THE IMPACT OF FINANCIAL DEVELOPMENT ON ECONOMIC GROWTH: EVIDENCE FROM SUADI ARABIA

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ABSTRACT

In this study the aim was to investigate empirically the impact of financial development on economic growth for the Saudi Arabia economy 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) = 69.67% and statically significant indicating the speed of adjustment towards the long run per year. All the said variables are statistically significant at 1 percent level of significance to explain the dependent variable in the long run. Also, the results clearly highlight the fact that there is long run causal relationship between ECM and LEC and two-way weak Granger Causality at 10 percent level of significance between ECM and LCPI and between LCPI and ECM. However, in the short run, the There is an evidence of one-way Granger causality from LFD to LGDP and between LGDP and LCPI and LPOP and LCPI and between LPOP and LFD and from LCPI to LFD.

KEYWORDS: Economic growth, Energy consumption, Financial Development, Autoregressive Distributed Lag ARDL Granger Causality.

1. INTRODUCTION

The relationship between financial development and economic growth has been the subject of theoretical and empirical research in the last decades. financial development is an important source for the economic growth and development of an economy.In the literature. Economic researchers have used several different indicators to measure financial development. 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, 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 economic growth 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 economic growth and other macroeconomic factors are explored using annual time series data covering the period ranging from 1971 to 2014. 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 (ECM) 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.

Considering the above, this study aimed to test the impact of EC, POP,CPI and FD on economic growth using the ARDL approach toidentifythelongrunequilibriumrelationship betweeneconomic growth 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. The model used for this research has similar characteristics to those previous studies. 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 byproviding updated data along with a wide array of explanatory variables that have yet to be analyzed collectively. To my knowledge, this is the first study that evaluates the impact of, EC, POP, CPI and FD on economic growth in Saudi Arabia. Also, the paper aims to examine the causality between the said variables and economic growth in Saudi Arabia.

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 Energy consumption, financial development, population and consumer price index on economic growth 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, economicgrowth, 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. IbrahimA. 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.

Based on the results of recent empirical studies on the relationship between the economic growth, energy consumption and the financial development and to ensure an adequate examination of the Saudi Arabia evidence, our study will have to answer the following questions regarding the impact of financial development, energy consumption, Gross domestic Product, Population and consumer Price Index on economic growth. Which are:

a. *Does an association exist between economic growth and financial development? If so, is it positively or negatively related to GDP?*

b. *Does an association exist between economic growth and energy consumption? If so, is it positively or negatively related to GDP?*
c. *Does an association exist between population and GDP?*
d. *Does an association exist between consumer price index and GDP?*

e. *What is the direction of association between the financial development and GDP?*
f. *What is the direction of association between the financial development and economic growth?*
g. *What is the direction of association between the energy consumption and GDP?*

The direction of association between Gross domestic Product, energy consumption, Population and consumer Price Index on economic growth. for Saudi Arabia may consist of five possible alternatives. These are:

i. *No association.*
ii. *Financial development affects GDP and vise-versa.*
iii. *Energy consumption affects GDP and vise-versa.*
iv. *Population affects GDP and vise-versa.*
v. *Consumer price index affects GDP and vise-versa.*

3. CONCEPTUAL MODEL

3.1. Data, Methodology and Model Specification

The data employed in this study involves annual time series for Energy Consumption (EC) is measured as kiloton (kt) of oil equivalent, economic growth (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:

$GDP = f(EC, FD, POP, CPI)$ (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

$LGDP_t = \alpha + \beta_1 LFD_t + \beta_2\ LEC_t + \beta_2\ LPOP_t + \beta_3 LCPI_t + \varepsilon_t$ (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).

