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Electricity Consumption in Lesotho: The Role of Financial Development, Industrialisation and Urbanisation

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Abstract

Similar to other developing economies, Lesotho's security of electricity supply is threatened by the growing energy demands with the peak power deficits being met through imports. This study seeks to understand the key determinants behind this growth of electricity consumption. It examines the role played by financial development, industrialisation, and urbanisation in Lesotho's energy-growth nexus between 1973 and 2012. The findings from the co integration analysis reveal that economic growth, financial development, and industrialisation are positively related to electricity consumption in the long-run. Urbanisation, however, is found to have no significant effect on electricity consumption. Furthermore, the introduction of regulation has impacted positively on electricity demand in Lesotho. This partly explains the observed increase in household electrification level in recent years, which has been rising in tandem with electricity demand. In addition, the study finds bidirectional causality between financial development and electricity consumption, and between urbanisation and economic growth. It also finds unidirectional causality from electricity consumption to industrialisation, from industrialisation to urbanisation, and from urbanisation to financial development.

Keywords: Electricity Consumption, Financial Development, Industrialisation, Urbanisation, Cointegration, Lesotho.

1. Introduction

Over a last decade, several emerging economies have experienced energy shortages due to rapid increase in the demand for energy services (see Shahbaz and Lean, 2012; Zaman et al., 2012; Inglesi-Lotz, 2011). This called for more scholarly attention in identifying the factors influencing energy demand as well as its appropriate control measures. Similar to other developing countries, Lesotho's security of energy (or more specifically, electricity) supply is threatened by the growing energy demands, with peak power deficits being met through imports. Since 1969, the country has been importing almost all of its electricity from Eskom in South Africa till the establishment of the 'Muela Hydropower Plant (MHP) in 1998. However, given the increasing level of electrification in subsequent years[4], the country was forced to continue importing extra electricity from Eskom and later from Eletricidade de Mozambique (EdM) following the 2008 electricity crisis. In recent years, the country's peak electricity demand has been rising in tandem with the electrification level, reaching 143 MW in 2014. This led to a peak power deficit of about 50% that has to be met through imports, hence threatening the national security of electricity supply (LEWA, 2014).

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[4]For example, household electrification level increased from 5% in 2001 to over 30% in 2013 (Thamae at al., 2015)

The study seeks to understand the key determinants behind the growth of electricity consumption in Lesotho. Given that other studies in Lesotho focus on the relationship between economic growth and electricity consumption (see Sekantsiand Thamae, 2016; Thamae et al., 2015; Makhetha, 2013), this paper takes into account the role of financial development, industrialisation and urbanisation as well as institutional factors in Lesotho's energy-growth nexus. The study contributes to the empirical literature on the drivers of energy consumption in developing countries. It also applies the co integration techniques using the longest time series data available for Lesotho covering the period 1973-2012. The findings reveal that economic growth, financial development, and industrialisation are positively related to electricity consumption in the long-run, while urbanisation is found to have no significant effect on electricity consumption. The introduction of regulation has also impacted positively on electricity demand in Lesotho, partly explaining the observed increase in household electrification level in recent years.

The rest of the paper is structured as follows. The next section provides an overview of Lesotho's electricity sector. It is followed by a brief review of the literature on electricity (or more broadly, energy) demand and the methodology. The empirical results are then presented and lastly, the concluding remarks together with recommendations are offered.

1. Lesotho's Electricity Sector

The Lesotho electricity sector currently has four main players (see Thamae et al., 2015). The first player is the Lesotho Electricity Company (LEC), which was established by the Government of Lesotho (GoL) in 1969 with the aim of improving electricity supply throughout the country. In line with the Electricity Act No. 7 of 1969, LEC was mandated to generate, transmit, distribute, and supply electricity within the country. Prior to that period, the supply of electricity in Lesotho was under the direct control of the GoL, which used a small coal-fired generating plant to supply electricity to the administrative centre of the capital city – Maseru, and to a few nearby residential areas, mostly occupied by foreigners. However, when electricity demand increased in subsequent years, LEC entered into an agreement with Eskom (South Africa) to supply the country with additional electricity.

