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Renewable electricity consumption, foreign direct investment and economic growth in Egypt: An ARDL approach

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Abstract

This study examines the relationship between renewable electricity consumption, foreign direct investment and economic growth in Egypt. In this regard the study used Auto Regressive Distributed Lag (ARDL) bound testing approach over time series data from the period 1980 to 2011. The empirical findings show that the variables in the study are cointegrated indicating the existence of long-run relationship among them. Furthermore, renewable electricity consumption and foreign direct investment have a long-run positive effect on economic growth. Granger causality test shows that there exists unidirectional causality running from foreign direct investment to economic growth, in addition there is bidirectional causality between economic growth and renewable electricity consumption. This result supports feedback hypothesis. The stability of model was also checked at the end.

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Keywords: Economic growth ; Renewable electricity consumption ; Foreign direct investment ; Granger causality.

1. Introduction

Energy plays an important role in economic, human and social improvements which are essential inputs to achieve sustainable development especially in developing countries. Consumption of energy in developing countries is growing rapidly in response to rapid economic growth, population growth and industrialization (OECD, 2007), and the demand for world primary energy is expected to increase as the International Energy Agency's current policies

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scenario projects that energy growth rate will be 1.4% per year until 2035, where non-OECD countries face the fastest growth rate especially China and India (UNEP, 2011). But the major challenges will face the world concerning continuous growth of energy consumption are rising and unstable prices of fossil fuels and climate change problem (global warming) mostly driven by burning of fossil fuels with its adverse effect on human and living organisms. All these raise the world concern about energy security which will lead to the importance of transition to alternative energy resources including renewable energy resources (UNEP, 2011). Renewable energy is that energy derived from wind, solar, biofuel hydropower, geothermal and it is known as clean energy and shifting to it will not only protect the environment but will also contribute to the growth of income and jobs (UNEP, 2011).

Several studies focus on the causality interrelation between energy consumption or renewable energy consumption and economic growth as this is an important indication of correct policy decisions. In the case of the presence of bidirectional causality between energy consumption and economic growth (feedback hypothesis), this indicates the interdependence between the two variables. Whereas if the causality relationship is unidirectional but running from economic growth to energy consumption (conservation hypothesis), this may reflect the little or no impact of energy conservation policies on economic growth. On the contrary, unidirectional causality running from energy consumption to economic growth (growth hypothesis) indicates the importance of energy to economic growth, and this implies that energy conservation policies may affect negatively economic growth. In the case where there is no causality between economic growth and energy consumption (neutrality hypothesis) this reflects the insignificant effect of energy conservation policies on economic growth (Apergis and Danuletiu, 2014).

Egypt as one of the developing countries depends heavily on energy and faces a rapid growth in energy consumption as a response to economic expansion and industrialization (Razavi, 2012). And although, all energy forms are increasing continuously, electricity consumption shows the highest rapid growth, as total electricity net consumption rises from 72 billion Kilowatt-hours in 2002 to reach 136 billion Kilowatt-hours in 2012 (EIA, 2015), where residential sector and industrial one considered the two major end-users (Environics, 2010). In general, generating electricity mainly depends on natural gas, as about 70% of electricity in Egypt is fueled by it while the remainder 30% is fueled by oil and renewable energy (mainly hydroelectricity) (EIA, 2015). So, it is clear that Egypt's energy situation is precarious due to decline in domestic crude oil resources beside also aging infrastructure and inadequate transmission capacity (EIA, 2015; Environics, 2010) making it a necessity to search for alternative energy resources mainly renewable energy resources. And although Egypt has enormous renewable energy resources mainly wind, solar and hydropower energy, but renewable energy sector is still relatively undeveloped especially that solar energy is very costly (EIA, 2015; Environics, 2010).

Nowadays, Energy strategy is of high priority in Egypt to face challenges for shortages of crude oil and increases its capabilities to meet the continuous increasing demand for energy, so Egypt has an essential present strategy which is increasing the share of renewable energy to account for 20% for its power generation capacity by 2022. This is expected to be met largely by wind power as it is expected to generate 12 % of total electricity, while the remaining 8% would be generated from solar and hydropower energy and this will reduce the dependence on fossil fuels and decrease pollution (Razavi , 2012; Ibrahim, 2012) .

