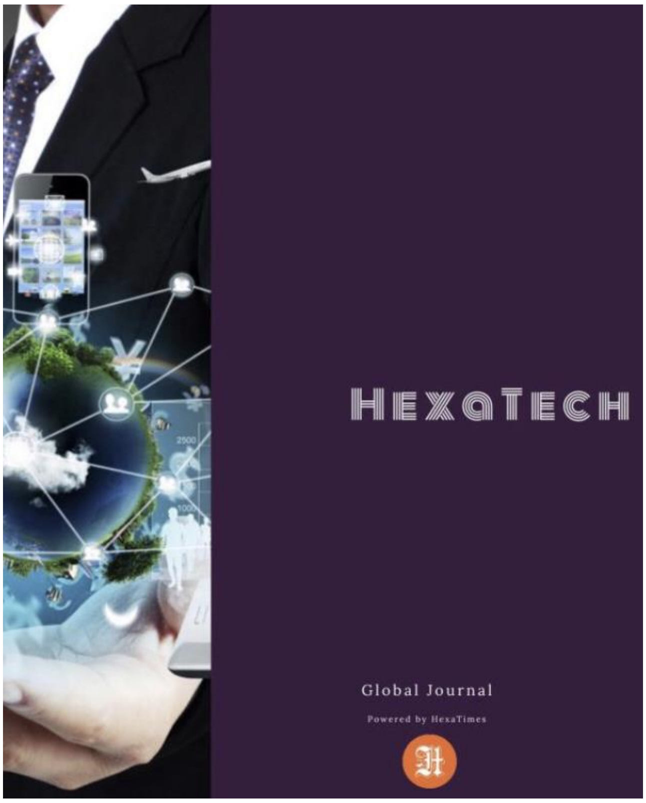

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https://doi.org/10.5281/zenodo.8066055

ABSTRACT

This paper examines the impact of Financial development on energy consumption for Saudi Arabia during 1971–2014. We employ bounds testing cointegration procedure proposed by Pesaran et al. (2001) to compute the short and long-run elasticities of economic growth (GDP), Energy consumption (EC), Financial development (FD), Population (pop) and consumer price index (CPI). the ADF and PP unit root tests are applied to examine the stationarity properties of each series. We find that the series are cointegrated. After detection of cointegrating relationship, the error-correction based Granger causality test is employed to examine the both long-run and short-run causality issues between the variables. We also implement CUSUM and CUSUMSQ stability tests on the economic growth. The empirical results indicate that the model is stable. The results reveal the presence of long run associationship between variables under study. Also, there is a positive and statistically significant short run relationship where ECT (-1) = 23.10% and statically significant at 5 percent level of significance. There is positive relationship between GDP and, CPI with EC and statistically not significant. Also, there is negative relationship statistically not significant between POP, FD and EC. There is an evidence of two-way Granger causality from LFD to LCPI .Alsot here is one-way from LCPI to LEC and from LFD to LEC and from LPOP to LFD .There is one-way long run Granger causality from LCPI to ECM and from LFD to ECM a well.

KEYWORDS: Energy consumption, Financial Development, GDP; Autoregressive Distributed Lag ARDL Granger Causality.

1. INTRODUCTION

The relationship between energy consumption and financial development has been widely discussed in the literature. Economic researchers have used several different indicators to measure financial development. In this paper, a wide range of these measurements within financial sector development and their impact on the Saudi Arabian economy is discussed The relationship between energy consumption and financial development has been a well-studied topic in the field of energy economics because of the importance it has in present-day economies, ranging from developed economies to developing ones. Moreover, in addition to the increase in energy prices, the decrease in existing energy resources, the search for alternative energy resources and the use of these new resources also affect the relationship between energy and economic growth. The direction and level of the causal relationship play an important role in the determination of energy policies. Sadorsky, P. (2010) reported that economic growth as a key determinant of energy demand is promoted by financial development.However, the impact of financial development on the demand for energy has received very little attention in the literature.Financial development improves the financial efficiency of a country, allows foreign direct investment, reduces financial risk and borrowing constraints, increases transparency between lenders and borrowers, thereby affecting demand for energy by increasing consumption and fixed investment.

In this research, we identify and estimate the main macroeconomic factors that determine energy consumption in Saudi Arabia, which is one of the most-oil dependent countries, making it a particularly interesting case for this research. Using the Vector Error Correction Model (VECM) and Pesaran's Bounds Testing approach to Autoregressive Distributed Lagged model (ARDL), a long-run relationship between energy consumption and other macroeconomic factors are explored using annual time series data covering the period ranging from 1971 to 2014. The results of the study are crucial for economic policymakers to formulate policies in favor of sustainable economic growth.