As a second player, the Lesotho Highlands Development Authority (LHDA) came on board in 1998 with the ownership of the 72 MW capacity MHP. Nevertheless, given the increasing electrification level in the 2000s, LEC had to continue importing electricity not only from Eskom but also from EdM. As a result, the MHP's effect of stabilising electricity prices was diminishing with the long-run marginal cost of electricity in Lesotho being largely determined by Eskom and EdM prices. In 2004, the third player – the Lesotho Electricity Authority (LEA)[5], was established to regulate the electricity industry. LEA then licensed LHDA to generate electricity while LEC was licensed only to transmit, distribute, and supply electricity. The Rural Electrification Unit (REU) in the Department of Energy (DoE), as a fourth player, was granted a license-exemption by LEA to operate Electricity Access Pilot Projects (EAPPs) that are outside LEC's service territory where electrification is expected not to be commercially viable.

2. Literature Review

The literature indicates that energy consumption can be influenced by various factors including economic growth, financial development, industrialisation and urbanisation. Medlock and Soligo (2001) argue that changes in the structure of production and consumption resulting from economic development are important factors affecting energy demand. This is because as the economy develops, people, especially those in urban areas, tend to use more electricity-dependent gadgets for heating, cooking, recreation and comfort. In addition, as the economy develops through different stages of production, energy consumption tends to increase as well. For example, production methods in industrial sector require more energy than traditional production methods in earlier stages. Energy consumption can also influence economic growth through its role as an input in production (see Lee and Chang, 2008; Stern, 2004). In this case, energy becomes one of the important agents in the transformation of materials, resources and other inputs into goods and services. Nevertheless, the empirical studies reveal mixed results on the direction of causality between energy consumption and economic growth (see Aslan, 2014; Kwakwa, 2012; Odhiambo, 2009a; and Odhiambo, 2009b).

Aslan et al. (2014) and Cobanand Topcu (2013) present various channels through which financial development can also impact energy consumption.

[5]It is now called Lesotho Electricity and Water Authority (LEWA) following its transformation into a multi-sector regulatory body since 2013 with additional powers to regulate urban water and sewerage services.

First, a developed financial system allows individuals to access funds at cheaper costs and this enables them to buy durable goods whose production and consumption increase energy demand. Second, financial development brings about improvements in financial infrastructure, which helps businesses to acquire loans cheaply and invest in advanced machinery and equipment that use more energy. Third and lastly, financial development may boost consumer confidence and this has a potential to stimulate economic growth and energy consumption. Other empirical studies such as Chang (2015), Salman and Atya (2014) and Shahbaz and Lean (2012) support the idea that financial development enhances energy consumption. Industrialisation and urbanisation also have a positive effect on energy consumption. This is pertinent because industrialisation involves the use of heavy machinery and equipment in industries, which require energy for their operation (see Sadorsky, 2010; Ekpo et al., 2011). Alternatively, urbanisation involves structural changes in the economy as a result of population shifts. This in turn increases demand for electricity as urban dwellers switch from conventional sources of fuel such as biomass, paraffin, and oil to electricity.

The reviewed literature therefore provides evidence on the relationship between energy consumption and its main determinants, which are economic growth, financial development, industrialisation and urbanisation. According to Karanfil (2009), country specific factors also matter in the analysis of energy demand and energy policy. However, the mixed findings from empirical studies on this subject may be due to differences in estimation techniques, study periods, and development levels of countries being studied.

3. Methodology

Following Salman, and Atya, (2014), the basic model for electricity consumption is specified as follows:

$$ENC_t = \beta_0 + \beta_1 GDP_t + \beta_2 FD_t + \beta_3 IND_t + \beta_4 URB_t + \beta_5 Z_t + \varepsilon_t \quad \textbf{(1)}$$

WhereENC_t,GDP_t, FD_t, IND_t and URB_t denote the natural logarithms of electricity consumption, economic growth, financial development, industrialisation and urbanisation, respectively. t is the time period, $\beta's$ are long-run parameters to be estimated, ε_t is the white noise error term and $Z_t$is any exogenous variable affecting the demand for electricity in Lesotho. All the coefficients of the explanatory variables are expected to be positive, except β_5 which is ambiguous.

