	IMF / Central Bank of Lesotho	$\beta_4 > 0$
RS	Recurrent Spending	IMF / Central Bank of Lesotho	β_5 = ambiguous

The E-G cointegration test relies on the use of the standard unit root tests. In testing for a long-run equilibrium with standard unit root tests on the residuals, then $\mathbf{H_0}$ = no cointegration. Failure to reject

$\mathbf{H_0}$ occurs when the test statistic is less than its critical value. This implies that the residuals are stationary in level and there is a long-run relationship between the variables.

4.2 Unit root tests

To establish the order of integration of the variables, this paper uses two unit root tests: Augmented Dickey Fuller (ADF) test by Dickey and Fuller (1979), complemented by Phillips-Perron (PP) test by Phillips and Perron (1988). This is because ADF has been found to have low power in certain circumstances and PP corrects for any serial correlation and heteroskedasticity in the errors by directly modifying the test statistics and does not require specification of lag length. This is also to ensure that the series are I(1) because Engle and Granger (1987) state that the non-stationary time series are said to be cointegrated. However the tests are further conducted to ensure that the residual are stationary in level or I(0) for existence of cointegration. To decide on the number of lags in unit root testing the lowest Akaike Information Criterion (AIC) complemented by Schwartz Bayesian Criterion (SBC) are used for better fit. The AIC and SBC estimate the quality of each model, relative to each of the other models and help for the choice of parsimonious model because there is a penalty to adding higher lags. However, for residual testing, the asymptotic critical values are invalid for a standard unit root tests. The calculated t-statistic is compared with a set of statistics provided by Dividson and MacKinnon (1993).

5. The Empirical Results

5.1 Unit Root Procedure

It can be seen from Table 2 that the unit root test results, using the ADF unit root test and PP test, suggest that all series are I(1) because they become stationary after being differenced once. Therefore, the Engle and Granger (1987) can be employed.

Table 2: *ADF and PP Unit Root Test Results*

	H_0:non-stationary in levels		**H_0:non-stationary in first differences**	
Variable in logs	**ADF**	**PP Statistic**	**ADF Statistic**	**PP Statistic**

	Statistic			
REV	-0.623	-1.435	-7.453*	-7.534*
ER	0.269	0.930	-4.443*	-4.605*
G	-1.145	-1.185	-5.011*	-5.028*
L	-2.234	-2.178	-7.289*	-7.321*
RS	-1.321	-1.328	-3.667*	-5.894*

Note: *The asterisks *, ** and *** denote significance level at 1 per cent, 5 per cent and 10 per cent, respectively for the ADF and PP test of unit root. The null hypothesis is that the series are non-stationary.*

5.2 Long-Run Analysis

The statistical inference for the long run estimated results are found to be valid since the residuals are stationary in level. This concludes that the variables are cointegrated or there is a long run relationship between the varibles. The results of the Long-run estimation are presented in eqation 4 along with the corresponding diagnostic tests in table 3. To find out how well the model fits a set of observations, the R^2 indicates that 99.4 per cent of the variation in growth of government expenditure on infrastructure is explained within the model. Nontheless, the R^2 cannot determine whether the coefficient estimates and predictions are biased, hence futher assessment of the residual plots using the following test is necessary: Residual autocorrelation test: This implies that errors must be independent, $E\{\mathcal{E}'_i\mathcal{E}_j\} = 0$, for any i, j; Homoskedasticity: the error variance must be constant, $Var\{\mathcal{E}\} = E\{\mathcal{E}'\mathcal{E}\} = \sigma^2$; and Normality: residuals must be normally distributed, $\mathcal{E}_t = N(0, \sigma^2)$.

$$lnGP_t = 0.4654^{*}\, ln\mathrm{REV}_t + 0.010\, lnER_t + 0.8112^{*}\, lnG_t + 0.0957^{*}\, lnL_t - 0.3112\, lnRS_t + 0.393842^{*}\, DUM1993 - 0.3660 DUM1998 + 0.3461^{*}\, \mathrm{DUM2010} + \varepsilon_t \quad (4)$$

Note: *The asterisks *, ** and *** denote significance level at 1 per cent, 5 per cent and 10 per cent, respectively. And the DUM1993, DUM1998 and DUM2010 are dummy variables representing structural changes and outliers*.

Table 3: *Diagnostics Tests*

Test	statistics

R^2	0.993554
Adj R^2	0.991571
Durbin-Watson	2.187156
Wald Test	7.226883*
Breusch-Godfrey Serial Correlation LM Test	1.887142
Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.608087

Note: *The asterisks *, ** and *** denote significance level at 1 per cent, 5 per cent and 10 per cent, respectively.*

The Jarque Bera (JB) test for normality and the Breusch-Pagan-Godfrey (BPG) heteroskedasticity confirm that the errors are white noise. In addition, the null hypothesis of the coeffieicnts not being jointly statisically different from zero is rejected in the Wald test. The tests on the model also indicate that there is no serial correlation and heteroskedaasticity. All cofficients are statistically significant and can be used to explain growth of government expenditure on infrastructure except LER and LRS. In Lesotho, governments grants are highly significant in influencing the GP. The government revenue also plays an inportant role in determining GP as a percentage change in REV increases GP by 0.465 percent. However, the governement does not consider external reserves and the level of expenditure on total current budget outlays when making decisions on the expendiuture on infrastructure. There is no trade off or oppotunity cost between the recurrent outleys, external reverses and capital outleys.