Therefore, from the mentioned above, it is essential to examine the relationship between renewable electricity consumption and economic growth in Egypt, so the aim of this study is to add to strand of literature on renewable electricity consumption and economic growth nexus, but conducts tri-variate approach to try to avoid omitted variables bias (Abdullah, 2013). So, following a few studies like Tang (2009), Bekhet and Othman (2011), Bento (2011) and Abdullah (2013) that examined the relationship between economic growth, foreign direct investment (FDI) and electric power or energy consumption, the study examines the relationship between economic growth, renewable electricity consumption and foreign direct investment especially that several studies confirmed the importance of FDI to economic growth and development (see for example, Barrel and Pain 1999, Li and Liu 2005, Maji and Odoba 2011).

The study employs Autoregressive Distributed Lag (ARDL) model to examine renewable electricity consumption, economic growth and foreign direct investment nexus in Egypt from the period 1980 to 2011 and applies Granger causality test to investigate the relationship between economic growth and renewable electricity consumption on one hand and economic growth and foreign direct investment on the other hand.

The rest of the paper is organized as follows. Section 2 provides a brief review of the literature. Section 3 explains the model specification, data and methodology. Section 4 discusses the empirical results. Section 5 concludes the paper and discusses policy implications.

2. Literature review

There are several researchers aimed at focusing on the relationship between economic growth and energy consumption or electricity consumption, so in this part some empirical studies will be presented and they will be divided into two subsections, the first one will be concerned with empirical studies that examined the relationship between energy consumption or electricity consumption and economic growth, while the second one will be concerned with those studies that examined the relationship between renewable energy consumption or renewable electricity consumption and economic growth.

2.1 Energy consumption and economic growth

Various studies have investigated the energy or electricity consumption –economic growth nexus, beginning with studies concerned with this relationship within specified individual country where Kraft and Kraft (1978) introduced the first study where they found a unidirectional causality from economic growth to energy consumption in USA from 1947 to 1974. Then different studies following Kraft and Kraft (1978) examined economic growth-energy consumption relationship. Abosedra and Baghestani (1989) found also causality from economic growth to energy for USA. Soytas et al. (2001) found a unidirectional causality from energy consumption to GDP in Turkey using cointegration methodology and VECM and that energy consumption has a positive effect on economic growth in the long-run. Tang (2009) examined the relationship between electricity consumption, foreign direct investment and economic growth for Malaysia and the results indicate bilateral causality between the three variables. Bekhet and Othman (2011) examined the relationship between electricity consumption, economic growth, inflation and foreign direct investment (FDI) for Malaysia and found a long-run causality from electricity consumption to FDI, economic growth and inflation. Also, Bento (2011) confirms a long-run linear cointegration relationship between economic growth, energy consumption and FDI for Portugal and that there is a positive relationship between economic growth and energy consumption and negative relationship between FDI and energy consumption. Isik (2010) examined the relationship between natural gas consumption and economic growth in Turkey using ARDL model and found that natural gas consumption affects positively economic growth in the short-run while affects it negatively in the long-run. Waqas et al. (2013) examined the relationship between electricity consumption per capita and real income per capita, and also the relationship between energy consumption per capita and economic growth in Pakistan using Johansen cointegration method and Granger causality and found bidirectional causality between electricity consumption per capita and economic growth on one hand and between energy consumption per capita and economic growth on the other hand. Banafea (2014) also used cointegration procedure and error-correction models and found unidirectional causality running from economic growth to energy consumption in Saudi Arabia in short-run only, whereas in long-run it is vice-versa as it is running from energy consumption to economic growth. Kargi (2014) found bidirectional causality between economic growth and electricity consumed in residential and industrial sectors in turkey. Hwang and Yoo (2014) analyzed the short-run and the long-run causality between economic growth, CO_2 emissions and energy consumption for Indonesia and the result was the existence of bidirectional causality between CO_2 emissions and energy consumption and a unidirectional causality from economic growth to energy consumption and CO_2 emissions. Lin and Jr (2014) also found unidirectional causality running from energy consumption to economic growth for South Africa by adopting a nonparametric bootstrap method. Aslan et al. (2014) confirms feedback hypothesis for USA at intermediate time scales. Kyophilavong et al. (2015) investigated the relationship between economic growth, energy consumption and trade openness in Thailand using Bayer and Hanck cointegration method and the results confirm the presence of cointegration between the variables and the existence of bidirectional causality between economic growth and energy consumption, and between energy consumption and trade openness.