The study uses the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to investigate the order of integration of the variables. This is done to ensure that all variables are integrated of the same order so as to avoid spurious results in the presence of different orders of integration. If the variables are found to be integrated of order one, the next step is to test whether they are co integrated or not. Different co integration techniques such as the Johansen maximum likelihood test (see Johansen, 1988; Johansen and Juselius, 1990) and Engle-Granger (EG) residual based test (see Granger, 1988) exist in the literature. Since the aim is not to study all possible co integration relationships between the variables, the paper employs EG test for co integration, which imposes a unique co integrating vector between the variables. This test is performed by first pre-estimating co integration regression (equation 1) by fully modified ordinary least squares (FMOLS) procedure instead of the standard ordinary least square (OLS) technique (see Phillips and Hansen, 1990).

The FMOLS method uses kernal estimators of nuisance parameters that affect the asymptotic distribution of OLS estimators to produce optimal estimates of co integration regression. In order to achieve asymptotic efficiency, this technique modifies the least squares to allow semi-parametric correction for serial correlation in the co integrating vector and controls the potential for endogeneity of the regressors. Once the co integration regression has been estimated, the existence of co integration between the variables is confirmed by testing for unit root on the residuals produced from the co integrating regression using the ADF test. In this case, the null hypothesis of no co integration is tested against the alternative hypothesis of co integration. The rejection of the null hypothesis therefore implies that there is co integration (see Narayan and Narayan, 2004; Shahbaz, 2009; Facchiniand Melki, 2013).

Following the identification of co integating relation among the variables, the following error-correction model (ECM), which links the short-run dynamics to the long-run relationship, is estimated:

$$\Delta ENC_t = \delta + \alpha CE_{t-1} + \sum_{i=1}^{p} \lambda_{1i} \Delta ENC_{t-i} + \sum_{i=0}^{p} \lambda_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{p} \lambda_{3i} \Delta FD_{t-i} + \sum_{i=0}^{p} \lambda_{4i} \Delta IND_{t-i} + \sum_{i=0}^{p} \lambda_{5i} \Delta URB_{t-i} + \varphi Z_t + \mu_t \quad (2)$$

Where

$$CE_{t-1} = ENC_{t-1} - (\beta_1 GDP_{t-1} + \beta_2 FD_{t-1} + \beta_3 IND_{t-1} + \beta_4 URB_{t-1}) \quad (3)$$

is the error-correction term, Δ is the first difference operator, p is the optimal lag length, δ is the constant term, α is the adjustment coefficient, λ_i is short-term impact of *i*-lagged variable, μ_t is a white noise disturbances term and φ is the effect of exogenous conditions on electricity demand. The existence of co integration between the variables may imply that causality runs at least in one direction. Thus, the paper goes further to investigate Granger-block causality between electricity consumption and its determinants (see Granger, 1969; and Granger, 1988).

4. Data and Estimation Results

4.1 Data Description

The paper uses annual time series data covering the period 1973-2012. The data on electricity consumption (measured in kWh per capita) is obtained from LEC, while that on economic growth (measured by real GDP per capita), financial development (proxied by domestic credit to private sector as a share of GDP), industrialisation (measured as a ratio of industrial value-added to GDP) and urbanisation (proxied as a share of urban population to total population) is sourced from the World Bank Development Indicators (WDI). Figure 1 shows the plots of the variables over 1973-2012 period in logarithms. The trending of the graphs could imply that the variables are non-stationary. This should be confirmed by unit-root test which is presented in the next sub-section.