The role of government is to building minimum infrastructure platform, especially to link production centres and markets and to facilitate external trade and development of private sector. A dummy variable representing the start of boom in infrastrue development due to LHWP project around 1993 (DUM1993), possitively affect GP as well as the dummy variable for the inception of the MCA projects (DUM2010). However, the dummy variable for the 1998 political instability in Lesotho (DUM1998) negatively and significantly influence GP.

5.3 Short-Run Analysis

Equation 5 below presents the estimated Error Correction Model (ECM) for growth of government expenditure on infrastructure in Lesotho as well as its associative diagnostic tests. The corresponding

sign of Error Correction Term (ECT) is negative and significant. This means that there is a long run causality running from independent variables to the dependent variable. The negative sign of (ECT) indicates a move back towards equilibrium following a shock to the system in the preivous year. Similar to the results under the estimated long-run model, government grants and government revenue strongly and significatly affect growth of government expenditure on infrastructure in Lesotho. This is consistent with a small open economy which is dependent on grants (Molapo 2016).

However, debt/loans and external reserves are not playing a role in determiing growth of government expenditure on infrastructure in Lesotho in the short-run. This means that, in the short run, the governemnt does not borrow to finance infractructure activities. The governement of Lesotho does not also consider external reserves for short term investment in infrastructure. The influence of recurrent expenditure on government expenditure on infrastructure is highly significant but marginal in short run. Thus, a percentage increase in the growth of government recurrent expenditure increase government spending on infrastructure by 0..0001 percent. This concludes that recurrent outlays are partially used to execute capital outlays.

$$\Delta lnGP_{\mathrm{t}} = -0.1144^{***} + 0.4231^{***}\Delta\, ln\mathrm{REV}_{\mathrm{t}} + 0.2374\,\Delta lnER_{\mathrm{t}} + 0.6714^{*}\,\Delta lnG_{\mathrm{t}} - 0.4323\,\Delta lnL_{\mathrm{t}} - 0.0001^{*}\,\Delta lnRS_{\mathrm{t}} + 0.2666^{**}\,DUM1993 + \varepsilon_{\mathrm{t}} \quad (5)$$

Note: *The asterisks *, ** and *** denote significance level at 1 per cent, 5 per cent and 10 per cent, respectively. And the DUM1993 is dummy variables representing structural change in 1993.*

Table 4: *Diagnostics Tests*

Test	**statistics**
R^2	0.667963
Adj R^2	0.561712
Durbin-Watson	1.952394
Wald Test	8.889915*
Breusch-Godfrey Serial Correlation LM Test	0.763264

Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.060147

Note: *The asterisks *, ** and *** denote significance level at 1 per cent, 5 per cent and 10 per cent, respectively.*

6. CONCLUSION

This study expanded the line of research evaluating the effect of factors related to the growth of government expenditure on infrastructure with the use of Engle and Granger (1987) approach employing annual time series data from 1980 to 2014. The residual test showed that there is a stable long-run relationship among the included variables even in the presence of an endogenously determined structural break, which means that non-spurious Error Correction Models (ECM) can be estimated on the basis of the series. Using the Engle-Granger approach, an error correction model was generated that reconciles both the short-and long-run properties of the variables. The ECM has relatively good explanatory power and was able to track the turning points of the in-sample data well.

The results, both in the long-run and short-run indicate that the government of Lesotho is highly dependent on grants and government revenues to finance growth of its spending on infrastructure. Debt is highly positively associated with changes in the growth of government spending in the long-run, but not in the short run. There is no evidence of association between growth of government spending on infrastructure and external reserves both in the long –run and short-run. The absence of opportunity cost of reserves can lead to accumulation of reserves above the optimal level (Molapo 2016).

Overall Government expenditures remain comparatively high in Lesotho. Government expenditures have amounted to about 60 percent of GDP or more in recent years, with spending becoming increasingly slanted towards recurrent expenditures. Based on the findings of the study, both in the long and short-run, government revenue remains a highly significant determinant of government expenditure on infrastructure which government has direct control over.

Looking ahead, an increase in the allocation of government resources to capital expenditure will boost the country's economic growth and development. However, there is a need to increase the absorption

capacity of government capital budget by borrowing from the MCA project model for execution of capital budget in Lesotho. The MCA model has a 100 percent record of execution of the budget, (Central Bank of Lesotho 2016). With the changing structure of the world economy and classification requirement for eligibility of grants, there need to be a drastic shift from the grant dependent to own resource dependency for economic transformation. From a policy point of view, it is suggested that more thrust may be given for boosting the capital formation in the economy in order to achieve high economic growth in Lesotho economy.

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Variables in levels