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The Nexus between Electricity Consumption and Economic Growth: New Insights from Meta-Analysis

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ABSTRACT: Although many factors have been identified to explain the nexus between electricity consumption and economic growth, the empirical evidence is rather mixed. Given these contradictory conclusions, the aim of this paper is to find out which outcome the meta-analysis would support by applying meta-analysis to a sample of the empirical results of 43 studies published between 1996 and 2013. We found that the conservation hypothesis is widely associated to American and European countries. However, conservative policies are likely to have an adverse effect on the economic growth in Asian and MENA countries. Conversely to expectations, the growth hypothesis is heavily associated to studied countries and considered modeling specifications. Additionally, while a neutrality hypothesis is insignificantly associated to MENA countries, the feedback hypothesis is not supported when appealing a panel of American economies. Therefore, the inconclusive results may be mainly due to the different country samples, econometric methodologies and to the fact that energy policies cannot be designed without considering economic and environmental factors, which are unfortunately excluded in the majority of studies. Further analysis should focus more on the new approaches rather than usual methods based on a set of common variables for different countries.

Keywords: electricity consumption; economic growth; meta-analysis.
JEL Classifications: C2; Q43

1. Introduction

After the energy crisis of 1971-1980 and the post-energy crisis of 1981-2000 the price of energy hikes up. Thus, it becomes important to assess whether energy consumption stimulates economic growth or economic growth spurs energy consumption. As a result, the relationship between energy consumption and economic growth has undergone extensive investigation. Given its importance in formulating the energy policies, the nexus between energy consumption and growth has been and continues to be one of the main subjects of intense empirical economics research.

Many studies have investigated the direction of causality between electricity and economic growth (Masih and Masih (1996), Glasure and Lee (1997), Ghali and El-Sakka (2004), Wolde-Rufael (2005), Chiou-Wei et al. (2008), Acaravci and Ozturk (2010), Niu et al. (2011), Ozturk and Acaravci (2011), Shahbaz et al. (2011), Solarin (2011), Arouri et al. (2012), Georgantopoulos (2012), Acaravci and Ozturk (2012), Akpan and Akpan (2012), Shahbaz and Feridun (2012), Bouoiyour and Selmi

(2013), among others). These studies have focused on different countries and various econometric methodologies have been used. The purpose of assessing the nexus between these two variables is to make policy recommendation for government and other policy makers. Normally, the results should help them in implementing future electricity policies such as investigating more in electricity consumption when energy consumption causes economic development or engaging in electricity conservation when the inverse link is supported. However, the empirical outcomes have been varied widely and found to be inconsequential.

We found only three papers in the literature (Chen et al., 2012; Kalimeris et al., 2014; and Menegaki, 2014) in which meta-analysis of energy consumption and growth relationship is examined. However, there is no a paper that investigates the electricity consumption and growth nexus in a meta-analysis framework. It seems hardly difficult to find firm evidence for the causality between electricity consumption and economic growth. Thus, this paper provides first attempt to contribute to the above existing literature on the topic especially that of Ozturk (2010) and Payne (2010) by adding new findings and by carrying out meta-analysis techniques developed by Hunter et al. (1982) for a sample of 43 studies published between 1996 and 2013. This method can make a substantial contribution to the focal relationship by highlighting more accurately the main factors behind the inconclusive results.

The remainder of the paper is organized as follows: Section 2 presents the previous empirical aspects on the nexus between electricity consumption and economic growth. Section 3 describes data and methodological framework. Section 4 discusses main empirical results. Section 5 concludes the paper.

2. Literature Survey

Since the seminal work of Kraft and Kraft (1978), there has been a growing interest in the literature that has undertaken the nexus between energy consumption and economic development in American countries (Soytas and Sari (2003), Ghali and El-Sakka (2004), Lee (2006), Narayan and Parasad (2008)), Asian countries (Masih and Masih (1996), Asafu-Adjaye (2000), Tang (2008) and Ghosh (2009)), low and middle income countries (Ozturk et al. (2010)), European countries (Belke et al . (2011), Niu et al. (2011) and Dobnick (2011)) and MENA countries (Al-Mulali (2011), Arouri et al. (2012) and Bouoiyour and Selmi (2013)). However, there is no consensus on the results found. This issue has been assessed and the results have varied widely.

Several researches on this field have focused on various econometric methods. Some works have used the traditional VAR or simple log-linear models without any regard for the nature of the time series properties of the concerned variables (Erol and Yu (1987), Yu and Choi (1985) and Abosedra and Baghestani (1989)). However, in more recent works, authors have tried to investigate whether there is a short-run or long-run dynamic relationship between energy consumption and economic growth using co-integration and Granger causality tests such as Sim's technique, Hsiao's technique or Toda-Yamamoto test (Kraft and Kraft (1978), Lee (2006) and Soytas and Sari (2003), respectively.

Kraft and Kraft (1978) show a unidirectional causality running from economic growth to energy consumption only in the case of the United States over the period 1947-1974 by carrying out Sims (1972) methodology. There has been a proliferation of some works using different techniques and time periods since then. For example, Soytas and Sari (2003) provide evidence in favor of neutrality hypothesis for USA in the period from 1950-1992 and using cointegration and Toda-Yamamoto causality test. Accordingly, Lee (2006) employs Hsiao's technique for the period from 1960 to 2001, leading to support feedback hypothesis. More recently, Apergis and Payne (2010) examined the nexus between electricity consumption and economic growth in a multivariate framework by including measures of real gross fixed capital formation and labor force. They argue that there are both short-run and long-run causality from energy consumption to economic growth in a panel of nine South American countries, supporting therefore the growth hypothesis.

In addition, the direction of causality between energy consumption and economic growth appears also inconsistent for Asian countries. For example, Masih and Masih (1997) found a unidirectional causality in Korea that runs from energy consumption to economic growth which implies that conserving energy could reduce economic growth in this country over the period 1955-1991. For the same country, Glasure and Lee (1997) show no causality in either direction called neutrality hypothesis, which means that conservative policy in relation to energy consumption has no adverse effect on economic growth in Korea for the period from 1961 to 1990.

Furthermore, the previous studies related the focal linkage on MENA countries have shown inconclusive outcomes. A large stream of works assessed the relationship between energy consumption and economic growth in a bivariate framework, except Mahadevan and Asafu-Adjaye (2007) and Arouri et al. (2012). For instance, Ozturk and Acaravci (2011) investigate the relationship between energy consumption and economic growth in the selected MENA countries using cointegration analysis developed by Pesaran and Shin (1999), and Granger causality test. The results show that there is no cointegration and causal link between the electricity consumption and the economic growth in Iran, Morocco and Syria. However, the cointegration and causal relationship is found for the rest of selected countries, i.e. Egypt, Israel, Oman and Saudi Arabia. Intuitively, they argue that the energy conservation policy of MENA countries can have a no powerful impact on economic growth. Inversely, Bouoiyour and Selmi (2013), using causality tests proposed by Predoni (2004), support a conservation hypothesis in Morocco and Oman and growth hypothesis in Syrian case.