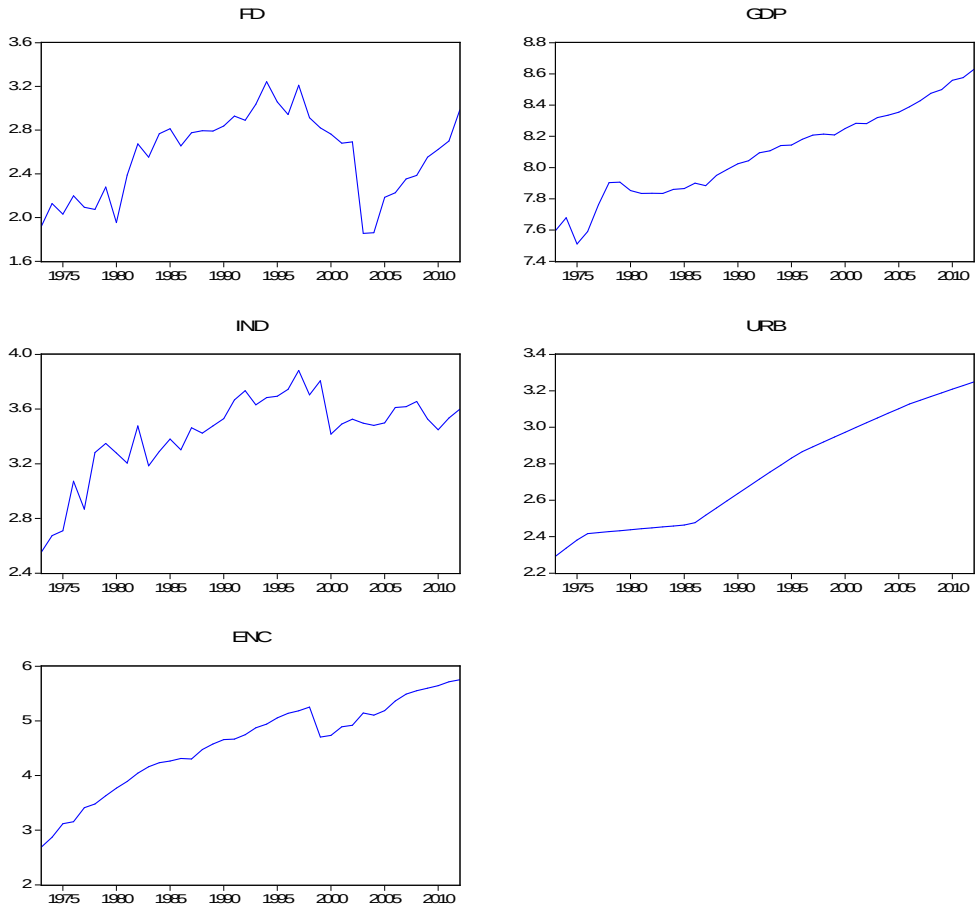

Figure 1: Data trends of variables over 1973 – 2012 periods

4.2 Unit Root Test Results

The study begins by applying ADF and PP unit root tests to determine the order of integration of the variables. The null hypothesis states that the series is non-stationary and failure to reject the null indicates that there is unit root. Table 1 presents the ADF and PP unit root tests results in both levels and first differences.

The results indicate that electricity consumption, economic growth, financial development, urbanisation and industrialisation are integrated of order one or $I(1)$. Therefore, a long-run relationship might exist between electricity consumption and its determinants.

Table1: ADF and PP Unit Root Test Results

	H_0:non-stationary in levels		H_0:non-stationary in first differences	
Variable	ADF Statistic	PP Statistic	ADF Statistic	PP Statistic
ENC_t	-1.409 (0.825)	-1.561 (0.790)	-5.875 (0.000)	-5.875 (0.000)
GDP_t	-1.045 (0.925)	-0.349 (0.986)	-5.624 (0.000)	-6.781 (0.000)
FD_t	-1.905 (0.327)	-1.943 (0.309)	-6.921 (0.000)	-6.894 (0.000)
URB_t	1.342 (0.952)	1.394 (0.847)	-4.632 (0.004)	-4.645 (0.003)
IND_t	-2.572 (0.294)	-2.927 (0.166)	-10.19 (0.000)	-10.33 (0.000)