In addition to single country analysis, researchers examined economic growth-energy consumption or economic growth-electricity consumption nexus through multiple-country analysis, beginning with Yu and choi (1985) that concluded the presence of causality between economic growth and energy consumption but it differs between various countries. Masih and Masih (1996) concluded different causality relationship between energy consumption and economic growth where they support growth hypothesis for India, feedback hypothesis for Pakistan, conservation hypothesis for Indonesia and neutrality hypothesis for Singapore, Philippines and Malaysia. Soytas and Sari (2003) concluded the presence of conservation hypothesis in Italy and Korea, feedback hypothesis in Argentina, and growth hypothesis in Turkey, France, Germany and Japan. Abdullah (2013) examined the causality relationship between electric power consumption, economic growth and FDI in India and Pakistan, and concluded that for Pakistan the causality in the long-run was running from FDI and economic growth to electric power consumption, while for India the causality relationship was running from electric power consumption and FDI to economic growth and also from electric power consumption and economic growth to FDI. Dogan (2014) examined energy consumption-economic growth nexus in four sub-Saharan countries and found only growth hypothesis exists in Kenya and no causality relationship exists in Congo, Benin and Zimbabwe. Azam et al. (2015) investigated the relationship between energy consumption and economic growth in Indonesia, Thailand, Malaysia, Philippines and Singapore and found that energy consumption has long-run relationship with economic growth for almost the five countries.

2.2 Renewable energy consumption and economic growth

A number of empirical studies have investigated the relationship between economic growth and renewable energy consumption or renewable electricity consumption either within country context or panel data studies. Beginning with those studies within country context, Sari et al. (2008) examined the relationship between disaggregate energy consumption (coal, fossil fuels, hydroelectric power, solar energy, wind energy, wood and waste) and industrial output and employment in USA using ARDL model and concluded the presence of cointegration between the variables. Yildirim et al. (2012) applied Toda-Yamamoto procedure and bootstrap-corrected causality test for USA data, and they found growth hypothesis between biomass-waste energy consumption and economic growth, and no other causality relationship was found between economic growth and other kinds of renewable energy (biomass energy consumption, hydroelectric power consumption, geothermal energy consumption, total energy consumption and biomass-wood derived energy consumption). Pao and Fu (2013) investigated the relationship between economic growth and various types of energy consumption in Brazil and found mixed results as conservation hypothesis between non-renewable energy consumption and economic growth, growth hypothesis between non-hydroelectric renewable energy consumption and economic growth and feedback hypothesis between economic growth and total renewable energy consumption. Ocal and Aslan (2013) applied ARDL model and Toda-Yamamoto causality test to examine the relationship between renewable energy consumption and economic growth in Turkey and concluded that renewable energy affects negatively economic growth and causality test supports conservation hypothesis. Tiwari (2014) applied Granger-causality for USA data and found feedback hypothesis between economic growth and various kinds of energy consumption (natural gas consumption, primary energy consumption and total renewable energy consumption) and conservation hypothesis between economic growth and coal consumption and growth hypothesis between economic growth and total electricity end use. Leitao (2014) applied time series (OLS, GMM, VECM and Granger causality) to examine the relationship between economic growth, carbon dioxide emissions, globalization and renewable energy in Portugal, and he concluded that renewable energy, carbon dioxide emissions, globalization are correlated positively with economic growth, and causality test indicated conservation hypothesis between renewable energy and economic growth. Lin and Moubarak (2014) concluded that there is a bidirectional long term causality between economic growth and renewable energy consumption in China by applying Granger causality test. Shahbaz et al. (2015) applied ARDL model, rolling window approach (RWA) and Granger causality to examine the relationship between renewable energy consumption and economic growth in Pakistan and they added capital and labour to the model, and they found that renewable energy consumption, labour and capital enhance economic growth, in addition they concluded feedback effect between renewable energy consumption and economic growth.

