The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/2631-3561.htm

Received 8 January 2020
Revised 30 April 2020
8 September 2020
Accepted 14 September 2020

The validity of Wagner's law in Egypt from 1960–2018

Noha Hesham Ghazy and Hebatallah Ghoneim
Department of Economics, German University in Cairo, Cairo, Egypt, and
Dimitrios Paparas
Land, Farm and Agribusiness Management Department, Harper Adams University College, Newport, UK

Abstract

Purpose – One of the main theories regarding the relationship between government expenditure and gross domestic product (GDP) is Wagner's law. This law was developed in the late-19th century by Adolph Wagner (1835–1917), a prominent German economist, and depicts that an increase in government expenditure is a feature often associated with progressive states. This paper aims to examine the validity of Wagner's law in Egypt for 1960–2018. The relationship between real government expenditure and real GDP is tested using three versions of Wagner's law.

Design/methodology/approach – To test the validity of Wagner in Egypt, law time-series analysis is used. The methodology used in this paper is: unit-root tests for stationarity, Johansen cointegration approach, error-correction model and Granger causality.

Findings – The results provide strong evidence of long-term relationship between GDP and government expenditure. Moreover, the causal relationship is found to be bi-directional. Hence, this study provides support for Wagner's law in the examined context.

Research limitations/implications – It should be noted, however, that there are some limitations to this study. For instance, in this paper, the government's size was measured through government consumption expenditure rather than government expenditure due to data availability, which does not fully capture the government size. Moreover, the data available was limited and does not fully cover the earliest stages of industrialization and urbanization for Egypt. Furthermore, although time-series analysis provides a more contextualized results and conclusions, the obtained conclusions suffer from their limited generalizability.

Originality/value – This paper aims to specifically make a contribution to the empirical literature for Wagner's law, by testing the Egyptian data using time-series econometric techniques for the longest time period examined so far, which is 1960–2018.

Keywords Wagner's law, GDP, Government expenditure, Time-series analysis, Egypt

Paper type Research paper

1. Introduction

While Egypt was suffering from a large fiscal imbalance that amounted to 12% of the GDP in 2016/2017 (Downie, 2017), the level of government expenditure simultaneously

JEL classification – C22, E60, H50, O4

Review of Economics and Political Science
Vol. 6 No. 2, 2021
pp. 98-117
Emerald Publishing Limited
e-ISSN: 2631-3561
p-ISSN: 2356-9980
DOI 10.1108/REPS-01-2020-0004

constituted an alarming percentage of 34.48% of the gross domestic product (GDP) on average during the five years from 2012–2016 (IMF, 2018). Therefore, it is crucial to understand the relationship between the government expenditure and GDP and examine whether Egypt's high government expenditure is justifiable, through thoroughly understanding the nature and direction of relationship between these two variables.

The relationship between government expenditure and GDP is one of the most controversial topics in the literature of economic growth and has ever been successful in attaining the interest of both political scientists and economists (Abu-Eideh, 2015). Studying the relationship between such macroeconomic variables is of critical importance, especially with policy makers, who need to adequately understand these dynamic variables to be able to design and implement suitable policies (Salih, 2012).

One of the main theories regarding the relationship between government expenditure and GDP is Wagner's law. This law was developed in the late-19th century by Adolph Wagner (1835–1917), a prominent German economist, and depicts that an increase in the government expenditure is a feature often associated with progressive states. This made him the first scholar to suggest a positive relationship between the extent of a country's economic development and the size of public expenditures (Henrekson, 1993), offering a theory that is "explanatory rather than prescriptive in character" (Peacock and Wiseman, 1961: 16). His ideas postulated government expenditure as an endogenous factor that results from economic growth (Ansari *et al.*, 1997). Wagner elaborated his ideas in *Finanzwissenschaft* (Wagner, 1883) and *Grundlegung der politischen Ökonomie* (Wagner, 1893); nevertheless, his work attracted significant attention post-translation to English by Cooke (1958).

Wagner provided propositions why the government's activities tend to increase in the case of progressive economies. This stems from the social progress achieved by a country, which necessitates expanded state activities, and consequently leads to growth in government's expenditures. First, as the economy becomes more complex throughout the processes of urbanization and industrialization, the public sector tends to substitute the private sector. The economy would then need more regulatory bodies that conduct contractual agreements and enforce law and order. Second, as a country develops, the income-elastic expenditures increase. Wagner specifically mentioned education and culture expenditures as part of this category, illustrating that the government would do a more efficient job managing these entities than private enterprises. Third, the technical advancements in the manufacturing industry can be too large for private enterprises to undertake, as they require huge capital investments; hence, such capital would be more effectively managed by the public corporations; this is specially the case with natural monopolies (Henrekson, 1993). Another major theory was developed by Keynes (1936), who believed that government expenditure is an exogenous factor that can be manipulated by the government to stimulate the economy (Magazzino *et al.*, 2015). Thereby, according to Keynes, government expenditure is an exogenous factor manipulated by the government to influence the level of national income (Ansari *et al.*, 1997).

Egypt is a country that fulfils many of the assumptions postulated by Wagner, which makes it a suitable country for analyzing his law. Wagner stipulates that the increase in urbanization and population density are factors that necessitate an expansion in government expenditure due to an increasing need for regulation (Richter and Paparas, 2013). Egypt experienced urbanization with a large percentage of the population moving to urban cities in the quest of finding better employment opportunities over the years. In the 1950s, one-fifth of the Egyptian population lived in cities, and the number increased to almost one-quarter of the population by 1960 (Abu-Lughod, 1965). In the 1990s, the urbanization slowed down as a consequence of the development of small town and villages into "Urban status," and the migration was mainly circular migration between urban areas and one another rather than migration from rural to urban areas (Abdelhamid, 2004). However, the informal settlements around the major cities can explain their growing population densities, which puts strains on their resources and provides the government with strong incentives to strategically design and implement urban planning programs (Fahmy and Wahba, 2013).