Considering the above, this study aimed to test the impact of GDP, EC, POP,CPI and FD on energy consumption using the ARDL approach to identify the long run equilibrium relationship between energy consumption and the said variables as well as the short run and long run causality tests to identify the direction of the causal relationship between these variables using annual data from 1971 to 2014. To my knowledge, this is the first study that evaluates the impact of , EC,POP,CPI and FD on energy consumption in Saudi Arabia. Also, the paper aims to examine the causality between the said variables and economic growth in Saudi Arabia.

The choice of ARDL in departure from the Johansen-Juselius procedure, used by Ang (2008), is appropriate given the sample size. The Granger procedure is used to test the direction of causality within the Vector Error Correction Models (VECM). If a set of variables is cointegrated, they must have an error correction representation wherein an error correction term (ECT) must be incorporated in the model (Engle and Granger, 1987). The VECM reintroduces the information lost due to the differencing of series. This step is helpful in examining the long- run equilibrium and the short-run dynamics.

The four major public policy goals of Saudi Arabia are: economic growth (GDP), financial development (FD) population growth (POP) and CPI. It is of interest to know how they interact with each other. Also, an understanding of the long and short run causality among the series and their direction, if any, is more than a matter of just intellectual curiosity - they can have significant policy implications. Against the backdrops, the need to explore long run relation and causal link among the growth rates in FD, population, GDP, CPI and energy consumption use in Saudi Arabia gains importance.

The aim of this paper is to examine the effect of financial development on energy consumption in Saudi Arabia using an Autoregressive Distributed Lag (ARDL) model. This study builds on the work of the papers mentioned previously. The model used for this research has similar characteristics to those previous studies. The analysis is carried out using annual time series data from Saudi Arabia from 1971 to 2014. Specifically, this study sought to determine whether these indicators, in conjunction or independently, affect Saudi Arabian economic growth And in what way and to what extent. In addition, This paper will add to the current literature by providing updated data along with a wide array of explanatory variables that have yet to be analyzed collectively.

The remainder of this paper is organized as follows. Section 2 reviews the literature. Section 3 presents the data and methodology, the econometric models and discusses the results presents in section 4. Section 5 draws the main conclusion.

2. RELAVANT EMPIRICAL LITERITURE

There are many studies that investigated the relationship between financial development and economic growth. These studies included finance in their analysis as a proxy of financial development. However, studies that investigated the impact of economic growth, Gross Domestic Saving and financial development on Energy consumption are few in the literature.

Several empirical studies have been conducted to test the relationship between financial development and economic growth. Samargandi, Fidrmuc, and Ghosh (2013) examined the impact of financial development on economic growth in Saudi Arabia using a sample of 252 observations and five variables during the period from 1968 to 2010. The autoregressive distributed lag (ARDL) is used to analyze the factors or indicators it examined. Their study also contained three levels of measurements, including broad money, liquid liabilities, and credit to the private sector. Ibrahim's (2013) study used annual data from 1989 to 2008 and implemented fully-modified ordinary least squares (FMOLS) to analyze the indicators of financial sector development that affect economic growth in Saudi. He found that the domestic bank credit to the private sector ratio has a significant and positive impact on economic growth in the long-term but an insignificant and negative impact on economic growth in the short-term.