3.2. 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:

$DGDP_t$= 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}+ δ2FD_{t-1}δ3POP_{t-1}+δ4GDP_{t-1}+ δ5$CPI_{t-1}\ \varepsilon_{1t}$………… ………… (3)

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}+ δ2FD_{t-1}δ3POP_{t-1}+δ4GDP_{t-1}+ δ5$CPI_{t-1}\ \varepsilon_{1t}$………… ……….. (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}+ δ2FD_{t-1}δ3POP_{t-1}+δ4GDP_{t-1}+ δ5$CPI_{t-1}\ \varepsilon_{1t}$………… ………… (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}+ δ2FD_{t-1}δ3POP_{t-1}+δ4GDP_{t-1}+ δ5$CPI_{t-1}\ \varepsilon_{1t}$………… ………… (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}+ δ2FD_{t-1}δ3POP_{t-1}+δ4GDP_{t-1}+ δ5$CPI_{t-1}\ \varepsilon_{1t}$………… ………… (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):

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

$DGDP_t=\alpha_{1+} \sum_i^n \beta_1 DGDP_{t-1}+\sum_i^{n1} \beta_2\, DEC_{t-1}+\sum_i^{n2} \beta_3\, DFD_{t-1}+\sum_i^{n3} \beta_4\, DCPI_{t-1}+$
$_i^{n4}\beta_5 DPOP_{t-1}+\ \delta ECT_{t-1}+\varepsilon_{2t}$ ------- (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 (2, 2, 2, 1, 1) specification. The results obtained by normalizing on EC.

4. EmpiricalResults

The ARDL model does not require all variables to be nonstationary or stationary;however,itis importanttoconductaunitroottesttoensurethatnone 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 isaunitrootforeachvariableornot,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. GDPandCPI 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	--4.071769I(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 EViews9.

Table 2: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LGDP LEC LFD LPOP
Exogenous variables: C LCPI
Date: 07/23/18 Time: 13:41
Sample: 1971 2014
Included observations: 41

Lag	LogL	LR	FPE	AIC	SC	HQ
0	26.20084	NA	4.84e-06	-0.887846	-0.553490	-0.766092
1	231.1119	349.8482	4.85e-10	-10.10302	-9.099954	-9.737759
2	292.7898	93.26898	5.40e-11	-12.33121	-10.65943	-11.72244
3	328.0425	46.43042*	2.27e-11*	-13.27037*	-10.92988*	-12.41809*

* 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 EViews9.

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 GDP is taken as dependent variable and EC, FD, POP and CPI as independent variables, the F-statistic is 10.92 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 EC by making it dependent to check weather GDP, FD, POP and CPI will make long run association. Result shows that F-statistics 5.66 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
LGDP *(LEC, LFD, LPOP, LCPI)*	3	10.92	Cointegration
LEC *(LGDP, LFD, LPOP, LCPI)**	3	5.66	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)	I(1)
		3.74	5.06

Lower and Upper-bound critical values are taken from Pesaran et al. (2001), Table CI(ii) Case II.
** See Table A3,A5,A7,A9 and A11*
Source: Authors' calculation using EViews9.

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 69.67% 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:

LGDP = 18.6577+ 0.362421*LEC --0.459148*LPOP -0.341836*LFD + 1.624103*LCPI

Here we can take each variable individually and test the significance as: First I talk about LEC. where p-value = 0.000 > 0.01, meaning that LEC positive coefficient and statistically significant to explain the dependent variable LGDP. Meaning that if LEC increase by 1 percent, this will lead LGDP to increase by the value of the coefficient 0.362421, meaning that we reject H_0 as hypothesized by H1. LCPI positive coefficient and statistically significant to explain the dependent variable LGDP. meaning that if LCPI increase by 1 percent this will lead LGDP to increase by the value of the coefficient 1.62, meaning that we have the evidence to reject H_0 and accept the H_1as hypothesized by H1. While LFD p-value less than 0.01, meaning that we reject H_0, meaning that LFD has negative and statistically significant to explain the dependent variable as hypothesized by H1.Similarly, LPOP negative coefficient and statistically significant to explain the dependent variable LGDP. All variables are statistically significant at 1 percent level of significance to explain the dependent variable in the long run.