Furthermore, Egypt meets another assumption of Wagner's law having gone through various stages in the industrialization process, some of which occurred in the = period analyzed in this paper 1960–2018. First, industrialization refers to the advancements in the efficiency of the social and economic processes of creating value over time. These more efficient processes are often labeled as the secondary sector or the industrial sector. Meanwhile, the primary sector refers to the more primitive ways of creating value, such as: extraction of raw materials, farming, hunting and fishing; and the tertiary sector refers to the services sector (Simandan, 2009). Privatization slowly took place during the 1990s, and by 2004, 93 public companies were completely privatized, and 110 were only partially privatized. In 2006, the Ministry of Trade and Industry formed the Egypt Industrial Development Strategy (EIDS), through which the government aids in the development of strategies for the different manufacturing sectors (Loewe, 2013). Now, the government is fostering industrial development as an integral part of vision 2030. This is represented in the government's effort to conduct legislative reforms, have industrial clusters, provide assistance to troubled factories, create a green economy, nurture competitiveness and encourage both innovation and scientific research links with industry (MTI, 2017).

In short, testing Wagner's law is relevant to Egypt, as it is a country that fulfills Wagner's criteria for a progressive state and industrialization processes (Hawash, 2007). Therefore, this paper aims to specifically make a contribution to the empirical literature for Wagner's law, by testing the Egyptian data using time-series econometric techniques for the longest period examined so far, which is 1960–2018.

The remainder of this paper is organized as follows. Section 2 presents the different versions of Wagner's law as well as a review on previous empirical literature. Section 3 describes the data used for the paper and briefly explains the methodology. Section 4 discusses the results (covering unit-root tests, unit-root tests with structural breaks, Johansen cointegration, error-correction model and Granger causality). This section also provides a discussion of the results. Section 5 provides the conclusions of the paper, some policy implications and future research ideas.

2. Wagner's law and empirical background

According to Dutt and Ghosh (1997), Wagner did not provide an unambiguous mathematical formulation to his law. Therefore, his law was tested by different researchers in a number of different forms. At least six variants of his law (Peacock and Wiseman, 1961; Gupta, 1967; Goffman, 1968; Pryor, 1969; Musgrave, 1969; Mann, 1980) have been investigated in empirical studies. These six versions can be presented as following (Table 1).

G is the real government expenditure, ***GDP*** is the real gross domestic product, ***GGDP*** is the real government expenditure expressed as a percentage of the real GDP, ***GP*** is the real government expenditure per capita, ***GC*** is the real government consumption and the ***GDPP*** is the GDP per capita. The ***L*** before the abbreviations denotes that the data are in the logarithmic form.

There is also vast literature exploring Wagner's law in developing countries, such as Narayan *et al.* (2008) tested the validity of Wagner's law in 24 Chinese provinces, subclassifying them into smaller clusters as well. They discovered that more support was found to Wagner's law in the cluster of provinces that were in earlier stages of development, than China as a whole or higher-income provinces. Varelas *et al.* (1998) was another study conducted at a provincial level, examining the data for different regions in Greece in the period 1980–1995. They found strong support to Wagner's law in all of the examined regions. Moreover, the elasticity of government expenditure was greater than one, indicating that the government expenditure grew at a rate higher than GDP growth.

Another study that incorporated additional variables in studying Wagner's law is that of Kyissima *et al.* (2017). This study tested Wagner's law for Tanzania in the period 1996–2014. In their analysis, they wanted to study the long-run relationship between GDP, government expenditure, foreign direct investment (FDI) and gross domestic savings. Their results supported Wagner's law with Granger causality running from GDP to government expenditures. Nevertheless, the Granger causality test suggested that FDI and gross domestic savings exhibited independence from GDP.

As for the studies in the Asian continent, the data for Bangladesh in the period 1973–2012 tested by Rana (2014) supported Wagner's law. The long-term cointegration between GDP and government expenditure was established through Johansen cointegration and further validated through ECM, while the direction of relationship between the two variables in the two tested variants of the law was established to be bi-directional through Granger causality test. Another Asian study is Afzal and Abbas (2010), which tested the validity of Wagner's law for Pakistan in the period 1960–2007. They wanted to further enhance their study by incorporating the fiscal deficit and the population growth, which they used as a proxy for urbanization, as Murthy (1994) suggested that these were relevant variables and disregarding them might lead to omission bias. They divided the time horizon into three periods, and Wagner's law was only supported from 1981–1991, when the fiscal deficit is added but not when the population growth is considered. For all the other periods and forms the law, no support was found. Moreover, when the disaggregated data was considered, the law was not supported.

The Middle East and North Africa (MENA) region countries are particularly known for the dominant role the national governments play in their economies, through allocating resources and contributing to the national output. Moreover, the region is often characterized with high fiscal imbalances and macroeconomics instability (Eken *et al.*, 1997), which signifies the importance of focusing on government expenditures and its relation to economic growth in the Middle East. Respectively, a number of literature are provided, such as Ghali (1997).

Ghali (1997) attempted to examine Wagner's law in the context of Saudi Arabia in the period 1960–1996. He conducted Granger causality technique by using vector autoregressions (VARs) and adopting Musgrave's (1969) version of Wagner's law. He first used aggregated government expenditure data and later disaggregated it into investment

Peacock–Wiseman "traditional" version (1961)	LG = f(LGDP)
Gupta (1967)	LGP = f(LGDPP)
Goffman (1968)	LG = f(LGDPP)
Pryor (1969)	LGC = f(LGDP)
Musgrave (1969)	LGGDP = f(LGDPP)
Mann (1980)	LGGDP = f(LGDP)

Source: Adapted from the work of Demirbas (1999)

Table 1. Six versions of Wagner's law

and consumption expenditures to verify whether the sub-components of government expenditure would yield similar results. He found that the relation consistently ran from GDP to both the aggregated and disaggregated government expenditure, which were represented as a share of GDP, supporting Wagner's law. He then provided a policy recommendation of fiscal consolidation, claiming it will not significantly hinder GDP growth and would help solve the immense budget deficit problem Saudi Arabia was suffering from. Ageli's (2013) results confirmed those of Ghali (1997), as he also found support for Wagner's law in the Saudi Arabian context for the period 1970–2012. Ageli (2013) conducted the cointegration tests using both the real GDP and the non-oil GDP using all six versions of Wagner's law. He found that both the real and non-oil GDP were cointegrated with the different formulations of government expenditure, as used in the different versions of Wagner's law. Moreover, using the error correction model, he found that the relationship between the variables in most of the law's variants was bi-directional, supporting both Wagner and the Keynesian hypothesis similarly.