Mukhtarov et.al (2018**)** investigated the impact of economic growth and financial development on energy consumption. After testing variables for unit root, the results showed their stationarity at first differenced form. Hence, the variables can be tested for a common long-run trend. The Johansen trace and maximum eigenvalue tests concluded one cointegration relationship among the variables. In addition, Pesaran's Bounds test also resulted in the existence of a long-run relationship. This implies that there is a long run relationship between energy consumption, economic growth, and financial development in Azerbaijan. Estimation results show that economic growth increases energy consumption in the long-run, namely, a 1% increase in economic growth increases energy consumption by 0.12%. Moreover, the coefficient of the financial development proxy is found to be positive and statistically significant, numerically being equal to 0.19%. The positive and statistically significant impact of financial development on energy demand can be considered as one of the signs of improvements in a business-friendly environment. Ibrahim A. et.al (2016) investigated the nexus between financial development and energy consumption in Nigeria between 1971 and 2014, using the ARDL Bounds testing approach. A significant long-run relationship was confirmed between financial development and energy consumption in Nigeria. It was also deduced that the development of the financial sector exerted positively and significantly on energy demand in the Nigerian economy, both in the short-run and the long-run periods. Siddique and Majeed (2015) find long-run relationship exist among economic growth, energy consumption, trade and financial development in South Asian countries of India, Nepal, Pakistan, Sri Lanka and Bangladesh. They also established non-existence of link between energy consumption and financial development in the short-run. Safaynikou and Shadmehri (2014) conducted that there is a significant relationship among energy consumption, economic growth, financial development and trade openness in Iran using the ARDL model for the period of 1967-2010. The effect of financial development, trade openness and economic growth on energy consumption was mainly positive. Samargandi, et al (2013), investigate the relationship between financial development and the economic growth in the context of an oil-rich economy "Saudi Arabia case study" and applied the Autoregressive Distributed Lag (ARDL) .The study found that the financial development has a positive impact on the growth of the non-oil sector in Saudi Arabia. The study showed a negative and insignificant impact on total GDP growth. Islam *et al.* (2013) found that energy consumption is influenced by financial development and economic growth both in the short and long run in Malaysia. A bi-directional causality was also found between energy consumption and financial development in the long run while it runs from financial development to energy consumption in the short run. Also, population exerts a significant positive influence on energy consumption in the long run with its influence found to be insignificant in the short run. Ozturk and Acaravci (2013) also examine long-run and causal analysis of energy, growth, openness and financial development on carbon emissions in Turkey using ARDL and error correction based Granger causality test. They found evidence of short-run unidirectional causal relationship from financial development to per capita energy consumption, per capita real income and square per capita real income between 1960 and 2007. They inferred that improvements in the financial sector will result into increase in energy consumption and income in Turkey in the short-run. Al-Malkawi, et al (2012),investigate the relationship between financial development and economic growth in UAE, the study applied (ARDL) approach to cointegration and two indicators to examine this relation: the first is the size of the financial intermediaries sector ,and the second indicator is the ration of the credit provided to private sector by commercial banks as a percentage of the GDP .The study found a significant negative relationship between financial development and economic growth , also the results suggest a bidirectional causality between the two variables.Kakar *et al*. (2011) found a significant relationship between financial development and energy consumption in the long-run for Pakistan while the relationship in the short-run was insignificant for the period of 1980-2009 using the cointegration and error techniques as well as the Granger causality test. The Granger causality indicates that financial development does affect energy consumption. Dan and Lijun (2009) found one directional causality from financial development to energy consumption in their study investigating China.

Despite the importance of the topic, there has been a shortage of empirical studies exploring the impact of financial development and economic growth on energy consumption in a systematic manner until very recent times. And generally, the existing empirical literature focused on the economic growth and energy consumption context and indicators of financial development are used as control variables due to the omitted variable bias. An interesting aspect of the existing literature is that the relationship between energy consumption and the main macroeconomic factors that determine energy consumption in Saudi Arabia, may differ between short run and long run even within the same country.

3. Methodology, Model, and Data

The data employed in this study involves annual time series for Energy Consumption

(EC) is measured as kiloton (kt) of oil equivalent, GDP, consumer prices Index (CPI), POP refers to total population. And Financial Development (FD) measured with broad money (M2) as share of GDP for the1971-2014 period of Saudi Arabia. and obtained from the World Development Indicators (2017).

Several econometric methods are proposed in the last two decades. The most commonly used methods include the residual based Engle-Granger (1987) test, and the fully modified OLS procedures of Phillips and Hansen's (1990). With regards to multivariate cointegration, Johansen (1988) and Johansen and Juselius (1990) procedures and Johansen's (1996) full information maximum likelihood procedures are widely used in empirical research.

Autoregressive distributed lag (ARDL) also deals with single cointegration and is introduced originally by Pesaran and Shin (1999) and further extended by Pesaran et al. (2001). This method has certain econometric advantages in comparison to other single cointegration procedures. Firstly, endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger method are avoided. Secondly, the long and short-run parameters of the model are estimated simultaneously. Thirdly, all variables are assumed to be endogenous. Fourthly, the econometric methodology is relieved of the burden of establishing the order of integration amongst the variables and of pre-testing for unit roots. In fact, whereas all other methods require that the variables in a time-series regression equation are integrated of order one, i.e., the variables are I(1), only that of Pesaran et al. could be implemented regardless of whether the underlying variables are I(0), I(1), or fractionally integrated. A Vector Auto Regressive (VAR) model was initially specified with the endogenous variables of EC, GDP, POP and FD, and the exogenous variable of the energy price. Considering that energy price data is not available for Saudi Ariba, we use the consumer price index (CPI) as a proxy for energy prices following the previous studies by Mahadevan and Asafu-Adjaye [2007] and Sadorsky [2010], Chang [2015,], Komal et al. [2015]. To find out the impact of independent variables on dependent variable in Saudi Arabia may be expressed as:

$$EC = f(GDP, FD, POP, CPI) \qquad (1)$$

Log-linear specification produces better results as compared to simple linear functional form of model [see Cameron (1994); Ehrlich (1975, 1977, 1996) for details]. So, in this study we use log-linear specification. The estimable equation is modeled as follows

$$LEC_t = \alpha + \beta_1 LFD_t + \beta_2\ LGDP_t + \beta_2\ LPOP_t + \beta_3 LCPI_t + \propto_t \qquad (2)$$

