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Renewable energy consumption, financial development and economic growth: Evidence from panel data for the Middle East and North African countries

Nagmi Moftah Aimer
Higher Institute of Marine Sciences Techniques- Sabratha, Libya

Abstract

This paper aims to explore the relationship between economic growth and financial development of the MENA countries over the period 1990 to 2015. The results of the fixed and random effect tests showed that there is a negative relationship between renewable energy consumption and economic growth, but their impact on oil-importing countries is greater than that of oil-exporting countries. While the impact of domestic credit to the private sector has a positive affect economic growth, it appears that its impact on oil-importing countries is greater than that on oil exporting. In addition, the unidirectional causality stems from growth to domestic credit in long run, the bidirectional causality between economic growth and renewable energy consumption in the MENA. In the case of oil-importing countries, there is no causal relationship between the variables, whereas for the oil-exporting countries there is a unidirectional causality that extends from real GDP to domestic credit, as well as from renewable energy consumption to real GDP. In addition, there is unidirectional causality that stems from the domestic credit to energy consumption. These results indicate that the MENA countries are an economy independent of energy and that economic growth is crucial in providing the resources necessary for sustainable development.

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Contact: Nagmi Moftah Aimer - najmimuftah@gmail.com.
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1. Introduction

The finance growth nexus has received broad attention from economists over the past decade. Although the relationship has been known since the Industrial Revolution, made manifest by the studies of Schumpeter (1911), Gurley & Shaw (1955) and in particular by Hicks et al., (1969), who claimed that, in the absence of a well-developed financial system, the innovations of the industrial revolution would remain only projects, it is known that the systematic investigation of the report is very recent and given by the works of King & Levine (1993a, b), Atje & Jovanovic (1993) which have been followed by countless other studies, both theoretical and empirical. Although the latter are considerably more numerous than the former, the theoretical foundation on which they are based is to be considered consolidated and must be sought, as well as in the predictions of the new theories of endogenous growth, in some functions performed by the financial system, highlighted by macroeconomists. In economies with market imperfections, the financial system provides key services, such as the mobilization of savings, the diversification of risk, the allocation of savings towards innovative investments, which if carried out effectively reduce transaction and information costs, improve l the allocation of resources reduces the cost of capital, translating at an aggregate level into greater profitability of investments and higher economic growth.

Indeed, in recent years, the need to better qualify the link between financial and real variables has made it clear that the results of empirical tests, which take the form of cross-section and cross-country growth equations, are poorly informative of the specific role of financial factors in growth experiences of individual countries.

The complexity of the financial systems, the difficulty of obtaining data of sufficient comparability, as well as the fact that the effectiveness of the financial variables crucially depends on the institutional characteristics of each country, all these elements make the results very fragile and easily questionable in terms of methodological. Already De Gregorio & Guidotti (1995) showed skepticism about the positive value of the coefficients of the financial indicators for the OECD countries that emerged from their own analysis. Now that skepticism is shared by a number of scholars and recent works Tadesse (2002), Hahn (2005), Manning (2003), Rousseau & Wachtel (2005) Fisman & Love (2007) who exhibit a variety of results, depending on the sample used, the inclusion or otherwise of some outliers, the method, the period and the number of observations included in the analysis. Moreover, looking at the evolution of indicators related to the MENA countries, as in Table 1.

Table 1: The growth rates of the variables

Varabile	Algeria	Egypt	Iran	Jordan	Libya	Morocco	Saudi	Tunisia	Turkey	UAE
					1990-2015					
GDP	4.1%	5.6%	3.0%	4.6%	-3.2%	4.6%	8.6%	0.9%	6.3%	5.6%
DCPS	-3.7%	0.1%	3.9%	0.5%	0.9%	6.7%	5.5%	1.5%	5.7%	4.7%
REC	-4.3%	-1.6%	-1.2%	0.6%	-1.8%	-2.1%	-7.1%	-0.6%	-2.4%	-1.4%
MBG	-13.6%	-1.7%	1.2%	-0.4%	-1.7%	-5.2%	-1.8%	-1.4%	-4.6%	-198.4%
					1990-2007					
GDP	2.7%	7.3%	4.2%	5.4%	2.4%	4.9%	9.2%	0.9%	6.6%	6.6%
DCPS	-8.2%	3.5%	4.3%	2.3%	-8.9%	7.3%	5.5%	0.3%	3.2%	4.8%
REC	5.1%	-1.9%	0.3%	-1.0%	-2.6%	-0.8%	-8.8%	-0.1%	-3.9%	-3.3%
MBG	4.2%	-2.4%	3.8%	2.4%	4.2%	-1.2%	9.1%	3.3%	-7.1%	-210.0%
					2008-2015					
GDP	6.6%	0.4%	0.6%	3.4%	-16.3%	1.7%	5.1%	0.9%	7.1%	4.1%
DCPS	7.8%	-6.7%	4.0%	-1.9%	26.5%	5.0%	5.8%	4.1%	10.3%	2.3%