Magableh *et al.* (2014) also used disaggregated data to test the validity of Wagner's law and found support for Wagner's law depicted in Peacock and Wiseman variant, for the Jordanian data in the period 1980–2013. They classified the government expenditure into real capital expenditure and real current expenditure and found that the real current expenditure exhibited greater responsiveness to changes in economic growth. They added that this strained the government, which needs to quickly raise revenues to keep up with the increasing expenditures, especially in the light of the high budget deficit. Contradicting results were obtained by Al-Fazari (2006) who tested the law for Oman for the period 1971–2002 using both the GDP and growth national product as well as the disaggregated government expenditure – recurrent and investment expenditures – and did not find a causal relationship supporting Wagner's law.

Another support for the law was brought about by Al-Ghalbi (2012) for Iraq in the period 1975–2010, with Mann's (1980) variant of the law tested using Engel–Granger cointegration and Granger causality. He thought that government expenditure was an important topic to study, especially in the case of developing countries where the public sector constitutes a large sector of the economy. These results of Al-Ghalbi (2012) partially agree with an earlier study of Asseery *et al.* (1999) on Iraq for the period 1950–1980. In that study, the same methodology was used, but the government expenditure was disaggregated for more unbiased results. This study demonstrated that although the government expenditure and GDP were cointegrated for both the aggregated and disaggregated data for government expenditure, the Granger causality produced mixed results. When the nominal data was used, unidirectional Granger causality test for all the data supported Wagner's law. However, when the real data is used, most of the disaggregated real data for government expenditure displayed a bi-directional relationship, except for real spending on economic services that ran in a unidirectional way, which is opposite to that proposed by Wagner.

Salih's (2012) study conclusively supported Wagner's law in the Sudanese context from 1970-2010. Another study that exhibited a unidirectional support to Wagner's law is that of Driouche and AbdelKader (2012), which tested Wagner's law for Algeria in 1970–2009, using the autoregressive distributed lag (ARDL) bound test approach. Four of the five examined variants of the law supported Wagner's hypothesis, while no support was provided for the Keynesian hypothesis by the examined data. On the other hand, the study of Abu-Eideh (2015), which tested Wagner's law in the Palestinian context for the period 1994–2013, demonstrated a bi-directional relationship between the variables, supporting both Wagner's law and the Keynesian hypothesis alike. Abu-Eideh explained that these results implicated that the Palestinian government should promote increasing developmental expenditure to fuel GDP growth.

Moreover, Burney (2002) felt that the oil-exporting countries represented an interesting scenario to study Wagner's law, as their GDP per capita puts them in the rich countries category, but their social and industrial indicators resemble that of developing countries. This is why, he tested Wagner's law for Kuwait in the period 1969/1970–1994/1995. He tested the law with 75 different specifications, for which the national income and the government expenditure were reflected through different proxies, and he also included structural breaks. Although there were mixed results, very little support was provided for Wagner's law through cointegration tests.

Egypt has received little attention in the empirical literature regarding the relationship between government expenditure and GDP. Nonetheless, there has been an earlier attempt to examine the relation between government spending and economic growth in Egypt by Abu-Bader and Abu-Qarn (2003) for the period 1975–1998 alongside Israel for the period 1967–1998 and Syria for the period 1973–1993. They examined the aggregated government expenditure and also disaggregated it into civilian and military expenditures. Nonetheless, the examined aggregate variables for Egypt did not have the same order of integration, and consequently, the cointegration tests were not performed for the examined period.

Ahmad and Ahmed (2005) is another study that tested the validity of Wagner's law for Egypt, this time in the context of being a member of the D-8 (Developing 8) countries. They used Musgrave's version of the law to study the time-series data for each of the D-8 countries, namely, Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan and Turkey. For Egypt, they considered the nominal GDP and government consumption expenditure for the period 1973–2003. They found no evidence of cointegration between the examined variables of Egypt for that period. Hence, no support was provided for Wagner's law in the Egyptian context for 1973–2003.

However, both the studies of Abu-Bader and Abu-Qarn (2003) and Ahmad and Ahmed (2005) are outdated studies and do not adequately reflect the current situation with all the dynamic changes that took place and affected the policies and economic situation of Egypt such as the 2011 revolution. Eldemerdash and Ahmed (2019) is another paper that recently published testing Wagner's law as well as Keynesian proposition for the Egyptian economy over the period 1980–2012. Eldemerdash and Ahmed (2019) concluded that government expenditure and GDP follows Wagner's law; nevertheless, it depended only on Mann's version in its analysis. Other studies such as El Husseiny (2019) have come through Wagner law within their scope of exploring the effect of large-sized governments on economic growth; nevertheless, its main concern was to evaluate an optimal size for the government.

Other studies have examined the relation between fiscal policy and economic growth but without checking the validity of Wagner law, such as El Husseiny *et al.* (2013) that proved empirically based on 1981/1982–2011/2012 annual data the total public expenditure, as the share of GDP is positively correlated to economic growth rates in the long run, but negatively correlated to it in the short run. El Husseiny *et al.* (2013) concentrated mainly on the military and civilian components of public expenditure, and it showed that in the long run, the share of the civilian expenditure to GDP is positively and significantly correlated to the economic growth. This paper also demonstrated that the military expenditure to GDP ratio is insignificantly correlated to the long-run economic growth rates.

This is the reason why this paper attempts to examine the validity of Wagner's law with the longest period for which it was examined in the Egyptian context, using data from 1960–2018. Moreover, unlike Ahmad and Ahmed (2005), this paper uses real data, as using nominal data can be biased because the price level changes with the level of income in an economy (Ram, 1987). Also, unlike Eldemerdash and Ahmed (2019), this paper explores five versions of Wagner's law.

3. Data and method

Long-term data is necessary for studying Wagner's law. Therefore, this paper uses real long-term data (Constant 2010 EGP) for general government consumption (GC) expenditure, obtained from the World Bank's World Development Indicators (WDI) database. This indicator incorporates all the government spending for the purchase of goods and services, including the compensation for employees. It also incorporates the majority of the government's defense expenditures. Other indicators obtained for the study are the real GDP (Constant 2010 EGP) and population data, which are also obtained from the World Bank's WDI database. Population data is obtained to compute the government consumption per capita. All the variables are obtained for the period 1960–2018, as it is the period for which the data for all the variables were available.

GC is used due to the lack of availability of long-term data for government expenditure in Egypt, which is necessary for studying Wagner's law, government consumption expenditure is used instead. This makes Pryor (1969) the main version examined in this paper, as it originally uses the government consumption expenditure. Nonetheless, to enhance the analysis, the other versions, namely, Gupta (1967), Goffman (1968), Musgrave (1969) and Mann (1980), are also examined, with government consumption expenditure as a proxy for government expenditure. Peacock and Wiseman's (1961) version is not tested, as it is the same as Pryor version but uses the government expenditure rather than government consumption expenditure; hence, by adopting the proxy of government consumption expenditure, they yield identical results. (Table 2 sums the variables used in each Wagner's law version.)