Where GDP is the Gross Domestic Product in millions USD); consumer price index (CPI) and Energy Consumption (EC) is measured as kiloton (kt) of oil equivalent and Financial Development (FD) measured with broad money (M2) as share of GDP and POP refers to total population and ε is error term.We use the two-step procedure from the Engle and Granger (1987) model to examine the causal relationship among real GDP, EC, FD, POP and CPI. In the first step, we explore the long-run relationships between the variables. In the second step, we employ error-correction based on Granger causality model to test causal relationship among variables in the model.

Before running the causality test the variables must be tested for stationarity. For this purpose, in this current study we use the conventional ADF tests, Dickey-Fuller generalized least square (DF-GLS) de-trending test proposed by Elliot et al. (1996).

3.1. ARDL BOUNDS TESTS FOR COINTEGRATION

To test the long-run and short-run interactions among the variables under study (GDP, EC, FD_GDP, POP and CPI), we apply the autoregressive distributed lag (ARDL) cointegration technique. The ARDL cointegration approach was developed by Pesaran and Shin (1999) and Pesaran et al. (2001). It has three advantages in comparison with other previous and traditional cointegration methods. The first one is that the ARDL does not need that all the variables under study must be integrated of the same order and it can be applied when the underlying variables are integrated of order one, order zero or fractionally integrated. The second advantage is that the ARDL test is relatively more efficient in the case of small and finite sample data sizes. The last and third advantage is that by applying the ARDL technique we obtain unbiased estimates of the long-run model (Harris and Sollis, 2003). The ARDL model for the linear functional specification of long-run relationship among gross domestic product (GDP), EC, FD ,POP and CPI may follows as:

DEC_t=α1+ $\sum_i^n \beta_1 DEC_{t-1}$+$\sum_i^n \beta_2\, DFD_{t-1}$+$\sum_i^n \beta_3\, DGDP_{t-1}$+$\sum_i^n \beta_4\, DCPI_{t-1}$+ $\sum_i^n \beta_5\, DPOP_{t-1}$ δ1EC_{t-1}+ $\delta 2 FD_{t-1} \delta 3 POP_{t-1}$+$\delta 4 GDP_{t-1}$+ $\delta 5 CPI_{t-1}\ \varepsilon_{1t}$………… ……….. (3)

$DGDP_t$= α1+ $\sum_i^n \beta_1 DEC_{t-1}$+$\sum_i^n \beta_2\, DFD_{t-1}$+$\sum_i^n \beta_3\, DGDP_{t-1}$+$\sum_i^n \beta_4\, DCPI_{t-1}$+ $\sum_i^n \beta_5\, DPOP_{t-1}$ δ1EC_{t-1}+ $\delta 2 FD_{t-1} \delta 3 POP_{t-1}$+$\delta 4 GDP_{t-1}$+ $\delta 5 CPI_{t-1}\ \varepsilon_{1t}$………… ………… (4)

DFD_t= α1+ $\sum_i^n \beta_1 DEC_{t-1}$+$\sum_i^n \beta_2\, DFD_{t-1}$+$\sum_i^n \beta_3\, DGDP_{t-1}$+$\sum_i^n \beta_4\, DCPI_{t-1}$+ $\sum_i^n \beta_5\, DPOP_{t-1}$ δ1EC_{t-1}+ $\delta 2 FD_{t-1} \delta 3 POP_{t-1}$+$\delta 4 GDP_{t-1}$+ $\delta 5 CPI_{t-1}\ \varepsilon_{1t}$………… ………… (5)

$DCPI_t$= α1+ $\sum_i^n \beta_1 DEC_{t-1}$+$\sum_i^n \beta_2\, DFD_{t-1}$+$\sum_i^n \beta_3\, DGDP_{t-1}$+$\sum_i^n \beta_4\, DCPI_{t-1}$+ $\sum_i^n \beta_5\, DPOP_{t-1}$ δ1EC_{t-1}+ $\delta 2 FD_{t-1} \delta 3 POP_{t-1}$+$\delta 4 GDP_{t-1}$+ $\delta 5 CPI_{t-1}\ \varepsilon_{1t}$………… ………… (6)