REC	-20.7%	-0.6%	3.8%	2.4%	0.7%	-4.1%	-2.7%	-2.1%	1.1%	3.2%
MBG	-43.4%	8.5%	10.8%	-13.7%	-17.8%	-11.4%	-22.9%	-12.1%	-5.7%	-17.7%

Source: Author based on World Bank database.

CAGR is one of the most accurate ways to calculate and determine returns for anything that can rise or fall in value over time. The compound growth rate was calculated based on the following formula:

$$\text{Compounded Annual Growth Rate } (CAGR) = \left(\sqrt[\frac{1}{N}]{\frac{Final\ Year}{Starting\ Year}}\right)\text{-1}$$, n=Number of years.

Table (1) shows that the domestic credit to the private sector indicator achieved the highest compound annual growth rate during the period (2008-2015) in Libya of 26.5%, as well as 10.3% in Turkey, undoubtedly that the large increase in private domestic credit justifies the use of intermediate financing as a main source of financing and weakening the financial market. Whereas, the lowest (negative) growth rate for the same indicator was in Libya and Algeria for the period (2007-2015) of (-8.9%) and (-8.2%), respectively.

While real GDP achieved the highest compound annual growth rate over the period (1990-2015), where it was 8.6% in Saudi Arabia, and 7.3% in Egypt during (1990-2007), and this indicator is dangerous in affecting the economic stability of the country. While real GDP achieved the lowest compound annual growth rate (negative) in Libya for the period (2008-2015) of (-16.3%), and (1990-2015) of (-3.2%) for the same country. Thus, the Libyan economy may experience economic shocks because of dependence on oil and influence very quickly in global financial crises. While the rest of the sample countries have achieved a positive annual growth rate for all three annual periods.

In addition, the renewable energy consumption indicator, we note that most of the sample countries have achieved a negative annual growth rate. Whereas, the lowest growth rate was in Algeria for the period (2008-2015) of (-20.7%), while the highest growth rate was achieved in the same country (Algeria) for the period (1990-2007) of 5.1% (see Fig.1 and Fig.2).

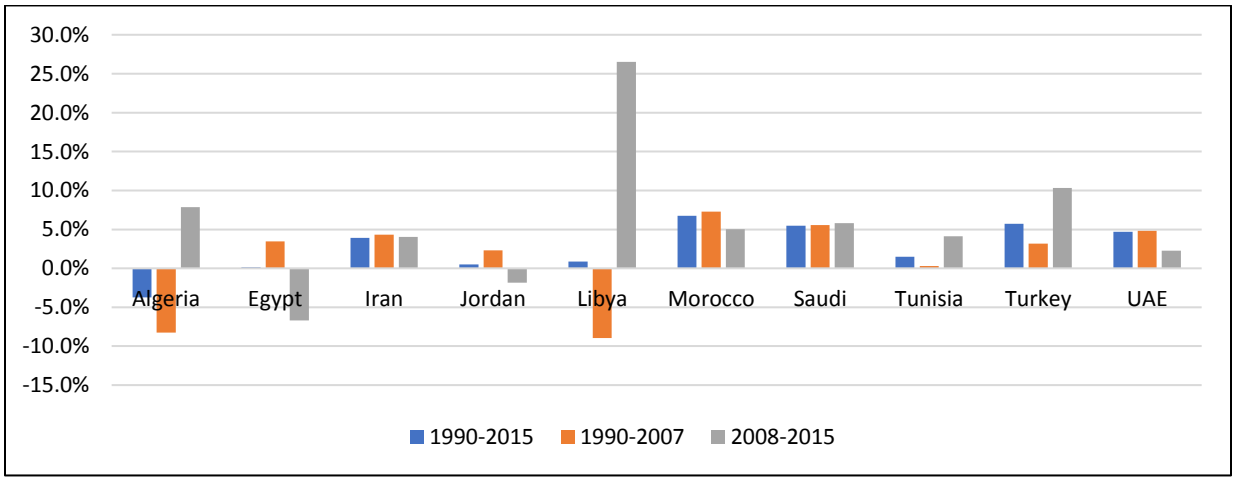

Fig. 1. Compound annual growth rate of the private domestic credit.