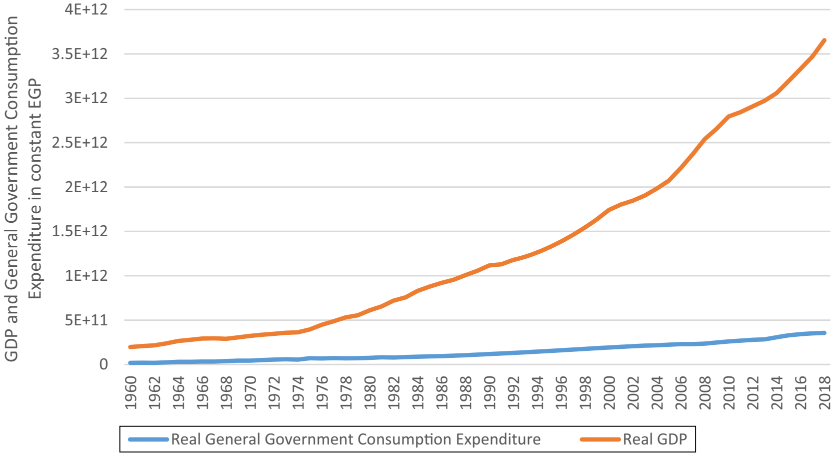
The government has always played an important role in the Egyptian economy; however, the degree of involvement fluctuated over time. In general, the general government consumption expenditure grew by a percentage of 1,867.314% in the period 1960–2018, meanwhile the GDP recorded a growth percentage of 1,757.737% over these 59 years, as demonstrated in Figure 1 (World Bank, 2020).

This paper adopts a quantitative methodology with annual time-series data to test Wagner's law. Time-series data was used for several reasons, e.g. Abu-Eideh (2015: 193) explained that Wagner's law is predominantly a "time-series phenomenon" adding that "inferences made from international cross-sectional studies are irrelevant." Thereby, even though time-series studies have limited generalizability, they tend to be more informative than cross-sectional studies (Kweka and Morrissey, 2000). Moreover, the pooled data estimates provided through cross-sectional studies demonstrate the relationship between the economic growth and size of public expenditure but do not thoroughly reflect the secular trend for each country alone (Yuk, 2005), as they do not consider the country-specific nature of the variables (Ghali, 1997). Afzal and Abbas (2010: 13) added that using cross-sectional data and disregarding the differences in "geography, size, economic conditions, political stability" between the different countries is unrealistic and consequently unreliable.

For this paper, Wagner's law is quantitatively examined through time-series econometric techniques using E-Views 11 statistical package. Time-series econometric analysis was used because traditional regression methods using ordinary least squares are not enough to provide support for Wagner's law, as they fail to provide evidence for the direction of causality between the two variables. When government expenditure is simply regressed on GDP and the relationship is significant, the results do not pinpoint whether this supports

Version of Wagner's law	Year	Dependent variable (Based on Wagner's law)	Independent variable (Based on Wagner's law)	Expected causal relationship	Source of data
Pryor	1969	LGC	LGDP	LGDP → LGC (Wagner's law) LGC → LGDP (Keynesian hypothesis)	World Bank, WDI
Goffman	1967	LG, but LGC is used as proxy	LGDPP	LGDPP → LGC (Wagner's law) LGC → LGDPP (Keynesian hypothesis)	
Gupta	1968	LGP, but LGCP is used as proxy	LGDPP	LGDPP → LGCP (Wagner's law) LGCP → LGDPP (Keynesian hypothesis)	
Musgrave	1969	LGGDP, but LGCGDP is used as proxy	LGDPP	LGDPP → LGCGDP (Wagner's law) LGCGDP → LGDPP (Keynesian hypothesis)	
Mann	1980	LGGDP, but LGCGDP is used as proxy	LGDP	LGDP → LGCGDP (Wagner's law) LGCGDP → LGDP (Keynesian hypothesis)	

Table 2. Variables used to test Wagner's law



Source: World Bank, WDI (2020)

Figure 1. Real GDP and government consumption expenditure 1960–2018

Wagner's law, the Keynesian hypothesis or both when there is a bi-directional causal relationship (Yuk, 2005).

4. Results and discussion

4.1 Unit-root tests

In time-series analysis, checking variables stationarity is a very important and affects the feasibility of further testing and estimation techniques. Table 3 shows the results of the unit-root test conducted using augmented Dickey–Fuller (ADF) test with trend and intercept for the period 1960–2018 in Egypt.

It is shown in Table 3 that at level (without differencing), the null hypothesis of the log variables having a unit-root cannot be rejected at a 1, 5 or 10% level of significance for LGC, LGDP, LP, LGDPP and LGCP. However, the null hypothesis of non-stationarity can be rejected only at a 10% level of significance for LGCGDP. Meanwhile, when the first difference of the variables is obtained, the null hypothesis of non-stationarity can be rejected at 5% level of significance for LGC, LGDP, LP, LGCGDP, LGDPP and LGCP. This illustrates that all the log variables are stationary when differenced once or are integrated of order one I(1).

4.2 Unit-root test with structural breaks

According to Perron (1989), exogenous shocks could have a permanent impact on the mean of economic variables. Hence, it is crucial to test for unit roots with structural breaks, because if structural breaks are not detected, the unit-root tests are falsely biased toward not rejecting the null hypothesis of non-stationarity (Harris, 1995). In this paper, Zivot and Andrews (1992) test is used to examine the null hypothesis of whether a series has a unit root with the consideration of a structural break $T_{b,}$ this is done for the data of Egypt for the period 1960–2018.

