

**EXPLORING LINKS BETWEEN FDI INFLOWS, ENERGY
CONSUMPTION, AND ECONOMIC GROWTH: FURTHER EVIDENCE
FROM MENA COUNTRIES**

MOHAMED ABDOULI AND SAMI HAMMAMI

University of Sfax, Tunisia

This study aims to examine the nexus between economic growth, FDI inflows and energy consumption on a panel of 17 countries using a ‘growth model’ framework and simultaneous-equation models estimated by the generalized method of moments (GMM) over the 1990-2012 period. We also implement these empirical models for 17 countries selected on the basis of data availability. They include: (a) 12 Middle Eastern countries, namely: Saudi Arabia, Qatar, Oman, Kuwait, Lebanon, United Arab Emirates, Iraq, Turkey, Iran, Syria, Jordan and Yemen, (b) 5 North African countries, namely: Egypt, Morocco, Tunisia, Algeria and Libya. Our results indicate that there is a bidirectional causal relationship between FDI inflows and economic growth, as between well as energy consumption and economic growth. Besides, there is a unidirectional causal relationship between energy consumption to FDI inflows for the global panel. This implies that the increase of energy consumption increases the FDI inflows for individual and collective countries.

Keywords: Energy Consumption; FDI Inflows; Economic Growth, MENA Countries, Simultaneous Equation Models

JEL Classification: O11, B22, B27, B41, C33

1. INTRODUCTION

The relationship between energy consumption, foreign direct investment as well as energy consumption and economic growth has been the subject of considerable academic research over the past few decades (Omri and Kahouli, 2014). Several studies have focused on different countries, time periods, modeling techniques and different proxy variables which have been used to determine the links between FDI inflows, energy consumption and economic growth. Roughly, we can categorize past studies into three lines of research.

The first line focuses on the relationship between energy consumption and economic growth. The relationship between energy consumption and economic growth has

become a hot topic in environmental science and energy economics (Kraft and Kraft, 1978). A large volume of empirical research from the last two decades has found that economic growth and energy consumption may be jointly determined (e.g. Omri, 2013; Ahmed and Azam, 2016). Most of the empirical results indicated that higher economic growth requires more energy consumption (see, inter alia, Glasure, 2002; Ghali and El-Sakka, 2004; Akinlo, 2008; Apergis and Payne, 2009; Omri, 2013; Achour and Belloumi, 2016). They also indicated that economic growth can indeed cause increases in energy consumption. Moreover, more efficient energy use needs a higher level of economic growth (e.g. Chan and Lee, 1996; Aqeel and Butt, 2001; Wei, 2002; Halicioglu, 2007; Chang *et al.*, 2009; Shabbir *et al.*, 2014; Saidi and Hammami, 2015; Jammaz and Aloui, 2015; Komal and Abbas, 2015; Iyke, 2016).

The second line of research investigated the correlation between the FDI inflows and economic growth has been subject to rigorous research for years. According to the FDI-led growth hypothesis, FDI inflows can stimulate growth for the host countries by increasing the capital stock, creating new job opportunities, and easing the transfer of technology (see, inter alia, Borensztein *et al.*, 1998; De Gregorio, 2003; De Mello, 1997; Ekanayake *et al.*, 2003; Tsang and Yip, 2007; Omri and Kahouli, 2013; Abbes *et al.*, 2015; Abdouli and Hammami, 2015). In turn, higher economic growth creates new investment opportunities in the host country and can also cause larger inflows of FDI (e.g. Tsai, 1994; Rodrik, 1999; Kim and Seo, 2003; Mah, 2010; Anwar and Sun, 2011; Omri and Kahouli, 2014; Omri *et al.*, 2015).

The third line of research examined the link between foreign direct investment and energy consumption. Several studies have found that the FDI inflows induce energy consumption through the expansion of industrialization, transportation and manufacturing sector development while energy consumption is required to support the manufacturing process (e.g. Mielnik and Goldemberg, 2000; Mielnik and Goldemberg, 2000; Tang, 2009; Sadorsky, 2010; Bekhet and Othman, 2011; Omri and kahouli, 2014; Doytch and Narayan, 2016).

The main objective of this paper is to investigate the relationship between FDI inflows, energy consumption, and economic growth for a panel of 17 MENA countries over the 1990-2012 period. We used the simultaneous equation model based on structural modeling to produce new evidence on the links between FDI inflows, energy consumption and economic growth. The introduction of the function of Cobb–Douglas production framework helped us to explore the causal relationships between the following variables: FDI inflows, energy consumption, and economic growth in a growth framework.

The contribution of this paper to the existing literature is expressed by giving the first integrated approach to examine the three-way linkages between FDI inflows, energy consumption and economic growth in the MENA region. Particularly, this paper uses three structural equation models, which allow us ne to simultaneously examine the impact of (i) economic growth and energy consumption on FDI inflows (ii) economic growth and FDI inflows on energy consumption (iii) energy consumption and FDI

inflows on economic growth.

The rest of the paper is organized as follows: after the introduction, which is provided in Section 1. above, a brief literature review is carried out in Section 2. The methodological framework is explained in Section 3. The Data and the results are discussed in Section 4. The Final section concludes the study and gives some policy implications.

2. OVERVIEW OF RELATED LITERATURE

There is extensive literature on the nexus of energy consumption, FDI Inflows and economic growth that have used panel data modeling techniques. Therefore, it should be noted that the modeling techniques with panel data are relatively recent compared to modeling techniques based on time series data. Generally, the empirical studies on the relationship between FDI inflows energy consumption and economic growth can be divided into two major groups. The first group focuses on the country-specific studies, while the other group focuses on multi-country studies.

2.1. Country-specific Studies

We begin our discussion with the findings of country-specific studies in the literature about the links between FDI inflows, economic and energy consumption. For example, Ghosh (2002), Mozumder and Marathe (2007), Pao (2009), Ghosh (2010) and Sbia *et al.* (2014) revealed that there was unidirectional causality running from economic growth to energy consumption in Turkey, Bangladesh, Taiwan, India, and UAE, respectively. However, Stern (1993), Altinay and Karagol (2004), Yuan *et al.* (2007), Belloumi (2009), Chandran *et al.* (2010), Yalta (2011) and Ikegami and Wang (2016) found that that there is a unidirectional causality from per capita electricity consumption to economic growth in USA, Turkey, China, Tunisia, Malaysia, Turkey and Germany. Moreover, other studies such as Khaliq and Noy (2007), Tang *et al.* (2008), Zhang (2011), Azlina and Mustopha (2012) and Fadhil and Almsafir (2015) found evidence of unidirectional causality running from FDI inflows to economic growth in Indonesia, China, Malaysia and Malaysia. In addition, Liu *et al.* (2002), Chakraborty and Nunnenkamp (2006), Feridum and Sissoko (2011) and Olusanya and Olumuyiwa (2013) documented that economic growth attract more FDI inflows in China, India, Singapore and Nigerian.

The direction of causality between electricity consumption and FDI inflows are analyzed by many studies, Chima (2007), Hubler (2009), Hai (2009) and Sbia *et al.* (2014) found that foreign direct investment declined energy demand in China, USA, China, and UAE.

In addition, the study of Anwar and Nguyen (2010) examined the foreign direct investment-economic growth nexus in Vietnam. There finding is thus consistent with the

feedback hypothesis. In Portugal, Shahbaz *et al.* (2011) suggested that there is a bi-directional causality between electricity consumption and economic growth. On the other hand, Shahbaz *et al.* (2013) demonstrated that there is no causality linkage between GDP and energy consumption in the case of Indonesia.

2.2. Multi-country Studies

Several studies have developed the direction of causality between FDI inflows, energy consumption and economic growth for multi-country studies. For example, Tsai (1994) examined the links between FDI and economic growth for 62 countries and for 51 countries and find that FDI promotes economic growth and, in turn, economic growth is viewed as a tool to attract FDI. However, De Mello (1997) claimed that FDI boosts economic growth in the long run through technological progress and knowledge spillovers in OECD and non-OECD countries for the 1970–1990 period. Similarly, Borensztein *et al.* (1998) tested the effect of FDI on economic growth in 69 developing countries. The empirical evidence supports the existence of a bi-directional relationship between foreign direct investment and economic growth. Moreover, other studies, such as Lee (2013) show that there is of a unidirectional causality running from FDI to economic growth for 19 of the G20 countries.

In addition, Omri (2013) used simultaneous-equation models to examine the nexus between CO₂ emissions, energy consumption and economic growth in 14 MENA countries. Their empirical results showed that there exists a bidirectional causal relationship between energy consumption and economic growth. In the same context, Omri *et al.* (2014) found that foreign direct investment and economic growth have a bi-directional causality in 54 countries. In addition, Omri and Kahouli (2014) examined the energy consumption-foreign direct investment-economic growth nexus of 65 countries and found there is mixed result about the causal relationship between income, FDI inflows and energy consumption.