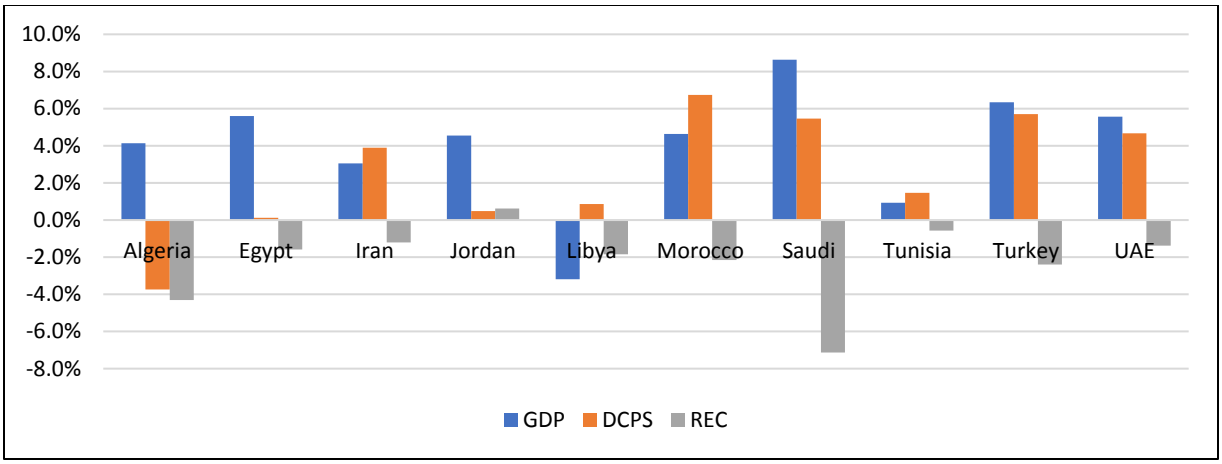

Fig. 2. Compound annual growth rate: real GDP, the private domestic credit and renewable energy consumption for (1990-2015).

For this purpose, this study aims to address this gap in the literature by focusing on these countries during 1990 - 2015, and this period is considered crucial for these countries due to the financial crises. The second section reviews the literature on the subject of the study. While the third section presents the research methodology and the proposed models, the fourth section presents the experimental results and their interpretation. Finally, the last section draws conclusions.

2. Literature review

In this context, we divide the literature into two parts. The first part is devoted to the relationship between economic growth and financial development, while the second part is devoted to the relationship between economic growth and renewable energy consumption.

2.1. Economic growth and financial development

Authors of the likes of Bagehot (1873) and Hicks et al. (1969) have already discussed the importance of institutional development and, in particular, of financial development in economic growth. Subsequently, in the 1970s, a broad literature on development and industrialization appeared that analyzes the relationship between financial intermediaries and economic growth (Gurley & Shaw, 1955; Cameron, 1967; Goldsmith, 1969; McKinnon, 1973 and 1976; Shaw, 1973). These authors affirm that the existence of information and transaction costs, in the fulfillment of contracts and exchange of goods and financial titles, motivates the emergence of markets and financial intermediaries. Financial institutions seek to mitigate the economic effects of friction, in order to expand markets and achieve more efficient resource allocations and increases in productivity and growth rates. These works, which are pioneers in analyzing the role of finance and economic growth, develop models that formalize the financial sector through money, raising the distinction between the real part of the economy and the financial one. Fry (1988) examines several growth models with money, derived from these contributions, among which Kapur (1976), Galbis (1977) and Mathieson (1980). Traditional literature on economic growth (Romer, 1986, 1990; Aghion & Howitt, 1990) has generally neglected the role of financial institutions as an engine of economic growth. The main reason is that endogenous growth models are obtained within the general equilibrium framework of Arrow-Debreu and do not accommodate frictions and market imperfections. King & Levine (1993) which is considered one of the most important applied studies related to determining the causality relationships between financial

development and economic growth of 80 countries during (1960-1989), used measures of economic growth including average per capita income and indicators reflecting the exchange rate and fiscal and monetary policy. The results indicated its support for the hypothesis that financial development positively affects economic growth. Evidence in this direction is found rather in the successive works of Levine, Loayza and Beck (Levine et al., 2000; Beck et al., 2000). In the first article, these authors examined a sample of 71 countries for the period 1961-1995 and used legal origin (Porta et al., 1998) as an instrument for financial development. They then found a significant effect of the exogenous component of financial development on long-term growth and concluded that their results were consistent with the idea that financial development has a causal effect on economic growth.