Depending to country-to-country variation, as it shown in Table 1 which was formed based on both country-specific and multi-countries, the observed directions of causality are different from each other's. These dissimilar findings might be owing to different countries' characteristics such as political arrangements, the quality of institutions and the different adopted energy policies (Chen et al., 2007; Ozturk, 2010). Besides, studies based on different countries, different econometric methodologies and different development stages also yielded mixed results (Yuan et al., 2008; Halkos and Tzermes, 2009).

These different outcomes have been synthetized into four testable hypotheses within the literature[1]. Firstly, the *conservation hypothesis* is based on a unidirectional causal relationship running from growth to energy consumption. This hypothesis implies that GDP growth causes energy consumption. It suggests that an economy that functions in such a causal relationship is less energy dependent; consequently, any conservation policies concerning energy consumption will have little or no adverse effect on economic growth.

Secondly, the *growth hypothesis* suggests that energy consumption is a crucial component in economic growth. It implies that energy consumption causes GDP growth. This means that while energy is a limiting factor to growth, a policy to increase investment in industrial sectors, particularly electrification is likely to stimulate the economic development. Therefore, while increases in energy consumption may contribute to further economic growth, reductions in energy consumption may have negative effects on growth. Thirdly, the *feedback hypothesis* or the bidirectional causality emphasizes an interdependent relationship between electricity consumption and economic development. Both energy consumption and GDP growth trigger each other. Finally, the *neutrality hypothesis* means that energy consumption is not correlated with GDP and suggests that neither conservative nor expansive energy policies have any effects on economic growth. In other words, no causal relation exists between GDP growth and energy consumption (Ozturk, 2010).

[1] The denotations of neutrality hypothesis and the bidirectional link or the feedback hypothesis have been widely used by the previous studies on the energy consumption-economic growth nexus. However, the denotations of the other directions of causality (i.e. growth hypothesis and conservation hypothesis) were proposed by Apergis and Payne (2009).

Table 1. Some selected studies on the energy consumption- growth nexus

Authors	Period	Countries	Causality direction	Hypothesis
American countries				
Soytas and Sari (2003)	1950-1992	Canada USA	Energy ↔ Growth Energy ↔ Growth	Neutrality hypothesis Neutrality hypothesis
Ghali and El-Sakka (2004)	1961-1997	Canada	Energy ↔ Growth	Feedback hypothesis
Lee (2006)	1960-2001	Canada USA	Energy → Growth Energy ↔ Growth	Conservation hypothesis Feedback hypothesis
Chiou-Wei et al. (2008)	1954-2006	USA	Energy ↔ Growth	Neutrality hypothesis
Narayan and Parasad (2008)	1971-2002	Canada Mexico USA	Energy ↔ Growth Energy ↔ Growth Energy ↔ Growth	Neutrality hypothesis Neutrality hypothesis Neutrality hypothesis
Asian countries				
Masih and Masih (1996)	1952-1992	Korea Taiwan	Energy → Growth Energy ↔ Growth	Conservation hypothesis Feedback hypothesis
Glasure and Lee (1997)	1961-1990	Korea Singapore	Energy ↔ Growth Energy → Growth	Neutrality hypothesis Conservation hypothesis
Lee and Chang (2005)	1954-2003	Taiwan	Energy → Growth	Conservation hypothesis
Tang (2008)	1972-2003	Malaysia	Energy → Growth	Conservation hypothesis
Ghosh (2009)	1950-1997	India	Growth → Energy	Growth hypothesis
Niu et al. (2011)	1971-2005	Developed Developing	Energy → Growth Growth → Energy	Conservation hypothesis Growth hypothesis
European countries				
Narayan and Parasad (2008)	1960-2002	Belgium Netherlands France Italy Greece Spain Poland Norway Sweden United Kingdom	Energy ↔ Growth Growth → Energy Energy ↔ Growth Energy ↔ Growth Energy → Growth Energy ↔ Growth Energy ↔ Growth Energy ↔ Growth Energy ↔ Growth Energy ↔ Growth	Neutrality hypothesis Growth hypothesis Neutrality hypothesis Neutrality hypothesis Conservation hypothesis Neutrality hypothesis Neutrality hypothesis Neutrality hypothesis Neutrality hypothesis Neutrality hypothesis
Belke et al. (2011)	1981-2007	OECD countries	Energy ↔ Growth	Feedback hypothesis
Dobnick (2011)	1971-2009	OECD countries	Energy ↔ Growth	Feedback hypothesis
MENA countries				
Al-Iriani (2006)	1971-2002	GCC countries	Growth → Energy	Growth hypothesis
Mahadevan and Asafu-Adjaye (2007)	1971-2002	Energy exporters Energy importers	Energy ↔ Growth Energy ↔ Growth	Feedback hypothesis Feedback hypothesis
Ozturk et al. (2010)	1971-2005	Upper and lower income countries	Energy ↔ Growth	Feedback hypothesis
Al-Mulali (2011)	1980-2009	MENA countries	Energy ↔ Growth	Feedback hypothesis
Arouri et al. (2012)	1981-2005	MENA countries	Energy → Growth	Conservation hypothesis
Bouoiyour and Selmi (2013)	1975-2010	Energy exporters Algeria Egypt Iran Oman Saudi Arabia Syria UAE Energy importers Jordan Morocco Sudan Tunisia Turkey	Growth ↔ Energy Growth ↔ Energy Growth ↔ Energy Growth ↔ Energy Growth → Energy Growth ↔ Energy Energy → Growth Growth ↔ Energy Energy → Growth Energy → Growth Growth → Energy Growth ↔ Energy Growth ↔ Energy Growth → Energy	Neutrality hypothesis Feedback hypothesis Feedback hypothesis Neutrality hypothesis Conservation hypothesis Feedback hypothesis Growth hypothesis Feedback hypothesis Growth hypothesis Growth hypothesis Conservation hypothesis Neutrality hypothesis Feedback hypothesis Conservation hypothesis

3. Meta-Analysis Methodology

3.1. Meta-analysis technique

Since the findings in several issues were inconclusive, meta-analysis is a helpful tool in reconciling and clarifying the inconsistencies (Stanley, 2005). The present study follows the same procedure used by Hunter et al. (1982) while trying to elucidate the understanding of policymaking about electricity consumption-economic growth nexus. This technique requires the use of the effect size to determine the magnitude of the association between the dependent and the independent variables. The effect size for pair of variables from each work is measured by the coefficient of correlation. Based on this technique, we followed five main steps.