$DPOP_t$= α1+ $\sum_i^n \beta_1 DEC_{t-1}$+$\sum_i^n \beta_2\, DFD_{t-1}$+$\sum_i^n \beta_3\, DGDP_{t-1}$+$\sum_i^n \beta_4\, DCPI_{t-1}$+ $\sum_i^n \beta_5\, DPOP_{t-1}$ δ1EC_{t-1}+ $\delta 2 FD_{t-1} \delta 3 POP_{t-1}$+$\delta 4 GDP_{t-1}$+ $\delta 5 CPI_{t-1}\ \varepsilon_{1t}$………… ………… (7)

Where ε and D are the white noise term and the first difference operator respectively,

The bounds test is mainly based on the joint F-statistic which its asymptotic distribution is non-standard under the null hypothesis of no cointegration. The first step in the ARDL bounds approach is to estimate the four equations (3,4,5,6 and 7) by ordinary least squares (OLS). The estimation of the four equations tests for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables, i.e.,

Null Hypotheses(H0): There is no cointegration.

Alternative Hypotheses(H1): There is cointegration.

If the calculated *F*-statistics lies above the upper level of the bound critical values, the null is rejected, indicating cointegration. If the calculated *F*-statistics is below the upper bound critical values, we cannot reject the null hypothesis of no cointegration. Finally, if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. Recently, the set of critical values for the limited data (30 observations to 80 observations) were developed originally by Narayan (2005). If there is an evidence of long-run relationships (cointegration) between the variables, the second step is to estimate the following long-run and short-run models that are represented in Equations (7) and (8):

EC_t=$\alpha_{1+}\sum_i^n \beta_1 GDP_{t-1}$+$\sum_i^{n1} \beta_2\, EC_{t-1}$+$\sum_i^{n2} \beta_3\, FD_{t-1}$+$\sum_i^{n3} \beta_4\, CPI_{t-1}$+$\sum_i^{n4} \beta_5\, POP_{t-1} + \ \varepsilon_{1t}$ -- (8)

$$DEC_t = \alpha_{1+} \sum_i^n \beta_1 DGDP_{t-1} + \sum_i^{n1} \beta_2 DEC_{t-1} + \sum_i^{n2} \beta_3 DFD_{t-1} + \sum_i^{n3} \beta_4 DCPI_{t-1} + \sum_i^{n4} \beta_5 DPOP_{t-1} + \delta ECT_{t-1} + \varepsilon_{2t} \quad \text{-------} \quad (9)$$

Where δ is the coefficient of error correction term ECT_{t-1}. It shows how quickly variables converge to equilibrium and it should have a statistically significant Coefficient with a negative sign.

The orders of the ARDL (n, n1, n2 ,n3 and n4) model in the four variables are selected by using AIC. Equation (3) is estimated using the following ARDL (1, 1, 0, 0,2) specification. The results obtained by normalizing on EC.

4. Empirical Results

The ARDL model does not require all variables to be nonstationary or stationary; however, it is important to conduct a unit root test to ensure that none of the variables are stationary at a second difference (I(2)) or beyond. We, therefore, performed the ADF (see Dickey and Fuller, 1981) and PP unit root tests (see Phillips and Perron, 1988) in levels and first differences., to determine whether there is a unit root for each variable or not, The results of the ADF and the PP tests computed over the sample period for the levels and first differences of variables with constant only and with intercept and trend are presented in Table 1. GDP and CPI are stationary at levels I(0), while EC and FD are stationary at a level with the intercept only. while Pop is stationary at level with no intercept and no trend. Since that they are stationary at different levels, employing the ARDL model is appropriate for this study. However, before this, there is a need to determine the optimal lag length The number of lags was initially considered, and both the lag selection criteria and lag exclusion test statistics propose that a lag of order three is optimal, using the Schwarz Information Criteria (AIC) which is intuitively applicable given the small number of observations? Lag 3 is found to be the optimal lag length for our study (Table 2).

Table 1: Stationarity (Unit Root) Tests with ADF

Variables	ADF Statistics				PP Statistics			
	Level		First Difference		Le ve		First Difference	
LGDP	--4.071769	I(1)	-4.071769	I(1)	3.434622	I(1)	5.860482	I(1)
LEC	-1.750534	I(0)	-3.107494	I(1)	-1.677619	I(0)	5.058489	I(1)
LFD	-2.679230	I(0)	-4.293965	I(1)	-2.333863	I(0)	4.429338	I(1)
LCPI	--3.263249	I(1)	-2.335359	I(0)	-3.943060	I(1)	-2.093049	I(0)
LPOP	-3.036821	I(1)	-1.287298	(I(0)	-1.630600	I(0)	-3.263249	I(1)

Source: Authors' calculation using EViews 9.