Kar & Pentecost (2000) examined the relationship between financial development and the rate of Turkish economic growth, where they reached mixed results; it was found that causation tends from financial development to economic growth. While using it a variable of the ratio of bank deposits, the ratio of private credit and domestic credit to gross national product and they found that causality tends from the rate of growth to financial development. Blackburn & Hung (1998) and Khan (2001) develop theoretical models to show the causality between growth and financial development in both directions. The former carries out an analysis in which they show how private agents obtain external financing for their research projects through compatible incentive loan contracts. Their analysis shows how the causality between growth and financial development is in both directions. Khan's work analyzes how, when loans are rationed, producers with access to financial intermediaries obtain higher returns than those without access. This leads to incentives to participate in formal financial activity, which, over time, leads to a reduction in the cost of financial intermediation that raises the total return on investment and consequently economic growth. The level of financial intermediation may be the most important for economic growth in the initial stages of development, while in the richest countries the efficiency and composition of financial intermediation are probably more important as determinants of growth (Aimer, 2016, 2019). However, the first study by King & Levine (1993) and later studies by Andrés et al. (2004) and Leahy et al. (2001) are consistent with this opinion, since they were unable to find significant links between bank credit / GDP ratios and subsequent economic growth rates in OECD countries.

2.2. Economic growth and renewable energy consumption

The question of whether a causal relationship exists between energy consumption and economic growth has been the subject of much research in the economic literature (Kraft & Kraft, 1978; Abosedra & Baghestani, 1989; Oh & Lee, 2004; Lee, 2005; Mehrara, 2007; Ozturk, 2010; Ozturk et al., 2010; Apergis & Payne, 2012; Omri, 2013; Ackah et al., 2014; Sebri & Ben-Salha, 2014; Iyke, 2015; Dlamini et al., 2015; Ackah & Asomani, 2015; Bhattacharya et al., 2016), but fundamentally, he could not completely end this causal relationship and had results that differ from one country to another according to the time period, in addition to the model used for the study, etc. The first generation of approach was marked by the work of Kraft & Kraft (1978) used the Sims causality technique and found a unidirectional causality from GDP to energy consumption in the USA over the period 1947-1974. This study was challenged by Akarca & Long (1980). They pointed out that the period chosen was unstable since it included the first oil shock, by reducing the period (1947 to 1974) to another period from 1950 to 1968, and by the same method of analysis, they found the absence of causality between GDP and energy consumption in the American economy. Lee et al. (2008) the data used was relevant data for 16 Asian countries from 1971 to 2002. They found that in the short term, there is no causality relationship between economic

development and energy consumption due to too many factors, but in long run, there is a causality relationship between energy consumption and economic growth, which means that reducing, will adversely affect GDP. Stern & Cleveland (2003), for their part, have emphasized the effect of changes in energy supply on economic growth, in developed and developing countries. If energy supply is seen as a homogeneous input to the production function, it means that policy constraints affect energy supply, and then economic development will suffer.

Osigwe & Arawomo (2015) study the relationship between energy consumption, oil prices and economic growth in Nigeria; and, based on their results, they recommend the introduction of policies that promote energy consumption and economic growth. One way to achieve this is through the adoption of a convenient energy-pricing framework, which is aware of both the present and future generations. In particular, and based on the previous studies, the results of the causality relationship differ from one country to another, due to perhaps a result of the different time periods and the model used for the study, etc. The difference between the literature review and our study is that the primary purpose of our study is to highlight the relationship between economic growth, financial development, and renewable energy consumption. Through the study of the literature, no study was conducted on renewable energy consumption, financial development expressed in domestic credit to the private sector, the broad money growth and its impact on economic growth as a proxy for real GDP in the countries of the MENA. Moreover, the absence of such a study on the MENA region, which is represented by oil importing and exporting countries.