Table 4 demonstrates the results of the unit-root tests with structural break, which verify the results obtained through the unit-root tests. All the variables are stationary when differenced or integrated of order one I(1), except for LGCGDP which is stationary at levels or integrated of order zero I(0) at only 10% level of significance in the standard unit-root test but is significant at level at a 1% significance level in the unit-root tests with structural break. Moreover, by selecting the break date, the null hypothesis of non-stationary at difference is rejected at a 1% level of significance for all the variables, except for LP which is only significant at 5%. Therefore, the cointegration tests can be undertaken because the variables have the same order of integration, except for the variants of Wagner's law that

Table 3.
ADF unit-root tests [1]

Variables at level	t(ADF)	p-value	Variables at first difference	t(ADF)	p-value
LGC(1)	−2.913744	0.1661	*DLGC(0)*	−10.11869***	0.0000
LGDP(1)	−1.670099	0.7516	*DLGDP(0)*	−4.635649***	0.0023
LP(4)	0.074494	0.9963	*DLP(10)*	−4.272665***	0.0075
LGCGDP(4)	−3.274044*	0.0816	*DLGCGDP(1)*	−4.571061***	0.0029
LGDPP(1)	−2.076764	0.5473	*DLGDPP(0)*	−4.616827***	0.0025
LGCP(0)	−3.060362	0.1255	*DLGCP(0)*	−10.14214***	0.0000

Notes: ***Indicates rejection of the null hypothesis of the variables having a unit root at a level of significance of 1%; **at a 5% level of significance and *at 10% level of significance use LGCGDP. Hence, for further tests of cointegration, the versions of Musgrave (1969) and Mann (1980) are excluded.

4.3 Johansen cointegration technique

To test if there is a long-term relationship between government consumption expenditure and GDP, Johansen cointegration technique is used. Johansen cointegration test undertakes the estimation with a VAR model examining two main statistics, namely, trace and maximum eigenvalue statistics. The null hypothesis for the former is that there is a maximum number of $n - 1$ cointegrating vectors, while the later tests for the existence of exactly n number of cointegrating vectors as a null hypothesis. From the unit-root test using ADF, it was found that the log variables were all integrated of order one, except for LGCGDP. Johansen cointegration technique is normally used with I(1) variables, as the test is built upon the assumption that the variables used have a unit root or else further restrictions need to be applied (Österholm and Hjalmarsson, 2007), which is why some researchers prefer not to use Johansen cointegration with variables that are not of the same order of integration (Abu-Bader and Abu-Qarn, 2003). Hence, Johansen cointegration is tested in this paper with all the versions of Wagner's law that strictly have I(1) variables. Thus, the versions using LGCGDP that are integrated of order zero I(0), namely the versions of Musgrave and Mann, are not tested.

Thereby, three of the six versions of Wagner's law discussed in Section 2 are tested; these are Pryor, Gupta, Goffman. Data for government expenditure for the period 1960–2018 is not available, and the general government consumption expenditure is used instead, making Pryor version the main version examined in this paper, as it originally uses the government consumption expenditure. However, to enhance the analysis, two other versions are also tested with the government consumption expenditure as a proxy for government expenditure. Peacock and Wiseman version is not tested, as it is the same as Pryor version but uses the government expenditure rather than government consumption expenditure; hence, by adopting the proxy of government consumption expenditure, they yield identical results.

The optimum number lags for the VARs is selected through examining the optimum lag length chosen by the different information criterion. All the information criterion agreed on a lag length of four, except for Schwartz criterion, which suggested an optimum lag length of two for the VARs. Hence, the optimal lag length of four was chosen because it was chosen by the majority of lag order selection information criteria. Therefore, the lag length used to test for cointegration and used in the error-correction model is three, which is equivalent to the lag length of the VAR minus one.

Variables at level	Break date	*t*(ADF)	*p*-value	Variables at first difference	Break date	*t*(ADF)	*p*-value
LGC(9)	1981	−4.224751	0.2448	*DLGC(0)*	1964	−12.01246***	<0.01
LGDP(2)	1979	−4.659291*	0.0860	*DLGDP(2)*	1974	−5.769906***	<0.01
LP(4)	1977	−2.120078	>0.99	*DLP(10)*	2006	−5.184592**	0.0185
LGCGDP(9)	1975	−5.647702***	<0.01	*DLGCGDP(0)*	1975	−9.864715***	<0.01
LGDPP(2)	1979	−4.715145	0.0742	*DLGDPP(2)*	1974	−5.625216***	<0.01
LGCP(9)	1981	−4.372095	0.1782	*DLGCP(0)*	1964	−12.01729***	<0.01

Notes: ***Indicates rejection of the null hypothesis of the variables having a unit root at a level of significance of 1%, **at a 5% level of significance and *at 10% level of significance

Table 4. Structural breaks using Zivot and Andrews test (1992)

As can be seen from the results denoted in Tables 5, 6, 7, both Johansen cointegration rank and maximum eigenvalue tests demonstrate that there is cointegration relationship between real government consumption expenditure and real GDP by rejecting the null hypothesis at a 1% level of significance. This is applicable in the three tested variants of Wagner's law, namely, Pryor Gupta and Goffman, indicating a long-term relationship between the

Hypothesized no. of CE(s)	Eigenvalue	Test statistic	Probability
Johansen cointegration trace statistic			
None *	0.445847	41.70780***	0.0000
At most 1	0.154654	9.240535***	0.0024
Johansen cointegration maximum Eigenvalue statistic			
None *	0.445847	32.46727***	0.0000
At most 1	0.154654	9.240535***	0.0024

Note: The ***in the table of result for Johansen cointegration denotes that the null hypothesis of the existence of no cointegrating vectors is rejected at a 1% level of significance

Table 5. Johansen cointegration test for Pryor's version of Wagner's law

Hypothesized no. of CE(s)	Eigenvalue	Test statistic	Probability
Johansen cointegration trace statistic			
None *	0.416245	38.09317***	0.0000
At most 1	0.143010	8.488086***	0.0036
Johansen cointegration maximum eigenvalue statistic			
None *	0.416245	29.60509***	0.0001
At most 1	0.143010	8.488086***	0.0036

Note: The ***in the table of result for Johansen cointegration denotes that the null hypothesis of the existence of no cointegrating vectors is rejected at a 1% level of significance

Table 6. Johansen cointegration test for Gupta's version of Wagner's law

Hypothesized no. of CE(s)	Eigenvalue	Test statistic	Probability
Johansen cointegration trace statistic			
None *	0.391673	36.77244***	0.0000
At most 1	0.157640	9.435109***	0.0021
Johansen cointegration maximum eigenvalue statistic			
None *	0.391673	27.33733***	0.0003
At most 1	0.157640	9.435109***	0.0021

Note: The ***in the table of result for Johansen cointegration denotes that the null hypothesis of the existence of no cointegrating vectors is rejected at a 1% level of significance

Table 7. Johansen cointegration test for Goffman's version of Wagner's law

examined variables. However, the direction of the relationship is not illustrated by Johansen cointegration techniques.