Note: Values in parentheses are p-values

4.3 Co integration Test Results

Since all the variables are found to be $I(1)$, the paper applies FMOLS procedure to estimate the co integration regression. Table 2 provides the results of the estimated model and its associated diagnostic tests. In terms of diagnostic tests, the model fits the data well since about 95% of the variation in the electricity consumption is explained within the model. The Jarque-Bera (JB) and Durbin-Watson (DW) tests for normality of errors and serial correlation, respectively, also indicate that the residuals are white noise[6]. Furthermore, the ADF statistic is found to be statistically significant at 1% level of significance and as a result, the null hypothesis of no co integration is rejected. Therefore, there is a stable and unique long-term relationship between electricity consumption, economic growth, financial development, urbanisation and industrialisation in Lesotho.

All the estimated coefficients in the co integrating vector, with an exception of urbanisation, are not only statistically significant but also consistent with the theory. Specifically, economic growth, financial development, and industrialisation are found to be positively related to electricity consumption in the long-run. The positive economic growth coefficient implies that, *ceteris paribus*, a percentage increase in economic growth raises electricity demand by 1%. This result is similar to that of Thamae et al. (2015), who found that economic growth is one of the main drivers of electricity consumption in Lesotho. As previously, a 1% increase in domestic credit to the private sector spurs electricity demand by about 0.4%. This is because financial development promotes investments, which in turn increase the demand for electricity (see Sadorsky, 2010). The positive and highly significant coefficient of industrialisation also suggests that 1% rise in industrial value-added leads to about 0.9% increase in electricity consumption in the long-run. All these findings are consistent with that of Shahbazand Lean (2012), who found that economic growth, financial development, and industrialisation enhance energy demand in Tanzania – a developing economy like Lesotho.

[6]This is also supported by the Q-statistics and correlogram of squared residuals, which are statistically insignificant at all lags and therefore provide evidence of no serial correlation and heteroscedasticity in the residuals of the model.

Table 2: Co integration Regression Results

Variable	Coefficient	t-statistic	p-value
c	-9.934	-2.934	0.006
GDP_t	1.013	1.814	0.079
FD_t	0.360	3.026	0.005
URB_t	0.498	1.075	0.290
IND_t	0.894	3.985	0.000
$LEWA$	0.266	1.899	0.067
$D98$	-0.257	-1.678	0.103
Diagnostics Tests R^2 = 0.947 $Adj\ R^2$ = 0.937 DW = 1.977 JB = 0.352 (0.838) ADF = -7.757 (0.000)			

Note: Values in parentheses are the p-values.

The role played by exogenous factors such as the inception of the regulator – LEWA, in 2004 ($LEWA$), and the 1998 political instability ($D98$) is examined along with the long-run determinants of electricity consumption in Lesotho. It is evident from the results provided in Table 2 that the introduction of regulation had a positive and significant effect on electricity demand while the 1998 political instability seems to have had no significant effect. The former finding suggests that the observed increase in household electrification level in recent years, which has been rising in tandem with the electricity demand, is partly attributable to the efficiency brought by regulation in the electricity sector. However, the country's low household electrification level of about 30% or less (see Thamae et al., 2015) could also explain why urbanisation is found to play a less important role in influencing the dynamics of electricity demand in Lesotho. Thus, it is not surprising why some of the urban areas in Lesotho are not electrified.

