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GOVERNMENT EXPENDITURE AND ECONOMIC GROWTH NEXUS IN MENA COUNTRIES: FREQUENCY DOMAIN SPECTRAL CAUSALITY ANALYSIS

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Abstract. The paper aims at examining the causal relationship between economic growth and government expenditure in selected MENA countries over the period of 1987–2017. Unlike previous studies, we examine the causality in both panel data and time series data to get a clear idea about the causal relationships individually and as a full sample. We also revisited the causal relationship between the two variables within the framework of frequency domain causality. Our findings support the neutrality hypotheses in the short-run term for most of the countries. Thus, economic growth and government expenditure at most frequency levels evolve independently. On the other hand, we found the support of Wagner's law, Keynes view, neutrality and bi-directional hypotheses in the long term.

Keywords: *Economic growth; Government expenditure; Frequency domain spectral causality; Wagner's law; MENA countries.*

JEL Classification: C10; H50; O10

INTRODUCTION

After the Russian revolution in 1917 and the Great Depression in 1929, the relationship between government expenditure and economic growth became a hot debate among economists and policy-makers especially in developing countries (Karhan, 2018). An inspired result from this period is that the government expenditure can be a key determinant for the economic growth, because any changes in government spending size can directly affect the economic growth both in the short run and long run. The German economist Adolph Wagner (1893) was the first who attempted to test the causal relationship between economic growth and government expenditure (published the Foundations of Political Economy, the main idea of this book is that economic growth in any nation enhances the role of government and this is referred to as Wagner's law in the economic literature). It is clear that there is a unidirectional causal relationship running from economic growth to government expenditure not the opposite (Wagner, 1892). However, at the other extreme, according to Keynes's (1936) view (who published the General Theory of Employment, Interest and Money, in which he showed the crucial role of government in stimulating economic growth), the causal relationship is running from government expenditure to economic growth, which means that government expenditure is seen as an exogenous factor (unlike Wagner where government expenditure is an endogenous factor) to impulse economic growth (Ansari, Gordon and Akuamoah, 1997). In other words, according to Keynes's theory it does not matter how the money is spent but with time it will provide income and employment. However, Riedl (2010) suggests that government expenditure stimulates the long-term growth by directing and promoting productivity and employment according to education spending (human capital development), public infrastructure spending and development of institutions (Riedl, 2010).

The economic theory does not give a final decision about the causal relationship between government expenditure and economic growth. We distinguish between two major views in this area. Atkinson and Stiglitz (1980); Slemrod, Gale and Easterly (1995); Tanzi and Zee (1997) and King (2012) suggested that one of the most important economic lessons obtained from World War II was that government expenditure was the most important tool to boost economic growth due to the fiscal policies pursued by the governments around the world during and after the war. Keynes's view is supported by Babatunde (2011), Shahbaz, Khan & Tahir (2013), Chipaumire, Ngirande and Ruswa (2014) and Ebaid and Bahari (2019). On the other hand, the Wagner's view is more supported by researchers such as Musgrave (1969), Al-Faris (2002), Menyah and Wolde-Rafael (2012), Magazzino (2012), Ono (2014), Bayrakdar *et al*. (2015) and many others. During the last decades, many scholars tried to examine the Wagner's view using different methods and proxies for both government expenditure and economic growth. These methods were summarised by Pula and Elshani (2018) as follows.

Equation 1: RGE = f(RGDP); Peacock-Wiseman (1961)
Equation 2: RGCE= f(RGDP); Pryor (1968)
Equation 3: RGE = f(RGDP/N); Goffman (1968)
Equation 4: RGE/N = f(RGDP/N); Gupta (1967), Michas (1975)
Equation 5: RGE/ RGDP = f(RGDP/N); Musgrave (1969)
Equation 6: RGE/RGDP = f(RGDP); Mann (1980)

RGE is the real government expenditure; RGDP is the real GDP; N is population; RGCE is the real government consumption expenditure; RGDP/N is the real GDP per capita; RGE/N is the real government expenditure per capita and RGE/RGDP is the ratio of government expenditure to real GDP.

Akitoby, Clements, Gupta and Inchauste (2006) declared that Wagner's law is held for developed countries, while Keynes's view is held in developing countries. Ram (1986), Dar and Amir Khalkhali (2002) assumed that the relationship between economic growth and government expenditure is a U-curve relationship. Sheehey (1993) showed that while the ratio of government consumption expenditure to GDP was less than 15 %, economic growth and government expenditure had a positive relationship. However, if the ratio was larger than 15 %, the relationship became negative. Hansson and Henrekson (1994) suggested that educational expenditure had a positive effect on economic growth, consumption expenditure had a negative effect while government investment had no effect on GDP. Subsequently, the relationship and causality between economic growth and government expenditure is unclear in the literature. Agell, Lindh and Ohlsson (1997) showed that the reason for this fuzzy relationship was the measurement of government expenditure, the selection of samples and even the specification of econometric models.