4.4 Error correction model (ECM) and Granger causality

In the tested versions of Pryor, Gupta and Goffman, the government consumption expenditure is cointegrated with the real GDP and the real GDP per capita; this means that they can be estimated using the error correction model (ECM). The bivariate ECM comprising both real government consumption expenditure and real GDP in their respective forms in each of the versions is used to demonstrate the long-term relationship between the variables, as well as reflect the speed of adjustment of the dependent variable to reach its long-run equilibrium state. The long-run cointegration is validated through vector ECMs, given that the error correction term (ECT) is both negative and significant.

Table 8 shows that all ECTs are negative and significant at 10, 5 and 1%, which suggests cointegration between GDP and government consumption expenditure in their respective forms. According to Pryor's version of Wagner's law, 44% of the deviation of the real government consumption expenditure in its respective form from its long-run equilibrium is corrected annually. Meanwhile, the version of Gupta suggests a speed of adjustment of 49%, and Goffman, a speed of 37%. The three versions of the law indicate a moderate adjustment momentum of returning to the long-term equilibrium.

With LGC as the dependent variable, the cointegration equations, which represent the long-run equilibrium relations between government consumption expenditure and GDP in their respective forms, are reported in Tables A1, A2 and A3 in Appendix, for the versions of Pryor and Goffman, respectively. It can be viewed from the equations that the coefficients for both the LGDP and LGDPP have significant positive signs, which suggests a positive long-run relationship between the two variables in Pryor, Gupta and Goffman's versions of the law supporting Wagner's hypothesis.

The Granger causality test is used to indicate the direction of relationship in the short run. In this paper, it is only tested for the three versions that exhibited cointegration and were estimated using ECMs, namely, Pryor, Gupta and Goffman as Wagner. The Granger causality investigates the causal relationship between the examined variables. The null hypothesis for the test is that a variable X does not Granger cause the other variable Y (Rana, 2014). The results for the Granger causality tests are illustrated in Table 9.

Table 9 demonstrates that the three versions of Wagner's law exhibit a short-run causal relationship between GDP and GC in their respective forms, as the null hypothesis stating the absence of causality between GC and GDP is rejected for both directions at a level of significance of 5 and/or 1%. The results indicate that there is a short-run bi-directional causal relationship, running in both the directions proposed by Wagner's law and the Keynesian hypothesis. This means that the GDP growth Granger causes government consumption expenditure and likewise, government consumption expenditure Granger causes the GDP growth.

Version of wagner's law	ECT	Standard error	*t*-statistic
Pryor	−0.262677	0.04443	−5.91168***
Gupta	−0.257480	0.04859	−5.29915***
Goffman	−0.191077	0.03683	−5.18792***

Note: The ***denotes that the ECT is significant at a 1% level of significance

Table 8. ECT for the VECMs

The results indicate that there is a bi-directional relationship between government consumption expenditure and GDP. The three tested versions of Wagner's law were proved to be cointegrated, and upon further inspection using ECMs, the long-term relationship was found to be of positive nature. Hence, Wagner's hypothesis of existence of long-run relationship running from GDP to government consumption expenditure can be accepted. This provides support to Wagner's propositions that government expenditures increase as an integral part of the development of economies because of the need for an elevated government's administrative role, more government welfare and culture-associated expenditures, such as education expenditures and the inclination of the government to undertake some services that the private sector will be refrained from doing such as substantially large capital investments (Khan, 1990).

It should be noted that many of the studies that have been conducted in countries with similar economic conditions to Egypt yielded similar results to those of this paper. Hence, it is useful to compare the paper results to results of studies done on the MENA region countries, as they are also characterized with the dominant role the national governments play in their economies and their high fiscal imbalances and macroeconomics instability. While this paper produces mixed results, the results are more inclined in favor of accepting Wagner's law. Likewise, the studies of Ghali (1997), Salih (2012), Al-Ghalbi (2012), Magableh *et al.* (2014) and Abu-Eideh (2015) did find support for Wagner's law in the context of Saudi Arabia, Sudan, Iraq, Jordan and Palestine, respectively.

This goes in line with what was propounded by Lamartina and Zghini (2010) regarding the idea that more support to Wagner's law is provided by countries with lower income per capita, as development government expenditures increase in an attempt to catch up with the more developed countries. They came to this conclusion as they tested Wagner's law for panel data of 23 Organization for Economic Co-operation and Development (OECD) countries and found that the relationship between the per capita GDP and government expenditure was stronger in countries with lower per capita income. Most the countries of the MENA region are considered developing countries with low to middle income per capita. And, even though the Gulf countries have higher income per capita, their social and industrial indicators resemble that of developing countries (Burney, 2002). Furthermore, Egypt, more specifically, is considered to be a lower-middle income country with an income per capita figure of US$2,724 in 2016; this is below the average GDP per capita for low- and middle-income countries, which recorded a figure of US$4,384 in the same year

Null hypothesis	F-statistic	*p*-value	Null hypothesis	F-statistic	*p*-value
Pryor					
LGDP does not Granger cause LGC	3.48292**	0.0226	LGC does not Granger cause LGDP	6.12465***	0.0013
Gupta					
LGDPP does not Granger cause LGCP	4.58446***	0.0066	LGCP does not Granger cause LGDPP	3.46393***	0.0231
Goffman					
LGDPP does not Granger cause LGC	4.58359***	0.0066	LGC does not Granger cause LGDPP	3.96372**	0.0131

Notes: **Indicates the rejection of the null hypothesis of the existence of no Granger causation at a level of significance of 5%; ***is at a level of significance of 1%

Table 9.
Granger causality tests

(World Bank, 2017a). The current results of the study also go in line with El Husseiny (2019) who examined the Egyptian government optimal size and showed that the Egyptian economy is near its optimal size, and government spending is one of the determinants of economic growth. El Husseiny (2019) has stressed on the importance of directing expenditure efficiently rather than decreasing government size.

Moreover, the results indicate that when government consumption expenditures increase with the level of economic growth in Egypt as per Wagner's law, this increase in government consumption expenditure also Granger causes GDP to increase. This is inferred from both the Granger causality test, indicating a bi-directional relationship and the positive relationship running in the direction proposed by Keynes, as displayed in the cointgration equations reported in Tables A3 and A4 in Appendix. This, however, goes against the findings of Grier and Tullock (1989) who used continents' aggregated data, and Aschauer (1989), who empirically tested the data of the USA for the period 1949–1985. They both found a negative relationship between government consumption expenditure and GDP and considered the government consumption expenditures to be unproductive. These researchers were, hence, in favor of encouraging government investment expenditures instead.