3. Data and methodology

We use annual data on real GDP, domestic credit to the private sector, renewable energy consumption and broad money growth (annual %) during the period 1990-2015, to estimate a panel data model made up of ten MENA countries (Algeria, Egypt, Iran, Jordan, Libya, Morocco, Saudi, Tunisia, Turkey, United Arab Emirates), specified by equation (1 and 2), as follows.

$$lnGDP_{it} = f(lnDCPS_{it};\ lnREC_{it};\ lnMBG_{it})$$
$$lnGDP_{it} = \alpha_0 + \alpha_1(lnDCPS_{it}) + \alpha_2\ (lnREC_{it}) + \alpha_3(lnMBG_{it}) + \mu_{it} \quad (1)$$

$$lnDCPS_{it} = f(lnGDP_{it};\ lnREC_{it};\ lnMBG_{it})$$
$$lnDCPS_{it} = \beta_0 + \beta_1(lnGDP_{it}) + \beta_2\ (lnREC_{it}) + \beta_3(lnMBG_{it}) + \eta_{it} \quad (2)$$

Where *i=1,...,,10* denotes the countries in the panel and *t=1990,....,2015* denotes to the time period. μ and η are error term. Table (2) shows the data used and their source.

Table 2. Definition of Variables

Symbol	Variable	Source
GDP	GDP (constant 2015 US$)	The World Bank, International Monetary Fund, International Financial Statistics
DCPS	Domestic credit to the private sector (% of GDP)	
REC	Renewable energy consumption (% of total final energy consumption)	
BMG	Broad money growth (annual %)	

The unit root tests in panel data have known spectacular advances, in the two groups, we find two types of tests: on the one hand, those which admit the null hypothesis is that each series in the panel contains a unit root, (Levin et al., 2002, Harris & Tzavalis, 1999, Breitung, 2001, Im et al., 2003, Maddala & Wu, 1999, Choi, 2001) and the other tests based on the Lagrange multiplier test (LM) which admit the null hypothesis that panel data is (trend) stationary (e.g. Hadri, 2000). The

traditional augmented Dickey-Fuller unit root test (ADF) suffers from a problem of low rejection power of the null hypothesis of stationary series, especially for data from short period, thus the recent literature shows that the stationarity tests on panel are more powerful than those based on the individual time series Al-Iriani (2006), among the tests recently developed, we have, the unit root test LLC of Levin et al. (2002); IPS from Im et al. (2003), Hadri (2000) and Narayan & Smyth (2009) used the Breitung (2001) because this test is generally more robust than any test of the first generation of unit root panel tests.

After determining this, it is required that the model series, in this case, model (1), share a long-term relationship, that is, that they are cointegrated; for this purpose, cointegration tests must be applied to panel data models that allow statistical evidence to be presented that the series share a long-term relationship. To determine this, we used cointegration test by Pedroni (1999, 2000, 2004), which is used in heterogeneous panel data models and allows interdependence between panel individuals (cross-country dependency) with different individual effects, using two types of tests (Within dimension and Between dimension).

For panel cointegration models, the asymptotic properties of the estimators of the regression model coefficients and the associated statistical tests are different from those estimated by the time series cointegration models (Baltagi, 2008). Some of these differences have been revealed in recent works such as those by Kao & Chiang (1999), Phillips & Moon (1999), Pedroni (2000), 2004) and Mark & Sul (2003), to mention the most prominent. Panel cointegration models are designed to study questions about long-term relationships typically found in macroeconomic and financial data. Such long-term relationships are often postulated by economic or financial theory and, therefore, the main interest in estimating regression coefficients is to test whether or not theoretical constraints are satisfied.

From a statistical point of view, there are several types of regressions. For the present study, two types of regressions have been carried out multiple regression by random effects and multiple regression by fixed effects. What we achieve with this is to analyze which of the regressions studied is the most convenient for the extraction of results, through different econometric tests. The econometric model was estimated as in Form (1). Finally, through the Hausman test, we compare the goodness of multiple regression for fixed effects and multiple regression for random effects. It is recommended when comparing fixed effects and random effects in linear regression because it is much less likely that there will be a negative difference in the covariance matrix. To test the Hausman test, the null hypothesis is that the difference in the coefficients is not systematic. On the contrary, the alternative hypothesis argues that the sample follows random differences. To test the alternative hypothesis, we applied the Hausman test (Hausman, 1978: 1251-1271).

4. Empirical results

4.1. Panel unit root analysis

The analysis of the results suggests in Table 3 that the series in levels (logarithms) have a unit root, that is, the series of $lnGDP$ and $lnDCPS$ are non-stationary in levels. Specifically, for both series, the null hypothesis of unit root cannot be rejected for IPS, Fisher type ADF, Fisher type PP and Breitung. However, the results of the panel unit root tests for the first differences of the series, in order to test if there are more unit-roots, and thus determine the order of integration of the series. The results indicate that the first differences of the series are stationary.

