Modelling financial development and electricity consumption nexus for Ghana

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Abstract

The paper contributes to the body of knowledge in the area of energy consumption and financial sector development by empirically assessing the long run and short run links and causality between electricity consumption and financial development (proxied by credit to the private sector). The paper is based on quantitative causal study using time series data from 1970-2011. Data were analysed using Autoregressive Distributed Lag Model (ARDL) and Granger Causality Test. There is significant cointegration relationship among the series variables in the model estimated. There is no statistical significant long run and short run relationship between financial development (proxied by credit to the private sector) and electricity consumption. There is bidirectional causality between financial development and electricity consumption. This calls for future studies to contribute to the debate by assessing structural breaks in the series. Policy makers should consider these findings in planning for electricity consumption to avoid unplanned energy shortage which might have adverse effect on the economy.

Keywords: Financial Development; capital stock; electricity consumption; Bi-directional Causality; Credit to the private sector.
Jet Classification: 011; 016

1.1. Introduction

In recent times there has been an increase concern of the role of the financial sector in electricity consumption and the vice versa by researchers, energy experts, financial economists, development economists, and energy economists (Tang & Shahbaz, 2013; Shahbaz & Lean, 2012; Kakar, Khilji, & Khan, 2011; Karanfil, 2009). Various theoretical and empirical frameworks have been used to investigate the extent to which financial sector influences electricity consumption in both developed and in developing economies. In the face of energy crisis and the recent financial crisis the link between financial development and energy consumption cannot be taken for granted (Faridul, Muhammad & Mahmudul, 2011; Sadorsky, 2010). Researchers (Yeboah, 2015; Shahbaz, 2011; Beakert et al., 2005, 2002) report that financial development results in more income for the purchase of technologies and equipments that are powered by energy.

The ongoing debates in the literature are four. One debate is that energy consumption causes financial development. The second debate is that financial development causes energy consumption. The third debate is that there is feedback effect from energy consumption to financial development and from financial development to energy consumption. The last debate is that there is neutral effect between energy consumption and financial development (Shahbaz, 2011).

Various cointegration models (ARDL; Johansen cointegration; GMM) have been used to examine the link between financial development and energy consumption in developed and developing economies in multivariate and bivariate analysis. The findings are found in the works of various researchers (Yeboah, 2015; Shahbaz & Lean (2012; Shahbaz, 2011; Faridual et al., 2011; Sadorsky, 2010; Dan & Lijun, 2009). Some of the researchers (Shahbaz

& Lean, 2012) have reported of long run relation between financial development and energy consumption but not in the short run. Other researcher (Faridul et al., 2011; Shahbaz, 2011; Sadorsky, 2010; Sadorsky, 2009) have also established both long run and short run links between financial development and energy consumption.

Many researchers after identified cointegration relationship between financial development and energy have examined and reported of various directions of causality empirically in relation to the theoretical debates that has produced inconsistent results in the literature. The directions are bidirectional (Shahbaz & Lean, 2012; Faridul et al., 2011); unidirectional causality (Dan & Lijun, 2009) from energy consumption to financial development; unidirectional from financial development to energy consumption (Kakar et al., 2011) and neutral effect. The neutral effect indicates that none of the variables cause the other variable.

In summary the findings on the relationship and causality between financial development and energy consumption are inconsistent. There is also limited current research works on the topic. Some researchers report of significant bidirectional causality between energy consumption and financial development. Others report of only unidirectional link between finance and energy consumption. Other works also report of long run and short run relationships between energy consumption and financial development whereas there are also reports of only long run and only short run nexus.

Increase in energy use in all economies have become intractable and as such the understanding of the variables that impact on the consumption of energy could not be ignored but rather current empirical researches are needed to ensure continuous energy supply. The paper investigates the long run and short run relationship and the nature of causality between financial development and energy consumption in Ghana. The research is necessitated by the fact that there are few empirical researches in the literature especially on the study area with inconsistent results, findings and conclusion as well as recommendations. The current research fills in the literature gap by providing empirical results to enrich the literature using ARDL model to examine long run and short run relations and also testing for the direction of causality.

The paper contributes to the theories of growth and development by providing answers to the research questions raised in the paper by investigating the finance-energy consumption link and direction of causality. The empirical results provide information to policy makers on how to plan energy consumption to avoid unplanned energy shortage. Students of research, finance, energy and economics will find the results useful as reference material.