First, we compute the mean correlation $(\bar{r})$ which is represented by:

$$\bar{r} = \frac{\sum (N_i r_i)}{\sum N_i} \tag{1}$$

where N_i : the sample size for study i and r_i the Pearson correlation coefficient for study i

Second, we determine the unbiased estimate of the population variance S_p^2 expressed as follows:

$$S_p^2 = S_r^2 - S_e^2 \tag{2}$$

where S_r^2 : The observed variance equal to $\sum \left[N_i (r_i - \bar{r})^2\right] / \sum N_i$

S_e^2 : The estimate of sampling error variance equal to $\left[(1-\bar{r}^2)^2 k\right] / \sum N_i$

Third, we determine the 95 percent confidence interval. As our sample size is larger than 30, the z-statistics are determined as follows:

$$\left[\bar{r} - 0.975 S_P , \bar{r} + 0.975 S_p\right] = \left[\bar{r} - 1.96 S_p , \bar{r} + 1.96 . S_p\right] \tag{3}$$

Fourth, we test the statistical validity of the considered model using this statistic:

$$\chi_{k-1}^2 = \frac{N S_r^2}{(1-\bar{r}^2)^2} = k \frac{S_r^2}{S_e^2} \tag{4}$$

Statistically, if we obtain a high value of χ_{k-1}^2 , i.e. there is a need to perform tests using subgroups meta-analysis within the four hypotheses mainly supported across the several studies on the concerned issue (i.e. growth hypothesis, conservation hypothesis, feedback hypothesis, neutrality hypothesis). In the present study, we can provide new evidence on the focal linkage by extracting our meta data set into 12 subgroups depending to the above hypotheses: studies focused on American countries (*AMC*), on Asian countries (*ASC*), on European countries (*EUC*), on MENA countries (*MENAC*), works assessing short run dynamic between the key variables (*SR*) or long-run dynamic (*LR*) or jointly (*JR*), studies examining panel data (*Panel*) or time series (*TS*), using cointegration method (*CO*) or Granger causality test (*GC*) or jointly (*JM*). The subgroup meta-analysis can help researchers reduce heterogeneity and identify accurately the main causes behind the inconclusive outcomes (Souissi and Khlif, 2012). Appendices display in detail this decomposition.

Finally, with respect to the empirical studies that do not report Pearson's coefficient but includes t-statistics, we mention in the following the conversion into *r* statistics:

$$r_{y,x} = \sqrt{\frac{t^2}{(t^2 + df)}} = \frac{|t|}{\sqrt{(t^2 + df)}} \tag{5}$$

The literature on meta-analysis framework provides no clear-cut evidence of meta-regression in the absence of clear information about the signs of t-statistic and Pearson's coefficient. To resolve this problem, we apply an approach based on dummy variable following the Bernoulli rule:

$$P(D = d) = p^d (1-p)^{1-d} ; d \in \{0,1\}; 0 \prec p \prec 1$$

and $P(D = d) = 0$ otherwise, considering the following hypothesis:

$$H_0 : p = 0.9 \quad against \quad H_1 : p < 0.9 \tag{6}$$

where d is equal to 1 if t-statistic, Pearson's coefficient and $r_{y,x}$ are correlated with the same sign and 0 if not; the p is the proportion of cases in which either the t-statistic or Pearson's coefficient is associated with the same sign as $r_{y,x}$.

3.2. Database

The database for the analysis has been constructed based on the several published empirical papers on the nexus between electricity consumption and economic growth. They have been collected by searching the EconLit database and through the literature review of the different papers in this field. Out of the 43 papers from 1996 to 2013 will be used in our meta-analysis to suggest new lines of enquiry on the relationship in question (i.e. 9 studies supporting growth hypothesis, 9 studies supporting conservation hypothesis, 10 studies supporting neutrality hypothesis and 15 supporting the feedback hypothesis). As is the norm in meta-analysis, we excluded all non-empirical researches on this issue such as Ozturk (2010) and Payne (2010). Hence, the present study includes only the works that have measure of electricity consumption as the dependent variable and measure of economic development as our variable of interest[2].

3.3. Testing and controlling for publication bias

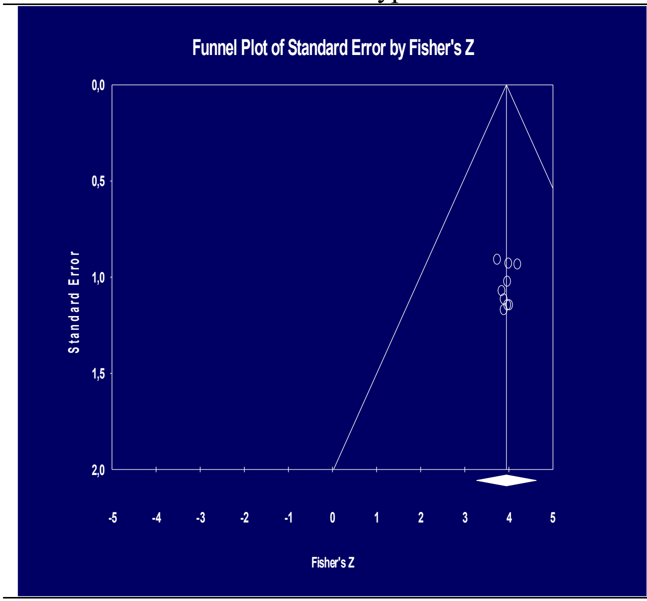
Publication bias occurs when the considered meta data set have similar results (i.e. negative, positive, significant, insignificant or ambiguous). The publication bias may induce inconsequential findings and false conclusions. Researchers in economics have an incentive to conform. More precisely, when each study suggests a positive or ambiguous relationship between two variables and the majority of works on the same field show a negative and significant link, the study is unlikely to be accepted for publication (Pugh et al. 2012, p. 283). As a result, researchers may not submit unconventional or weakly findings and the empirical literature on the concerned issue may be affected by publication bias. Hence, it seems highly crucial to assess the publication bias before starting our estimates. Funnel plot is usually used to detect bias selection (Jarell and Stanley (1990), Doucouliagos (2005), Stanley (2005) and Coric and Pugh (2010)). In the absence of publication bias, the considered works will be distributed symmetrically about the combined effect size. By contrast, in the presence of bias, we would show a higher concentration of studies on one side of the mean than on the other. For our case, it is well depicted from Figure 1 below mentioned that the asymmetrical plot is unobserved neither for the growth hypothesis, nor conservation hypothesis, nor the feedback hypothesis, nor the neutrality hypothesis. This means that the published papers on the focal link differ within the concerned hypotheses.

In addition, Begg and Mazumdar rank correlation test is added as a technique for publication bias and as a formal procedure to complement the funnel graph (Borenstein, 2005). This test reports the Kendall's tau or the rank correlation between the standardized effect size and the standard errors of these effects (Begg, 1994). A value of zero indicates no relationship between effect size and precision and a deviation from zero implies the presence of a relationship (Begg and Berlin, 1988 ; Begg and Mazumdar, 1994). Our results summarized in Table 2 reveal the Kendall's tau either with or without continuity correction deviates widely from zero for all the hypotheses under consideration, which imply that there is a significant association between the effect size and precision. This tau appears insignificant at almost all cases, this does not mean necessary the absence of bias. Accordingly, Sterne et al. (2001) argue that a non-significant tau should not be taken as proof that bias is absent.