Table 4: long-run and short-run models

ARDL Cointegrating And Long Run Form
Dependent Variable: LGDP
Selected Model: ARDL(2, 2, 2, 1, 1)
Date: 07/23/18 Time: 13:25
Sample: 1971 2014
Included observations: 42

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	0.221350	0.073574	3.008519	0.0054
D(LEC)	0.169587	0.082176	2.063712	0.0481
D(LEC(-1))	-0.185977	0.080729	-2.303717	0.0286
D(LPOP)	-2.161424	0.399285	-5.413239	0.0000
D(LPOP(-1))	1.511631	0.364709	4.144759	0.0003
D(LFD)	-0.798565	0.086553	-9.226298	0.0000
D(LCPI)	0.687032	0.158056	4.346766	0.0002
CointEq(-1)	-0.696744	0.122662	-5.680191	0.0000

Cointeq = LGDP - (0.3624*LEC -0.4591*LPOP -0.3418*LFD + 1.6241*LCPI + 18.6577)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEC	0.362421	0.068963	5.255307	0.0000
LPOP	-0.459148	0.048639	-9.439922	0.0000
LFD	-0.341836	0.041212	-8.294476	0.0000
LCPI	1.624103	0.118003	13.763271	0.0000
C	18.657657	0.565691	32.982076	0.0000

Source: Authors' calculation using EViews9.

4.1. Granger Causality Test

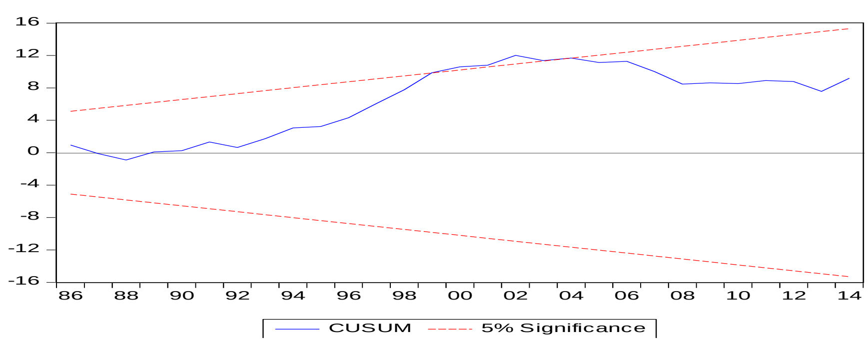
After identifying that there is cointegration among the variables, we move towards ascertaining the direction of causality by performing a multivariate Granger causality test (table A1 Appendix) presents the results of the causal relationship between energy consumption and financial development. The results clearly highlight the fact that there is long run causal relationship between ECM and EC and two-way weak Granger Causality at 10 percent level of significance between ECM and LCPI and between LCPI and ECM. However, in the short run, the There is an evidence of one-way Granger causality from LFD to LGDP and between LGDP and LCPI and LPOP and LCPI and between LPOP and LFD and from LCPI to LFD.

4.2. Stability and Diagnostic Tests

Pasaran and Pasaran(1997) advocated implementing a residual stability test after using the error correction model. This test namely is known as a cumulative sum of recursive residuals (CUSUM) and a cumulative sum of squares of recursive residual (CUSUMSQ) of the ARDL models are given below. If CUSUM and (CUSUMSQ) plots was found to be within the 5% critical bound, then the null hypothesis of the stability of the parameters cannot be rejected.

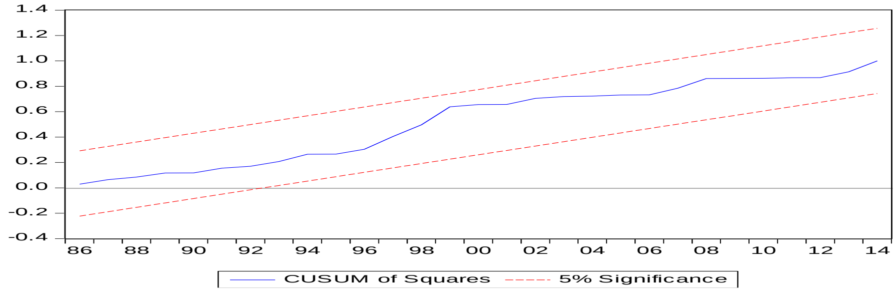
The test is conducted to ensure the stability of the models, as shown in (Figures 1 and 2). All tests remainedwithinthecriticalboundariesof5percentandindicatedthatthemodel is stable.