4.4 Error-Correction Model and Granger Causality Test Results

The study uses the residuals of the co integrating regression to estimate the ECM in order to get an insight into the short-run relationship between electricity consumption and its determinants. Table 3 presents the ECM estimation results and its associated diagnostic tests. The results indicate that the residuals are approximately white noise. This is supported by Jarque-Bera (JB), Breusch-Godfrey (BG) Lagrange multiplier (LM) and ARCH Heteroscedasticity diagnostic tests, which fail to reject the null hypotheses of normality, no serial correlation, and no heteroscedasticity, respectively[7]. The adjustment coefficient also bears the correct (negative) sign and is statistically significant at the 5% level. This ensures the attainment of long-run equilibrium following a system shock. Furthermore, all other coefficients of the endogenous variables, except that of the first difference of economic growth and lagged differences of urbanisation and industrialisation, are statistically significant. The results show that electricity consumption in Lesotho is significantly influenced by its lagged value at the 10% level. Financial development is also found to be positively related to electricity consumption in the short-run, a result consistent with the findings of Shahbazand Lean (2012). However, unlike in the long-run where an increase in industrial activities demand more electricity to power various plants and machinery used in the industrial sector, the coefficient of industrialisation is found to be statistically insignificant in the short-run.

[7]In addition, the Q-statistics and correlogram of squared residuals are found to be statistically insignificant, providing more evidence that the residuals in the model are not only serially uncorrelated but also homoscedastic.

Table 3: ECM Test Results

Variable	Coefficient	t-statistic	p-value
c	0.039	1.173	0.250
CE_{t-1}	-0.292	-2.537	0.017
ΔENC_{t-1}	0.221	1.790	0.084
ΔGDP_t	0.159	0.584	0.564
ΔFD_{t-1}	0.188	2.900	0.007
ΔIND_{t-1}	-0.006	-0.055	0.956
ΔURB_{t-1}	0.753	0.743	0.464
$D98$	-0.318	-5.298	0.000
$LEWA$	0.081	1.566	0.128
Diagnostics Tests, Adj R^2 = 0.664, JB = 6.033 (0.489) BG Serial Correlation LM test = 12.928 (0.114) ARCH Heteroscedasticity test = 10.608 (0.225)			

In order to capture the effects of the establishment of LEWA and the 1998 political instability on short-run dynamics of electricity consumption in Lesotho, the paper incorporates the dummy variables *LEWA* and *D*98 as exogenous variables in the estimation of ECM. The results presented in Table 3 reveal that the 1998 political instability reduced electricity demand in the short-run, shown by a negative coefficient of *D*98, which is statistically significant at the 1% level. This may be on account of the fact that a number of businesses and factories in Lesotho closed following the 1998 political unrest. However, the dummy variable for the establishment of LEWA appeared insignificant, suggesting that the introduction of regulation had no significant effect on electricity demand in the short-run.

Table 4: Granger Causality Test Results

Null hypothesis	Wald statistic	p-value
FD does not Granger cause ENC	6.764	0.034
GDP does not Granger cause ENC	1.462	0.481
URB does not Granger cause ENC	1.722	0.423
IND does not Granger cause ENC	0.432	0.806
ENC does not Granger cause FD	5.770	0.056
GDP does not Granger cause FD	0.309	0.857
URB does not Granger cause FD	5.768	0.059
IND does not Granger cause FD	1.544	0.462
ENC does not Granger cause GDP	4.177	0.124
FD does not Granger cause GDP	0.159	0.924
URB does not Granger cause GDP	11.13	0.004
IND does not Granger cause GDP	0.032	0.984
ENC does not Granger cause URB	2.035	0.362
FD does not Granger cause URB	1.212	0.546
GDP does not Granger cause URB	8.473	0.015
IND does not Granger cause URB	5.742	0.057
ENC does not Granger cause IND	8.123	0.017
FD does not Granger cause IND	0.022	0.989
GDP does not Granger cause IND	0.286	0.867
URB does not Granger cause IND	0.719	0.698

The paper also performs Granger causality test to examine the direction of causality between electricity consumption and its determinants. Table 4 presents the Granger causality test results, which reveal that there is bidirectional causality between financial development and electricity consumption, and between urbanisation and economic growth. The former result shows that an increase in credit extension by financial institutions in Lesotho plays a vital role in increasing energy demand. This is so because financial institutions enable individuals to access credit at cheaper costs, which in turn raises demand for electrical appliances, and consequently lead to increased demand for electricity. Also, an increased electricity usage will lead to more economic and investment activities, which increase demand for financial services and therefore lead to financial development (see Shahbazand Lean, 2012, for similar finding). The results further indicate unidirectional causality from industrialisation to urbanisation, from urbanisation to financial development, and from electricity consumption to industrialisation. The latter shows that industrial growth in Lesotho demands more energy as an input in production of goods and services.