Owing to the foregoing, we examine the causal relationship between government expenditure and economic growth in the selected MENA countries as a group and individually for the first time in the Middle East and North Africa region in order to test which view is supported in the case of each country and all the MENA countries in one sample. The present study is novel in three ways. First, we use two kinds of econometric study: the panel data analysis and time series analysis to get a clear idea about the nexus government size and economic growth. Second, our paper differs from the other studies by the use of frequency domain spectral causality depending on Breitung and Candelon (2006) procedure unlike the use of time domain causality depending on Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) procedure (TYDL). Finally, this study decomposes the total spectral interdependence into short-run and long-run periods. We structure the rest of this paper as follows. Section 2 presents the modern literature review; Section 3 focuses on the methodology, data and model of study. Section 4 presents the empirical results inspired from the econometric study, and finally Section 5 concludes the study.

1. LITERATURE REVIEW

There are five possible hypotheses to explain the nexus between economic growth and government expenditure. The first is the Wagner's law hypothesis or economic growth leading to government expenditure, which is the most prevalent in the literature; the Wagner's law hypothesis suggests that an increase in real GDP and productivity in the economy resultantly causes an increase in the government size (the ratio of government expenditure to the total output of the economy). The second is the Keynes's view hypothesis or government spending leading to economic growth; this hypothesis argues that the government spending can stimulate the economic growth both in short-run and long-run terms and any increase in the government size will cause an increase in the total output of economy. The third hypothesis is the bidirectional causal relationship, which suggests that government spending and economic growth lead/ follow each other. The fourth hypothesis is the neutrality (no causal relationship), which suggests that government spending and economic growth neither lead nor follow each other, and the last hypothesis is the U-curve hypothesis. According to Ram (1986) and Armey (1995), there is a non-linear relationship between the two variables, which suggests a positive relationship up to a certain threshold and the negative relationship beyond this threshold. All these hypotheses have been validated in many empirical studies, especially with the causality testing. Table 1 presents a summary of modern studies.

Table 1. Summary of Empirical Studies

Author	**Period**	**Sample**	**Econometric approach**	**Results**
Islam (2001)	1929– 1996	The USA	Co-integration and causality analysis	Wagner's law

Burney (2002)	1969–1995	Kuwait	Co-integration and causality analysis	Wagner's law
Al-Faris (2002)	1970–1997	Gulf countries	Co-integration and causality analysis	Wagner's law
Halicioĝlu (2003)	1960–2000	Turkey	Co-integration and causality analysis	Wagner's law
Abu Bader and Abu Qarn (2003)	1967–1998	3 MENA countries	Co-integration and causality analysis	Bidirectional
Dritsakis and Adamopoulos (2004)	1960–2000	Greece	Granger causality analysis	Keynes's view
Loizides and Vamvoukas (2005)	1960–1995	Ireland, Greece and the UK	Trivariate Granger causality	Keynes's view
Jiranyakul (2013)	1993–2006	Thailand	Granger causality analysis	Keynes's view
Narayan, Prasad and Singh (2008)	1970–2002	Fiji	Co-integration analysis	Wagner's law
Liu, Hsu and Younis (2008)	1974–2002	The USA	Granger causality analysis	Keynes's view
Kalam and Aziz (2009)	1976–2007		Bangladesh	Wagner's law
Abdullah and Maamor (2010)	1970–2007	Malaysia	ARDL bound testing analysis	Wagner's law
Babatunde (2011)	1970–2006	Nigeria	ARDL bound testing, Toda Yamamoto causality analysis	Keynes's view
Fallahi and Shoorkchali (2012)	1961–2008	Greece	Smooth transition regression analysis	U-curve
Salih (2012)	1970–2010	Sudan	Co-integration and causality analysis	Wagner's law
Antoniou, Katrakilidis & Tsaliki (2013)	1833–1938	Greece	ARDL bound testing analysis	Wagner's law
Shahbaz, Khan & Tahir (2013)	1980–2010	Portugal	ARDL bound testing analysis	Keynes's view
Dada and Adewale (2013)	1961–2011	Nigeria	Co-integration analysis	Wagner's law
Asghari, Heidari & Mohseni Zonouzi (2014)	1990–2011	17 developing countries	Panel smooth threshold regression analysis	U-curve
Ele, Okon, Ibok and Brown (2014)	1961–2010	Nigeria	Co-integration and causality analysis	Wagner's law
Ibok and Bassey (2014)	1961–2012	Nigeria	Co-integration and causality analysis	Wagner's law
Ono (2014)	1960–2010	Japan	ARDL bound testing analysis	Wagner's law
Chipaumire, Ngirande & Ruswa (2014)	1990–2010	South Africa	Co-integration analysis	Keynes's view
Bayrakdar *et al*. (2015)	1998–2004	Turkey	Co-integration with regime shift and causality analysis	Wagner's law
Cavicchioli and Pistoresi (2016)	1962–2009	Italy	Co-integration analysis	Wagner's law