Figure 1: Plot of CumulativeSum of RecursiveResiduals



The straightlines representcritical boundsat 5% significancelevel

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



The straight lines represent critical bounds at 5% significance level

Diagnostic tests were conducted to check for serial correlation and heteroskedasticity. To check for serial correlation, Serial Correlation LM test was adopted while for Heteroskedasticity, ARCH & White test were adopted. The specification of the model was tested using Ramsey reset test. The results show the presence of no serial correlation and heteroskedasticity. The value of the Ramsey reset test indicates the presence of a well specified model (table 6)..

Table 6: Diagnostic Tests

Model (1) ARDL (1, 0, 0, 2)			
Null Hypotheses	Statistics	sig	Decision
There is no serial correlation in the residual	χ2 = 1.685415	0.6402	fail to reject H0
There is no autoregressive conditional heteroscedasticity	χ2 = 19.83046	0.0704	fail to reject H_0
Ramsey RESET Test	F = 1.480129	0.2339	
Normal distribution	JB=2.0288	0.3626	fail to reject H_0
Heteroskedasticity Test: ARCH	χ2= 4.714419	0.1939	fail to reject H_0

Source: Authors' calculation using EViews9

5. CONCLUSIONS AND POLICY IMPLICATIONS

The present study the effect of Financial Development, energy consumption, population and consumer price index on economic growth 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 confirm cointegration among these series. The effect of LEC positive coefficient and statistically significant to explain the dependent variable LGDP. Meaning that if LEC increase by 1 percent, this will lead LGDP to increase by 0.362421, meaning that we reject H_0 as hypothesized by H1. LCPI positive coefficient and statistically significant to explain the dependent variable GDP. meaning that if LCPI increase by 1 percent this will lead LGDP to increase by 1.62, meaning that we have the evidence to reject H_0 and accept the H_1as hypothesized by H1. While LFD p-value less than 0.01, meaning that we reject H_0, meaning that LFD has negative and statistically significant to explain the dependent variable as hypothesized by H1. Similarly, LPOP negative coefficient and statistically significant to explain the dependent variable LGDP. All variables are statistically significant to explain the dependent variable in the long run.

The results of the causal relationship between energy consumption and financial development. 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 ECM and EC and two-way weak Granger Causality at 10 percent level of significance between ECM and LCPI and between LCPI and ECM. However, in the short run, the There is an evidence of one-way Granger causality from LFD to LGDP and between LGDP and LCPI and LPOP and LCPI and between LPOP and LFD and from LCPI to 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: 07/23/18 Time: 14:14
Sample: 1971 2014
Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
LEC does not Granger Cause LGDP	41	1.27180	0.2996
LGDP does not Granger Cause LEC		1.71487	0.1824
LPOP does not Granger Cause LGDP	41	0.91847	0.4423
LGDP does not Granger Cause LPOP		0.51163	0.6770
LFD does not Granger Cause LGDP	41	2.50267	0.0758
LGDP does not Granger Cause LFD		3.67619	0.0214
LCPI does not Granger Cause LGDP	41	1.91456	0.1458
LGDP does not Granger Cause LCPI		2.41174	0.0838
ECM does not Granger Cause LGDP	41	2.25122	0.1001
LGDP does not Granger Cause ECM		0.65741	0.5839
LPOP does not Granger Cause LEC	41	0.70110	0.5579
LEC does not Granger Cause LPOP		0.66351	0.5802
LFD does not Granger Cause LEC	41	6.25952	0.0017
LEC does not Granger Cause LFD		1.78525	0.1685
LCPI does not Granger Cause LEC	41	3.87385	0.0174
LEC does not Granger Cause LCPI		1.39932	0.2598
ECM does not Granger Cause LEC	41	4.85577	0.0064
LEC does not Granger Cause ECM		2.15611	0.1113
LFD does not Granger Cause LPOP	41	1.33873	0.2780
LPOP does not Granger Cause LFD		2.90981	0.0485
LCPI does not Granger Cause LPOP	41	0.53118	0.6640
LPOP does not Granger Cause LCPI		5.57891	0.0032
ECM does not Granger Cause LPOP	41	0.56969	0.6388
LPOP does not Granger Cause ECM		0.43131	0.7319
LCPI does not Granger Cause LFD	41	3.45823	0.0270
LFD does not Granger Cause LCPI		2.07147	0.1223
ECM does not Granger Cause LFD	41	1.90464	0.1474
LFD does not Granger Cause ECM		0.02071	0.9959
ECM does not Granger Cause LCPI	41	2.73246	0.0589
LCPI does not Granger Cause ECM		2.35476	0.0893