The general objective of the research is to contribute to the body of knowledge that exists in the literature in the area of finance and energy consumption by empirical investigating the long run and short run relationship and the nature of causality between finance and electricity consumption. The paper specifically assess:

- The nature of long run and short run relationship between electricity consumption and financial development and why.
- The nature of causality between financial development and electricity consumption and why.

The paper provides answers to two main questions. The questions are as follows:

- How does finance influence electricity consumption?
- What is the nature of causality between electricity consumption and financial development?

Answers are provided to these questions through the use of econometric analysis using the models of ARDL and Granger causality test.

Three main hypotheses are tested. These are;

H1: There is long run relationship between financial development and electricity consumption.
H2: There is short run relationship between financial development and electricity consumption.
H3: There is bidirectional causality between electricity consumption and financial development.

The findings are based on secondary data from official sources. Challenges with the use of secondary data affect the interpretation of the findings. Issues such as data massaging and errors in variables might affect the interpretation of the findings. The model estimated suffers from serial correlation. The model again suffers from incorrect functional specification. The estimated model did not pass the normality test. Much empirical works have been done in this area of research hence few works have been reviewed. Articles based on time series econometric analysis such as the examination of unit roots are only reviewed for the research. The rest of the paper considers the research methodology, empirical results; conclusions and recommendations.

2.0 Methodology

2.1 Data

Data for the study are taken from World Development Indicators (WDI-2011). The study period is from 1970-2011. The data used are reported in Table 1. The paper is based on time series modelling, quantitative research, and causal study.

Table 1 Data Description, Proxies and Sources

Data Description	Proxy	Source
1 Economic Growth (Y)	Nominal GDP	WDI)
2 Electricity consumption (EC)		WDI)
3 Investment (V)	Capital Stock	WDI
4 Government Expenditure (GE)		WDI
5 Financial Development (FD)	Credit to the Private Sector	WDI
6 Climate Change (CC)	Carbon emission	WDI

2.2 Conceptual Framework

The paper modelled the link between financial sector development and electricity consumption for Ghana. The control variables in the model are V, GE, CC, and Y. The dependent variable is electricity consumption (EC) and the independent variable is financial sector development (FD).

2.3 Econometric Model

The research is based on a multivariate model as specified in equation (1) with electricity consumption as the dependent variable and financial sector development as explanatory variable. The rest of the variables are control variables.

$$\ln EC_t = a + b\ln CC_t + c\ln FD_t + d\ln Y + f\ln V + g\ln GE + e_t \quad \text{...................(1)}$$

2.4 Estimation Methods

The paper is based on the following estimation methods; Augmented Dickey-Fuller (ADF) and Kwiatkowski et al (KPSS) tests for unit root investigation, the autoregressive distributed lag model (ARDL), and the granger causality testing (GCT).

2.4.1 Augmented Dickey-Fuller (ADF) and Kwiatkowski et al (KPSS) Tests for Unit Root.

The unit root test is conducted to determine whether the series in the model are stationary or non-stationary. If the series are non-stationary they should be made stationary through differencing before they are used in the estimation. If this is not done the regression results become spurious and not valid. In the study the unit root test is performed using the Augmented Dickey-Fuller (1981) (ADF) and Kwiatkowski et al. (1992, KPSS).

The null hypothesis (H_0) for ADF states that there is a unit root or the series are non-stationary in levels. The alternative hypothesis (H_1) states that the series are stationary or there is no unit root in the series. The critical values are compared with the calculated values at 5%, 1% and 10% levels of significance. If the levels of the series are not stationary, they are differenced until they become stationary. The decision rule for the use of the ADF is that if calculated ADF value is less in absolute term than critical values, the series in the model are not stationary or has unit roots.

The KPSS test is based on the null assumption (Ho) that the series variables under investigation are stationary (series are not unit root) against the alternative hypothesis (H1) that the series are not stationary (series are unit root). The KPSS is a reversed test for unit root. It is used in the current study for confirmation of the stationarity properties of the series.

2.4.2 Cointegration Analysis Base on the Pesaran, Shin and Smith ARDL Methodology

With the use of the Johansen-Juselius cointegration analysis, the order of integration of the series must be known with certainty. Yet some of the tests for the assessment of the order of integration have low power of detection. Some of these tests are the ADF, PP, and KPSS. For this reason the use of the ARDL model developed by Pesaran et al. (2001) for cointegration has become very popular. It allows for the examination of statistical significant long run and short run relationship among series variables whether in their levels or in their difference forms. The cointegration analysis is performed for the model under the null hypothesis (H_0) that there is no cointegration among the variables in the model against the alternative hypothesis (H_1) that the variables are cointegrated. The rejection /Acceptance of the H_0 is based on the Wald F tests.