Paparas and Stoian (2016)	1995–2015	Romania	Co-integration and causality analysis	Wagner's law
Pula and Elshani (2018)	2004–2016	Kosovo	Co-integration and causality analysis	Keynes's view
Kimaro, Keong and Sea (2017)	2002–2015	25 Sub Saharan African countries	Panel GMM analysis	Keynes's view
Ebaid and Bahari (2019)	1970–2015	Kuwait	Co-integration and causality analysis	Keynes's view

2. DATA, MODEL AND METHODOLOGY

2.1. Data

We employed a balanced panel dataset comprising of nine MENA countries over the period 1987–2017 based on data availability. We proxied economic growth with GDP per capita sourced from the World Bank database (2019), and government expenditure per capita as a proxy for the government expenditure sourced from the World Bank database (2019).

2.2. Model

We use in this paper the Pryor's (1968) version of Wagner's law (Equation 2). This study employs government consumption expenditure per capita as a proxy of government spending and the real GDP per capita as a proxy of economic growth (in natural logarithms form) as in a bivariate vector autoregressive (VAR) model as follows:

$$\ln GEC_t = \beta_0 + \beta_1 \ln GDPC_t + \varepsilon_t; \quad (1)$$

$$\ln GDPC_t = \alpha_0 + \alpha_1 \ln GEC_t + \mu_t, \quad (2)$$

where ln stands for natural logarithms, GEC is the government consumption expenditure per capita; GDPC is GDP per capita; β_0, β_1, α_0 and α_1 are the parameters of the regression and ε_t and μ_t are the white noise for each equation.

2.3. Econometric Methodology

2.3.1. Westerlund Co-integration Panel Test

Westerlund (2007) developed four different co-integration tests that were an extension of Banerjee *et al*. (1998) using the Fisher effect. These tests are based on structural dynamics; all variables should be I(1) series. The four tests (G_a, G_t, P_a and P_t) are based on the error correction model (ECM); the first test G_a and G_t statistics test H_0: $a_i = 0$ for all *i* versus H_1: $a_i < 0$ for at least one o the series, the other tests P_a and P_t statistics test H_0: $a_i = 0$ for all *i* versus H_1: $a_i < 0$ for all cross-section units for the following ECM model (Westerlund, 2007):

$$Dy_{it} = c_i + a_{i1}Dy_{1t-1} + \ldots + a_{ip}Dy_{1t-p} + b_{i0}Dx_{1t} + b_{i1}Dx_{1t-1} + \ldots + b_{ip}Dx_{1t-p} + a_i\left(y_{it-1} - b_1 Dx_{it-1}\right) + \mu_{it} \quad (3)$$

G_t and P_t tests are calculated with the standard errors of a_i by a standard way, while G_a and P_a are based on the Newey and West's (1994) standard errors. These four tests examine whether the co-integration relationship in a panel data is present or not by determining whether ECT (Error Correction Term) is present for all panel individuals or only for some individuals (Westerlund, 2007).

2.3.2. Dumitrescu-Hurlin Causality Panel Test

The general pair of panel Granger causality models is given by:

$$y_{i,t} = \alpha_{0,i} + \alpha_{1,i}y_{i,t-1} + \ldots + \alpha_{l,i}y_{i,t-1} + \beta_{1,i}x_{i,t-1} + \beta_{l,i}x_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

$$x_{i,t} = \alpha_{0,j} + \alpha_{1,j}x_{j,t-1} + \ldots + \alpha_{l,j}x_{j,t-1} + \beta_{1,j}y_{j,t-1} + \beta_{l,j}y_{j,t-1} + \varepsilon_{j,t} \quad (5)$$

Granger causality tests the following hypotheses (Fritsche and Pierdzioch, 2016):

$$\alpha_{0,i} = \alpha_{0,j},\ \alpha_{1,i} = \alpha_{1,j}, \ldots,\ \alpha_{l,i} = \alpha_{l,j},\ \forall\ i, j$$
$$\beta_{1,i} = \beta_{1,j}, \ldots,\ \beta_{l,i} = \beta_{l,j},\ \forall\ i, j.$$

However, the Dumitrescu and Hurlin (2012) tests the causality for these hypotheses:

$$\alpha_{0,i} \neq \alpha_{0,j},\ \alpha_{1,i} \neq \alpha_{1,j}, \ldots,\ \alpha_{l,i} \neq \alpha_{l,j},\ \forall\ i, j;$$
$$\beta_{1,i} \neq \beta_{1,j}, \ldots,\ \beta_{l,i} \neq \beta_{l,j},\ \forall\ i, j.$$

Moreover, the pair of Homogeneous Non-Causality (HNC) null and alternative hypotheses is (Dumitrescu and Hurlin, 2012):

$$H_0:\ \beta_i = 0\ \forall\ i\ \text{with}(\beta_i = \beta_{1,i} = \beta_{1,j} = \ldots = \beta_{l,i} = \beta_{l,j});$$
$$H_1: \begin{cases} \beta i \neq 0 \forall i = 1, \ldots, N1 \\ \beta i \neq 0 \forall i = N1+1, N1+2, \ldots, N \end{cases}.$$