$DEC_t = \alpha_1 + \sum_i^n \beta_1 DEC_{t-1} + \sum_i^n \beta_2 DFD_{t-1} + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_4 DCPI_{t-1} + \sum_i^n \beta_5 DPOP_{t-1}\ \delta 1 EC_{t-1} + \delta 2 FD_{t-1} \delta 3 POP_{t-1} + \delta 4 GDP_{t-1} + \delta 5 CPI_{t-1}\ \varepsilon_{1t}$ .... (4)

Table 2: ARDL Cointegrating And Long Run Form

ARDL Cointegrating And Long Run Form
Dependent Variable: LEC
Selected Model: ARDL(1, 1, 0, 0, 2)
Date: 07/23/18 Time: 15:43
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(LPOP)	-0.068206	0.074789	-0.911984	0.3684
D(LFD)	-0.006692	0.063788	-0.104908	0.9171
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

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

Long Run Coefficients

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

Table A3: ARDL Bounds Test

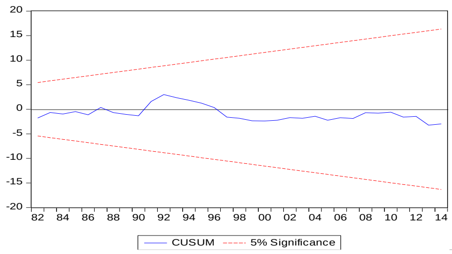
Date: 07/23/18 Time: 15:43
Sample: 1973 2014
Included observations: 42
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.661700	4

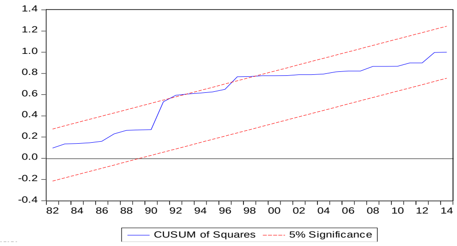
Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Figure A1: Plot of CumulativeSum of RecursiveResiduals



FigureA 2: Plot of CumulativeSum of Squares of RecursiveResiduals



The straight lines represent critical bounds at 5% significance level

$DFD_t = \alpha_1 + \sum_i^n \beta_1 DEC_{t-1} + \sum_i^n \beta_2 DFD_{t-1} + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_4 DCPI_{t-1} + \sum_i^n \beta_5 DPOP_{t-1}\ \delta 1 EC_{t-1} + \delta 2 FD_{t-1} \delta 3 POP_{t-1} + \delta 4 GDP_{t-1} + \delta 5 CPI_{t-1}\ \varepsilon_{1t}$ .... (5)