2.4.3 The Granger Causality Testing (GCT)

The GCT aims at testing whether there is neutral causality, unidirectional causality or bidirectional causality between the variables. For the purposes of the study, Engel Granger (EG) causality test is used. According to Granger (1986), if time series data are integrated of order one I(1) and are cointegrated in addition, then there is at least one form of causality such as unidirectional causality. The GCT is based on the null assumption that there is no causality between the variables in the model against the alternative hypothesis that there is cointegration between the variables.

2.4.4 Diagnostic Methods

The estimated model is assessed for it goodness of fit using various diagnostic tests such as the R-Square (R^2), Joint significance test, J-B Normality test, Breusch-Godfred LM test, ARCH LM test, White Heteroskedasticity test, Ramsey RESET. The stability of the model is tested using the Cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). The reset test for specification is based on the assumption of adequate specification; The test for heteroskedasticity test is based on the null assumption of heteroskedasticity not present; The test for normality of residual is based on null assumption that the errors are normally distributed; The LM test for autocorrelation up to order 1 is based on the null assumption that there is no autocorrelation; The test for ARCH of order 1 is based on the null assumption that no ARCH effect is present, and CUSUM test for parameter stability is based on the null assumption that there is no change in parameters estimated. The CUSUM and CUSUMSQ tests are based on the null hypothesis that all coefficients in the given regression are stable and cannot be rejected.

3.0 EMPIRICAL RESULTS

3.1 Correlation Analysis

Multi-collinearity among the series variables was tested using the correlation matrix. The results are reported in Table 2. Electricity consumption shows insignificant negative and positive correlations with all the series variables. Overall, the magnitudes of the correlation coefficients indicate that multi-collinearity is not a potential problem in the regression models and the dataset together with the variables are appropriate for the current study. Financial development (proxied by credit to the private sector-CPS) is positively related to electricity consumption though insignificant. The finding is in line with Shahbaz and Lean (2012) who reported of statistical significant and positive link between financial development and energy consumption in Tunisia. Muhammad (2011) also reported of significant positive link between financial development and energy consumption and energy consumption and real capital stock in Pakistan.

Table 2 Correlation Matrix for Test's Variables

Variables	EC	Y	GE	CC	FD	V
EC	1.0000					
Y	-0.0040	1.0000				
GE	-0.0045	0.9806*	1.0000			
CC	-0.1705	0.5984*	0.6318*	1.0000		
FD	0.1661	0.0376	0.0499	0.2167	1.0000	
V	0.0019	0.4876*	0.5562*	0.7161*	0.2376	1.0000

NOTE: 5% critical value (two-tail) = 0.3044: * denotes significance at 5%

3.2: The ADF Test for Unit root

First, the Augmented Dickey-Fuller test was used to test for unit root without allowing for any structural breaks and a trend. The results of the ADF test for unit root in levels show that the series are non-stationary in intercept. Table 3 reports the results. The null hypothesis of unit root was accepted for all the series.

Taking the logarithm of the first difference of the series and testing these with intercept and trend makes some series stationary (Electricity consumption variable; economic growth variable; government expenditure variable; climate change variable; financial development variable, and investment variable). The null hypothesis of unit root was rejected. The results are reported in Table 4. These results indicate that the series exhibit unit root processes.

Table 3 ADF Stationarity Test Results with a Constant

Variables (Levels)	t-statistics	ADF P-Value	1% Critical Value	5% Critical Value	10% Critical Value	Results	Lag length
EC	-2.350	0.156	-3.662	-2.964	-2.614	Accept Ho (Unit root)	0
Y	3.905	1.000	-3.641	-2.955	-2.611	Accept Ho (Unit root)	0
GE	2.161	0.999	-3.641	-2.955	-2.611	Accept Ho (Unit root)	0
CC	-1.809	0.376	-3.662	-2.964	-2.614	Accept Ho (Unit root)	0
V	-1.376	0.594	-3.641	-2.955	-2.611	Accept Ho (Unit root)	0