Table 3. Unit Root Tests

All sample countries

Test/varabile	lnGDP	LnDCPS	lnREC	lnBM
Levin, et al.	-1.069	-3.315***	-6.016***	1.258
Breitung t-stat	0.478	0.240	3.448	1.417
Im, Pesaran	-0.652	-2.481***	-2.227**	-0.493
ADF- F. $\mathcal{X}^2$	23.888	57.510***	59.66***	20.803
PP- Fisher $\mathcal{X}^2$	222.182***	22.535	35.400***	46.815***
	D(lnGDP)	D(LnDCPS)	D(lnREC)	D(lnMB)
Levin, et al.	-4.510***	-6.496***	-6.711***	-3.771***
Breitung t-stat	-4.561***	-2.243**	-5.373***	-0.511
Im, Pesaran	-5.659***	-5.568***	-8.714***	-6.383***
ADF- F. $\mathcal{X}^2$	67.108***	68.356***	103.120***	80.151***
PP- Fisher $\mathcal{X}^2$	328.993***	82.408***	304.584***	526.240***
Oil importing countries				
Test/varabile	**lnGDP**	**LnDCPS**	**lnREC**	**lnBM**
Levin, et al.	-0.088	-1.178	0.008	-0.305
Breitung t-stat	-1.257	-0.060	-0.419	-0.223
Im, Pesaran	-0.656	0.518	0.406	-0.910
ADF- F. $\mathcal{X}^2$	10.920	6.001	5.775	11.907
PP- Fisher $\mathcal{X}^2$	13.609	2.929	12.51	24.522***
	D(lnGDP)	D(LnDCPS)	D(lnREC)	D(lnMB)
Levin, et al.	-3.837***	-2.634***	-1.915**	-2.399***
Breitung t-stat	-3.823***	-2.049**	-5.911***	-1.908**
Im, Pesaran	-4.184***	-3.181***	-4.443***	-4.698***
ADF- F. $\mathcal{X}^2$	35.078***	27.853***	37.280***	42.440***
PP- Fisher $\mathcal{X}^2$	266.661***	37.756***	157.358***	208.336***
Oil exporting countries				
Test/varabile	**lnGDP**	**LnDCPS**	**lnREC**	**lnBM**
Levin, et al.	-1.248	-5.139***	-6.675***	2.624
Breitung t-stat	1.290	0.545	3.879	2.160
Im, Pesaran	-0.265	-4.026***	-3.556***	0.198
ADF- F. $\mathcal{X}^2$	12.968	51.509***	53.885***	8.896
PP- Fisher $\mathcal{X}^2$	208.573***	19.605**	22.889**	22.293**
	D(lnGDP)	D(LnDCPS)	D(lnREC)	D(lnMB)
Levin, et al.	-2.497***	-6.491***	-6.638***	-2.922***
Breitung t-stat	-2.716***	-1.142	-3.005***	0.841
Im, Pesaran	-3.820***	-4.693***	-7.880***	-4.341***
ADF- F. $\mathcal{X}^2$	32.030***	40.502***	65.839***	37.710***
PP- Fisher $\mathcal{X}^2$	62.332***	44.652***	147.225***	317.903***

Note: ***, ** and * represent significance at 1%, 5% and 10% confidence levels.

4.2. Panel cointegration analysis

The cointegration test applied by Pedroni (1999, 2000, 2004). Table 4 presents the result of this test and it is observed that four of the seven statisticians reject the null hypothesis of non-cointegration, in favor of the alternative hypothesis of cointegration, with which we can say that

there is statistical evidence that supports the existence of a cointegration relationship between the variables.