Recently, Abdouli and Hammami (2016) found that FDI inflows and economic growth have a bi-directional causality in MENA countries.

To summarize the literature review, there has been an explosion of research on the relationship between FDI inflows, energy consumption and economic growth; however the existing research efforts failed to provide clear evidence on the direction of causality between these three variables. Therefore, our literature review suggests that the empirical results of the previous studies are inconclusive on the link between FDI inflows, economic growth and energy consumption at the same time in the MENA countries.

Table 1. Summary of the Existing Empirical Research

	Countries	Econometric techniques	Causality results
Panel A. Country-specific Studies			
Stern (1993)	USA	VAR model	EC→GDP
Ghosh (2002)	India	Cointegration test	GDP→EC
Altinay and Karagol (2004)	Turkey	Granger causality test	EC→GDP
Mozumder and Marathe (2007)	Bangladesh	Cointegration and VECM	GDP→EC
Yuan <i>et al.</i> (2007)	China	VAR model	EC→GDP
Belloumi (2009)	Tunisia	VAR model	EC→GDP
Pao (2009)	Taiwan	Cointegration test and VECM	EC→GDP
Ghosh (2010)	India	Cointegration test and VECM	EC→GDP
Anwar and Nguyen (2010)	Vietnam	GMM estimation	FDI↔GDP
Shahbaz <i>et al.</i> (2011)	Portugal	Cointegration and Granger causality test	EC↔GDP
Azlina and Mustopha (2012)	Malaysia	Johansen cointegration test and Granger causality based on VECM	FDI→GDP
Olusanya and Olumuyiwa (2013)	Nigerian	Granger causality test	GDP→FDI
Shahbaz <i>et al.</i> (2013)	Indonesia	Granger causality test	GDP→EC
Abdulrahman. and Aga(2014)	Turkey	VAR model	FDI≠GDP
Lau <i>et al.</i> (2014)	Malaysia	Auto regressive distributed lag and UECM	FDI↔GDP
Sbia <i>et al.</i> (2014)	UAE	Granger causality test	GDP→EC
Panel B. Multi-country Studies			
Tsai (1994)	62 countries	Granger causality test	FDI↔GDP
De Mello (1997)	OECD and non-OECD countries		FDI→GDP
Borensztein <i>et al.</i> (1998)	69 developing		FDI→GDP
Al-Irian(2007)	6 Gulf countries	Granger causality test	FDI↔GDP
Rudra and Pradhan (2009)	5 ASEAN countries	Cointegration and causality test	FDI↔GDP
Moudatsou and Kyrkilis (2011)	26 countries	Causality based on an ECM	FDI↔GDP
Lee (2013)	G20 countries	Panel cointegration approach	FDI→GDP
Omri (2013)	14 MENA countries	Simultaneous-equations models	EC↔GDP
Omri and Kahouli (2014)	65 countries	Simultaneous-equations models	EC↔GDP FDI↔GDP
Abdouli and Hammami (2015)	17 MENA countries	Fixed effects model and system GMM	FDI→EC FDI→GDP
Omri <i>et al.</i> (2014)	54 countries	Dynamic simultaneous-equation	FDI↔GDP

Notes: VECM refers to the vector error correction model, ECM refers to the error correction model, and EC refers to energy consumption. →, ↔, and ≠ indicate the unidirectional causality hypothesis, feedback hypothesis, and neutral hypothesis, respectively.

3. EMPIRICAL METHODOLOGY

3.1. Econometric Modeling

In this paper, we examine the three-way linkages between FDI inflows, energy consumption and economic growth for 17 MENA countries, namely Algeria, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, Yemen and the UAE. The data are obtained from the World Development Indicators produced by the World Bank. FDI inflows, energy consumption and economic growth are in fact endogenous. As mentioned earlier, most of the existing literature supposes that economic growth is likely to lead to changes in foreign investment and energy consumption. It has also established that these two variables are often a key determinant of economic growth. Therefore, the interrelationships between the three variables are worth investigating by considering them simultaneously in a modeling framework.

The interrelationship between these three variables can be examined by making use of the aggregate production function. For this purpose, we employ the Cobb–Douglas production function including capital and labor as additional factors of production. Menyah and Wolde-Rufael (2010), Shahbaz *et al.* (2012), Omri and Kahouli (2014), Omri (2013) and Abdouli and Hammami (2015) among others included the energy and FDI variables in their empirical model to examine the impact of these two variables on economic growth. However, they found that FDI and energy generally stimulate economic growth.

In addition, Adeniyi *et al.* (2015) and Pradhan *et al.* (2015), among others empirically tested the impact of financial development on economic growth. Moreover, and these studies showed that financial development has a statistical significant influence on economic growth. Thus, our proposed model, which is consistent with the broader literature on the determinants of economic growth cited above, takes the following form:

$$Y = e^{\varepsilon} AK^{\alpha} E^{\lambda} L^{\beta}. \quad (1)$$

In our model we allow technology to be endogenously determined by FDI inflows and financial development and within an augmented Cobb–Douglas production function (Omri *et al.*, 2014). Financial development encourages the inflow of foreign direct investment and transfer of superior technology; it promotes economic growth via capital formation in making its efficient use. Therefore, we have:

$$A(t) = \theta. (FD)^{\alpha} (FDI)^{\beta}, \quad (2)$$

where θ is time-invariant constant, FD and FDI denoting respectively, financial development and FDI inflows. Substituting Eq. (1) into Eq. (2):

$$Y = \theta \cdot E(t)^{\lambda_1} FD(t)^{\lambda_2} FDI(t)^{\lambda_3} K(t)^{\alpha} L(t)^{1-\alpha} e^{\varepsilon}. \quad (3)$$

In Eq. (1), we divide both sides by population to obtain all series in per capita terms. By taking log, the linearized production function can be given as follows:

$$\log Y_t = \alpha_0 + \alpha_1 \log FDI_t + \alpha_2 \log E_t + \alpha_3 \log K_t + \alpha_4 \log FD_t + \varepsilon_t. \quad (4)$$

Then, we write Eq. (3) in growth form with a time series specification, as follows:

$$g(Y)_{it} = \alpha_0 + \alpha_{1i} g(FDI)_{it} + \alpha_{2i} g(E)_{it} + \alpha_{3i} g(K)_{it} + \alpha_{4i} g(FD)_{it} + \varepsilon_{it}, \quad (5)$$

where subscript $i = 1, \dots, N$ denotes the country ($N=17$ in our study) and $t = 1, \dots, T$ denotes the time period, and $g(Y)$ represents the growth rate of per capita GDP, $g(K)$ the source the growth rate of capital stock, $g(FDI)$ the source the growth rate of per capita FDI inflows, $g(E)$ source the growth rate of per capita energy consumption, $g(FD)$ represents the growth rate of Financial development . The returns to scale are involved with FDI inflows, capital stock, energy consumption, and financial development and, are shown by α_1 , α_2 , α_3 and α_4 , respectively. We then use the production function in Eq. (5) to derive the empirical models to simultaneously examine the links between FDI inflows, energy consumption and GDP. These simultaneous-equation models are also constructed on the basis of the theoretical and empirical insights from the previous literature and allow the investigation of the three-way linkages between our variables of interest.

$$g(GDP)_{it} = \alpha_0 + \alpha_{1i} g(FDI)_{it} + \alpha_{2i} g(E)_{it} + \alpha_{3i} g(K)_{it} + \alpha_{4i} g(FD)_{it} + \varepsilon_{it}, \quad (6)$$

$$g(E)_{it} = \beta_0 + \beta_{1i} g(Y)_{it} + \beta_{2i} g(FDI)_{it} + \beta_{3i} g(CO_2)_{it} + \beta_{4i} g(TOP)_{it} + \varepsilon_{it}, \quad (7)$$

$$g(FDI)_{it} = \lambda_0 + \lambda_{1i} g(Y)_{it} + \lambda_{2i} g(E)_{it} + \lambda_{3i} g(K)_{it} + \lambda_{4i} g(PD)_{it} + \varepsilon_{it}. \quad (8)$$

In the above equations, in Eq. (6) α_1 , α_2 , α_3 and α_4 states that the FDI inflows, energy consumption, capital stock (K) and Financial development level (FD) as measured by the ratio of total credit of the private sector to GDP are the driving forces of economic growth (e.g., Omri, 2013; Abdouli and Hammami, 2015; Pegkas, 2015; Baek, 2016). In Eq. (7) β_1 , β_2 , β_3 and β_4 postulates the impact of economic growth, FDI inflows, trade openness and CO2 emissions on energy consumption (e.g., Omri *et al*, 2014; Saidi and Hammami, 2015; Shahbaz *et al.*, 2015). As we will show later, the all variables are stationary in their levels, hence no transformation is needed. With respect to Eq. (8), λ_1 , λ_2 , λ_3 and λ_4 postulates that the FDI inflows can be influenced by economic growth, energy consumption, and capital stock, population density as measured by people per sq. km of land area (e.g., Choe, 2003; Alsan *et al*, 2004; Ang, 2008; Anwar and Sun, 2011; Omri and Kahouli, 2014; Kinuthia and Murshed, 2015;

Salike, 2016).