Table 2: **VAR Lag Order Selection Criteria**

VAR Lag Order Selection Criteria
Endogenous variables: LEC
Exogenous variables: C LGDP LFD LPOP LCPI
Date: 07/20/18 Time: 17:24
Sample: 1971 2014
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	29.60246	NA	0.017134	-1.230123	-1.019013	-1.153792
1	43.69317	23.95421	0.008913	-1.884659	-1.631327	-1.793062
2	47.18610	5.763331	0.007879	-2.009305	-1.713751	-1.902442
3	54.20340	11.22768*	0.005843*	-2.310170*	-1.972394*	-2.188041*
4	54.31082	0.166499	0.006124	-2.265541	-1.885543	-2.128146

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Authors' calculation using EViews 9.

After determining the order of integration, next we employ ARDL approach to co-integration to determine the long run relationship among the variables. The F-Statistics tests the joint Null hypothesis that the coefficients of lagged level variables in equation (3) are zero. Table 3 reports the result of the calculated F-Statistics. The bound test evidence confirms the long run relationship for equation 3,4,5,6 and 7 with LEC, GDP, LFD, LPOP and LCPI as the dependent variables. As in these cases, the calculated F statistics greater than the critical values of the upper level of the bound at 5 Percent level of significance for equations 3,4,5,6 and 7. We choose a maximum lag order of 2 for the conditional ARDL vector error correction model by using the Akaike information criteria (AIC). The calculated F-statistics are reported in table 3 when each variable is considered as a dependent variable (normalized) in the ARDL-OLS regressions.After having the appropriate lag selection, we move to calculate F-statistics that are reported in table 3. When EC is taken as dependent variable and GDP, FD, POP and CPI as independent variables, the F-statistic is 5.66 that is greater than the upper bounds (5.06) at 1 percent level of significant. So, we conclude that there is a long run association among the variables. We replace independent variable GDP by making it dependent to check weather EC, FD, POP and CPI will make long run association. Result shows that F-statistics 18.18 that is greater than the upper bounds at 1 percent level of significant. So, we conclude that there is long run association among the variables. Similarly, when we take FD as a dependent variable we reject the null hypotheses of no cointegration as F-statistics found 12.15. when we take POP as a dependent variable we fail to reject the null hypotheses of no cointegration as F-statistics found 31.76. Finally, we take CPI as a dependent variable we reject the null hypotheses of no cointegration as F-statistics found 18.55.

Table 3: Results from bound tests

Dependant variable	AIC lags	F-statistic	Decision
LEC *(LGDP, LFD, LPOP, LCPI)*	3	5.66	Cointegration
LGDP *(LEC, LFD, LPOP, LCPI)*	3	18.18	Cointegration
LFD *(LEC, LGDP, LPOP, LCPI)*	3	12.15	Cointegration
LPOP *(LEC, LFD, LGDP, LCPI)*	3	31.76	Cointegration
LCPI *(LEC, LFD, LGDP, LPOP)*	3	18.55	Cointegration
Lower-bound critical value at 1%		I(0) 3.74	
Upper-bound critical value at 1%		I(1) 5.06	

Lower and Upper-bound critical values are taken from Pesaran et al. (2001), Table CI(ii) Case II.
Source: Authors' calculation using EViews 9.

To estimate the long-run and Short-run elasticities results using the ARDL approach to cointegration. The short-run and long run for equation 2 are reported in Tables (4). The table shows that ECM (-1) negative and statistically significant Less than 0.05, meaning that there is a SR associationship. The coefficients of ECM terms present the speed of adjustment in the long-run due to a shock. The coefficients of ECM terms imply that 23.10% of the disequilibria in EC of the previous year's shock adjust back to the long run equilibrium in the current year. The second part in table 4 is Long Run Coefficients:

$$LEC = 3.8571 + 0.0068*LGDP - 0.0290*LFD - 0.2952*LPOP + 1.1553*LCPI$$

Here we can take each variable individually and test the significance as: First I talk about LEC. where p-value = 0.000 > 0.05, meaning that LGDP positive coefficient and statistically not significant to explain the dependent variable LEC. Meaning that if LGDP increase by 1 percent, this will lead LEC to increase by the value of the coefficient 0.006771, meaning that we fail to reject H_0 as hypothesized by H0. LCPI positive coefficient and statistically not significant to explain the dependent variable LEC. meaning that if LCPI increase by 1 percent this will lead LEC to increase by the value of the coefficient 0.4251, meaning that we have the evidence to accept H_0 and reject the H_1as hypothesized by H0. While LFD p-value greater than 0.05, meaning that we fail to reject H_0, meaning that LFD has negative and statistically not significant to explain the dependent variable as hypothesized by H0. Similarly, POP positive coefficient and statistically not significant to explain the dependent variable LEC. All variables are statistically not significant to explain the dependent variable in the long run only.