The average statistic $W_{N,T}^{HNC}$ hypotheses can be written as follows:

$$W_{N,T}^{HNC} = \frac{1}{N}\sum_{i=1}^{N} W_{i,t}, \quad (6)$$

where $W_{i,t}$ is the individual Wald statistic values for cross-section units, and the average statistic $W_{N,T}^{HNC}$, which has asymptotic distribution for $T > N$, associated with the null of HNC hypotheses, is defined as follows:

$$Z_{N,T}^{HNC} = \sqrt{\frac{N}{2K}}\left(W_{N,T}^{HNC} - K\right)T, N\ . \quad (7)$$

2.3.3. Frequency Domain Spectral Causality Test

Fritsche and Pierdzioch (2016) used the VMA (Vector Moving Average) of the bivariate VAR model as follows:

$$y_t = \psi(L)\varepsilon_{t,} \tag{8}$$

where ε_t is the white noise distribution; L is the lag operator and ψ(L) is the lag polynomial.

The following vector shows the partitioning of ψ(L) into parts as

$$\psi(\mathrm{L}) = \begin{bmatrix} \psi_{11}(\mathrm{L}) & \psi_{12}(\mathrm{L}) \\ \psi_{21}(\mathrm{L}) & \psi_{22}(\mathrm{L}) \end{bmatrix}. \tag{9}$$

In this case, Geweke (1982) suggests to test the Granger non-causality as a specific frequency ω of the following measure $M_{y1\ \mathrm{cause}\ y2}$ (ω), which can be calculated as follows:

$$\mathrm{M}_{\mathrm{y1\ cause\ y2}}(\omega) = \log\left[1 + \frac{\left|\psi_{12}\left(\mathrm{e}^{-\mathrm{i}\omega}\right)\right|}{\left|\psi_{11}\left(\mathrm{e}^{-\mathrm{i}\omega}\right)\right|}\right], \tag{10}$$

where i is an imaginary number.

The next step is to test if y_1 causes y_2 ($M_{y1\mathrm{cause}\ y2}$) at any frequency ω. We tested the null hypotheses H_0: $M_{y1\mathrm{cause}\ y2}$ (ω) = 0 (Geweke, 1982). Breitung and Candelon (2006) proposed a modified frequency domain causality using the VAR specification as follows:

$$M_t = \omega_1 M_{t-1} + \ldots + \omega_p M_{t-p} + \ldots + \partial_1 N_{t-1} + \partial_p N_{t-p} + \varnothing_t. \tag{11}$$

The new null hypothesis became H_0: *R*(ω)Ω where Ω constitutes a vector of coefficients of *N* and

$$R(\omega) = \begin{bmatrix} \cos(\omega) & cos(2\omega) \ldots \cos(p\omega) \\ \sin(\omega) & sin(2\omega) \ldots \sin(p\omega) \end{bmatrix}. \tag{12}$$

The F-statistic for this equation follows F(2,T-2p) for $\omega \in (0, \pi)$, and it is necessary to note that high frequencies represented the short-run term causality and low frequencies represented the long-run term causality, and as considered by Toda and Phillips (1993) in co-integration systems the definition of the causality of frequency zero is equivalent to the concept of long-run causality (Toda & Phillips, 1993).

3. RESULTS

3.1. Panel Data Analysis

Before applying co-integration and causality panel tests, we must conduct some preliminary tests, including the CSD (Cross-Sectional Dependence) test and the unit root tests.

3.1.1. Cross-sectional Dependence Test

To avoid the transitions of the shocks between the countries in the sample of any panel data it is important to account for a cross-sectional dependence test. To test the CSD in our data we used 4 tests (Breusch Pagan LM test, Pesaran scaled LM test, Bias corrected scaled LM test and Pesaran CD test). The last test is the most important among the four tests proposed by Pesaran (2004), which is based on averaging the pairwise correlation coefficients on the OLS residuals (Ordinary Least squares residuals) from the individual country regressions in the full sample. Table 2 below shows the results of the four tests, and it is clear that the two variables do not suffer from cross-sectional dependence according to the rejection of the alternative hypotheses of cross-sectional dependence, which provides that the shocks in one sample do not affect another country for both variables.

Table 2. Cross-sectional Independence Test Results

Tests	**GEC**		**GDPC**	
	Statistic	**Prob**	**Statistic**	**Prob**
Breusch Pagan LM test	2.105	0.652	2.859	0.712
Pesaran scaled LM test	1.210	0.825	1.278	0.814
Bias corrected scaled LM	2.060	0.670	1.128	0.825
Pesaran CD	0.050	0.760	2.966	0.534
GEC: Government expenditure; GDPC: Economic Growth				

Note: The author's calculations.