4. DATA AND DESCRIPTIVE STATISTIC

We use annual data for the per capita FDI inflows, per capita GDP, per capita energy consumption, financial development (DF), per capita capital stock, Population density (PD), CO2 emissions in tones metric and trade openness (trade) as measured by the ratio of exports plus imports to GDP. All the data collected for the 1990–2012 period, are sourced from the World Bank's World Development Indicators. To estimate our models, we divide the variables by the population to get the variables in per capita terms. Our study covers 17 countries selected on the basis of data availability. They include: (a) 12 Middle Eastern countries, namely: Kuwait, Oman, Qatar, Saudi Arabia, Lebanon, Iraq, United Arab Emirates, Turkey, Syria, Iran, Yemen and Jordan; (b) 5 North African countries, namely: Algeria, Morocco, Tunisia, Egypt and Libya.

Based on to the statistics recorded in Table 2, it is clear that the highest average energy consumption is recorded for the high-income countries (Qatar) compared to other all countries. It is also worth highlighting that high-income countries' overall economic output is almost 64 times as much as that of low- income countries (Yemen). The coefficient of variation recorded for the energy consumption reveals that Kuwait (3568.894); is the most volatile compared to other countries. Qatar and Egypt have the highest coefficient of variation of 0.455 and 0.422, respectively, followed by Jordan and the UAE. In addition, the data reveal the same trend for trade measured as a percentage of GDP: Qatar, the UAE and Kuwait are more open compared to all other countries. This finding is consistent with international trade literature, which showed that petroleum Exporting Countries are more open to international trade (see, for example, Omri, 2013). Moreover, the highest average capital stock, CO2 emission and the level of financial development is for the countries have the highest economic growth and energy consumption countries.

The mean value, the standard deviation and the coefficient of variation of different variables for the MENA countries are given below in Table 2. This table provides a statistical summary associated with the variables for each country.

The highest mean GDP per capita is for Qatar (53,144.080), followed by the UAE (40,569.470) and Kuwait (26,113.050), the lowest is for Yemen, Egypt and Syria, respectively, (765.119), (1,175.913) and (1,519.974).

The more volatile in per capita GDP are in Kuwait, UAE and Qatar with a value (10,584.450), (40,569.470) and (4,515.345) respectively. The coefficients of variation are (0.405), (0.217) and (0.204), which is the highest for, Iran, Tunisia and Kuwait, respectively. Then, the lowest coefficient of variation is for Qatar and Yemen around (0.085) and (0.087), respectively.

Finally, the mean, standard deviation and the coefficient of FDI inflows are recorded highest for the UAE. It is also noted that the highest-income countries are more volatile

in FDI inflows; with coefficient of variation 3.313, which is the highest compared to other countries coefficient of variation.

For the global panels the highest, mean is the per capita GDP (10,760.160) and the standard deviation and the coefficient of variation of per capita FDI inflows (50,461.410) and (13.943), respectively.

Table 2. Summary Statistics

Panels	Descriptive Statistics	GDP	EN	FDI	K	FD	Trade	CO2	PD
Algeria	Mean	2709.083	924.669	0.316	3.063	675.746	19.938	1861.428	13.267
	Std. Dev.	337.473	112.810	0.257	0.243	208.312	10.041	222.549	1.391
	CV	0.125	0.122	0.813	0.079	0.308	0.504	0.120	0.105
Egypt	Mean	1175.913	714.815	0.643	2.054	2.054	217.082	7.559	736.498
	Std. Dev.	233.535	325.190	0.630	0.523	0.523	61.811	5.538	163.899
	CV	0.199	0.455	0.979	0.254	0.254	0.285	0.733	0.223
Iran	Mean	2482.948	2083.210	0.487	5.889	611.224	15.018	1424.434	40.709
	Std. Dev.	506.992	554.549	0.566	1.533	204.574	18.516	260.279	3.813
	CV	0.204	0.266	1.162	0.260	0.335	1.233	0.183	0.094
Iraq	Mean	2166.443	1209.247	0.465	3.416	208.679	11.472	1915.187	56.024
	Std. Dev.	411.470	298.246	0.662	0.464	174.907	12.003	240.935	10.848
	CV	0.190	0.247	1.425	0.136	0.838	1.046	0.126	0.194
Jordan	Mean	2166.443	1082.560	2.118	3.376	592.915	16.861	2901.539	55.449
	Std. Dev.	411.470	108.165	2.185	0.255	122.940	7.874	387.200	9.961
	CV	0.190	0.100	1.031	0.075	0.207	0.467	0.133	0.180
Kuwait	Mean	26113.050	8467.119	11.904	29.333	4405.879	240.057	25755.190	125.012
	Std. Dev.	10584.450	3568.894	33.645	3.232	953.886	57.368	10545.560	28.708
	CV	0.405	0.422	2.826	0.110	0.217	0.239	0.409	0.230
Lebanon	Mean	5697.711	1351.485	26.402	4.486	1481.125	45.850	4874.937	343.790
	Std. Dev.	819.686	269.581	19.515	0.528	313.075	19.183	1231.064	57.003
	CV	0.144	0.199	0.739	0.118	0.211	0.418	0.253	0.166
Libby	Mean	7158.602	2947.150	1.735	9.403	1036.483	67.054	5996.347	3.083
	Std. Dev.	1143.769	352.978	2.432	0.618	378.157	12.309	4450.734	0.352
	CV	0.160	0.120	1.402	0.066	0.365	0.184	0.742	0.114
Morocco	Mean	1869.858	392.852	0.412	1.385	483.625	16.271	1165.654	65.201
	Std. Dev.	365.510	82.257	0.363	0.312	164.113	5.630	387.584	5.240
	CV	0.195	0.209	0.881	0.225	0.339	0.346	0.333	0.080
Oman	Mean	12144.700	4555.961	3.359	12.501	7365.378	101.674	9956.463	7.785
	Std. Dev.	1787.024	2101.387	4.067	6.001	2681.148	28.962	1585.159	1.326
	CV	0.147	0.461	1.211	0.480	0.364	0.285	0.159	0.170
Qatar	Mean	53144.080	18159.170	15.469	53.273	13595.010	387.403	41267.530	74.942
	Std. Dev.	4515.345	2456.370	16.034	9.402	4160.869	155.136	3790.805	43.646
	CV	0.085	0.135	1.037	0.176	0.306	0.400	0.092	0.582
Saudi Arabia	Mean	13768.420	5372.242	4.068	15.258	2400.222	116.622	10357.270	10.442
	Std. Dev.	1830.044	901.331	4.970	2.045	160.048	35.055	397.702	1.893
	CV	0.133	0.168	1.222	0.134	0.067	0.301	0.038	0.181

Table 2. Summary Statistics (Cont.)

Panels	Descriptive Statistics	GDP	EN	FDI	K	FD	Trade	CO2	PD
Syrie	Mean	1519.974	959.791	0.384	3.024	327.946	10.788	1056.977	91.575
	Std. Dev.	182.338	109.031	0.326	0.283	42.204	4.838	289.436	15.407
	CV	0.120	0.114	0.849	0.094	0.129	0.448	0.274	0.168
Tunisia	Mean	2985.873	768.812	1.076	2.140	646.045	24.122	2621.143	61.636
	Std. Dev.	648.598	111.607	0.801	0.269	86.243	11.124	424.294	5.006
	CV	0.217	0.145	0.745	0.126	0.133	0.461	0.162	0.081
Turkey	Mean	6485.020	1205.264	21.773	3.386	1236.389	21.773	2518.543	83.265
	Std. Dev.	1045.912	187.433	47.894	0.531	328.165	47.894	997.003	8.069
	CV	0.161	0.156	2.200	0.157	0.265	2.200	0.396	0.097
Yemen	Mean	765.119	280.329	1.218	0.907	322.032	4.297	12299.510	34.873
	Std. Dev.	66.584	49.585	2.273	0.110	957.955	3.477	3323.394	7.290
	CV	0.087	0.177	1.866	0.122	0.297	0.809	0.270	0.209
UAE	Mean	40569.470	10578.570	61431.640	26.512	7545.951	620.022	103577.600	50.286
	Std. Dev.	8444.758	1775.014	203536.900	5.661	767.059	347.716	116624.700	28.411
	CV	0.208	0.168	3.313	0.214	0.102	0.561	1.126	0.565
Panel	Mean	10760.160	3592.642	3619.027	10.553	2708.925	101.575	13544.980	69.869
	Std. Dev.	15149.350	4809.856	50461.410	13.892	3761.490	187.660	37300.660	78.290
	CV	1.408	1.339	13.943	1.316	1.389	1.847	2.754	1.121

Notes: Std. Dev.: indicates standard deviation, CO2: indicates per capita carbon dioxide emissions, GDP indicate per capita economic growth, FDI indicate FDI inflows per capita, ENC: indicates per capita energy consumption, GDP: indicates per capita real GDP, K indicates real capital per capita, FD indicates level of financial development, TOP indicates Trade openness, CV indicates the coefficients of variation (standard deviation-to-mean ratio), respectively.