Beside single-country analysis, there are panel data studies, beginning with Sadorsky (2009) that examined the relationship between income and renewable energy consumption for emerging economies, and by applying panel cointegration he concluded that real per capita income affects positively per capita renewable energy consumption. Apergis and Payne (2011) examined the relationship between renewable and non-renewable energy consumption and economic growth in developed and developing countries and found bidirectional causality between the variables in both short-run and long-run. Also, Apergis and Payne (2012) applied panel error correction model and investigated Granger-causal relationship between economic growth and renewable and non-renewable electricity consumption for Central America data, and found the relationship between renewable energy consumption and economic growth confirms economic growth hypothesis in the short-run and feedback hypothesis in the long-run, and also they found bidirectional causality between non-renewable electricity consumption and economic growth in both short-run and long-run. Apergis and Danuletiu (2014) using the Canning and Pedroni (2008) long-run causality test examined the relationship between economic growth and renewable energy consumption for 80 countries and concluded bidirectional causality between renewable energy consumption and economic growth in the long-run. Kazar and Kazar (2014) investigated the relationship between development and renewable electricity net generation values for 154 countries with panel analysis and found the presence of bidirectional causality in the short-run, and that the causal relationship differs both in short run and long run depending on human development level. Omri et al. (2015) using dynamic simultaneous-equation panel data models for 17 developed and developing countries examined the relationship between nuclear consumption and renewable energy consumption and economic growth, and concluded mixed results for different countries and unidirectional causality running from economic growth to renewable energy consumption for the global panel.

From the previous studies, it can be concluded that mixed results were found for economic growth-renewable energy consumption nexus or economic growth- renewable electricity consumption nexus and Sebri (2015) on his meta-analysis for renewable energy consumption-economic growth nexus concluded that the variation in the results may be attributed to several characteristics as estimation techniques, model specification, data characteristics and development level of the country.

3. Econometric specification and methodology

3.1 Model specification and data

In order to examine the relationship between economic growth, renewable electricity consumption and foreign direct investment, a linear natural logarithm equation is specified as following:

$$Y_t = B_0 + B_1 RE_t + B_2 FDI_t + \varepsilon_t \quad \textbf{(1)}$$

Where Y is real GDP per capita (at constant 2005 US$), RE is net consumption of total renewable electricity (billion Kilowatt hours), FDI is net inflows of foreign direct investment (BOP, current US$). Data from 1980 to 2011 for foreign direct investment (net inflows) and real GDP per capita and were obtained from the World Development Indicators (WDI) database, while that of net consumption of total renewable electricity were obtained from International Energy Statistics.

3.2 Econometric methodology

The study will examine the relationship between economic growth, renewable electricity consumption and foreign direct investment by applying Autoregressive Distributed Lag (ARDL) approach introduced by Pesaran and Smith (1998) and Pesaran et al. (2001). ARDL model is chosen as it has certain advantages, one of them is that it can be applied irrespective of whether the time series variables are I(0), I(1) or frictionally integrated (Pesaran et al., 2001). Also, endogeneity problems can be avoided and small sample properties of ARDL approach are more reliable than that of Johansen and Juselius's cointegration methodology. Moreover, short-run and long-run parameters can be estimated simultaneously and error correction model can integrate short-run adjustment and long-run equilibrium without fear of losing long-run information (Jalil and Mahmud, 2009; Ahmed and Long, 2013).