3.1.2. Panel Unit Root Test

As the second step of the study we applied five different panel unit root tests (Levin, Lin and Chin (LLC) test, Breitung *t*-stat (BRE) test, Im, Pesaran and Shin W-stat (IPS) test, ADF-Fisher Chi-square (ADF) test and PP-Fisher Chi-square (PP) test). The results are summarised in Table 3. The main result obtained from the Table 3 is that the two variables are I(1), so we can use the Westerlund (2007) test for the long-run relationship.

Table 3. Unit Root Test Results

Tests	GEC		ΔGEC	
	Stat	**Prob**	**Stat**	**Prob**
LLC	−0.523	0.325	−1.619	0.000***
BRE	0.528	0.701	−4.717	0.000***
IPS	−0.134	0.444	−5.180	0.000***
ADF	17.095	0.522	58.866	0.000***
PP	20.669	0.296	108.012	0.000***
Tests	**GDPC**		**ΔGDPC**	
	Stat	**Prob**	**Stat**	**Prob**
LLC	−0.485	0.313	−4.331	0.000***
BRE	0.083	0.533	−3.023	0.001***
IPS	−0.137	0.445	−4.828	0.000***
ADF	17.072	0.518	57.101	0.000***
PP	24.153	0.150	129.983	0.000***
Δ: denotes the first differences; *** the significance at 1, 5 and 10 % significance level.				

Note: the author's calculations.

3.1.3. Co-integration Panel Test

After confirming the absence of cross-sectional dependence and the I(1) series obtained from unit root tests, we proceeded with the co-integration tests. The Westerlund (2007) test has the null hypotheses of no co-integration by inferring whether the error correction term (ECT) in a conditional panel error correction model (ECM) is equal to zero versus the alternative hypotheses depend on the specific test. The G_t and G_a test examine the alternative hypotheses that at least one unit is co-integrated, and the P_t and P_a tests have the alternative hypotheses that the panel is co-integrated as a whole. The results obtained from Table 4 are that there is no long-run relationship among the variables for all statistics either for normal *p*-value or for the robust *p*-value with 1000 repetitions, which means both of alternative hypothesis are rejected at 5 % significance level.

Table 4. Westerlund Co-integration Test Results

Tests	Statistic	*Z*-value	Probability	Robust *p*-value
G_t	−2.747	−1.405	0.080	0.060
G_a	−10.823	0.524	0.700	0.190
P_t	−5.856	0.550	0.709	0.610
P_a	−8.887	0.022	0.509	0.360
***: denotes the significance at 1, 5 and 10 % significance level.				

Note: The author's calculations.

3.1.4. Causality Panel Test

The final step in panel data analysis in this study is the causality test using Dumitrescu and Hurlin (2012) test (DH). The optimal lag length used for the test is determined according to the AIC criterion and the results are presented in Table 5. The results reveal that economic growth homogeneously causes government expenditure at 5 % significance level by a unidirectional causal relationship due to the absence of the causal relationship from government expenditure to economic growth. This result supports the Wagner's law hypothesis in MENA countries as a group over the period 1987–2017 using the government consumption expenditure per capita and the GDP per capita as a proxy of economic growth (Pryor 1968 equation).

Table 5. Dumitrescu Hurlin Causality Test Results

Direction of causality	***W*-bar statistic**	***Z*-bar statistic**	**Prob**
GDPC does not cause GEC	7.290	6.412	0.000
GEC does not cause GDPC	3.233	1.320	0.186

Note: The author's calculations.

3.2. Time Series Analysis

3.2.1. Unit Root Test

As usual, the first step in time series analysis is the unit root test, for this reason we applied the Phillips-Perron test (PP test) for the 3 equations of unit root test with constant, with constant and trend and without constant and trend. The results obtained from Table 6 show that both variables for all the countries are I(1) series. We can apply the Johansen (2002) co-integration for small samples.

Table 6. Unit Root Test Results

Countries	**GEC**			**ΔGEC**		
	1	**2**	**3**	**1**	**2**	**3**
Algeria	−0.157	−2.595	3.306	−4.552***	−4.539***	−4.285***
Egypt	−1.841	−1.950	6.054	−3.289**	−3.425*	−1.789*
Jordan	−2.763*	−2.534	−0.938	−3.820***	−3.826**	−3.791***
Mauritania	−1.384	−1.991	−0.088	−3.238**	−3.287*	−3.300***
Morocco	−0.857	−2.148	0.272	−5.053***	−6.094***	−5.126***
Sudan	0.125	−2.707	1.782	−5.110***	−5.213***	−4.724***
Tunisia	0.006	−2.193	3.655	−4.968***	−4.820***	−3.475***
Iran	−2.367	−2.714	−0.124	−5.056***	−4.937***	−5.159***
Turkey	2.069	−3.356*	5.850	−6.223***	−7.349***	−3.472***
Countries	**GDPC**			**ΔGDPC**		
	1	**2**	**3**	**1**	**2**	**3**
Algeria	−0.027	−2.609	1.231	−3.600***	−3.499***	−1.696*
Egypt	−0.562	−1.771	5.518	−3.209**	−3.441***	−1.629*
Jordan	−1.267	−2.780	-0.036	−2.777*	−3.399**	−2.518**
Mauritania	−0.484	−2.306	1.123	−4.981***	−4.960***	−4.865***
Morocco	−1.157	−1.881	2.758	−4.813***	−4.705***	−4.173***
Sudan	1.280	−4.708***	4.567	−5.763***	−8.716***	−3.504***
Tunisia	−0.677	−1.368	5.199	−4.823***	−4.979***	−2.514**
Iran	−0.353	−2.532	2.771	−5.251***	−5.188***	−4.408***
Turkey	2.008	−2.117	4.323	−5.707***	−8.163***	−4.267***
1: denotes equation with constant; 2: equation with constant and trend; 3: equation without constant and trend; ***: significance at 1, 5 and 10 % significance level						