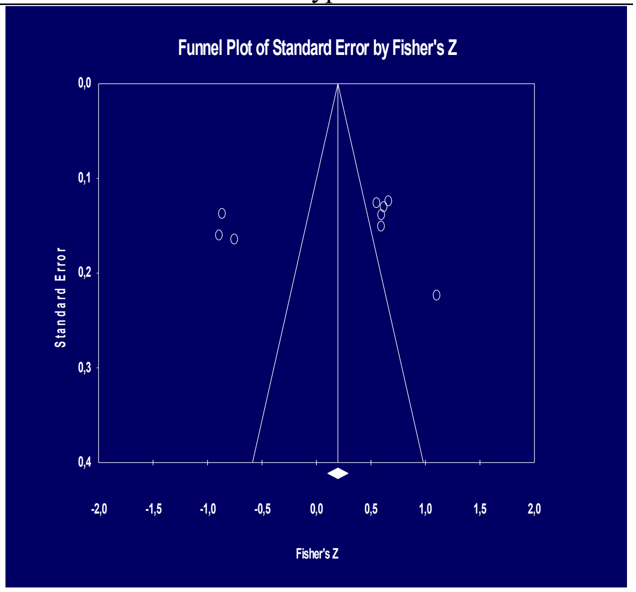
[2] The study by Wolde-Rufael (2004), for example, was excluded from our meta data set (see Appendices) given that Shanghai is not a country.

Figure 1. Funnel plots of considered studies

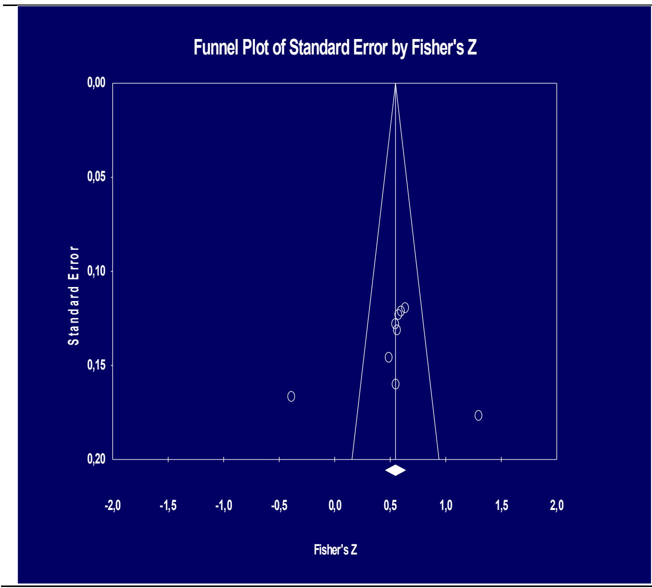
Conservation hypothesis



Growth hypothesis



Neutrality hypothesis



Feedback hypothesis

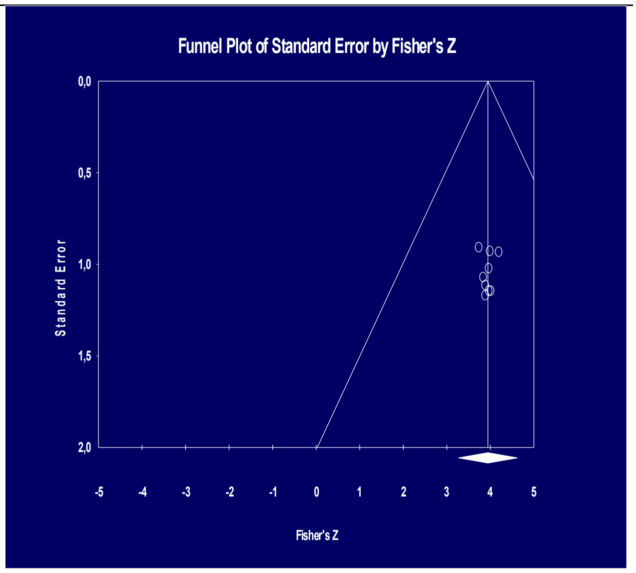


Table 2. Begg and Mazumdar rank correlation test

	Conservation hypothesis	Growth hypothesis	Neutrality hypothesis	Feedback hypothesis
Kendall's tau without continuity correction				
tau	-0.16667	-0.38889	0.05556	0.13337
z-value for tau	0.62554	1.45960	0.20851	0.84290
p-value (1-tailed)	0.26581	0.07220	0.41741	0.06052
p-value (2-tailed)	0.53161	0.14440	0.83483	0.12104
Kendall's tau with continuity correction				
tau	-0.13889	-0.36111	0.02778	0.11662
z-value for tau	0.52129	1.35534	0.10426	0.65172
p-value (1-tailed)	0.30108	0.08765	0.45848	0.08934
p-value (2-tailed)	0.60217	0.17531	0.91697	0.17869

4. Main Findings

4.1. Conservation hypothesis

The total meta-analysis based on 9 studies that support conservation hypothesis (Appendix A.1) indicates that these works are influenced intensely by the nature of countries, i.e. the results change depending to country-to-country variation. Contrary to expectations, we note from Table 3 that there is no significant association between conservation hypothesis and Asian and MENA countries with low mean correlations ($\bar{r}$). However, it is worthy observable the strong association between American and European countries and the nexus that runs from electricity consumption to real GDP with correlations equal to $\bar{r} = 0.533$ and $\bar{r} = 0.544$. This implies that high electricity consumption in *AMC* and *EUC* tends to have high economic growth, but not the reverse. Not surprisingly, Chiou-Wei et al. (2008) suggest that electricity consumption played an important role in economic growth in AMC. The same evidence has been provided by Niu et al. (2011) in the European case. Therefore, policies to manage the supply of electricity are required to ensure that the electricity is sufficient to support American and European economic growth. However, energy conservation policies, such as rationing electricity consumption are likely to have an adverse effect on economic development in Asia and MENA countries. Arguably, Ghosh (2009) and Bouoiyour and Selmi (2013) show that the energy growth policies regarding electricity consumption should be adapted in such a way that the development of the energy sector stimulates economic growth in these economies.

Table 3. Conservation hypothesis

	$\bar{r}$	S_r^2	S_e^2	S_p^2	$95\%CI$	χ_{k-1}^2
AMC	0.53300	0.00000	0.13001	0.13001	[0.18152 ; 0.88449]	0.00000
ASC	0.02609	0.23038	0.65963	0.42925	[-0.61279 ; 0.66479]	0.39702*
EUC	0.54425	0.00025	0.10210	0.10185	[0.23284 ; 0.85512]	0.00489
MENAC	0.14940	0.10045	0.21433	0.10998	[-0.17391 ; 0.47271]	0.93734*
Panel	0.55891	0.00091	0.09824	0.09733	[0.25473 ; 0.86307]	0.01852
TS	0.48736	0.03451	0.12642	0.09191	[0.19157 ; 0.78288]	0.81893*
SR+GC	-	-	-	-	-	-
LR+CO	0.80200	0.00000	0.02578	0.02578	[0.64545 ; 0.82713]	0.00000
JA+JM	0.39671	0.00952	0.02873	0.02874	[0.23122 ; 0.56077]	0.74569*

Notes: * significant at 5%.