Nonetheless, it was explained by Landau (1983, p. 784) that "substantial portions of government consumption expenditure are in fact investment in the broader sense, especially education and health care." This applies to Egypt that has been persistently pressured by external agencies such as the International Monetary Fund to reform its energy subsidies and redirect the funds to more important outlets such as the more called for health and education sectors (Sutherland, 2018). And indeed, Egypt has been answering to their advice and have repeatedly undertaken energy subsidies reform programs over the years with the latest "Third Fiscal Consolidation, Sustainable Energy, and Competitiveness Programmatic Development Policy Financing" program with the International Bank for Reconstruction and Development (IBRD), which was approved on the December 05, 2017. This program aims, among other goals, to reduce the energy subsidies percentage of GDP by 3.4% in the period 2017/2018 (World Bank, 2017b). In addition, the Egyptian Minister of Finance has stated that Egypt would increase the percentage of its budget allocated to health and education to comply with the international standards (Ahram Online, 2016).

The long-term relation between GDP and government consumption expenditure always created incentive for developing countries to take loans. This is due to the shortage in saving in comparison to demand of borrowing. Egypt had lately tried to achieve fiscal consolidation through increasing government tax and tariff revenue as well as phasing out emerging subsidy in an attempt to lower budget deficit. Nevertheless, with the COVID-19 economic shock, Egypt had to take further loan to combat the business cycle effect.

Speaking about COVID-19, although this global pandemic stressed the importance of directing resource toward health and education, showing that these two are not only pillars for creating human resources but also acting as a protector from economic shocks, it also raises the importance of expanding expenditure on e-government. Gebba and Zakaria (2015) stated that the lack of awareness, trust and security issues are the challenges why citizens do not prefer e-government in Arab countries. Currently under the fear of catching the virus, citizens would rather take the risk of using e-governments services than the risk of catching the virus. This is a great opportunity for the government to gain citizens' trust and develop better services, as well as train its employees that were afraid of electronic transition, so the pandemic is enforcing the change. The government has also provided a number of services related to issuing documents through post offices to overcome the shortage of IT skills for mass population. The use of post offices should work on improving e-services that would decrease red tape and facilitate exchange of information; however, the success of this approach depends on the government expenditure in developing the post offices' network as well as maintaining the existing offices. This policy would also accelerate growth based on Wagner law implication.

Another expenditure effort worth mentioning is that of the Ministry of Social Solidarity, which used Takaful and Karama program, the first conditional cash transfer program in Egypt, to combat the economic shock coincided with the pandemic. The program is used to offer one-off paid compensation to vulnerable labor, in an attempt to reduce the crisis impact on lower-income families. This stresses that efficient expenditure channels would not only increase the GDP but also work on creating a more inclusive growth.

To sum up, the results of this paper provide evidence for the validity of Wagner's law in the examined period, as demonstrated with the existence of a long-term relation between the GDP and government consumption expenditure. It also suggests such increase in government consumption expenditure does help stimulate the growth of GDP. From these results, a policy recommendation of increasing government consumption expenditure to the detriment of other sorts of expenditures such as energy subsidies can be suggested. However, in doing so, the Egyptian government needs to further investigate which of the components of the government consumption expenditure should be increased to stimulate growth. This is particularly important, especially with the high budget deficit Egypt has, which necessitate it to thoroughly conduct a cost/benefit analysis for any expenditures.

5. Conclusion

In light of the substantial fiscal imbalance in Egypt and the simultaneous large government expenditures, understanding the nature of the relationship between government expenditure and GDP is of significant importance. Hence, this paper aims to contribute to the empirical literature of this topic through examining the validity of Wagner's law in the Egyptian context for the period 1960–2018. Wagner's law was developed by the German economist Adolf Wagner in 1883 and is commonly known as the "law of expanding state activities." The law depicts that an increase in the government expenditure was a feature often associated with progressive countries (Bird, 1971). Egypt represents an interesting case to test this law, as it meets many Wagner's criteria for a progressive economy, having gone through several stages of the industrialization and urbanization processes over the years.

Time-series econometric techniques are used to test the law. First, variables stationarity was tested through unit-root tests and unit-root tests with structural break, the versions of the law for which all the variables had the same order of integration (Pryor, Gupta and Goffman) were examined to see whether the variables were cointegrated (exhibit a co-movement over the long run). Government consumption expenditure and GDP were cointegrated in their alternative forms in the three tested versions of the law, and because the variables were cointegrated in the versions of Pryor Gupta and Goffman, they were estimated using ECMs, which indicated a long-term positive relationship between the variables. Furthermore, the Granger causality tests revealed a bi-directional causal relationship between government consumption expenditure and GDP. Hence, the results provided support to Wagner's hypothesis of expanding state activities in the Egyptian context. It also suggested that an increase in government consumption granger causes GDP to increase. This means that increasing government consumption expenditure helps the economic growth in Egypt, so long as Egypt uses the right expenditure tools.

It should be noted, however, that there are some limitations to this study. For instance, in this paper, the government's size was measured through government consumption expenditure rather than government expenditure due to data availability, which does not fully capture the government size. Moreover, the data available was limited and does not fully cover the earliest stages of industrialization and urbanization for Egypt. Furthermore, although time-series analysis provides a more contextualized results and conclusions, the obtained conclusions suffer from their limited generalizability. Hence, for future research recommendations, a panel data analysis could be conducted for the MENA region countries, as they have similar economic and political environment, and such analysis would produce more generalizable results. In addition, disaggregating the expenditures could provide insights regarding how the different types of expenditures affect the economy, which will provide valuable policy recommendations. Also, further research could be conducted to explore the symmetry of effect of government consumption expenditure on the GDP, which would provide insights for policy makers regarding the use of fiscal policy .

Note

1. The numbers in the parenthesis beside the variables indicate the lag length based on Schwarz information criterion (SIC).

References

Abdelhamid, H. (2014), "Urban change in Cairo", in Marquina, A. (Ed.), *Environmental Challenges in the Mediterranean 2000-2050*, Kluwer Academic Publishers, pp. 331-344.