Note: The author's calculations.

3.2.2. Co-integration Test

Depending on Johansen (2002) co-integration procedure for small samples, according to both normal *p*-values and bootstrapping *p*-values with 1000 repetitions, Table 7 shows that there is no evidence of long-run relationship between the two variables in most countries (except Tunisia and Turkey) with one vector (both the *p*-value and *Rp*-value are less than 0.05), which means the co-integration relationship does not exist in 7 countries.

Table 7. Co-integration Results

Tests	Algeria			Egypt			Jordan		
	Trace	*p*-value	*Rp*-value	trace	*p*-value	*Rp*-value	Trace	*p*-value	*Rp*-value
None	6.844	0.900	0.992	18.814	0.077	0.207	18.255	0.092	0.566
At most 1	2.967	0.595	0.874	7.296	0.114	0.535	2.396	0.701	0.744
Tests	**Mauritania**			**Morocco**			**Sudan**		
	Trace	*p*-value	*Rp*-value	Trace	*p*-value	*Rp*-value	Trace	*p*-value	*Rp*-value
None	10.260	0.620	0.843	26.121	0.006	0.103	22.185	0.025	0.225
At most 1	1.000	0.936	0.990	4.127	0.406	0.655	8.363	0.071	0.382
Tests	**Tunisia**			**Iran**			**Turkey**		
	Trace	*p*-value	*Rp*-value	Trace	*p*-value	*Rp*-value	Trace	*p*-value	*Rp*-value
None	27.289	0.004	0.019	15.351	0.211	0.322	29.743	0.001	0.004
At most 1	6.346	0.171	0.453	5.924	0.204	0.360	7.198	0.119	0.324
p-value denotes the critical value at 5 % significance level; *Rp*-value denotes the bootstrapping *p*-value at 5 % significance level.									

Note: The author's calculations.

3.2.3. Frequency Domain Spectral Causality Test

The final step in this paper was to examine the individual causal relationship between economic growth and government expenditure in frequency domain spectral causality depending on Breitung and Candelon (2006) procedure. The results presented in Appendix indicate that in the short-run term only two countries (Algeria and Morocco) support the Keynes's view hypothesis; this implies a uni-directional causality from government expenditure to economic growth. For the Wagner's law hypothesis (a uni-directional causality from economic growth to government expenditure) we did not find any evidence of any causal relationship in all the countries. For most countries we found no causality between economic growth and government expenditure, hence supporting the neutrality hypothesis in the short-run term. In the long-run term, evidence for the Keynes's view hypothesis was found for three countries (Algeria, Egypt and Iran) and for Wagner's law hypothesis – for two countries (Tunisia and Turkey), bidirectional causality was found for only Morocco, and the remainder (Sudan, Mauritania and Jordan) showed no causality.

Table 8. Causality Test Results

Countries	**Short-run term**	**Long-run term**
Algeria	Keynes's view	Keynes's view
Egypt	Neutrality hypotheses	Keynes's view
Jordan	Neutrality hypotheses	Neutrality hypotheses
Sudan	Neutrality hypotheses	Neutrality hypotheses
Mauritania	Neutrality hypotheses	Neutrality hypotheses
Morocco	Keynes's view	Bi-directional hypotheses
Tunisia	Neutrality hypotheses	Wagner's law
Iran	Neutrality hypotheses	Keynes's view
Turkey	Neutrality hypotheses	Wagner's law

Note: The author's calculations.

Overall, our findings supported the neutrality hypotheses in the short-run term, suggesting that government expenditure and economic growth were independent, but in the long-run term, our findings supported Keynes's view for three countries and Wagner's law for two countries, bi-directional causality only for Morocco and the neutrality hypotheses were proved for three countries. Table 8 summarises these results.