4.2. Growth hypothesis

The meta-analysis outcomes on 9 papers supporting the growth hypothesis (Appendix A.2) reveal that almost all the considered features are associated to the unidirectional relationship that runs from economic growth to electricity consumption. We depict from Table 4 that the meta findings do not move depending to the group-by-group variation with a great average mean correlation of $\bar{r} = 0.556$. This means that a decrease in economic growth can lead to an absence of sufficient choice providing access to modern, adequate and efficient energy services able to mitigate economic development-damaging (Wolde-Rufael, 2006). This result confirms that *ASC, EUC* and *MENAC* are energy dependent, in which energy conservation policies may be implemented with adverse effects on real GDP. This explains also the quick increase in electrification in the different sectors in these economies, i.e. new instruments have been installed to make more efficient and industrial plans to enhance then the economic development in these countries (Narayan and Prasad (2008), Niu et al. (2011), among others). For MENA countries, Bouoiyour and Selmi (2013) suggest, especially for energy exporters, to combine rapid urbanization with growth to accelerate electricity usage.

Table 4. Growth hypothesis

	$\bar{r}$	S_r^2	S_e^2	S_p^2	$95\%CI$	χ^2_{k-1}
AMC	-	-	-	-	-	-
ASC	0.63700	0.00046	0.00701	0.00655	[0.63061 ; 0.64338]	0.26248*
EUC	0.51215	0.00050	0.12702	0.12652	[0.16535 ; 0.85894]	0.00393
MENAC	0.54948	0.00016	0.09504	0.09488	[0.24916 ; 0.84979]	0.00336
Panel	0.05467	0.00023	0.12426	0.35217	[0.16130 ; 0.99672]	0.00370
TS	0.53257	0.00034	0.11586	0.11553	[0.20117 ; 0.86396]	0.02054*
SR+GC	0.51744	0.00039	0.11650	0.11611	[0.18478 ; 0.84922]	0.00672
LR+CO	0.74612	0.02816	0.03647	0.00831	[0.65723 ; 0.83500]	0.54428*
JA+JM	0.41325	0.00010	0.17224	0.17214	[0.00837 ; 0.81762]	0.00290

Notes: * significant at 5%.

4.3. Neutrality hypothesis

The evidence from the meta-analysis on 10 works supporting the neutrality hypothesis (Appendix A.3) suggest that this latter is significantly associated to *AMC, ASC* and *EUC,* with mean correlations relatively amount to $\bar{r} = 0.739, \bar{r} = 0.448,\ \bar{r} = 0.799$ (Table 5). Neither conservative nor expansive policies in relation to electricity consumption have any effect on economic growth in the above countries. These results support the view of Payne (2010) that electricity conservation policies such as demand management policies that essentially flattens the demand curve for electricity is reduced relative to the average load. Such action would yields greater reliability of the electrical system but will have no significant effect on economic growth. Additionally, in ASC, the lack of causality in both directions implies that measures to save electricity usage can be taken without compromising economic growth because they have not yet reached a high level of electricity autonomy which allows them to reduce their energy use (Chiou-Wei et al. (2008) and Ghosh (2009)). However, when studying the nexus in MENAC, the association becomes no significant with $\bar{r} = 0.074$ and confidence interval $[-0.33305; 0.48244]$. This finding may be due to the rapid transition of these countries towards a digital economy that may profoundly affect energy usage. Households of *MENAC* switch to modern energy services yielding to high electricity consumption that stimulate their GDP (Arouri et al. 2012). The results change substantively when moving from short-run to long-run analysis, i.e. while there is a stronger correlation between *LR* and the nexus between key variables with $\bar{r} = 0.870$; there is no association between *SR* and the neutrality hypothesis with $\bar{r} = 0.024$.

Table 5. Neutrality hypothesis

	$\bar{r}$	S_r^2	S_e^2	S_p^2	$95\%CI$	χ^2_{k-1}
AMC	0.73984	0.00083	0.02786	0.02737	[0.57269 ; 0.90113]	0.08937*
ASC	0.44881	0.00014	0.08568	0.08555	[0.16364 ; 0.73398]	0.00817
EUC	0.79922	0.00022	0.01518	0.01496	[0.67974 ; 0.91847]	0.02898
MENAC	0.0745	0.45916	0.28409	0.17506	[-0.33305 ; 0.48244]	0.88124*
Panel	0.49795	0.00095	0.12470	0.12375	[0.15477 ; 0.84017]	0.01523
TS	0.11280	0.23574	0.19566	0.04008	[-0.08214 ; 0.30780]	0.40969*
SR+GC	0.02451	0.02759	0.19006	0.16241	[-0.36892 ; 0.41743]	0.43549*
LR+CO	0.87000	0.00000	0.00646	0.00646	[0.79170 ; 0.94829]	0.00000
JA+JM	0.17362	0.16894	0.09757	0.07137	[-0.08685 ; 0.43409]	0.69258*

Notes: * significant at 5%.

4.4. Feedback hypothesis

The 15 studies used in our meta data set supporting feedback hypothesis (Appendix A.4) vary depending to country coverage and the modeling choice. It is worthy notable from Table 6 that *ASC, EUC* and *MENAC* are heavily associated to the bidirectional link between energy consumption and economic growth with mean correlations relatively high $\bar{r} = 0.4858$, $\bar{r} = 0.2560$ and $\bar{r} = 0.3318$. Hence, policy makers in these countries should take into account this bidirectional nexus by implementing regulations to reduce energy usage. Arguably, Niu et al. (2011) show that modern energy can be a prerequisite for economic and technological progress as it completes the production process. Simultaneously, to make electricity accessible to overall economic sectors can improve the quality of population's lives and achieve economic growth (Arouri et al. 2012). At the same context, Belke et al. (2010) and Bouoiyour and Selmi (2013) suggest that economic growth should be decoupled from electricity consumption to avoid possible detrimental effects on economic performance. However, when our examination is performed with respect to *AMC*, the mean correlation becomes low $\bar{r} = 0.047$, implying that the feedback hypothesis is hardly supported in American countries. These results are not consistent with the previous evidences from Ghali and El-Sakka (2004) and Lee (2006), who suggest that a bidirectional nexus between electricity consumption and economic growth is supported for a panel of American countries. This inconsistency may be owing to the role that plays policy makers in each country and their ability or not to reduce the energy use (Belke et al., 2010).

Table 6. Feedback hypothesis

	$\bar{r}$	S_r^2	S_e^2	S_p^2	$95\%CI$	χ_{k-1}^2
AMC	0.04791	0.11456	0.13009	0.01553	[-0.07358 ; 0.16940]	0.88062
ASC	0.4858	0.00029	0.08610	0.08581	[0.20022 ; 0.77137]	0.01684
EUC	0.2560	0.00043	0.06985	0.06937	[-0.00795 ; 0.51272]	0.03080
MENAC	0.3318	0.00012	0.10244	0.10232	[0.02077 ; 0.64367]	0.00585
Panel	0.08572	0.11293	0.82560	0.71267	[-0.73738 ; 0.90879]	0.82071*
TS	0.51633	0.00017	0.09251	0.09230	[0.22012 ; 0.81254]	0.01837
SR+GC	0.01013	0.09526	0.11381	0.01855	[-0.12265 ; 0.14292]	0.83701*
LR+CO	0.19258	0.00411	0.09827	0.09416	[-0.10659 ; 0.49176]	0.12547*
JA+JM	0.56192	0.00010	0.04718	0.04708	[0.35036 ; 0.77347]	0.01483

Notes: * significant at 5%.