Table 4. Pedroni Residual Cointegration Test

			Weighted	
	Statistic	Prob.	Statistic	Prob.
All sample countries[a]				
Panel v-Statistic	-2.742	0.996	-2.757	0.997
Panel rho-Statistic	-0.886	0.187	-1.628*	0.051
Panel PP-Statistic	-2.051**	0.020	-3.303***	0.000
Panel ADF-Statistic	-2.145**	0.016	-3.427***	0.000
Between dimension test statistics				
Group rho-Statistic	0.483	0.685		
Group PP-Statistic	-1.795**	0.036		
Group ADF-Statistic	-2.302**	0.010		
Kao Residual	-1.887**	0.029		
Oil importing countries[b]				
Panel v-Statistic	1.584*	0.056	-2.507	0.993
Panel rho-Statistic	3.079	0.999	1.759	0.960
Panel PP-Statistic	1.166	0.878	-3.930***	0.000
Panel ADF-Statistic	-2.495***	0.006	-3.660***	0.000
Between dimension test statistics				
Group rho-Statistic	3.530	0.999		
Group PP-Statistic	-7.633***	0.000		
Group ADF-Statistic	-2.510***	0.006		
Kao Residual	-1.443*	0.074		
Oil exporting countries[c]				
Panel v-Statistic	-1.937	0.973	-1.941	0.973
Panel rho-Statistic	-2.390***	0.008	-2.699***	0.003
Panel PP-Statistic	-2.5482***	0.005	-2.809***	0.002
Panel ADF-Statistic	-1.354*	0.087	-1.610*	0.053
Between dimension test statistics				
Group rho-Statistic	-0.939	0.173		
Group PP-Statistic	-2.015**	0.021		
Group ADF-Statistic	0.023	0.509		
Kao Residual	-2.136**	0.016		

Notes: ***, ** and * represent significance at 1%, 5% and 10% confidence levels, respectively. a: no intercept, trend. b: based on AIC, lag=1. c: intercept and trend. based on AIC, lag=5.

Table 4 shows the results of the Pedroni and Kao tests, where the existence of a long-run relationship between these variables is concluded in both cases. We use the fixed-effects and random-effects approach in eq. (3 and 4).

Model (1) “All sample countries, GDP is dependent variable"

$$lnGDP_{it} = f(lnDCPS_{it};\ lnREC_{it};\ lnMBG_{it}) \quad (3)$$

Model (2) “All sample countries, DCPS is dependent variable”

$$lnDCPS_{it} = f(lnGDP_{it};\ lnREC_{it};\ lnMBG_{it}) \quad (4)$$

Model (3) “Oil importing countries” $lnGDP_{it} = f(lnDCPS_{it};\ lnREC_{it};\ lnMBG_{it})$

Model (4) "Oil exporting countries" $lnDCPS_{it} = f(lnGDP_{it};\ lnREC_{it};\ lnMBG_{it})$

Table 5. Estimation of long-run coefficients by fixed-effects and random-effects approach.

Models/Variables	Model (1) fixed	Model (2) fixed	Model (3) fixed	Model (4) random
lnGDP		0.484***		
lnDCPS	0.447***		0.548***	0.359***
lnREC	-0.402***	-0.110	-0.828***	-0.301***
lnMBG	0.03	-0.121***	-0.007	0.112**
Constant	22.702***	-7.875***	23.370***	22.904***
R^2	0.40	0.35	0.55	0.36
F-statistic	236.81***	65.52***	288.84***	
Hausman $chi^2(3)$	χ^2 (3)=24.91***	χ^2 (2)=485.82***	$\chi^2(3)$=29.92***	$\chi^2(3)$=3.88 (0.274)

Note: ***,**,*, indicates the rejection of null hypothesis of non-stationary at 1%, 5% and 10% significant level.

The results of Table (5) showed in the first model related to all the countries of the study sample, in the case of the dependent variable is the real GDP, as follows:
A positive, statistically significant effect of domestic credit to the private sector on real GDP that is when increasing domestic credit by 1% it will increase the GDP by 45%. While there is a negative impact of the consumption of renewable energy on real GDP, that is, when the consumption of renewable energy decreases by 1%, this will lead to a decrease in real GDP by 40%. Similarly, it was not any statistically significant effect of the broad money growth is on real GDP. In the case of the second model for the sample countries as a whole, the real GDP has a positive and statistically significant impact on domestic credit to the private sector. As for the broad money growth, it has a negative effect on domestic credit to the private sector, while there is no statistically significant effect of renewable energy consumption on domestic credit to the private sector. In the case of the third model that relates to the countries of the MENA (the oil-importing countries), domestic credit to the private sector has a positive and statistical impact on real GDP. This meaning that, when increasing domestic credit to the private sector by 1%, it will lead to an increase in real GDP by 54%. While there is a negative effect of statistically significant consumption of renewable energy on real GDP, and there is no statistically significant effect of the money supply on real GDP.
Finally, from the fourth model related to the countries of the MENA (oil-exporting countries), there is a positive and significant statistically significant effect of domestic credit to the private sector on real GDP, when increasing domestic credit to the private sector by 1%, this will lead to an increase in real GDP by 36%. While there is a negative effects of the consumption of renewable energy on the real GDP, as well as there is no statistically significant effect of the broad money growth on the real GDP. However, there is a diversity of results among the countries: on the one hand, nations with oil exporting and on the other, nations with oil importing. The effect of the private domestic credit on the real GDP of oil-importing countries is greater than on the real GDP of oil-exporting countries. Whereas the effect of renewable energy consumption on the real gross domestic product of oil-exporting countries is greater than its impact on the real gross domestic product of oil-importing countries.