5. MAIN RESULTS AND DISCUSSIONS

5.1. Panel Unit Root Tests

To estimate our models we start up our analysis with the implementation of the panel unit root tests. In panel data analysis, two-panel unit root tests are used to determine the stationary of variables are the Levin *et al.* (LLC) (2002) and Im and Pesaran (IPS) (2003). However, the two tests must be taken first in order to identify the stationary properties of the relevant variables. According to Levin *et al.* (LLC) (2002) and Im and Pesaran (IPS) (2003) the null hypothesis implies is that there exist unit root (i.e. the variables are non-stationary); whereas the alternative hypothesis states that no unit root exists in the series (i.e. the variables are stationary).

Table 3 show that the all the variables in level are statistically significant under the LLC and IPS tests, indicates that all variables are integrated of order zero, I(0).

Table 3. Results of Panel Unit Root Tests

	LLC test Level		IPS test Level	
	<i>t</i> -Statistics	p-value	<i>t</i> -Statistics	p-value
<i>g</i> (GDP)	-2.668*	(0.003)	-3.289*	(0.000)
<i>g</i> (Energy)	-13.219*	(0.000)	-7.244*	(0.000)
<i>g</i> (FDI)	-7.292*	(0.000)	-5.742*	(0.000)
<i>g</i> (CO2)	-3.657*	(0.000)	-3.990*	(0.000)
<i>g</i> (K)	-2.560*	(0.005)	-2.691*	(0.003)
<i>g</i> (FD)	-2.096**	(0.018)	-1.331***	(0.091)
<i>g</i> (TOP)	-0.950**	(0.017)	-0.240**	(0.048)
<i>g</i> (PD)	-22.616*	(0.0000)	-22.616*	(0.000)

Notes: Values in parenthesis are the estimated p-values. *, **, and *** indicates significance level at the 1%, 5% and 10%, respectively.

5.2. Results of Panel GMM Estimation

For estimated the three-way linkage between, FDI inflows, energy consumption and economic growth; the other variables were used as instrumental. We have used simultaneous equations are estimated by making use of two-stage least squares (2SLS), three stage least squares (3SLS) and the generalized method of moments (GMM). In what follows, we report the results of only GMM estimation. However, the parameter estimates remained similar in magnitude and sign and, the GMM estimation results were generally found to be statistically more robust.

The empirical results of Eq. (6), (7) and (8) based on the GMM-estimation, are presented respectively in Tables 4, 5 and 6.

To estimate the models by the GMM estimation, some tests have been used. We have two important specification tests are used for simultaneous equation regression models which are developed by Newey (1985) and Smith and Blundell (1986) who are the test of endogeneity, homogeneity and test of overidentifying restrictions.

First, we have used the Durbin–Wu–Hausman test to test the endogeneity for all three equations. The null hypothesis of the DWH endogeneity test is that an ordinary least squares (OLS) estimator of the same equation would yield consistent estimates; that is, an endogeneity between the regressors would not have deleterious effects on OLS estimates. A rejection of the null hypothesis indicates that the endogenous regressors' effects on the estimates are meaningful, and instrumental variables techniques are required.

Second, we may test the Hansen test to determine the overidentifying restrictions in order to provide some evidence of the instruments' validity. The instrument validity implies that which the null hypothesis of overidentifying restrictions cannot be rejected, as well as the null hypothesis that the instruments are appropriate, cannot be rejected.

Based on the above GMM technique, the estimated coefficients of Eqs. (5) to (7) are

given in Tables 4, 5 and 6.

The empirical results about Eq. (6) are presented in Table 4, which shows that per capita energy consumption has a positive and significant impact on per capita GDP for all the countries, except for Syria and Morocco. This implies that economic growth is elastic with respect to energy consumption, as a 1%, 5% and 10% increase in energy consumption raise economic growth within a range of 1.106%, 0.548%, 0.905%, 0.399%, 0.010%, 0.045%, 0.051%, 0.324%, 0.926%, 0.414%, 1.068%, 0.257%, 0.109%, 0.257%, 0.104%, 0.112%, and 0.118%, for Algeria, Iran, Kuwait, Libya, Saudi Arabia, Tunisia, Turkey, Yemen, UAE, Egypt, Iraq, Lebanon, Oman, Qatar and Jordan, respectively. For the remaining countries, no significant relationship is found. For the panel result, per capita energy consumption has a positive and significant impact on economic growth at 1% level. The magnitude of 0.725 implies that a 1% increase in energy consumption promotes economic growth by around 0.72%. This result is consistent with the findings of Shahbaz *et al.* (2011) for Portugal and of Omri (2013) for the MENA countries.

Table 4. Results of Panel GMM estimation for Eq. (6)

Dependent variable: Economic growth (GDP)									
	Intercept	EN	FDI	K	FD				
Alegria	1.027 (0.288)	1.106* (0.000)	0.026*** (0.066)	-0.157 (0.124)	0.105* (0.004)				
Egypt	5.286* (0.000)	0.109** (0.039)	-0.002 (0.573)	0.131* (0.000)	0.192* (0.000)				
Iran	1.616*** (0.079)	0.548* (0.000)	-0.002 (0.641)	0.327* (0.000)	-0.037 (0.129)				
Irak	4.674* (0.000)	0.257** (0.049)	-0.011 (0.346)	0.213* (0.007)	-0.033 (0.170)				
Jordan	5.370* (0.000)	0.118*** (0.085)	0.034 (0.894)	0.070* (0.002)	0.376* (0.000)				
Kuwait	6.789 (0.191)	0.905* (0.000)	0.008 (0.824)	-1.088 (0.307)	0.796 (0.186)				
Lebanon	4.529* (0.000)	0.112** (0.023)	0.096 (0.423)	0.189* (0.002)	0.438* (0.028)				
Libye	4.835* (0.000)	0.399* (0.000)	0.076* (0.000)	0.336* (0.000)	0.757* (0.000)				
Morocco	5.082* (0.000)	0.010 (0.948)	0.008** (0.014)	0.300* (0.000)	0.244* (0.004)				
Oman	6.567* (0.000)	0.257** (0.010)	0.001 (0.880)	0.271* (0.006)	0.561* (0.000)				
Qatar	8.529* (0.000)	0.104** (0.023)	-0.005 (0.195)	0.032 (0.736)	0.176** (0.014)				
Saudi Arabia	8.303* (0.000)	0.045* (0.003)	0.003*** (0.051)	-0.101 (0.656)	0.506* (0.000)				
Syrie	6.412* (0.000)	0.051 (0.322)	0.019** (0.024)	0.142 (0.355)	0.203* (0.000)				
Tunisia	5.944* (0.000)	0.324* (0.003)	0.008 (0.167)	0.214* (0.008)	0.412* (0.000)				
Turkey	1.563* (0.008)	0.926* (0.000)	0.009** (0.020)	0.089 (0.207)	0.099** (0.012)				
Yemen	3.780* (0.000)	0.414* (0.000)	0.002 (0.705)	0.065*** (0.053)	0.010 (0.601)				
UAE	0.147 (0.953)	1.068* (0.000)	-0.022 (0.415)	-0.077 (0.805)	0.220 (0.335)				
Panel	1.514* (0.000)	0.725* (0.000)	0.051* (0.000)	0.185* (0.000)	0.062* (0.007)*				
Hansen test (p-value)		9.754 (0.208)							
Durbin–Wu–Hausman test (p-value)		5.644 (0.0595)							

Note: DWH- test is the Durbin–Wu–Hausman test for endogeneity. UAE denotes United Arab Emirates. *, **, *** indicates significant level at 1%, 5% and 10%, respectively.