5. Conclusion and Policy Implications

The meta-analysis has improved our understanding on the nexus between electricity consumption and economic growth. The present study integrates different outcomes of several studies on this field with respect to the association between the four supported hypotheses across studies and the country coverage, the nature of analysis and the modeling choice. To tackle this issue, we applied meta-analysis techniques to a sample of 43 studies published between 1996 and 2013.

We found that the relationship is more complex than it appears. Out of the 43 papers from 1996 to 2013 used in our meta-analysis suggest the new lines of enquiry on the relationship in question (i.e. 9 studies supporting growth hypothesis, 9 studies supporting conservation hypothesis, 10 studies supporting neutrality hypothesis and 15 supporting the feedback hypothesis).

The conservation hypothesis is widely associated to American and European countries. However, conservative and expansive policies are likely to have an adverse effect on the economic growth in Asian and MENA countries. Conversely to expectations, the growth hypothesis is heavily associated to all studied countries and all considered econometric methods. Additionally, there is a significant association between neutrality hypothesis and American, Asian and European countries. These observed results change when moving from short-run to long-run analysis, i.e. while there is a stronger correlation between long-run analysis and the focal relationship, there is no association with short-run assessment. The feedback hypothesis is not supported when appealing a panel of American countries or when investigating the short-run dynamic between electricity consumption and GDP.

The different findings may be mainly attributed to the nature of concerned countries and to the modeling choice and to the fact that energy policies in each country cannot be designed without considering various economic and environmental factors excluded in the majority of studies on the issue. In addition, the different results may be due to the use of bivariate models with missing variables, such as energy prices, rather than employing multivariate models in the previous studies. Thus, the authors should focus more on the new approaches including additional variables and further studies with new findings can be conducted to find better paths.

References

Abosedra, S., Baghestani, H. (1989) New evidence on the causal relationship between US energy consumption and Gross National Product. Journal of Energy Development, 14, 285-292.

Acaravcı, A., Ozturk, I. (2010) Electricity Consumption- Growth Nexus: Evidence From Panel Data For Transition Countries, Energy Economics, 32(3), 604-608.

Acaravci, A., Ozturk, I. (2012) Electricity Consumption and Economic Growth Nexus: A Multivariate Analysis for Turkey, Amfiteatru Economic, 14(31), 246-257.

Akpan, G.E., Akpan, U.F. (2012) Electricity Consumption, Carbon Emissions and Economic Growth in Nigeria. International Journal of Energy Economics and Policy, 2(4), 292-306.

Al-Iriani, M.A. (2006) Energy–GDP Relationship Revisited: An Example from GCC Countries Using Panel Causality. Energy Policy, 34(17), 3342-3350.

Al-Mulali, U. (2011) Oil Consumption, CO2 Emission and Economic Growth in MENA Countries. Energy Policy, 36(10), 6165-6171.

Altinay, G., Karagol, E. (2005) Electricity consumption and economic growth: evidence for Turkey. Energy Economics, 27, 849-956.

Ang, J.B. (2008) Economic development, pollutant emissions and energy consumption in Malaysia. Journal of Policy Modeling 30, 271-278.

Apergis, N., Payne J-E. (2009) CO2 emissions, energy usage, and output in Central America. Energy Policy 37, 3282–3286.

Apergis, N., Payne, J.E. (2010) The Emissions, Energy Consumption, and Growth Nexus: Evidence from the Common Wealth of Independent States. Energy Policy, 38(1), 650-655.

Arouri, M.H., Ben Youssef, A., M'Henni, H, Rault, C. (2012) Energy Consumption, Economic Growth and CO2 Emissions in Middle East and North African Countries. CESifo Group Munich, Working Paper Series, 3726.

Asafu-Adjaye, J. (2000) The relationship between energy consumption, energy prices and economic growth: time series evidence from Asian developing countries, Energy Economics 22, 615-625.

Begg, C.B., Berlin, J.A. (1988) Publication bias: A problem in interpreting medical data. Journal of the Royal Statistical Society, Series A, 151, 419–463.

Begg, C.B. (1994) Publication bias. In H.M. Cooper and L.V. Hedges (eds), The Handbook of Research Synthesis. New York: Russell Sage Foundation.

Begg, C.B., Mazumdar, M. (1994) Operating characteristics of a rank correlation test for publication bias. Biometrics 50, 1088-1101.

Belke, A., Dobnik, F., Dreger, C. (2011) Energy consumption and economic growth: New insights into the cointegration relationship. Energy Economics 33(5), 782-789.

Borenstein, M., Hedges, L., Higgins, J., Rothstein, H. (2005) Comprehensive Meta-Analysis, Version 2. Englewood, NJ: Biostat.

Bouoiyour, J., Selmi, R. (2013) The nexus between electricity consumption and economic growth in MENA countries. Energy Studies Review. Energy Studies Review, 20(2), 25-41.

Chen, S.T., Kuo, H.I., Chen, C.C. (2007) The relationship between GDP and electricity consumption in 10 Asian countries. Energy Policy 35(4), 2611-2621.

Chen, P-Y., Chen, S-T., Chen, C-C. (2012). Energy consumption and economic growth: New evidence from meta analysis. Energy Policy, 44(5), 245-255.

Chiou-Wei, S.Z., Chen, Ching-Fu, Zhu, Z. (2008) Economic growth and energy consumption revisited—evidence from linear and nonlinear Granger causality. Energy Economics, 30(6), 3063-3076.

Coric, B., Pugh, G. (2010) The effects of exchange rate variability on international trade: a meta-regression analysis. Applied Economics, 42, 2631-2644.

Dobnick, F. (2011) Energy consumption and economic growth revisited: structural breaks and cross section dependence. Ruhr Economic Papers n° 303.

Doucouliagos, C. (2005), Publication Bias in the Economic Freedom and Economic Growth Literature. Journal of Economic Surveys, 19(3), 367-387.

Erdal, G., Erdal, H. and Esengun, K. (2008) The causality between energy consumption and economic growth in Turkey. Energy Policy, 36(10), 3838-3842.

Erol, U., Yu, E.S.H. (1987) On the causal relationship between energy and income or industrialized countries. Journal of Energy Development, 13, 113-122.

Georgantopoulos, A. (2012) Electricity Consumption and Economic Growth: Analysis and Forecasts using VAR/VEC Approach for Greece with Capital Formation. International Journal of Energy Economics and Policy, 2(4), 263-278.

Ghali, K.H., El-Sakka, M. (2004) Energy use and output growth in Canada: a multivariate cointegration analysis. Energy Economics 26, 225-238.

Ghosh, S. (2009) Electricity supply, employment and real GDP in India: evidence from cointegration and Granger-causality tests. Energy Policy, 37(8), 2926-2929.

Glasure, Y.U., Lee, A. (1997) Cointegration, error correction and the relationship between GDP and energy: the case of South Korea and Singapore. Resource and Energy Economics, 20, 17-25.

Glasure, Y.U. (2002) Energy and national income in Korea: further evidence on the role of omitted variables. Energy Economics, 24, 355-365.

Halkos, G.E. and Tzeremes, N. (2009) Electricity Generation and Economic Efficiency: Panel Data Evidence from World and East Asian Countries. Global Economic Review, 38(3), 251-263.