Table 6 Granger causality test under VECM

F-statistics (probability values) Dependent variable	$\Delta lnGDP$	$\Delta lnDCPS$	$\Delta lnREC$	$\chi 2$ -Stat (prob) for ECT_{t-1}
All sample countries				
$\Delta lnGDP$	-	21.522***(0.000)	1.696(0.428)	-0.0002***(0.001)
$\Delta lnDCPS$	3.622(0.163)	-	10.352***(0.005)	0.002***(0.001)
$\Delta lnREC$	5.483*(0.033)	2.944(0.229)	-	-0.002***(0.001)
Oil importing countries				
$\Delta lnGDP$	-	0.704(0.401)	0.493(0.482)	-0.001***(0.003)
$\Delta lnDCPS$	0.938(0.332)	-	1.755(0.185)	-0.006***(0.002)
$\Delta lnREC$	0.656(0.417)	0.021(0.883)	-	0.003***(0.0022)
Oil exporting countries				
$\Delta lnGDP$	-	17.781***(0.0001)	1.353(0.508)	0.017***(0.006)
$\Delta lnDCPS$	1.347(0.509)	-	6.154*(0.046)	-0.0002***(0.006)
$\Delta lnREC$	4.921*(0.085)	2.762(0.251)	-	-0.003***(0.008)

Note: ***,* and ** indicate the rejection of null hypothesis at 1% and 10% level of significance, respectively. The significance of ECT_{t-1} indicates a long-term causality that extends from independent variables to dependent variables for each model. ( ) are the probability values.

The results of Granger's causality test in Table 6 showed that there is one-way causality that stems from real GDP to domestic credit to the private sector. While causality is bidirectional between real gross domestic product and renewable energy consumption, which indicates support for the hypothesis of feedback for the situation in the countries of the MENA. In this case, the hypothesis called "Feedback" suggests that energy consumption and GDP are interdependent quantities and one is a complement to the other. Results indicating causality from increases in GDP towards increases in consumption, and at the same time, causality from increases in consumption towards increases in GDP is evidence in favor of this hypothesis. Even in this case, therefore, policies aimed at increasing energy efficiency can negatively affect GDP.

In the case of oil-importing countries, there is no causal relationship between the variables, whereas for the oil-exporting countries there is a one-way causality relationship that extends from real gross domestic product to domestic credit to the private sector, and from renewable energy consumption to real gross domestic product. Under the hypothesis called "neutrality", energy consumption is seen as a small component of GDP, and therefore devoid of a significant impact on economic growth. In this case, therefore, policies to reduce energy consumption do not necessarily lead to depression in the economies of the MENA (oil-exporting countries).

In addition, there is one-way causality that stems from the domestic credit for the private sector to the consumption of renewable energy, and this indicates that financial development is driven by the consumption of renewable energy and this supports the presumption of conservation in a case of the oil-exporting countries.

5. Conclusion

The results showed that there is a negative relationship between renewable energy consumption and economic growth in the four models, but their impact on oil-importing countries is greater than that of oil-exporting countries. While the impact of domestic credit to the private sector has a positive influence economic growth, it appears that its impact on oil-importing countries is greater than that on oil-exporting countries. Also, the findings from Granger's causality models reveal that the unidirectional causality from economic growth to domestic credit to the private sector, in the long run, the bidirectional causation between economic growth and renewable energy consumption

in the countries of the MENA. In the case of oil-importing countries, there is no causal relationship between the variables, whereas for the oil-exporting countries there is a unidirectional causality relationship that extends from real gross domestic product to domestic credit to the private sector, as well as from renewable energy consumption to real gross domestic product. In addition, there is unidirectional causality that stems from the domestic credit for the private sector to the consumption of renewable energy, and this indicates that financial development is driven by the consumption of renewable energy and this supports the presumption of conservation in a case of the oil-exporting countries.

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