Table 4: long-run and short-run models

ARDL Cointegrating And Long Run Form
Dependent Variable: LEC
Selected Model: ARDL(1, 1, 0, 0, 2)
Date: 07/20/18 Time: 16:33
Sample: 1971 2014
Included observations: 42

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP)	0.435215	0.172593	2.521629	0.0167
D(LFD)	-0.006692	0.063788	-0.104908	0.9171
D(LPOP)	-0.068206	0.074789	-0.911984	0.3684
D(LCPI)	-0.003674	0.460274	-0.007983	0.9937
D(LCPI(-1))	-0.903020	0.364638	-2.476480	0.0186
CointEq(-1)	-0.231043	0.109477	-2.110424	0.0425

LEC = 0.0068*LGDP -0.0290*LFD -0.2952*LPOP + 1.1553*LCPI+ 3.8571

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.006771	0.754404	0.008975	0.9929
LFD	-0.028964	0.288224	-0.100491	0.9206
LPOP	-0.295209	0.432816	-0.682065	0.5000
LCPI	1.155306	1.430571	0.807584	0.4251
C	3.857113	16.031786	0.240592	0.8114

Source: Authors' calculation using EViews 9.

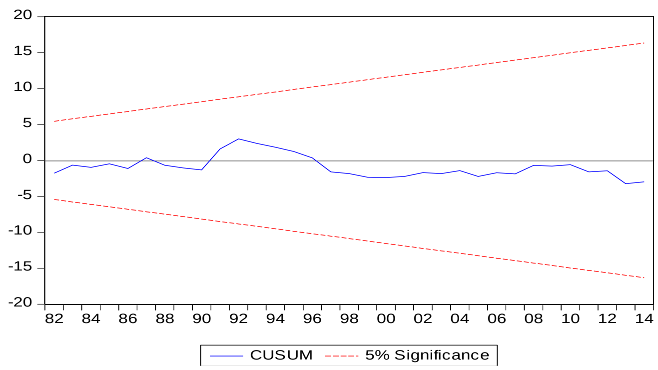
4.3. Granger Causality Test

Having determined the presence of cointegration for the models. we estimate the short-run and long-run causality. (Table A1 Appendix) presents the results of the causal relationship between energy consumption and financial development. The results clearly highlight the fact that there is long run causal relationship between LCPI and ECM between LFD and ECM .However, in the short run, the There is an evidence of two-way Granger causality from LFD to LCPI and weak two-way Granger causalities between LGDP and LEC and from LGDP to LFD at 10 percent level of significant. There is an evidence of one-way between LCPI and LEC and between LFD and LEC and between LPOP and LFD

4.4. Stability Test

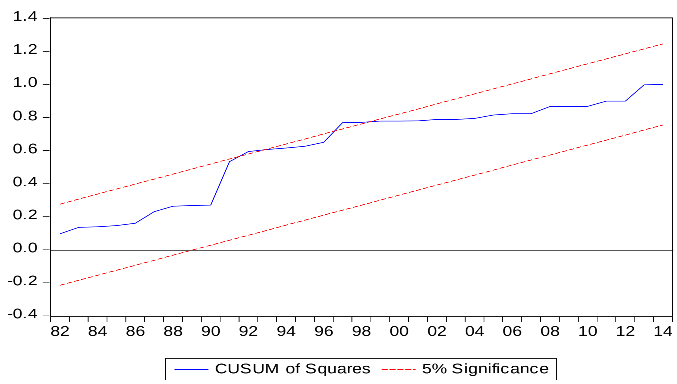
Pasaran and Pasaran(1997) advocated implementing a residual stability test after using the error correction model. This test is known as a cumulative sum of recursive residuals (CUSUM) and a cumulative sum of squares of recursive residual (CUSUMSQ). If the CUSUM and CUSUMSQ statistics lie between the lower and upper critical bounds at the five percent significance level, then the null hypotheses of all coefficients in the given regression are stable.The short run stability of the model was tested using A cumulative sum (CUSUM) test and cumulative sum square (CUSUMSQ) of the ARDL models are given below. The test are conducted to ensure the stability of the models, as shown in (Figures 1 and 2). All tests remained within the critical boundaries of 5 percent and indicated that the model is stable.

Figure 1: Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance le

Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

4.5. Diagnostic Tests

Diagnostic tests were conducted to check for Serial Correlation LM test, Heteroskedasticity, ARCH & White test were adopted. The empirical evidence shows that there is serial correlation exists, residual term is normally distributed, autoregressive conditional heteroskedasticity, and the null of homoscedasticity test ARCH is not rejected. Table 5.