Hondroyiannis, G., Lolos, S., Papapetrou, E. (2002) Energy consumption and economic growth: assessing the evidence from Greece. Energy Economics, 24, 319-336.

Hunter, J.E., Schmidt, F.L., Jackson, G.B. (1982) Cumulating Research Findings across Studies. Studying Organizations: Innovations in Methodology, Vol. 4, Sage, Beverly Hill, CA.

Jarrell, S.B., Stanley, T.D. (1990) A meta-analysis of the union-nonunion wage gap. Industrial and Labor Relations Review 44(1), 54-67.

Jobert, T. and Karanfil, F. (2007) Sectoral energy consumption by source and economic growth in Turkey. Energy Policy, 35, 5447-5456.

Kalimeris, P., Richardson, C., Bithas, K. (2014) A meta-analysis investigation of the direction of the energy-GDP causal relationship: implications for the growth-degrowth dialogue. Journal of Cleaner Production, 67, 1-13.

Karanfil, F. (2008) Energy consumption and economic growth revisited: does the size of unrecorded economy matter? Energy Policy, 36(8), 3029-3035.

Kraft, J., Kraft, A. (1978) On the relationship between energy and GNP. Journal of Energy and Development 3, 401-403.

Lee, C-C., Chang, C-P. (2005), Structural breaks, energy consumption, and economic growth revisited: evidence from Taiwan. Energy Economics 27, 857–72.

Lee, C.C. (2006) The causality relationship between energy consumption and GDP in G-11 countries revisited. Energy Policy 34, 1086-1093.

Lee, C.C., Chang, C.P., Chen, P.F. (2008) Energy-income causality in OECD countries revisited: the key role of capital stock. Energy Economics 30, 2359-2373.

Mahadevan, R., Asafu-Adjaye, J. (2007) Energy consumption, economic growth and prices: A reassessment using panel VECM for developed and developing countries. Energy Policy 35(4), 2481–2490.

Masih, A., Masih, R. (1996) Energy consumption and real income temporal causality, results for a multi-country study based on cointegration and error-correction techniques. Energy Economics 18, 165-183.

Masih, A. and Masih, R. (1997) On temporal causal relationship between energy consumption, real income and prices; some new evidence from Asian energy dependent NICs based on a multivariate cointegration/vector error correction approach. Journal of Policy Modeling 19(4), 417-440.

Mehrara, M. (2007) Energy consumption and economic growth: the case of oil exporting countries. Energy Policy 35(5), 2939-2945.

Menegaki, A.N. (2014) On energy consumption and GDP studies; A meta-analysis of the last two decades. Renewable and Sustainable Energy Reviews, 29, 31-36.

Narayan, P-K., Prasad, A. (2008) Electricity consumption-real GDP causality nexus: evidence from a bootstrapped causality test for 30 OECD countries. Energy Policy, 36, 910-918.

Niu, S., Ding, Y. Niu, Y. Li, Y., Luo, G. (2011) Economic growth, energy conservation and emissions reduction: A comparative analysis based on panel data for 8 Asian-Pacific countries. Energy Policy, 39(4), 2121-2131.

Ozturk, I. (2010) A literature survey on energy consumption-growth nexus. Energy Policy 38, 340-349.

Ozturk, I., Aslan, A., Kalyoncu, H. (2010) Energy Consumption and Economic Growth Relationship: Evidence from Panel Data for Low and Middle Income Countries. Energy Policy, 38(8), 4422-4428.

Ozturk, I., Acaravcı, A. (2011) Electricity Consumption and real GDP Causality Nexus: Evidence from ARDL Bounds Testing Approach for 11 MENA Countries. Applied Energy, 88(8), 2885-2892.

Paul, S., Bhattacharya, R.N. (2004) Causality between energy consumption and economic growth in India: a note on conflicting results. Energy Economics, 26(6), 977-983.

Payne, J-E. (2010) A survey of the electricity consumption and growth literature, Applied Energy 87, 723-73.

Pedroni, P. (2004) Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP. Econometric Theory 20, 597-625.

Pesaran, M., Shin, Y. (1999) An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis. S. Strom, (ed) Econometrics and Economic Theory in the 20th Century, Cambridge University.

Pugh, G., Coric, B., Haile, M-G. (2012) An introduction to meta-regression analysis (MRA): Using the example of trade effects of exchange rate variability. Chapter 20 of the edited Book: Macroeconomics and Beyond in Honour of Wim Meeusen.

Shahbaz, M., Tang, C.F., Shahbir, M.S. (2011) Electricity consumption and economic growth nexus in Portugal using cointegration and causality approaches. Energy Policy, 39(6), 3529-3526.

Shahbaz, M., Feridun, M. (2012) Electricity consumption and economic growth empirical evidence from Pakistan. Quality & Quantity, 46(5), 1583-1599.

Sims, C.A. (1972) Money, income, and causality. American Economic Review 62(4), 540-552.

Solarin, S.A. (2011) Electricity Consumption and Economic Growth: Trivariate investigation in Botswana with Capital Formation. International Journal of Energy Economics and Policy, 1(2), 32-46.

Soytas, U., Sari, R. (2003) Energy consumption and GDP: causality relationship in G-7 countries and emerging markets. Energy Economics 25, 33-37.

Souissi, M., Khlif, H. (2012) Meta-analytic review of disclosure level and cost of equity capital. International Journal of Accounting and Information Management 20, 49-62.

Stanley, T. (2005) Beyond publication bias. Journal of Economic Survey, 19(3), 309-345.

Sterne, J.A.C., Egger, M., Davey, S.G. (2001) Investigating and dealing with publication and other biases. In M. Egger, G. Davey Smith and D. G. Altman (eds), Systematic Reviews in Health Care: Meta-analysis in Context, 2nd edn. London: BMJ Books.

Tang, C.F. (2008) A re-examination of the relationship between electricity consumption and economic growth in Malaysia. Energy Policy 36, 3077–85.

Wolde-Rufael, Y. (2004) Disaggregated industrial energy consumption and GDP: the case of Shanghai. Energy Economics 26, 69-75.

Wolde-Rufael, Y. (2005) Energy demand and economic growth: the African experience. Journal of Policy Modeling 27(8), 891-903.

Wolde-Rufael, Y. (2006) Electricity consumption and economic growth: a time series experience for 17 African countries. Energy Policy 34, 1106-1114.

Yuan, J., Kang, J., Zhao, C., Hu, Z. (2008) Energy consumption and economic growth: evidence from China at both aggregated and disaggregated levels. Energy Economics 30(6), 3077-3094.

Yu, E., Choi, J. (1985) The causal relationship between energy and GNP: An international comparison. Journal of Energy and Development 10, 249-272.

Zamani, M. (2007) Energy consumption and economic activities in Iran. Energy Economics 29(6), 1135-1140.