The coefficient of FDI inflows is positive and significant only for 5 countries out of 17, such as Algeria, Libya, Saudi Arabia, Syria, and Turkey, in which it significantly affects per capita GDP. But, no significant relationship is found for the rest of the countries. This implies that economic growth is elastic with respect to FDI inflows, as a 5% increase in FDI inflows raise economic growth within a range of 0.026% (Algeria) to 0.019% (Syria). For the panel results, we find that only the FDI inflows have a positive significant impact on real GDP at 1% level. This implies that economic growth is elastic with respect to real GDP, as a 1% rise in FDI inflows raises economic growth within a range of 0.051%. This result is consistent with the findings of Azlina and Mustopha (2012) for Malaysia and Abdouli and Hammami (2015) for 17 MENA countries.

Furthermore, capital stock has a significant impact on per capita GDP only for 13 countries out of 17. Such as Egypt, Iran, Iraq, Jordan, Lebanon, Libya, Morocco, Oman, Qatar, Turkey, and Yemen. This implies that a 1% increase in capital stock increases the economic growth by around 0.131%, 0.327%, 0.213%, 0.070%, 0.189%, 0.336%, 0.300%, 0.27% and 0.214% for Egypt, Iran, Iraq, Jordan, Lebanon, Libya, Morocco, Oman, Qatar, and Turkey, respectively. The result is consistent with the findings of Abdouli and Hammami.

Finally, the coefficient of financial development is positive and significant for 12 countries out of 17. Such as Algeria, Egypt, Jordan, Kuwait, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, and Turkey, where it significantly affects per capita GDP. This implies that the increase of financial development increases economic growth, which is consistent with the results achieved by Omri *et al.* (2015) for the MENA countries.

According to the results from Eq. (7) presented in Table 5, it appears that per capita GDP has a positive and statistically significant impact on per capita energy consumption for 11 countries out of 17. This suggests that energy consumption is elastic with respect to economic growth, as a 1% increase in per capita GDP increases energy consumption by around 1.238%, 0.601%, 0.780%, 0.179%, 0.852%, 1.505%, and 1.590% for Algeria, Egypt, Iran, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar Saudi Arabia, Syria, Turkey, and UAE, respectively. Similarly, for Tunisia and Iraq a 10% increase in the per capita GDP increases energy consumption by 0.156% and 0.551%. The panel result shows that per capita GDP has a positive and significant impact on per capita energy consumption at 1% level. This indicates that a 1% increase in per capita GDP increases energy consumption by around 0.193%. This result could be in conforming to that of Sbia *et al.* (2014) for the UAE and of Omri and Kahouli (2014) for 65 countries.

Regarding the FDI inflow variable, it is found that FDI inflows have a positive and significant impact only for 6 countries out of 17, such as Egypt, Kuwait and Lebanon in which, it positively affects per energy consumption. This implies that a 5% increase in FDI inflows increases energy consumption by around 0.018%, 0.080%, and 0.214% in Egypt, Kuwait, and Lebanon, respectively. This is consistent with the results achieved by Omri and Kahouli (2014) for 65 countries and Leitão (2015) for Portugal. For the

remaining countries no significant relationship is found.

Table 5. Results of Panel GMM Estimation for Eq. (7)

	Dependent variable: Energy consumption (EN)									
	Intercept		GDP		FDI		CO2		TOP	
Alegria	-0.637	(0.324)	1.238*	(0.008)	0.007	(0.366)	0.239**	(0.014)	-0.345	(0.442)
Egypt	0.880	(0.457)	0.601*	(0.002)	0.018**	(0.036)	0.998	(0.000)	0.227	(0.000)
Iran	1.929***	(0.038)	0.780*	(0.000)	-0.006	(0.241)	0.536*	(0.000)	0.186	(0.017)
Irak	9.054*	(0.000)	0.551***	(0.072)	-0.011	(0.368)	0.758*	(0.000)	0.938	(0.001)
Jordan	3.121*	(0.000)	0.179*	(0.003)	0.005	(0.338)	0.376*	(0.015)	0.256	(0.002)
Kuwait	-1.373	(0.588)	0.852*	(0.001)	0.080**	(0.021)	-0.846	(0.493)	0.453	(0.029)
Lebanon	15.419*	(0.000)	1.505*	(0.001)	0.214**	(0.010)	1.651*	(0.000)	0.348	(0.267)
Libye	8.070*	(0.000)	-0.032	0.843	-0.011	0.672	-0.385*	0.003	0.130***	0.052
Morocco	8.070*	(0.000)	-0.032	(0.843)	-0.011	(0.672)	-0.385	(0.253)	0.130	(0.052)
Oman	2.938*	(0.000)	0.070	(0.623)	-0.005	(0.096)	0.401*	(0.000)	0.336	(0.000)
Qatar	0.931	(0.867)	-0.010	(0.984)	0.061*	(0.005)	0.560*	(0.008)	0.666	(0.467)
Saudi Arabia	1.817	(0.409)	0.937***	(0.093)	0.045	(0.000)	0.124	(0.385)	-0.263	(0.655)
Syrie	-32.262*	(0.000)	0.061	(0.687)	-0.010	(0.242)	-0.037	(0.654)	4.366	(0.000)
Tunisia	9.800*	(0.000)	0.911**	(0.016)	0.056***	(0.068)	0.159	(0.400)	0.524	(0.000)
Turkey	0.561	(0.303)	0.295*	(0.000)	0.003	(0.618)	0.097	(0.422)	0.465	(0.000)
Yemen	4.819*	(0.000)	0.156***	(0.079)	0.005**	(0.093)	0.832*	(0.000)	-0.013	(0.666)
UAE	-3.997*	(0.004)	1.590*	(0.000)	-0.012	(0.153)	0.419*	(0.002)	0.097	(0.089)
Panel	4.642*	(0.000)	0.193*	(0.000)	0.007	(0.895)	0.827*	(0.000)	0.023***	(0.097)
Hansen test (p-value)				11.979	(0.752)					
Durbin–Wu–Hausman test (p-value)				10.289	(0.006)					

Note: DWH-test is the Durbin–Wu–Hausman test for endogeneity. UAE denotes United Arab Emirates. *, **, *** indicates significant level at 1%, 5% and 10%, respectively.

Finally, the coefficients of CO2 emissions and trade openness have a positive and significant effect for 9 countries out of 17. Similarly, for the panel estimation, there is a positive and significant impact on demand of energy consumption at 1% and 10% levels. This suggests that a 1% and 10% increase in CO2 emission and trade openness raises energy consumption directly and indirectly by 0.82% and 0.02%, respectively. This implies that the increase of CO2 emission and trade openness increase energy consumption. This finding supports the view of Shahbaz *et al.* (2015) for Malaysia; and Destek (2015) for Turkey, and Saidi and Hammami (2015) for 58 countries.

Table 6 presents the estimated results about Eq. (8). It appears that per capita GDP has a positive and statistically significant impact on per capita FDI inflows for 9 countries out of 17. This implies that a 1%, 5% and 10% increase in per capita GDP accelerates FDI inflows by around 4.79%, 23.60%, 5.91%, 5.27%, 0.78%, 2.680%, 18.46%, 25.35%, and 32.50% for Algeria, Egypt, Iraq, Kuwait, Lebanon, Libya, Morocco, Saudi Arabia, and Turkey, respectively. For the remaining countries, no significant relationship is found. The panel estimation shows that per capita GDP has an

insignificant impact on FDI inflows. This implies that a 1% increase in economic growth increases FDI inflows by around 1.43%. This finding is in line with those of Olusanya and Olumuyiwa (2013) for Nigeria, and Omri and Kahouli (2013) for the MENA countries.

Regarding the energy variable, we find that per capita energy consumption has a positive and significant impact on FDI inflows for all the countries, except for Kuwait, Morocco, Oman, Qatar, Saudi Arabia, and Tunisia. This implies that per capita energy consumption is elastic with respect to per capita FDI inflows, as a 1% increase in the use of energy increases FDI inflows within a range of 10.11% (Algeria) 7.99%(Egypt) 1.76%(Iran) 13.92% (Jordan) 0.44 % (Lebanon) 6.27% (Libya), 9.54% (Yemen) and 12.21% (UAE). For the panel estimation, per capita energy consumption has a positive and significant impact on per FDI inflows at 1% level. The magnitude of 0.808 implies that a 1% rise in energy consumption increases FDI inflows by 0.80%. This implies that an increase in energy consumption raises the FDI inflows. The result is consistent with the finding of Leitão (2015) for Portugal. There are also positive and statistically significant impacts of capital stock, population density on FDI inflows.