Table A4: ARDL Cointegrating And Long Run Form

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

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFD(-1))	-0.274103	0.069458	-3.946299	0.0004
D(LEC)	0.046717	0.089038	0.524685	0.6037
D(LEC(-1))	-0.285795	0.071023	-4.023977	0.0004
D(LGDP)	-0.849628	0.083623	-10.160268	0.0000
D(LPOP)	-2.796974	0.401142	-6.972535	0.0000
D(LPOP(-1))	1.953338	0.385995	5.060531	0.0000
D(LCPI)	0.365449	0.186657	1.957860	0.0596
CointEq(-1)	-0.336579	0.029534	-11.396467	0.0000

Cointeq = LFD - (0.7902*LEC -2.5243*LGDP -1.3969*LPOP + 4.4273*LCPI + 47.7485)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEC	0.790237	0.125767	6.283339	0.0000
LGDP	-2.524303	0.227899	-11.076431	0.0000
LPOP	-1.396934	0.137877	-10.131721	0.0000
LCPI	4.427277	0.313511	14.121621	0.0000
C	47.748473	5.317231	8.979952	0.0000

Table A5: ARDL Bounds Test

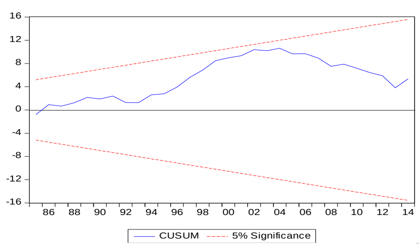
ARDL Bounds Test
Date: 07/20/18 Time: 16:42
Sample: 1973 2014
Included observations: 42
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	12.15079	4

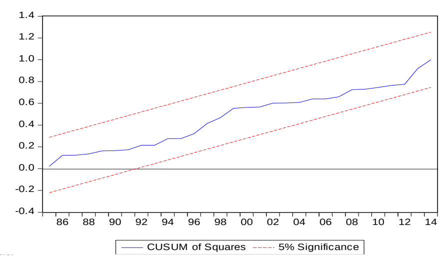
Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Figure A3: Plot of CumulativeSum of RecursiveResiduals



FigureA 4: Plot of CumulativeSum of Squares of RecursiveResiduals



The straight lines represent critical bounds at 5% significance level

$$DCPI_t = \alpha_1 + \sum_i^n \beta_1 DEC_{t-1} + \sum_i^n \beta_2 DFD_{t-1} + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_4 DCPI_{t-1} + \sum_i^n \beta_5 DPOP_{t-1}\ \delta 1 EC_{t-1} + \delta 2 FD_{t-1} \delta 3 POP_{t-1} + \delta 4 GDP_{t-1} + \delta 5 CPI_{t-1}\ \varepsilon_{1t} \text{...........................} (6)$$

Table A6: ARDL Cointegrating And Long Run Form

ARDL Cointegrating And Long Run Form
Dependent Variable: LCPI
Selected Model: ARDL(2, 2, 2, 0, 2)
Date: 07/23/18 Time: 15:57
Sample: 1971 2014
Included observations: 42

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	0.781616	0.094786	8.246124	0.0000
D(LGDP)	0.238504	0.048400	4.927729	0.0000
D(LGDP(-1))	-0.214060	0.050226	-4.261942	0.0002
D(LPOP)	0.878566	0.253528	3.465355	0.0017
D(LPOP(-1))	-0.414424	0.216978	-1.909980	0.0661
D(LFD)	0.163494	0.029233	5.592796	0.0000
D(LEC)	-0.033336	0.047647	-0.699646	0.4897
D(LEC(-1))	0.201668	0.046545	4.332787	0.0002
CointEq(-1)	-0.859957	0.119188	-7.215144	0.0000

Cointeq = LCPI - (0.5401*LGDP + 0.1607*LPOP + 0.1901*LFD -0.2113 *LEC -9.2817)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.540124	0.035122	15.378700	0.0000
LPOP	0.160676	0.024684	6.509337	0.0000
LFD	0.190119	0.014859	12.794918	0.0000
LEC	-0.211325	0.034187	-6.181409	0.0000
C	-9.281703	0.824601	-11.255993	0.0000