5. Conclusion

Lesotho's security of electricity supply is threatened by the growing energy demands, with the peak power deficits being met through imports from Eskom (South Africa) and EdM (Mozambique). This paper seeks to understand the key determinants behind this growth of electricity consumption by examining the role played by financial development, industrialisation and urbanisation in Lesotho's energy-growth nexus over the period 1973-2012. The findings from the co integration analysis reveal that economic growth, financial development and industrialisation are positively related to electricity consumption in the long-run, while urbanisation is found to have no significant effect on electricity consumption. Furthermore, the introduction of regulation has positively impacted on electricity demand in Lesotho, partly explaining the observed increase in household electrification level (and hence, electricity demand) in recent years. The 1998 political instability, however, reduced electricity demand only in the short-run. These results show that institutional factors such as regulation and political instabilities also matter in analysing the dynamics of energy demand.

The study also presents evidence of feedback causality between financial development and electricity consumption, and between urbanisation and economic growth. The former result shows that an increase in credit extension by financial institutions in Lesotho plays a vital role in increasing energy demand. There is also a unidirectional causality from industrialisation to urbanisation, from urbanisation to financial development, and from electricity consumption to industrialisation. The latter shows that industrial growth in Lesotho demands more energy as an input in production of goods and services. Thus, energy policymakers in Lesotho should ensure the availability of electricity by promoting efficient energy use and exploring other sources of energy. This could also reduce dependence from relatively costly electricity imports.

References

Aslan, A. (2014). Causality between Electricity Consumption and Economic Growth in Turkey: An ARDL Bounds Testing Approach", *Energy Sources, Part B: Economics, Planning, and Policy,* Vol. 9, No. 1, pp. 25-31.

Aslan, A., Apergis, N. and Topcu, M. (2014). "Banking Development and Energy Consumption: Evidence from a Panel of Middle Eastern Countries" *Energy*, Vol. 72, pp. 427-433.

Chang, S. (2015), "Effects of Financial development and Income on Energy Consumption", *International Review of Economics and Finance*, Vol. 35, pp. 28-44.

Coban, S. and Topcu, M. (2013). "The Nexus between Financial Development and Energy Consumption in the EU: A Dynamic Panel Data Analysis", *Energy Economics*, Vol. 39, pp. 81-88.

Ekpo, U. N. Chuku, C. A and Effiong, E. L.(2011). "The Dynamics of Electricity Demand and Consumption in Nigeria: Application of the ARDL Bounds Testing Approach". *Current Research Journal of Economic Theory*, Vol 3. No. 2,pp 43-52.

Facchini, F. and Melki, M. (2013). "Efficient Government Size: France in the 20th Century", *European Journal of Political Economy*, Vol. 31, pp. 1-14.

Granger, C. W. J. (1988). "Causality, Co integration, and Control" *Journal of Economic Dynamics and Control,* Vol. 12, pp. 551-559.

Granger, C. W. J. (1969)."Investigating Causal Relations by Econometric Models and Cross-spectral Methods", *Econometrica,* Vol. 37, No. 3, pp. 424-438.

Inglesi-Lotz, R.(2011). "The Evolution of Price Elasticity of Electricity Demand in South Africa: A Kalman Filter Application", *Energy Policy*, Vol. 39, No. 6, pp. 3690-3696.

Johansen, J. (1988). "Statistical Analysis of Co integration Vectors", *Journal of Economic Dynamic and Control*, Vol. 12, pp. 231-254.

Johansen, J. and Juselius, K. (1990). "Maximum Likelihood Estimation and Inferences on Co integration with Application to the Demand for Money", *Oxford Bulletin of Economics and Statistics*, Vol. 52, pp. 169-210.