Table6. Results of Panel GMM estimation for Eq. (8)

Dependent variable: Energy consumption (EN)										
	Intercept		GDP		EN		K		PD	
Alegria	-45.148*	(0.000)	4.790***	(0.093)	10.114*	(0.006)	6.179*	(0.000)	20.255*	(0.000)
Egypt	13.663	(0.256)	23.603**	(0.032)	7.994*	(0.003)	2.175	(0.320)	20.651	(0.156)
Iran	14.364	(0.735)	-13.206	(0.212)	1.765*	(0.002)	9.573**	(0.010)	10.611	(0.584)
Irak	31.132*	(0.000)	5.919***	(0.078)	3.783**	(0.032)	22.026*	(0.000)	89.027*	(0.000)
Jordan	-88.035*	(0.000)	1.422	(0.710)	13.929*	(0.000)	4.957*	(0.000)	2.814	(0.320)
Kuwait	74.154	(0.257)	5.279**	(0.037)	-0.889	(0.560)	-28.984	(0.133)	25.659*	(0.049)
Lebanon	30.047*	(0.000)	0.780***	(0.081)	0.446*	(0.000)	0.393*	(0.006)	3.421*	(0.000)
Libye	-15.740*	(0.000)	2.680*	(0.000)	6.270*	(0.000)	21.065*	(0.000)	58.309*	(0.000)
Morocco	-8.987	(0.838)	18.467***	(0.058)	8.848	(0.323)	-3.527	(0.473)	38.978**	(0.014)
Oman	2.523	(0.893)	-5.821	(0.144)	0.405	(0.739)	7.750**	(0.026)	9.364**	(0.010)
Qatar	0.987	(0.990)	-9.755	(0.298)	-2.688	(0.556)	17.800	(0.014)	8.408**	(0.016)
Saudi Arabia	-67.804*	(0.002)	25.356*	(0.008)	8.537	(0.191)	4.004*	(0.002)	-0.656*	(0.003)
Syrie	-79.906*	(0.001)	3.833	(0.264)	1.734***	(0.052)	15.081***	(0.069)	10.783***	(0.094)
Tunisia	-4.204	(0.633)	3.088	(0.151)	2.147	(0.472)	4.413*	(0.004)	15.366**	(0.018)
Turkey	-10.353	(0.528)	32.501*	(0.000)	10.054**	(0.027)	3.062	(0.131)	40.802*	(0.000)
Yemen	-19.937	(0.394)	1.364	(0.781)	9.546*	(0.000)	0.164	(0.761)	12.865*	(0.000)
UAE	16.936*	(0.000)	-1.478	(0.370)	12.216*	(0.000)	0.926	(0.502)	10.462*	(0.000)
Panel	-10.542*	(0.000)	1.430*	(0.000)	0.808*	(0.000)	0.424*	(0.001)	0.386*	(0.000)
Hansen test (p-value)				10.023	(0.184)					
Durbin–Wu–Hausman test (p-value)				17.306	(0.000)					

Note: DWH-test is the Durbin–Wu–Hausman test for endogeneity. UAE denotes United Arab Emirates. *, **, *** indicates significant level at 1%, 5% and 10%, respectively.

Overall, the above-discussed results regarding the individual cases can be

summarized as follows. First, according to the link between energy consumption and economic growth, our results supported the evidence of the feedback hypothesis for Algeria, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Saudi Arabia, Tunisia, Turkey, and the UAE. For Morocco the neutrality hypothesis is present. The unidirectional causality running from energy consumption to economic growth is supported for Libya, Oman, Qatar and Syria. In addition, for Yemen, the unidirectional causality running from economic growth in energy consumption also exists. Second, there is a bi-directional causal relationship between economic growth and FDI inflows for Algeria, Libya, Morocco, and Saudi Arabia. The neutrality hypothesis exists for Iran, Jordan, Kuwait, Oman, Qatar, and Tunisia. Furthermore, the unidirectional causality running from FDI inflows to economic growth is found only for Syria, Turkey, and Yemen; and the unidirectional causality running from economic growth to economic growth in Egypt, Iraq, Kuwait, Lebanon, Turkey, and Yemen; and the unidirectional causality running from economic growth to economic growth in Egypt, Iraq, Kuwait, Lebanon, Turkey, and Yemen. Finally, according to the relationship between FDI inflows and energy consumption, we showed that there is a bi-directional causal relationship for Egypt, Lebanon, and Yemen; a neutral hypothesis for Morocco, Oman, Saudi Arabia, and Syria, a unidirectional causality running from FDI inflows to energy consumption for Iran, and Tunisia; and a bidirectional causality running from FDI inflows to energy consumption.

For the panel results, we found that there is a bidirectional causality between FDI inflows and economic growth. This result is consistent with the findings of Anwar and Nguyen (2010) for Vietnam, and Lau *et al.* (2014) for Malaysia, and Omri and Kahouli (2014) for 65 countries. The existence of a bidirectional causality between energy consumption and economic growth supports evidence of feedback hypothesis. This is consistent with the finding of Shahbaz *et al.* (2011) for Portugal, and Omri (2013) for 14 MENA countries. Finally, the existence of a unidirectional causality running from energy consumption to FDI inflows shows that increases in energy consumption cause increases in FDI inflows. This is consistent with the finding of Leitão (2015) for Portugal.

6. CONCLUSIONS AND POLICY IMPLICATIONS

This study aims to determine the nexus between economic growth, FDI inflows, and energy consumption in 17 MENA countries over the 1990-2012 period using simultaneous equations models.

The main findings showed evidence of a bidirectional causality between energy consumption and economic growth. Feedback hypothesis is validated between FDI inflows and economic growth. A unidirectional causality running from energy consumption to FDI inflows is identified. This implies that the increase of energy consumption increases the FDI inflows for individual and collective countries.

Appropriate policies have been recommended for individual and collective countries:

First, we found a feedback relationship between energy consumption and economic growth. We showed that the neo-classical theory which assumes that energy is neutral for growth, is significantly rejected. As such, energy consumption is important in raising economic growth. The governments of these countries applied energy conservation policies, which will be favorable for these countries in terms of saving energy and making efficient use of it as energy is one of the major sources of goods and services production.

Second, the bi-directional causal relationship between FDI inflows and economic growth in the global panel shows that an increase in the FDI inflow increases economic growth which, in turn; attracts further FDI into these countries. This result supports that these countries applied sound economic policies and foreign through the abolition of trade barriers and the application of free movement of capital flows as a source of FDI attractiveness, which raises economic growth.

Third, the unidirectional causality running from energy consumption to FDI inflows for the global panel shows that increases in the demand of energy consumption increase the FDI inflows. This implies that the government also applied the conservation energy policy to attract more FDI inflows, while, FDI inflows have insignificant impact on energy consumption. In this case, it is obligatory for the policymakers to build foreign policies to protect a sustainable use of natural resources.

REFERENCES

- Abbes, M.S., D. Mostéfa, G. Seghir, and G. Yassine (2015), "Causal Interactions between FDI, and Economic Growth: Evidence from Dynamic Panel Co-integration," *Procedia Economics and Finance*, 23, 276-290.
- Abdouli, M., and S. Hammami (2015) "The Impact of FDI Inflows and Environmental Quality on Economic Growth: an Empirical Study for the MENA Countries," *Journal of the Knowledge Economy*, 8(1), 254-278.
- Achour, H., and M, Belloumi (2016), "Investigating the Causal Relationship between Transport Infrastructure, Transport Energy Consumption and Economic Growth in Tunisia," *Renewable and Sustainable Energy Reviews*, 56, 988-998.
- Adeniyi, O., A. Oyinlola, O. Omisakin, and O.E. Festus (2015), "Financial Development and Economic Growth in Nigeria: Evidence from Threshold Modeling," *Economic Analysis and Policy*, 47, 11-21.
- Aga, A.A.K. (2014). "The Impact of Foreign Direct Investment on Economic Growth: A Case Study of Turkey 1980-2012," *International Journal of Economics and Finance*, 6, 71-84.