4. CONCLUDING REMARKS

The main objective of this research was to examine the causal relationship between economic growth and government expenditure in 9 MENA countries based on data availability over the period of 1987–2017 using both the time series analysis and panel data analysis to get a clear idea about the causal relationship individually for each country and for the full sample. Previous studies used a time domain approach which did not allow for the distinction between time periods (short-run and long-run terms). In this study, we employed the frequency domain spectral causality test depending on Breitung and Candelon (2006) procedure, which allowed testing the causality in varying time periods in one test. We also employed the recent test for co-integration in panel data (Westerlund (2007) procedure) and the modern causality test in panel data (Dumitrescu and Hurlin (2012) test). Our results showed that there was no causal relationship between economic growth and government expenditure in the short-run term except for Algeria and Morocco (Keynes's view). We found evidence for the Keynes's view, Wagner's law and bi-directional hypotheses for three, two and one countries, respectively, but for the panel data causality we found support of Wagner's law hypothesis for the full sample. The outcomes of this study are very important for policy-makers and governments in MENA countries. We recommend that the governments in Algeria, Egypt and Iran should focus on government expenditure as an exogenous factor to impulse the economic growth in the long-run term; on the other hand, the governments in Tunisia and Turkey should focus on the economic growth as an exogenous factor to increase the size of government expenditure.

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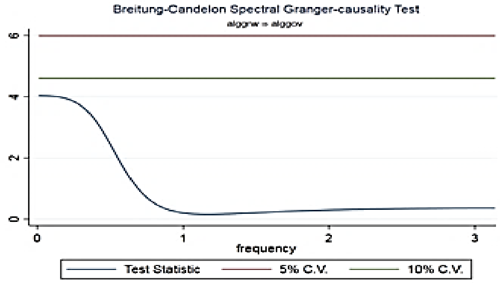
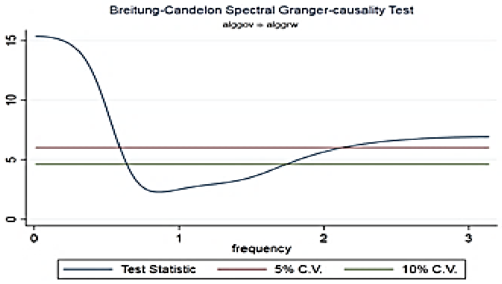
APPENDIX

Algeria





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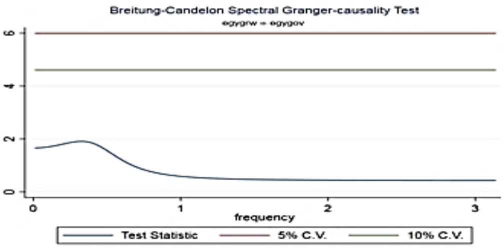

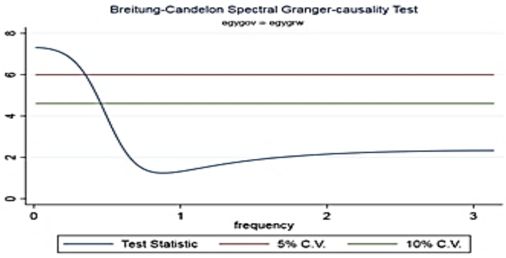

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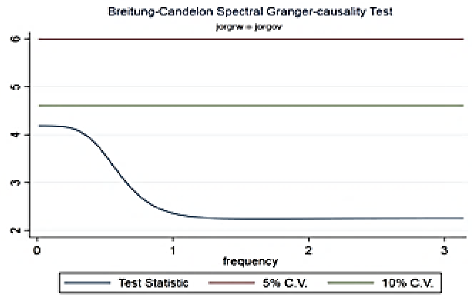

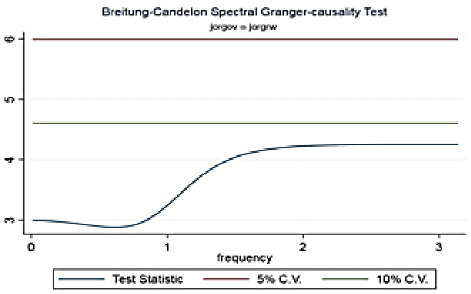

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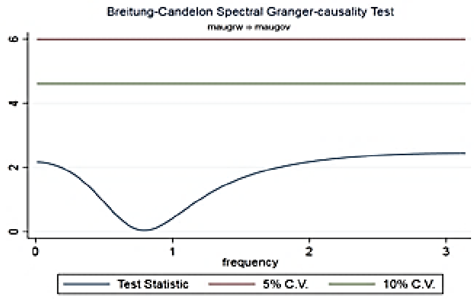