Appendices (the meta data set)

Appendix A1. Conservation hypothesis

Studies	Countries				Data		Analysis			Methods		
	AMC	*ASC*	*EUC*	*MENAC*	*Panel*	*TS*	*SR*	*LR*	*JA*	*CO*	*GC*	*JM*
Masih and Masih (1996)	0	1	0	0	0	1 (1)	0	1	0	1	0	0
Masih and Masih (1997)	0	1	0	0	0	1 (2)	0	1	0	1	0	0
Glasure and Lee (1997)	0	1	0	0	0	1 (3)	0	0	1	0	0	1
Chiou-Wei et al. (2008)	1	1	0	0	0	1 (4)	0	1	0	0	1	0
Narayan and Parasad (2008)	0	0	1	0	0	1 (5)	0	0	1	0	0	1
Tang (2008)	0	1	0	1	0	1	0	0	1	0	0	1
Niu et al. (2011)	0	0	1	0	1	0	0	0	1	0	0	1
Arouri et al. (2012)	0	0	0	1	1	0	0	0	1	0	0	1
Bouoiyour and Selmi (2013)	0	0	0	1	0	1 (6)	0	0	1	0	0	1

Notes : *AMC* : American countries ; *ASC :* Asian countries ; *EUC* : European countries ; *MENAC* : MENA countries *; TS :* Time series; *SR* : Short-run analysis ; *LR* : Long-run analysis ; *JA* : Joint analysis (i.e. SR and LR) ; *CO* : Cointegration ; *GC :* Granger causality ; *JM :* Joint methods (i.e. *CO* and *GC*) ; (1) : Hong Kong, Malaysia, Indonesia ; (5) : Greece ; (6) : Morocco, Oman and Turkey.

Appendix A2. Growth hypothesis

Studies	Countries				Data		Analysis			Methods		
	AMC	*ASC*	*EUC*	*MENAC*	*Panel*	*TS*	*SR*	*LR*	*JA*	*CO*	*GC*	*JM*
Masih and Masih (1996)	0	1	0	0	0	1 (1)	0	1	0	1	0	0
Wolde-Rufael (2005)	0	0	0	1	0	1	1	0	0	0	1	0
Al-Iriani (2006)	0	0	0	1	1	0	1	0	0	0	1	0
Zamani (2007)	0	0	0	1	0	1	0	0	1	0	0	1
Ang (2008)	0	1	0	0	0	1	0	1	0	1	0	0
Narayan and Prasad (2008)	0	0	1	0	0	1 (2)	0	0	1	0	0	1
Ghosh (2009)	0	1	0	0	0	1	0	0	1	0	0	1
Niu et al. (2011)	0	1	0	0	1 (3)	0	0	0	1	0	0	1
Bouoiyour and Selmi (2013)	0	0	0	1	0	1 (4)	0	0	1	0	0	1

Notes : AMC : American countries ; *ASC :* Asian countries ; *EUC* : European countries ; *MENAC* : MENA countries ; *TS :* Time series; *SR* : Short-run analysis ; *LR :* Long-run analysis ; *JA* : Joint analysis (i.e. *SR* and *LR*) *; CO* : Cointegration ; *GC :* Granger causality ; *JM* : Joint methods (i.e. *CO* and *GC*) ; (1) : Indonesia; (2) : Netherlands ; (3) : Developing countries ; (4) : Algeria, Egypt, Saudi Arabia, Tunisia, UAE.

Appendix A3. Neutrality hypothesis

Studies	Countries				Data		Analysis			Methods		
	AMC	*ASC*	*EUC*	*MENAC*	*Panel*	*TS*	*SR*	*LR*	*JA*	*CO*	*GC*	*JM*
Masih and Masih (1996)	0	1	0	0	0	1 (1)	0	1	0	1	0	0
Glasure and Lee (1997)	0	1	0	0	0	1 (2)	0	0	1	0	0	1
Soytas and Sari (2003)	1	1	1	0	0	1	0	0	1	0	0	1
Altinay and Karagol (2005)	0	0	0	1	0	1	1	0	0	0	1	0
Jobert and Karanfil (2007)	0	0	0	1	0	1	1	0	0	0	1	0
Chiou-Wei et al. (2008)	1	1	0	0	0	1 (3)	0	1	0	0	1	0
Karanfil (2008)	0	0	0	1	0	1	1	0	0	0	1	0
Lee and Chang (2005)	0	1	0	0	1	0	1	0	0	1	0	0
Narayan and Parasad (2008)	1	0	1	0	0	1 (4)	0	0	1	0	0	1
Bouoiyour and Selmi (2013)	0	0	0	1	1 (5)	1 (6)	0	0	1	0	0	1

Notes : *AMC* : American countries ; *ASC* : Asian countries ; *EUC* : European countries ; *MENAC* : MENA countries ; *TS :* Time series; *SR :* Short-run analysis *;* *LR* : Long-run analysis ; *JA* : Joint analysis (i.e. *SR* and *LR*) ; *CO* : Cointegration ; *GC :* Granger causality ; *JM :* Joint methods (i.e. *CO* and *GC*) ; (1) : Malysia, Philippines and Singapore ; (2) : South Korea ; (3) : USA, Thailand and South Korea ; (4) : Canada, Mexico and USA ; (5) : Energy exporters ; (6) : Iran and Sudan.

Appendix A4. Feedback hypothesis

Studies	Countries				Data		Analysis			Methods		
	AMC	*ASC*	*EUC*	*MENAC*	*Panel*	*TS*	*SR*	*LR*	*JA*	*CO*	*GC*	*JM*
Masih and Masih (1997)	0	1	0	0	0	1	0	1	0	1	0	0
Asafu-Adjaye (2000)	0	1	0	0	0	1	1	0	0	0	1	0
Glasure (2002)	0	1	0	0	0	1	0	0	1	1	0	0
Hondrioyiannis et al. (2002)	0	0	1	0	0	1	0	1	0	1	0	0
Ghali and El-Sakka (2004)	1	0	0	0	0	1	0	0	1	0	0	1
Paul and Bhattacharya (2004)	0	1	0	0	0	1	0	0	1	0	0	1
Lee (2006)	1	0	1	0	0	1	1	0	0	0	1	0
Mohadevan and Asafu-Adjaye (2007)	0	0	0	1	1	0	0	0	1	0	0	1
Lee et al. (2008)	0	0	1	0	1	0	0	1	0	1	0	0
Erdal et al. (2008)	0	0	0	1	0	1	0	0	1	0	0	1
Al-Mulali (2011)	0	0	0	1	1	0	0	1	0	0	0	1
Belke et al. (2011)	0	0	1	0	1	0	0	0	1	0	0	1
Dobnick (2011)	0	0	1	0	1	0	0	0	1	0	0	1
Ozturk and Acaravci (2011)	0	1	0	1	1	0	0	0	1	0	0	1
Bouoiyour and Selmi (2013)	0	0	0	1	0	1(1)	0	0	1	0	0	1

Notes : *AMC* : American countries ; *ASC* : Asian countries ; *EUC :* European countries ; *MENAC* : MENA countries ; TS : Time series; *SR* : Short-run analysis ; *LR* : Long-run analysis *; JA* : Joint analysis (i.e. *SR* and *LR*) ; *CO* : Cointegration ; *GC :* Granger causality ; *JM :* Joint methods (i.e. *CO* and *GC*) ; (1) : Algeria, Egypt, Saudi Arabia, Tunisia and UAE.