Able 7:ARDL Bound Test

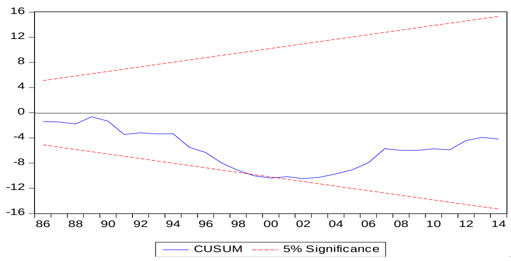
ARDL Bounds Test
Date: 07/23/18 Time: 15:58
Sample: 1973 2014
Included observations: 42
Null Hypothesis: No long-run relationships exist

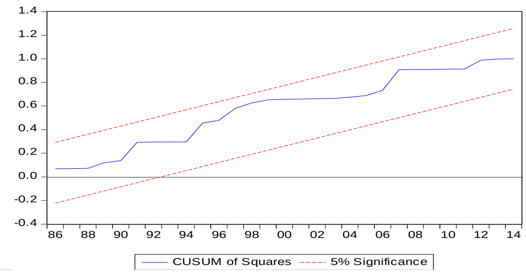
Test Statistic	Value	k
F-statistic	18.55196	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Figure A5: Plot of CumulativeSum of RecursiveResiduals **Figure A6: Plot of CumulativeSum of Squares of RecursiveResiduals**





The straight lines represent critical bounds at 5% significance level

$DPOP_t = \alpha_1 + \sum_i^n \beta_1 DEC_{t-1} + \sum_i^n \beta_2 DFD_{t-1} + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_4 DCPI_{t-1} + \sum_i^n \beta_5 DPOP_{t-1}\ \delta 1EC_{t-1} +$
$\delta 2FD_{t-1} \delta 3POP_{t-1} + \delta 4GDP_{t-1} + \delta 5CPI_{t-1}\ \varepsilon_{1t}$ .... (7)

Table A8: ARDL Cointegrating And Long Run Form

ARDL Cointegrating And Long Run Form
Dependent Variable: LPOP
Selected Model: ARDL(2, 2, 2, 1, 2)
Date: 07/20/18 Time: 16:45
Sample: 1971 2014
Included observations: 42

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPOP(-1))	0.741535	0.039273	18.881592	0.0000
D(LEC)	0.017457	0.024469	0.713431	0.4815
D(LEC(-1))	-0.077139	0.024679	-3.125680	0.0041
D(LFD)	-0.169443	0.036839	-4.599548	0.0001
D(LFD(-1))	-0.111477	0.022338	-4.990460	0.0000
D(LGDP)	-0.151339	0.041085	-3.683556	0.0010
D(LCPI)	0.132483	0.074951	1.767603	0.0880
D(LCPI(-1))	-0.137890	0.079539	-1.733615	0.0940
CointEq(-1)	-0.142665	0.012730	-11.207245	0.0000

LPOP= 0.6053*LEC -0.6692*LFD -1.9588*LGDP + 3.2381*LCPI+ 37.3150

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEC	0.605256	0.113716	5.322540	0.0000
LFD	-0.669214	0.065255	-10.255438	0.0000
LGDP	-1.958828	0.139794	-14.012286	0.0000
LCPI	3.238123	0.292672	11.063987	0.0000
C	37.315048	2.476702	15.066429	0.0000

Table A9: ARDL Bounds Test

ARDL Bounds Test		
Date: 07/20/18 Time: 16:45		
Sample: 1973 2014		
Included observations: 42		
Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	k
F-statistic	31.76328	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