The equation of the ARDL model is as follows:

$$\Delta(Y)_t = \beta_0 + \delta_1(Y)_{t-1} + \delta_2(RE)_{t-1} + \delta_3(FDI)_{t-1} + \sum_{i=1}^{p}\varpi_i\Delta(Y)_{t-i} + \sum_{i=1}^{p}\lambda_i\Delta(RE)_{t-i} + \sum_{i=1}^{p}\theta_i\Delta(FDI)_{t-i} + U_t \quad \textbf{(2)}$$

Where Δ is the first difference operator, Y_t is the dependent variable, RE_t and FDI_t are the explanatory variables, U_t is the white noise error term and δ_1, δ_2 and δ_3 correspond to the long run parameters.

The ARDL model starts first with examining unit root test to ensure that each variable is either I(0) or I(1) to satisfy the bound test assumption. Then in the second step, lag selection is selected by a criterion such as Akaike Information Criterion (AIC) and Schwarz criterion (SC) then estimate equation (2) by ordinary least square (OLS) method. The F-test or Wald test is conducted to investigate the existence of long-run relationship among the variables. The null hypothesis of having non-existence of cointegration, H_0: $\delta_1 = \delta_2 = \delta_3 = 0$ is tested against the alternative hypothesis, H_1: $\delta_1 \neq \delta_2 \neq \delta_3 \neq 0$, the variables are said to be cointegrated if null hypothesis is rejected which means the existence of long-run relationship.

The calculated F-statistics values will be compared with two sets of tabulated critical values developed by Pesaran et al. (2001) where one set assumes all the series are I(0) while the other one assumes they are I(1). If the computed *F*-statistics exceeds the upper bound of the critical values, then the null hypothesis of no cointegration is rejected whether the series are I(0) or I(1). If it is below the lower bounds value, then the null cannot be rejected whether the series are I(0) or I(1) , and the cointegration test becomes inconclusive if calculated F-statistic falls between the two levels of the bounds. Third, if a long-run relationship is established between the variables, an error correction model is estimated from the following equation:

$$\Delta(Y)_t = \beta_0 + \sum_{i=1}^{p}\varpi_i\Delta(Y)_{t-i} + \sum_{i=1}^{p}\lambda_i\Delta(RE)_{t-i} + \sum_{i=1}^{p}\theta_i\Delta(FDI)_{t-i} + \alpha ECT_{t-1} + U_t \quad \textbf{(3)}$$

The results of the error correction term will indicate the speed of adjustment to reach equilibrium after a short-term shock. Stability and diagnostic tests will be employed to ensure goodness of fit for the chosen ARDL model, which include serial correlation, heteroskedasticity, functional form and normality tests, in addition stability tests known as Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Square of Recursive Residuals (CUSUMQ) tests will be conducted.

4. Empirical results

The study is concerned mainly with examining the long-run relationship between economic growth, renewable electricity consumption and foreign direct investment as well as testing Granger causality between economic growth and renewable electricity consumption on one hand and economic growth and foreign direct investment on the other hand. The ARDL model will be employed through several steps, first, testing for stationarity, second, order of lags of ARDL model will be chosen automatically by E-views 9 statistical package, third, conducting F-statistic test to examine long-run relationship, fourth, estimating long-run coefficients and establishing error correction model, and finally, testing stability of the chosen model. In addition, Granger causality will be investigated.

So, first, unit root test is conducted to ensure that none of the variables are I(2) and the optimal lag is determined automatically by the E-views 9 depending on Schwarz Information Criterion.

Table 1. Unit root tests (ADF) results

Variables	Test value (level form) (Trend &intercept)	Test Value (First Differenced form) (Intercept)
Y	-1.644781	-3.445909**
RE	-2.531826	-6.763994***
FDI	-2.109683	-5.213076***

** and *** indicate the rejection of the null hypothesis of ADF test at 5% and 1% level of significance respectively.

It is shown from table 1 that Y, RE and FDI are non-stationary and integrated of order one. Then in the second step, the lag structure of the ARDL model is automatically selected by E-views 9 based on the Akaike Information Criterion (AIC) so that order of ARDL model is selected to be (2, 4, 0) with maximum lags automatically chosen to be 4. After conducting ADF and ensure that none of the series is I(2) investigating the long run relationship between the variables is the third step, and calculated F-statistics is 3.93. The critical value ranges are I(0)= 3.87 and I(1)=3.1 at 5% level of significance. From comparing calculated F-statistics with critical values, the null hypothesis will be rejected indicating the existence of long-run relationship between the variables. Fourth, the estimation of long-run coefficients of variables of ARDL (2, 4, 0) model is conducted and presented in table 2.