Karanfil, F. (2009). "How many Times again will we examine the Energy – Income Nexus using a Limited Range of Traditional Econometrics Tools?", *Energy Policy*, Vol. 30, pp. 1191-1194.

Kwakwa, P. A. (2012). "Disaggregated Energy Consumption and Economic Growth in Ghana", *International Journal of Energy Economics and Policy*, Vol. 2, No. 1, pp. 34-40.

Lee, C. C. and Chang, C.P. (2008). Energy Consumption and Economic Growth in Asian Economies: A more Comprehensive Analysis using Panel Data. *Resources and Energy Economics,* Vol 3, No.1, pp 50-65.

LEWA.(2014). "Annual Report 2013/2014", *Lesotho Electricity and Water Authority*, Maseru, Lesotho.

Makhetha, L. (2013), "Demand for Electricity: Case of Lesotho", *Master's Dissertation*, Department of Economics, National University of Lesotho.

Medlock, K. B. and Soligo, R. (2001). "Economic Development and End-use Energy Demand", *The Energy Journal*, Vol. 22, No. 2, pp. 77-105.

Narayan, S. and Narayan, P. K. (2004). "Determinants of Demand for Fiji's Exports: An Empirical Investigation", *The Developing Economies*, Vol. 42, Issue 1, pp. 95-112.

Odhiambo, N. M. (2009a). "Energy Consumption and Economic Growth Nexus in Tanzania: An ARDL Bounds Testing Approach", *Energy Policy*, Vol. 37, No. 2, pp. 617-622.

Odhiambo, N. M. (2009b)."Electricity Consumption and Economic Growth in South Africa: A Trivariate Causality Test", *Energy Economics*, Vol. 21, No. 5, pp. 635-640.

Phillips, P. C. B. and Hansen B. E. (1990). "Statistical Inference in Instrumental Variable Regression with I(1) Processes", *The Review of Economic Studies*, Vol. 57, No 1, pp. 99-125.

Sadorsky, P. (2010). "The Impact of Financial Development on Energy Consumption in Emerging Economies", Energy Policy, Vol. 38, Issue 1, pp. 2528-2535.

Salman, D. M. and Atya, E. M. (2014). "What is the Role of Financial Development and Energy Consumption on Economic Growth? New Evidence from North African Countries", *International Journal of Finance and Banking Studies*, Vol. 3, No. 1, pp 137-149.

Sekantsi, L. P. and Thamae, R. I. (2016). "Electricity Consumption and Economic Growth in Lesotho", *Energy Sources, Part B: Economics, Planning, and Policy*.

Shahbaz, M. and Lean, H. H. (2012). "Does Financial Development increase Energy Consumption? The Role of Industrialization and Urbanization in Tanzania", *Energy Policy,* Vol. 40, pp. 473-479.

Shahbaz, M. (2009). "A Reassessment of Finance-Growth Nexus for Pakistan: Under the Investigation of FMOLS and DOLS Techniques", *The UIP Journal of Applied Economics,* Vol. 8, No. 1, pp. 65-80.

Stern, D. I. (2004). "Economic Growth and Energy", *Encyclopedia of Energy*, Vol. 2, pp 35-51.

Thamae, L. Z., Thamae, R. I. and Thamae, T. M. (2015). "Assessing a Decade of Regulatory Performance for the Lesotho Electricity Industry", *Utilities Policy*, Vol 35, pp. 91-101.

Thamae, R. I., Thamae, T. M. and Thamae, L. Z. (2015). "Dynamics of Electricity Demand in Lesotho: A Kalman Filter Approach," *Studies in Business and Economics*, Vol. 10, No. 1, pp. 130-139.

Zaman, K., Khan, M. M., Ahmad, M., and Rustam, R. (2012). "Determinants of Electricity Consumption Function in Pakistan: Old Wine in a New Bottle", *Energy Policy*, Vol. 50, pp. 623-634.

Biographical Notes

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