- Ahmed, M., and M. Azam (2016), "Causal Nexus between Energy Consumption and Economic Growth for High, Middle and Low Income Countries using Frequency Domain Analysis," *Renewable and Sustainable Energy Reviews*, 60, 653-678.
- Akinlo, A.E. (2008), "Energy Consumption and Economic Growth: Evidence from 11 Sub-Saharan African Countries," *Energy Economics*, 30, 2391-2400.
- Al-iriani, M., and F. Al-shamsi (2007), "Foreign Direct Investment and Economic Growth in the GCC Countries: A Causality Investigation Using Heterogeneous Panel Analysis," *Topics in Middle Eastern and North African Economies*, electronic journal, 9, Middle East Economic Association and Loyola University Chicago.
- Alsan, M., D.E. Bloom, and D. Canning (2004), "The Effect of Population Health on Foreign Direct Investment," NBER Working Paper No.10596, National Bureau of Economic Research, Cambridge.
- Altinay, G., and E. Karag (2004), "Structural Break, Unit Root, and the Causality between Energy Consumption and GDP in Turkey," *Energy Economics*, 26, 985-994.
- Altinay, G., and E. Karagol (2005), "Electricity Consumption and Economic Growth: Evidence from Turkey," *Energy Economics*, 27, 849-856.
- Ang, J. (2008), "Economic Development, Pollutant Emissions and Energy Consumption in Malaysia," *Journal of Policy Modeling*, 30, 271-278.
- Anwar, S., and L.P. Nguyen (2010) "Foreign Direct Investment and Economic Growth in Vietnam," *Asia Pacific Business Review*, 16, 183-202.
- Anwar, S., and S. Sun, (2011), "Financial Development, Foreign Investment and Economic Growth in Malaysia," *Journal of Asian Economics*, 22, 335-342.
- Apergis, N., and J.E. Payne (2009), "Energy Consumption and Economic Growth in Central America: Evidence from a Panel Cointegration and Error Correction Model," *Energy Economics*, 31, 211-216.
- Aqeel, A., and M.S. Butt (2001), "The Relationship between Energy Consumption and Economic Growth," *Asia Pacific Development Journal*, 8, 101-110.
- Azlina, A.A., and N.H.M. Mustapha (2012), "Environmental Degradation, Economic Growth and Energy Consumption: Evidence of the Environmental Kuznets Curve in Malaysia," *Energy Policy*, 60, 892-905.
- Baek, J. (2016), "A New Look at the FDI-income-energy-environment Nexus: Dynamic Panel Data Analysis of ASEAN," *Energy Policy*, 91, 22-27.
- Bekhet, H.A., and N.S. Othman (2011), "Causality Analysis among Electricity Consumption, Consumer Expenditure, GDP and Foreign Direct Investment FDI: Case Study of Malaysia," *Journal of Economics and International Finance*, 3, 228-235.
- Belloumi, M. (2009), "Energy Consumption and GDP in Tunisia: Cointegration and Causality Analysis," *Energy Policy*, 37, 2745-2753.
- Borensztein, E., J. De Gregorio, and J.W. Lee (1998), "How does Foreign Direct Investment Affect Economic Growth?" *Journal of International Economics*, 45, 115-135.

- Chakraborty, C., and P. Nunnenkamp (2006), "Economic Reforms, Foreign Direct Investment and Its Economic Effects in India," Kiel Working Paper No. 1272.
- Chandran, V.G.R., S. Sharma, and K. Madhavan (2010), "Electricity Consumption Growth Nexus: The Case of Malaysia," *Energy Policy*, 38, 606-612.
- Chang, T.H., C.M. Huang, and M.C. Lee (2009), "Threshold Effect of the Economic Growth Rate on the Renewable Energy Development from a Change in Energy Price: Evidence from OECD Countries," *Energy Policy*, 37, 5796-5802.
- Chang, T., and S.B. Caudill (2005), "Financial Development and Economic Growth: The Case of Taiwan," *Applied Economics*, 37, 1329-1335.
- Chima, C.M. (2007), "Intensity of Energy use in the U.S.A.: 1949-2003," *Journal of Business and Economics Research*, 5, 17-30.
- Choe, J.I. (2003), "Do Foreign Direct Investment and Gross Domestic promote Economic Growth?" *Review of Development Economics*, 7, 44-57.
- De Gregorio, J. (2003), "The Role of Foreign Direct Investment and Natural Resources in Economic Development," Central Bank of Chile Working Paper No.196, Central Bank of Chile.
- De Mello, L.R. (1997), "Foreign Direct Investment in Developing Countries and Growth: A Selective Survey," *Journal of Development Studies*, 34, 1-34.
- Destek, M.A. (2015), "Energy Consumption, Economic Growth, Financial Development and Trade Openness in Turkey: Maki Cointegration Test," *Bulletin of Energy Economics*, 3, 162-168.
- Doytch, N., and S. Narayan (2016), "Does FDI Influence Renewable Energy Consumption? An Analysis of Sectoral FDI Impact on Renewable and Non-renewable Industrial Energy Consumption," *Energy Economics*, 54, 291-301.
- Ekanayake, E.M., V. Richard, and B. Veeramacheni (2003), "Openness and Economic Growth: Empirical Evidence on the Relationship between Output, Inward FDI and Trade," *Journal of Business Strategies*, 20, 59-72.
- Fadhil, M.A., and M.K. Almsafir (2015), "The Role of FDI Inflows in Economic Growth in Malaysia (Time Series: 1975-2010)," *Procedia Economics and Finance*, 23, 1558-1566.
- Ghali, K.H., and M.I.T. El-Sakka (2004), "Energy use and Output Growth in Canada: A Multivariate Cointegration Analysis," *Energy Economics*, 26, 225-238.
- Ghosh, S. (2010), "Examining Carbon Emissions-economic Growth Nexus for India: A Multivariate Cointegration Approach," *Energy Policy*, 38, 2613-3130.
- _____ (2002), "Electricity Consumption and Economic Growth in India," *Energy Policy*, 30, 125-129.
- Glasure, Y.U. (2002), "Energy and National Income in Korea: Further Evidence on the Role of Omitted Variables," *Energy Economics*, 24, 355-365.
- Halicioglu, F. (2007), "Residential Electricity Demand Dynamics in Turkey," *Energy Economics*, 29, 199-210.
- Hubler, M. (2009), "Energy Saving Technology Diffusion via FDI and Trade using CGE Model of China," Kiel Working Paper No.1491, Kiel Institute of World Economy.

- Ikegami, M., and Z. Wang (2016), "The Long-run Causal Relationship between Electricity Consumption and Real GDP: Evidence from Japan and Germany," *Journal of Policy Modeling*, 38, 767-784.
- Im, K.S., and M.H. Pesaran (2003), "On the Panel Unit Root Tests using Nonlinear Instrumental Variables," Cambridge Working Papers in Economics No.0347, University of Cambridge.
- Iyke, B.N. (2015), "Electricity Consumption and Economic Growth in Nigeria: A Revisit of the Energy-growth Debate," *Energy Economics*, 51, 166-176.
- Jammazi, R., and C. Aloui (2015), "On the Interplay between Energy Consumption, Economic Growth and CO2 Emission Nexus in the GCC Countries: A Comparative Analysis through Wavelet Approaches," *Renewable and Sustainable Energy Reviews*, 51, 1737-1751.
- Jia, M.Q., and J.Y. Yu (2011), "Empirical Research on the Environmental Effect of Foreign Direct Investment: The Case of Jiangsu Province," *Advanced Materials Research*, 204-210, 1-4.
- Kahouli, B., and N. Kadhraoui (2012), "Consolidation of Regional Groupings and Economic Growth: Empirical Investigation by Panel Data," *International Journal of Euro-Mediterranean Studies*, 1, 71-92.
- Khalilq, A., and I. Noy (2007), "Foreign Direct Investment and Economic Growth: Empirical Evidence from Sectoral Data in Indonesia," *Journal of Economic Literature*, 45, 313-325.
- Kim, D.D., and J.S. Seo (2003), "Does FDI Inflow crowd out Domestic Investment in Korea?" *Journal of Economic Studies*, 30, 605-622.
- Kinuthia, B.K., and S.M. Murshed, (2015), "FDI Determinants: Kenya and Malaysia Compared," *Journal of Policy Modeling*, 37, 388-400.
- Komal, R., and F. Abbas, (2015), "Linking Financial Development, Economic Growth and Energy Consumption in Pakistan," *Renewable and Sustainable Energy Reviews*, 44, 211-220.
- Kraft, J., and A. Kraft (1978), "Relationship between Energy and GNP," *Journal of Energy Finance and Development*, 3, 401-403.
- Lau, L., C. Choong, and Y. Eng (2014), "Investigation of the Environmental Kuznets Curve for Carbon Emissions in Malaysia: Do Foreign Direct Investment and Trade Matter?" *Energy Policy*, 68, 490-497.
- Lee, J.W. (2013), "The Contribution of Foreign Direct Investment to Clean Energy use, Carbon Emissions and Economic Growth," *Energy Policy*, 55, 483-489.
- Lee, J.W., and T. Brahmaseerene (2013), "Investigating the Influence of Tourism on Economic Growth and Carbon Emissions: Evidence from Panel Analysis of the European Union," *Tourism Management*, 38, 69-76.
- Leitão N.C. (2015), "Energy Consumption and Foreign Direct Investment: A Panel Data Analysis for Portugal," *International Journal of Energy Economics and Policy*, 5, 105-114.
- Levin, J.A., and D.A. Kauwell (2002), U.S. Patent No.6,434,556, Washington, DC:

- Patent and Trademark Office.
- Liu, X., P. Burridge, and P.J. Sinclair (2002), "Relationships between Economic Growth, Foreign Direct Investment and Trade: Evidence from China," *Applied Economics*, 34, 1433-1440.
- Mah, J.S. (2010), "Foreign Direct Investment Inflows and Economic Growth of China," *Journal of Policy Modeling*, 32, 155-158.
- Menyah, K., and Y. Rufael (2010), "Energy Consumption, Pollutant Emissions and Economic Growth in South Africa," *Energy Economics Journal*, 32, 1374-1382.
- Mielnik, O., and J. Goldemberg (2000), "Converging to a Common Pattern of Energy use in Developing and Industrialized Countries," *Energy Policy*, 28, 503-508.
- _____ (2002), "Foreign Direct Investment and Decoupling between Energy and Gross Domestic Product in Developing Countries," *Energy Policy*, 30, 87-89.
- Moudatsou, A., and D. Kyrkilis (2011), "FDI and Economic Growth: Causality for the EU and ASEAN," *Journal of Economic Integration*, 26, 554-577.
- Mozumder, P., and A. Marathe (2007), "Causality Relationship between Electricity Consumption and GDP in Bangladesh," *Energy Policy*, 35, 395-402.
- Narayan, P.K., and A. Prasad (2008), "Electricity Consumption- Real GDP Causality Nexus: Evidence from a Bootstrapped Causality Test for 30 OECD Countries," *Energy Policy*, 36, 910-918.
- Newey, W.K. (1985), "Semiparametric Estimation of Limited Dependent Variable Models with Endogenous Explanatory Variables," *Annales de L'insée*, 59/60, 219-237.
- Olusanya, S.O. (2013) "Impact of Foreign Direct Investment Inflow on Economic Growth in a Pre and Post Deregulated Nigeria Economy. A Granger Causality Test (1970-2010)," *European Scientific Journal*, 9, 335-356.
- Omri, A., D.K. Nguyen, and C. Rault (2014), "Causal Interactions Between CO2 Emissions, FDI, and Economic Growth: Evidence from Dynamic Simultaneous Equation Models," *Economic Modelling*, 42, 382-389.
- Omri, A. (2013), "CO2 Emissions, Energy Consumption and Economic Growth Nexus in MENA Countries: Evidence from Simultaneous Equations Models," *Energy Economics*, 40, 657-664.
- Omri, A., and B. Kahouli (2013), "The Nexus Among Foreign Investment, Domestic Capital and Economic Growth: Empirical Evidence from the MENA Region," *Research in Economics*, 68, 257-263.
- _____ (2014), "Causal Relationships between Energy Consumption, Foreign Direct Investment and Economic Growth: Fresh Evidence from Dynamic Simultaneous Equations Models," *Energy Policy*, 67, 913-922.
- Omri, A., S. Daly, C. Rault, and A. Chaibi (2015), "Financial Development, Environmental Quality, Trade and Economic Growth: What Causes What in MENA Countries," *Energy Economics*, 48, 242-252.
- Pao, H.T. (2009), "Forecast of Electricity Consumption and Economic Growth in Taiwan by State Space Modeling," *Energy*, 34, 1779-1791.

- Pegkas, P. (2015), "The Impact of FDI on Economic Growth in Eurozone Countries," *The Journal of Economic Asymmetries*, 12, 124-132.
- Pradhan, R.P. (2009), "The FDI- Led- Growth Hypothesis in ASEAN- 5 Countries: Evidence from Cointegrated Panel Analysis," *International Journal of Business and Management*, 4, 153-164.
- _____ (2009), "The Nexus between Financial Development and Economic Growth in India: Evidence from Multivariate VAR Model," *International Journal of Research and Reviews in Applied Sciences*, 1(2), 141-151.
- Pradhan, R.P., B.A. Mak, and R.N. Neville (2015), "Insurance Development and the Finance-Growth Nexus: Evidence from 34 OECD Countries," *Journal of Multinational Financial Management*, 31, 1-22.
- Rodriguez, F., and D. Rodrik (1999), "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross Country Evidence," NBER Working paper, no.7081, National Bureau of Economic Research.
- Rodrik, D. (1999), *The New Global Economy and Developing Countries: Making Openness Work*, Washington, D.C.: Overseas Development Council.
- Sadorsky, P. (2010), "The Impact of Financial Development on Energy Consumption in Emerging Economies," *Energy Policy*, 38, 2528-2535.
- Saidi, S., and S. Hammami (2015), "The Impact of CO2 Emissions and Economic Growth on Energy Consumption in 58 Countries," *Energy Reports*, 1, 62-70.
- Salike, N. (2016), "Role of Human Capital on Regional Distribution of FDI in China: New Evidences," *China Economic Review*, 37, 66-84.
- Sbia, R., M. Shahbaz, and H. Hamdi (2014), "A Contribution of Foreign Direct Investment, Clean Energy, Trade Openness, Carbon Emissions and Economic Growth to Energy Demand in UAE," *Economic Modelling*, 36, 191-197.
- Shabbir, M.S., M. Shahbaz, and M. Zeshan (2014), "Renewable and Nonrenewable Energy Consumption, Real GDP and CO2 Emissions Nexus: A Structural VAR Approach in Pakistan," *Bulletin of Energy Economics*, 2, 91-105.
- Shahbaz, M., S. Khan, and M.I. Tahir (2013), "The Dynamic Links between Energy Consumption, Economic Growth, Financial Development and Trade in China: Fresh Evidence from Multivariate Framework Analysis," *Energy Economics*, 40, 8-21.
- Shahbaz, M., I. Rehman, and T. Muzaffur (2015), "Revisiting Financial Development and Economic Growth Nexus: The Role of Capitalization in Bangladesh," *South African Journal of Economics*, 83, 452-471.
- Shahbaz, M., C.F. Tang, and M.S., Shabbir (2011), "Electricity Consumption and Economic Growth Nexus in Portugal using Cointegration and Causality Approaches," *Energy Policy*, 39, 3529-3536.
- Smith, R., and R. Blundell (1986), "An Exogeneity Test for a Simultaneous Equation Tobit Model with an Application to Labor Supply," *Econometrica*, 54, 679-685.
- Stern, D.I. (1993), "Energy use and Economic Growth in the USA, A Multivariate Approach," *Energy Economics*, 15, 137-150.
- Tang, C., and E. Tan (2015), "Does Tourism Effectively Stimulate Malaysia's Economic

- Growth?" *Tourism Management*, 46, 158-163.
- Tang, C.F., and S.Y. Chau (2009), "The Savings-growth Nexus in Malaysia: Evidence from Nonparametric Analysis," *The IUP Journal of Financial Economics*, 7, 83-94.
- Tang, C.F., W.T. Tan, and I. Ozturk (2016), "Energy Consumption and Economic Growth in Vietnam," *Renewable and Sustainable Energy Reviews*, 54, 1506-1514.
- Kim, D.D., and J.S. Seo (2003), "Does FDI Inflow Crowd Out Domestic Investment in Korea?" *Journal of Economic Studies*, 30, 605-622.
- Tsai, P.L. (1994), "Determinants of Foreign Direct Investment and Its Impact on Economic Growth," *Journal of Economic Development*, 19, 137-163.
- Tsang, E.W.K, and P. Yip (2007), "Economic Distance and Survival of Foreign Direct Investments," *Academy of Management Journal*, 50, 1156-1168.
- Wei, W. (2002), "Study on the Determinants of Energy Demand in China," *Journal of Systems Engineering and Electronics*, 13, 17-23.
- Yalta, A.T. (2011), "Analyzing Energy Consumption and GDP Nexus using Maximum Entropy Bootstrap: The case of Turkey," *Energy Economics*, 33, 453-460.
- Yuan, J., C. Zhao, S. Yu, and Z. Hu (2007), "Electricity Consumption and Economic Growth in China: Co-integration and Co-feature Analysis," *Energy Economics*, 29, 1179-1191.
- Zhang, Y.J. (2011), "The Impact of Financial Development on Carbon Emissions: Empirical Analysis in China," *Energy Policy*, 39, 2197-2203.

Mailing Address: University of Sfax, Faculty of Economics and Management of Sfax, Aeoport Km4 P14, 3018 Sfax, BP 1088, Tunisia. Email: mahmedabdouli3@gmail.com, sami_hammami2005@yahoo.fr.

Received August 31, 2016, Revised January 14, 2017, Accepted February 13, 2017.