Table 2. Long-run estimates results

Dependent variable:Y		
Regressors	**Coefficients**	**t-values**
Intercept	2.390432	4.077064***
RE	0.692878	6.243821***
FDI	0.151256	4.400051***
Diagnostic tests	**Test-statistics**	**p-value**
Serial correlation LM	0.124363	0.7287
Heteroskedasticity	1.718211	0.1619
Normality test	1.002	0.6057
Functional Form	0.161190	0.6931

*** indicates 1% level of significance.

From table 2, it is shown that RE and FDI are statistically significant and are correlated positively with the dependent variable Y in the long-run, the coefficient of RE is 0.69 which means 1% increase in net consumption of renewable electricity will lead to 0.69 % increase in real GDP per capita while the coefficient of FDI is 0.151, this means that 1% increase in foreign direct investment will lead to 0.151 % increase in real GDP per capita. The ARDL passes through diagnostic test statistics which supports the results of the ARDL model.

The error correction model is estimated and the results are shown in table 3.

Table 3. Error correction model estimates

Regressors	**Coefficient**	**t-values**
Δ RE	0.064954	3.813214***
Δ FDI	0.015738	5.318070***
ECT(-1)	-0.103405	-5.950169***
ECT= Y - (0.6929*RE + 0.1513*FDI + 2.3904)		

*** indicates 1% level of significance.

From table 3, it is concluded that the coefficient of the error correction term is statistically significant at 1% significance level, and has a negative sign. And it is shown that error correction term is -0.103. This indicates that around 10% of the disequilibrium of real GDP per capita of the shock of previous year will adjust back to the long-run rate equilibrium of real GDP per capita and should be corrected in the current year. And the rest of the specified variables are significant, so this implies that there is an effect for the specified variables (renewable electricity consumption and foreign direct investment) on real GDP per capita in the short-run.

Finally, stability of the model is checked by applying CUSUM and CUSUMQ tests, and it can be seen from figures 1 and 2 that the results are within the critical bounds implying that estimated coefficients of the model are stable and the straight lines in figures 1 and 2 represent critical bounds at 5% significance level.