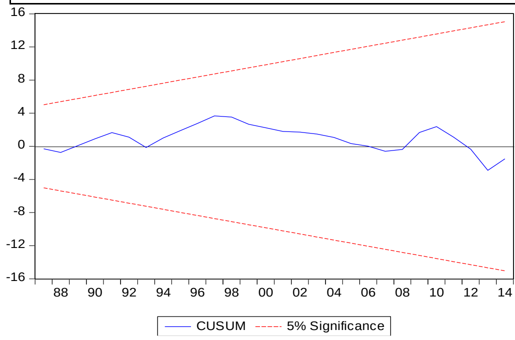
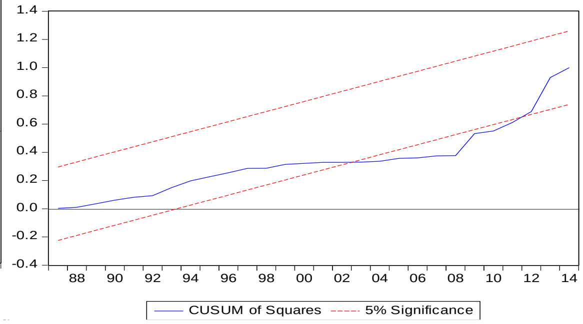


Figure A7: Plot of CumulativeSum of RecursiveResiduals



FigureA8: Plot of CumulativeSum of Squares of RecursiveResiduals

$DCPI_t = \alpha_1 + \sum_i^n \beta_1 DEC_{t-1} + \sum_i^n \beta_2\, DFD_{t-1} + \sum_i^n \beta_3\, DGDP_{t-1} + \sum_i^n \beta_4\, DCPI_{t-1} + \sum_i^n \beta_5\, DPOP_{t-1}\ \delta 1 EC_{t-1} + \delta 2 FD_{t-1} \delta 3 POP_{t-1} + \delta 4 GDP_{t-1} + \delta 5 CPI_{t-1}\ \varepsilon_{1t}$………… ………… (6)

Table A10: ARDL Cointegrating And Long Run Form

ARDL Cointegrating And Long Run Form
Dependent Variable: LCPI
Selected Model: ARDL(2, 2, 2, 2, 0)
Date: 07/20/18 Time: 16:29
Sample: 1971 2014
Included observations: 42

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	0.781616	0.094786	8.246124	0.0000
D(LEC)	-0.033336	0.047647	-0.699646	0.4897
D(LEC(-1))	0.201668	0.046545	4.332787	0.0002
D(LGDP)	0.238504	0.048400	4.927729	0.0000
D(LGDP(-1))	-0.214060	0.050226	-4.261942	0.0002
D(LPOP)	0.878566	0.253528	3.465355	0.0017
D(LPOP(-1))	-0.414424	0.216978	-1.909980	0.0661
D(LFD)	0.163494	0.029233	5.592796	0.0000
CointEq(-1)	-0.859957	0.119188	-7.215144	0.0000

Cointeq = LCPI - (-0.2113*LEC + 0.5401*LGDP + 0.1607*LPOP + 0.1901 *LFD -9.2817)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEC	-0.211325	0.034187	-6.181409	0.0000
LGDP	0.540124	0.035122	15.378700	0.0000
LPOP	0.160676	0.024684	6.509337	0.0000
LFD	0.190119	0.014859	12.794918	0.0000
C	-9.281703	0.824601	-11.255993	0.0000

Table A11: ARDL Bound Test

ARDL Bounds Test
Date: 07/20/18 Time: 16:30
Sample: 1973 2014
Included observations: 42
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	18.55196	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Figure A9: Plot of CumulativeSum of RecursiveResiduals

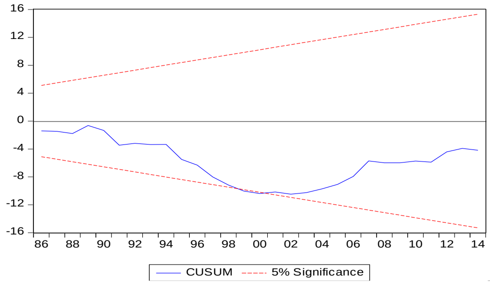


Figure A10 : Plot of CumulativeSum of Squares of RecursiveResiduals