Source: Author's computation

Table 4 ADF Stationarity Test results with a Constant and a Time Trend

Variables (1st diff.)	t-statistics	ADF P-Value	1% Critical Value	5% Critical Value	10% Critical Value	Results	Lag length
Δln EC	-4.543	0.001	-4.288	-3.560	-3.216	Reject Ho (Stationary)	2
ΔlnY	-3.410	0.050	-4.270	-3.552	-3.211	Reject Ho (Stationary)	2
ΔlnGE	-3.316	0.064	-4.270	-3.552	-3.211	Reject Ho (Stationary)	2
ΔlnCC	-6.461	0.000	-4.288	-3.560	-3.216	Reject Ho (Stationary)	2
ΔlnFD	-3.780	0.018	-4.270	-3.552	-3.211	Reject Ho (Stationary)	2
ΔlnV	-4.540	0.001	-4.270	-3.552	-3.211	Reject Ho (Stationary)	2

Source: Author's computation, 2013

3.3 The KPSS Test

The results of the KPSS test are reported in Table 5. The series were examined in levels and in first difference as well as in their logarithm form. The results are mixed. Some series are unit root in levels but become stationary in first difference, indicating that they are integrated of order one, I(1). Series variables that are stationary at levels are integrated of other zero, I(0). The levels of significance are 1%; 5% and 10%. Some series are stationary at 10% but not at 1% and 5%.

Table 5 KPSS stationarity test results with a constant and a time trend

Variable	KPSS P-value	Results	Lag Length
ΔEC-1st diff.	0.051	Reject Ho (Unit root)	3
EC-level	0.082	Reject Ho (Unit root)	3
ΔlnEC-1st diff.	0.049	Reject Ho (Unit root)	3
Y-level	0.199	Accept Ho (Stationary)	3
ΔlnY-1st diff.	0.113	Accept Ho (Stationary)	3
ΔlnGE-1st diff.	0.047	Reject Ho (Unit root)	3
GE-level	0.195	Accept Ho (Stationary)	3
ΔlnCC-1st diff.	0.097	Reject Ho (Unit root)	3
CC-level	0.239	Accept Ho (Stationary)	3
FD-level	0.148	Accept Ho (Stationary)	3
ΔlnFD-1st diff.	0.052	Reject Ho (Unit root)	3
V-level	0.151	Accept Ho (Stationary)	3
ΔlnV-1st diff.	0.127	Accept Ho (Stationary)	3

Source: Author's computation, 2013

In conclusion, the test results from the ADF and the KPSS indicates that the series exhibit unit root processes and are integrated of order one, I(1). The detection of unit roots in the series indicate that shocks to the series will have permanent effects and not transitory effects. The results also indicate that any regression analysis using the series without taking into account the stationarity properties of the series will be spurious.

3.4 Bound Test approach to Cointegration

Table 6 reports the results of the bound test for the presence of cointegration. Each variable in the electricity demand model is used as independent variable and its associated F-statistics in then computed and compared with the critical values developed by Pesaran et al. (2001 and Narayan (2004) to determine whether there is cointegration among the series variables. The lag selection method used is the Schwarz Beyesian Criterion (SBC) and lag one is used for the estimation. The calculated F-values exceed the critical upper bound values at 5%; 10% and 1%, which indicated rejection of the null assumption of no cointegration among the series variables. There is cointegration among three of the model which model 1; 4 and 6 with electricity consumption, climate change, and investment as the dependent variables. The results indicate stable long-run relationship among the variables. Hence, Y, GE, CC, FD, and V are the long-run equilibrium variables that explain the demand for electricity consumption for the period under review.

Table 6 Test for Cointegration Relationship

Critical Bounds of the F -statistic: intercept and trend			
	90% level	95% level	99% level
	$I(0)$ $I(1)$ 2.915 3.695	$I(0)$ $I(1)$ 3.538 4.428	$I(0)$ $I(1)$ 5.155 6.265
Computed F -Statistic		Decision	
F_{EC}(EC/Y, GE, CC, FD, V)	27.212	Cointegrated	
F_{Y}(Y/EC, GE, CC, FD, V)	0.227	Not Cointegrated	
F_{GE}(GE/EC, Y, CC, FD, V)	0.124	Not Cointegrated	
F_{CC}(CC/EC, Y, GE, FD, V)	5.925	Cointegrated	
F_{FD}(FD/EC, Y, CC, GE, V)	0.051	Not Cointegrated	
F_{V}(V/EC, Y, CC, GE, FD)	6.558	Cointegrated	

Source: Author's computation, 2013: Note: critical values are obtained from Pesaran et al., (2001) and Narayan, (2004).