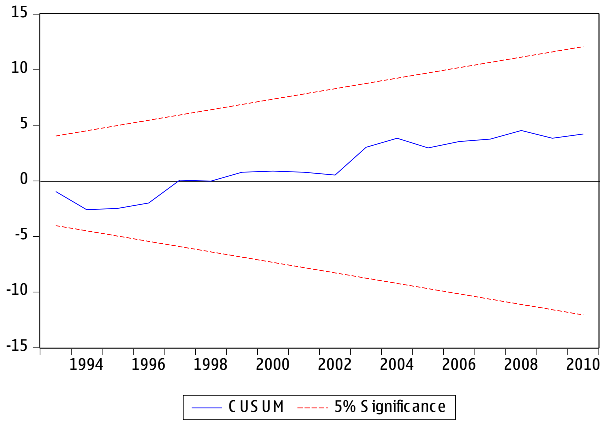

Fig. 1. Plot of cumulative sum of recursive residuals

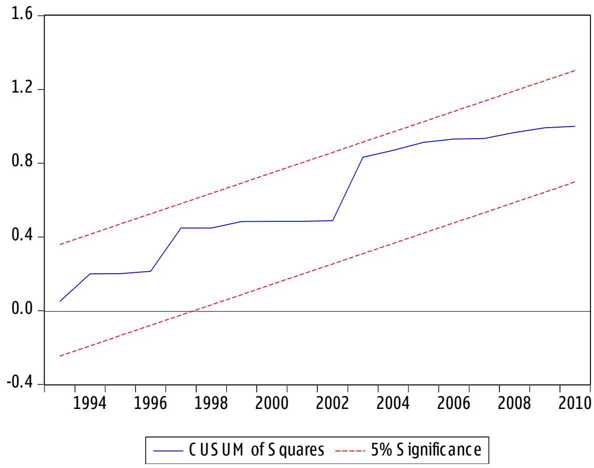

Fig. 2. Plot of cumulative sum of squares of recursive residuals

Also, it is of importance to examine the causality between economic growth and renewable electricity consumption on one hand and economic growth and foreign direct investment on the other hand, so Granger causality is employed under the null hypothesis of no causality and the result is shown in table 4.

Table 4. Pair-wise Granger-causality test

Null-hypothesis	F-statistic	Prob.
Y does not Granger Cause FDI	2.56499	0.1209
FDI does not Granger Cause Y	3.96845	0.0566
Y does not Granger Cause RE	3.28691	0.0806
RE does not Granger Cause Y	4.95557	0.0342

The previous results in table 4 indicate that causality relationship is running from renewable electricity consumption to economic growth at 95% confidence interval and running from economic growth to renewable electricity consumption at 90% confidence interval, so there is bidirectional causality between economic growth and renewable electricity consumption which means the existence of feedback hypothesis, while there is unidirectional causality between foreign direct investment and real GDP per capita running from foreign direct investment to economic growth at 90% confidence interval.

5. Conclusion and policy implications

Energy sources play a critical role in development especially in developing countries in general and Egypt in specific, but now Egypt is struggling to satisfy the needs of energy despite it was net exporter of oil in the past, so it is very essential to shift to another sources of energy mainly renewable energy resources that are vast and clean source.

Therefore, this study aims at examining the relationship between economic growth, renewable electricity consumption and foreign direct investment. This is done by conducting ARDL model and Granger causality test between economic growth and renewable electricity consumption on one hand and economic growth and foreign direct investment on the other hand. The study confirms the presence of cointegration between economic growth, renewable electricity consumption and foreign direct investment and that both renewable electricity consumption and foreign direct investment are correlated positively with economic growth. The error correction term is observed statistically significant with negative sign and the diagnostic tests together with CUSUM and CUSUMQ techniques for stability test indicate the robustness of the results of ARDL model. In addition, Granger causality test indicates unidirectional causality from foreign direct investment to economic growth and bidirectional causality between renewable electricity consumption and economic growth which confirms feedback hypothesis.

These results have a number of policy implications for Egypt. *First*, since economic growth causes renewable electricity consumption, this is an indication of the importance of economic growth in the development of renewable electricity sources and as pointed out by Apergis and Danuletiu (2014), this can be done by using the resources generated by economic growth in introducing new techniques and technologies in the domain of expansion of renewable electricity sources and providing suitable infrastructure needed. *Second*, as renewable electricity consumption causes economic growth, this means that economic growth depends on renewable electricity consumption, therefore there must be a clear and comprehensive strategy for encouraging renewable electricity expansion policies like providing incentives to attract public and private capital to invest in generating renewable electricity sources through offering loans on favorable terms. Also, government has to direct a substantial percentage of financial resources towards research and development activities in environmentally technologies related to renewable electricity sources, and focuses on training and education of workforce in this field. And *finally*, as foreign direct investment causes economic growth and since economic growth causes renewable electricity consumption, so foreign direct investment is important for both economic growth and renewable electricity sources, therefore economic and social improvements are essential conditions to benefit from foreign direct investment's spillovers correctly. This means that great efforts must be done in this field and government must work on introducing the proper mechanism together with partnerships between the public sector and the private sector to facilitate achieving these improvements through providing local sufficient conditions in Egypt. The presence of highly educated workforce and sufficient development financial system are both very important local sufficient conditions, since the absence of these conditions hinder the exploitation of foreign direct investment' spillovers as concluded by Borensztein et al.(1998) and Alfaro et al. (2004) respectively.

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