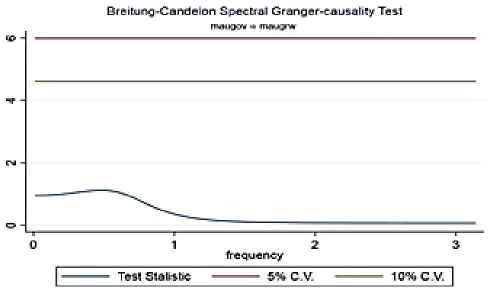

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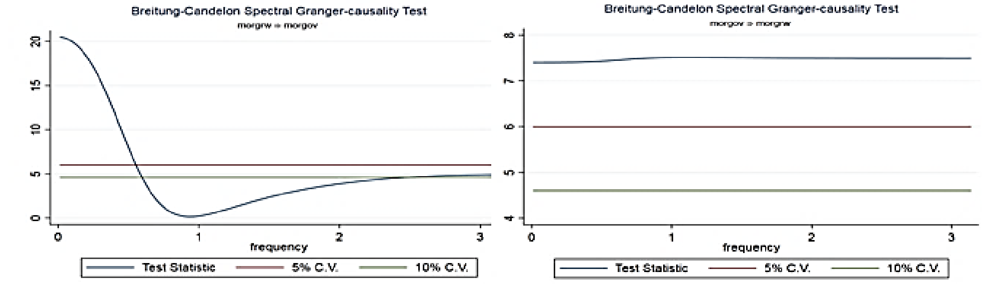
Morocco



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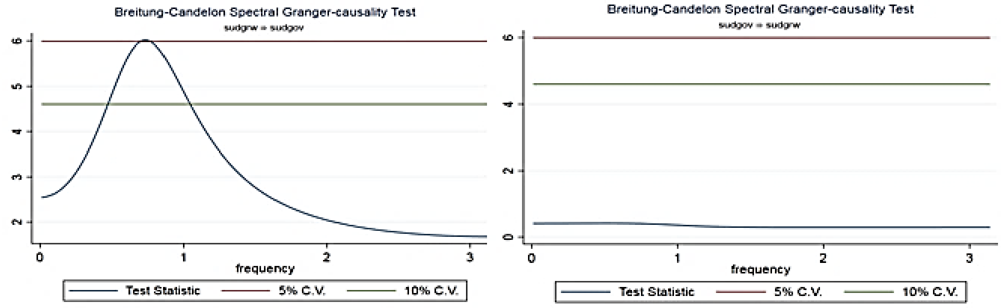
Sudan



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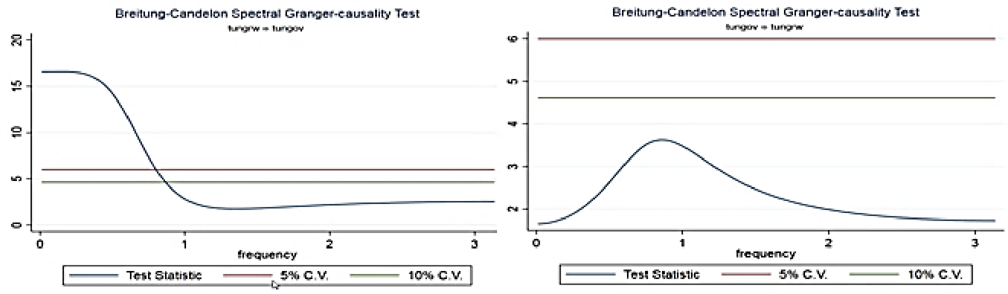

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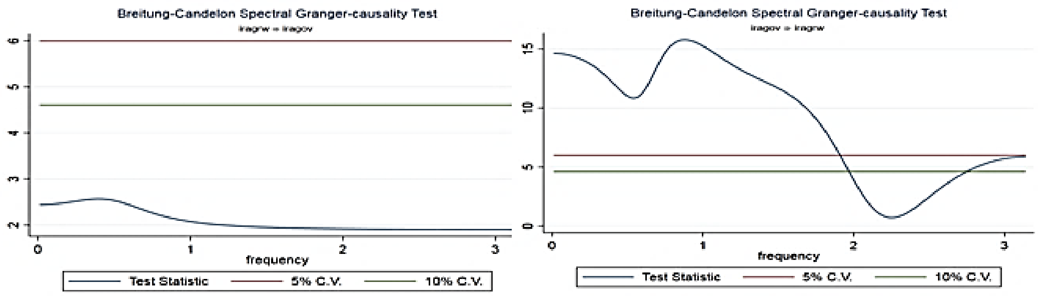
Iran



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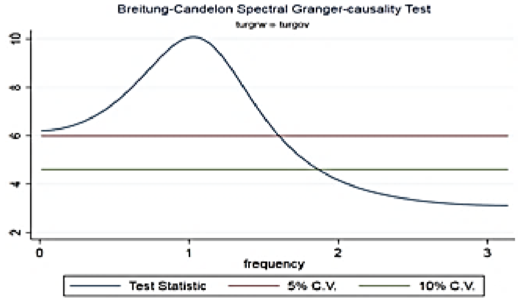

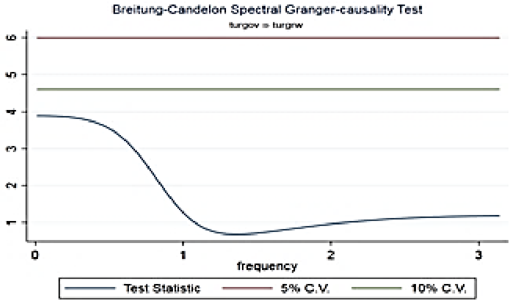

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