3.5 Results of Long-Run Elasticities of ARDL model

The long-run determinants of electricity consumption were estimated using the model in which electricity consumption is the dependent variable. The results are reported in Table 7. The variables that statistically significantly determine electricity consumption are investment and climate change. The coefficient of climate change has expected a priori theoretical sign. The theoretical coefficient sign is negative to indicate efficient energy consumption (Nnaji et al., 2013). In the current study, the sign is negative and significant. This indicates that electricity use in Ghana during the period under discussion is efficient. The findings are not in line with that of previous studies such as Nnaji et al. (2013) and Omisakin (2009) for Nigeria and Chebby and Boujelbene (2008) for Tunisia.

The long run coefficient of investment has expected a priori theoretical sign which is positive. This means in the long run, increase in investment leads to increase in electricity consumption, other things equal. Investment is a determinant of electricity consumption. The findings on the relationship between investment and electricity consumption is in line with the findings of Muhammad (2011) who established weak but significant link between investment and energy consumption for Pakistan over the period 1971-2008. The significantly positive relationship between investment and energy demand has also been established by researchers such as Bartleet and Gounder (2010) for New Zealand, and Lean and Smyth (2009) for ASEAN.

The conclusion from the long-run and the short-run results is that investment is related to electricity consumption. The variables that are not significant determinants of electricity consumption are government expenditure (GE), economic growth (Y) and financial development which is proxied by credit to the private sector (FD). These variables have expected theoretical signs of positive but are not significant. The conclusion from these results is that economic growth, financial development and government spending have no significant long run effect on electricity consumption The findings are not in line with that of Yeboah (2015) who reported of significant link between electricity consumption and financial development (proxied by money supply) in a bivariate modelling.

Table 7 Estimated long-run coefficients. Dependent variable is $lnEC$

Variable	Coefficient	Std. Error	T-ratio	P-value
Constant	628.811	196.582	3.199	0.003**
Trend	-10.868	5.179	-2.099	0.044**
Y	0.6350×10^{-8}	0.1309×10^{-7}	0.485	0.631
GE	0.4656×10^{-7}	0.1349×10^{-6}	0.345	0.732
CC	-1518.300	860.8078	-1.764	0.088*
FD	0.867	3.848	0.225	0.823
V	16.973	7.111	2.387	0.023**

Source: Author's computation, 2013Note: ** and * denotes statistical significance at the 5% and 10% levels respectively. ARDL (1) selected based on Akaike Information Criterion

3.6 Results of Short-Run Elasticities of ARDL model

The results of short-run dynamic equilibrium relationship coefficients estimated with trend, intercept and error correction term (ecm) are reported in Table 8. The results on the nature of the short run coefficients are not different from that of the long-run coefficients. Investment is significant determinant of electricity consumption in the short run. The short-run findings are contrary to the findings of Muhammad (2011) who established no short run significant effect of investment on electricity consumption and concluded that in the short run, financial sector development does not matter for electricity consumption. Climate change is significant determinant of electricity consumption in the short run with expected theoretical sign at 5% and 10% significant levels. The short run results reinforce that of the long run results. The rest of the variables are insignificant determinant of electricity consumption.

The error correction mechanism serves as a means of reconciling short-run behaviour of an economic variable with its long-run behaviour. The error correction term (ecm) is statistically significant at 1%, 5% and 10% level of significance and have the theoretical expected sign which is negative. The coefficient of -0.36398 indicates that, after 1 percent deviation or shock to the system, the long-run equilibrium relationship of electricity consumption is quickly reestablished at the rate of 36.4% percent per annum. The value does not indicate stronger adjustment rate.

Table 8 Short-run representation of ARDL model. ARDL (1) selected based on Schwarz Bayesian Criterion. Dependent variable: $\Delta lnEC$

Variable	Coefficient	Standard error	T-statistic	P-value
Constant	228.876	65.778	3.479	0.002***
Trend	-3.956	2.123	-1.863	0.072*
ΔlnY	0.2311×10^{-8}	0.4849×10^{-8}	0.477	0.637
ΔlnGE	0.1695×10^{-7}	0.4812×10^{-7}	0.352	0.727
ΔlnCC	-552.621	227.030	-2.434	0.021**
ΔlnFD	0.316	1.404	0.225	0.824
ΔlnV	6.178	2.412	2.561	0.016**
ecm (-1)	-0.364	0.122	-2.985	0.005**