Table 5: Diagnostic Tests

Model (1) ARDL (1, 0, 0, 2)			
Null Hypotheses	Statistics	sig	Decision
There is no serial correlation in the residual	$\chi 2$ = 0.694634	0.8745	fail to reject H_0
There is no autoregressive conditional heteroscedasticity	$\chi 2$ =9.297302	0.3178	fail to reject H_0
Normal distribution	JB=0.8903	06407	fail to reject H_0
Heteroskedasticity Test: ARCH	$\chi 2$=7.223983	0.0651	fail to reject H_0

Source: Authors' calculation using EViews 9

5. Conclusions and Policy Implications

The present study the effect of Financial Development on energy consumption in Saudi Arabia during the period 1971-2014, implements autoregressive distributive lag model (ARDL) to cointegration and the Granger causality test within VECM to investigate the long run and short run relationship among the variables and the direction of causality and the behavior of forcing variables on energy consumption.

The results based on time series data from 1971 to 2014 confirm cointegration among these series. The effect of LGDP positive coefficient and statistically not significant to explain the dependent variable LEC and LCPI positive coefficient and statistically not significant LFD has negative and statistically not significant to explain the dependent variableSimilarly, POP positive coefficient and statistically not significant to explain the dependent variable LEC. All variables are statistically not significant to explain the dependent variable in the long run only.

The results clearly highlight the fact that there is long run causal relationship between LCPI and ECM between LFD and ECM .However, in the short run, the There is an evidence of two-way Granger causality from LFD to LCPI and weak two-way Granger causalities between LGDP and LEC and from LGDP to LFD at 10 percent level of significant. There is an evidence of one-way between LCPI and LEC and between LFD and LEC and between LPOP and LFD

The economic growth literature emphasizes the importance of financial development on economic prosperity. Among others, an aim of the energy literature is to examine the relationship between financial development and energy consumption. The empirical models used here fit the data reasonably well and pass all diagnostic tests were conducted to check for Serial Correlation LM test, Heteroskedasticity, ARCH & White test were adopted. The empirical evidence shows that no serial correlation exists, the residual term is normally distributed, autoregressive conditional heteroskedasticity, and the null of homoscedasticity test ARCH is not rejected. The results show that financial development measured by money supply (M2) as share of GDP. and hence the parameters do not suffer from any structural instability over the time of the study.

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APPENDIX

Table A1: short run and long run Granger Causality test

Pairwise Granger Causality Tests
Date: 07/20/18 Time: 16:38
Sample: 1971 2014
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
LCPI does not Granger Cause LEC	40	4.45413	0.0058
LEC does not Granger Cause LCPI		1.39448	0.2588
LFD does not Granger Cause LEC	40	4.05960	0.0092
LEC does not Granger Cause LFD		1.11234	0.3684
LGDP does not Granger Cause LEC	40	2.14495	0.0988
LEC does not Granger Cause LGDP		2.22513	0.0891
LPOP does not Granger Cause LEC	40	0.79319	0.5386
LEC does not Granger Cause LPOP		0.82933	0.5168
ECM does not Granger Cause LEC	40	3.09507	0.0297
LEC does not Granger Cause ECM		2.11885	0.1022
LFD does not Granger Cause LCPI	40	3.37961	0.0209
LCPI does not Granger Cause LFD		4.30324	0.0070
LGDP does not Granger Cause LCPI	40	0.34400	0.8461
LCPI does not Granger Cause LGDP		2.31972	0.0790
LPOP does not Granger Cause LCPI	40	1.24919	0.3109
LCPI does not Granger Cause LPOP		0.90938	0.4707
ECM does not Granger Cause LCPI	40	1.12887	0.3610
LCPI does not Granger Cause ECM		3.38926	0.0207
LGDP does not Granger Cause LFD	40	2.25856	0.0854
LFD does not Granger Cause LGDP		2.26452	0.0847
LPOP does not Granger Cause LFD	40	3.86005	0.0117
LFD does not Granger Cause LPOP		0.97974	0.4328
ECM does not Granger Cause LFD	40	1.29105	0.2949
LFD does not Granger Cause ECM		3.57968	0.0164
LPOP does not Granger Cause LGDP	40	1.61195	0.1961
LGDP does not Granger Cause LPOP		0.56636	0.6889
ECM does not Granger Cause LGDP	40	1.65870	0.1847
LGDP does not Granger Cause ECM		2.25866	0.0854
ECM does not Granger Cause LPOP	40	0.20131	0.9357
LPOP does not Granger Cause ECM		0.47537	0.7535

Source: Authors' calculation using EViews 9