R-Squared =0.40835	R-Bar-Squared =0.27476
S.E. of Regression =47.3395	F-stat. F(7, 31) =3.0566[0.014]
Mean of Dependent Variable =0.28877	S.D. of Dependent Variable =55.5881
Residual Sum of Squares =69471.9	Equation Log-likelihood = -201.2984
Akaike Info. Criterion = -209.2984	Schwarz Bayesian Criterion = -215.9526
DW-statistic =2.1053	

Source: Author's computation, 2013: Note: *, ** and *** denotes statistical significance at the 10%, 5% and 1% levels respectively. ARDL (1) selected based on Schwarz Bayesian Criterion

3.7 Results of Diagnostic Tests

The diagnostic tests of the short-run estimation to examine the reliability of the results of the error correction model are reported in Table 9. The null hypothesis of no serial correlation could not be rejected using the Lagrange multiplier test and the F-statistics. The RESET test showed evidence of incorrect functional specification of the model through a rejection of the null hypothesis. The estimated model did not pass the normality test. The model passed Heteroscadasticity test indicating the variances are constant over time. The R^2 (0.408) and the adjusted R^2 (0.275) are not an indication of a very well behave model. The coefficient indicate approximately 40.1% of the variations in electricity demand are attributed to the explanatory variables.

Table 9 Short-Run Diagnostic Tests of ARDL Model

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 0.34108[0.559]	F(1, 30)=0.26468[0.611]
B:Functional Form	CHSQ(1)= 4.2634[0.039]	F(1, 30)= 3.6820[0.065]
C:Normality	CHSQ(2)= 15.0450[0.001]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 0.026965[0.870]	F(1,37)=0.025600[0.874]
A:Lagrange multiplier test of residual serial correlation B:Ramsey's RESET test using the square of the fitted values C:Based on a test of skewness and kurtosis of residuals D:Based on the regression of squared residuals on squared fitted values		

4. The Causality Link between Electricity Consumption and Financial Development

The causality between financial development and electricity consumption is examined using Granger causality test. The results are reported in Tables 10. The Granger causality test is based on the null assumptions that FD does not Granger cause EC and EC does not Granger cause FD against the alternative assumptions that FD Granger cause EC and EC Granger cause FD. The results in Table 10 indicate that the null hypothesis that FD do not Granger causes EC is rejected at 10% level of significance. The null hypothesis that EC does not Granger causes FD is rejected at 1% level of significance. The results imply that electricity consumption cause financial sector development whereas financial sector development also cause electricity consumption. The results indicate bidirectional causality from electricity consumption to financial sector development with a feedback effect.

Hence, the results mean that the financial sector is useful to forecast electricity consumption in Ghana with a feedback. Electricity consumption is useful to forecast financial sector development in Ghana. The findings are inconsistent with that of Tang and Shahbaz (2013) who reported of unidirectional Granger causality running from financial development to electricity consumption in Portugal and Tang and Tan (2012) study which reported of unidirectional causality from energy consumption to financial development in Malaysia. Shahbaz and Lean (2011) established unidirectional causality from energy consumption to financial development in Tunisia.

Table 10 Granger Causality Test between Electricity Consumption and Credit to the Private Sector

Variables	Chi-square value	P-values	Decision
FD does not Granger cause EC	8.193	0.085*	Reject the null hypothesis
EC does not Granger cause FD	19.685	0.001***	Reject the null hypothesis

Source: Author’s computation, 2013: Note: *** and * denote significant at 1% and 10% levels respectively

6 Conclusions

The objectives of the research have been achieved. The feedback hypothesis have been supported against the finance-led; energy-led and neutrality hypotheses. The results on the link between financial development and electricity consumptions are not as expected theoretically. In the long run and short run financial development is not significant explanatory variable for electricity consumption in Ghana. There is causal relationship between financial development (proxied by credit to the private sector) and electricity consumption in Ghana during the period under discussion. Policy to conserve electricity consumption will not be appropriate in Ghana for the period under discussion. There is the need for increase investment on research and development to articulate new energy savings technology to sustain economic growth. There is the need to introduce policies such as offering and distributing financial resources to efficient and profit oriented ventures to meet the increasing electricity consumption demand. Policy makers in energy should incorporate these findings in their energy planning policies to ensure sufficient energy supply for the development of the financial sector. Future studies should consider structural break issues in the cointegration analysis using Gregory-Hansen cointegration model.

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