Abu-Bader, S. and Abu-Qarn, A.S. (2003), "Government expenditures, military spending and economic growth: causality evidence from Egypt, Israel and Syria", *Journal of Policy Modeling*, Vol. 25 Nos 6/7, pp. 567-583.

Abu-Eideh, O.M. (2015), "Causality between government expenditure and GDP growth in Palestine: an econometric analysis of Wagner's", *Law. Journal of Economics and Sustainable Development*, Vol. 6 No. 2, pp. 189-199.

Abu-Lughod, J. (1965), "Urbanization in Egypt: present state and future prospects", *Economic Development and Cultural Change*, Vol. 13 No. 3, pp. 313-343.

Afzal, M. and Abbas, Q. (2010), "Wagner's law in Pakistan: another look", *Journal of Economics and International Finance*, Vol. 2 No. 1, pp. 12-19.

Ageli, M.M. (2013), "Wagner's law in Saudi Arabia 1970-2012: an econometric analysis", *Asian Economic and Financial Review*, Vol. 3 No. 5, pp. 647-659.

Ahmad, N. and Ahmed, F. (2005), "Does government size matter? A case study of D-8 member countries", *Pakistan Economic and Social Review*, Vol. 2, pp. 199-212.

Ahram Online (2016), "Egypt healthcare, education bill to account for 17% of Govt spending in FY16/17. Retrieved on 17 Feb. 2018 from Ahram online website", available at: http://english.ahram.org.eg/NewsContent/3/12/201887/Business/Economy/Egypt-healthcare,-education-bill-to-account-for–o.aspx

Al-Fazari, K.S. (2006), "Fiscal policy and economic performance in Oman during 1970-2003", Doctoral thesis, Durham University.

Al-Ghalbi, K.S.H. (2012), "Government expenditure and test the law of Wagner in Iraq for the period 1975-2010", *Al GHAREE for Economics and Administration Sciences*, Vol. 8 No. 25, pp. 29-52.

Ansari, M.I., Gordon, D.V. and Akuamoah, C. (1997), "Keynes versus Wagner: public expenditure and national income for three African countries", *Applied Economics*, Vol. 29 No. 4, pp. 543-550.

Aschauer, D. (1989), "Is government spending productive?", *Journal of Monetary Economics*, Vol. 23 No. 2, pp. 177-200.

Asseery, A.A., Law, D. and Perdikis, N. (1999), "Wagner's law and public expenditure in Iraq: a test using disaggregated data", *Applied Economics Letters*, Vol. 6 No. 1, pp. 39-44.

Bird, R.M. (1971), "Wagner's law of expanding state activity", *Public Finance*, Vol. 26, pp. 1-26.

Burney, N.A. (2002), "Wagner's hypothesis: evidence from Kuwait using cointegration tests", *Applied Economics*, Vol. 34 No. 1, pp. 49-57.

Cooke, N. (1958), *Three Extracts on Public Finance by Adolph Wagner Translated from German*, London: Macmillan and Co. Ltd.

Downie, A. (2017), "Egypt. Retrieved on 5 Jan. 2018 from African economic outlook website", available at: www.africaneconomicoutlook.org/en/country-notes/egypt

Driouche, D.M. and Abdelkader, N. (2012), "Economic growth and trend of Algerian public spending: some empirical evidences to Wagner's law using ARDL bound test approach", *Economics and Management Review of the Faculty of Economics*, commerce and Management, Tlemcen University, *11*, pp. 1-23.

Dutt, S.D. and Ghosh, D. (1997), "An empirical examination of the public expenditure-economic growth correlations", *Southwest Oklahoma Economic Review*, Vol. 12 No. 4, pp. 14-26.

Eken, S. Helbling, T. and Mazarei, A. (1997), "Fiscal policy and growth in the Middle east and North Africa region", (IMF Working Paper Number WP/97/101) available at: www.imf.org/external/pubs/ft/wp/wp97101.pdf

Eldemerdash, H. and Ahmed, K.I.S. (2019), "Wagner's law vs. Keynesian hypothesis: new evidence from Egypt", *International Journal of Arts and Commerce*, Vol. 8 No. 9, pp. 1-18.

El Husseiny, I.A. (2019), "The optimal size of government in Egypt: an empirical investigation", *The Journal of North African Studies*, Vol. 24 No. 2, pp. 271-299.

El Husseiny, I.A., Al-Sayed, O. and El Sayed, S. (2013), "Does the military public expenditure matter for economic growth? Evidence from Egypt during the period (1981/1982-2011/2012)", *Advances in Management and Applied Economics*, Vol. 3 No. 6, pp. 265-287.

Fahmy, N. and Wahba, K. (2013), "The utilization of system dynamics in concluding policies for greater cairo sustainable development [conference paper]", *System Dynamics*, available at: www.systemdynamics.org/conferences/2013/proceed/papers/P1416.pdf

Gebba, T.R. and Zakaria, M.R. (2015), "E-government in Egypt: an analysis of practices and challenges", *International Journal of Business Research and Development*, Vol. 4 No. 2, pp. 11-25.

Ghali, K.H. (1997), "Government spending and economic growth in Saudi Arabia", *Journal of Economic Development*, Vol. 22 No. 2, pp. 165-172.

Goffman, I.J. (1968), "On the empirical testing of Wagner's law: a technical note", *Public Finance*, Vol. 23, pp. 359-364.

Grier, K. and Tullock, G. (1989), "An empirical analysis of cross-national economic growth 1951-1980", *Journal of Monetary Economics*, Vol. 24 No. 2, pp. 259-276.

Gupta, S.P. (1967), "Public expenditure and economic growth; a time-series analysis", *Public Finance*, Vol. 22, pp. 423-461.

Harris, R.I. (1995), *Using Cointegration Analysis in Econometric Modelling*, Prentice Hall. London.

Hawash, R. (2007), "Industrialization in Egypt: historical development and implications for economic policy", The German University in Cairo working paper No. 1.

Henrekson, M. (1993), "Wagner's law – a spurious relationship?", *Public Finance*, Vol. 48 No. 2, pp. 406-415.

International Monetary Fund (2018), "Database. Retrieved Jan. 17, 2018 from international monetary fund website", available at: http://data.imf.org/regular.aspx?key=61545864

Keynes, J.M. (1936), *The General Theory of Employment, Interest and Money*, London: Macmillan.

Khan, A.H. (1990), "Wagner's 'law' and the developing economy: a time-series evidence from Pakistan", *Indian Econ*, Vol. 38 No. 1, pp. 115-123.

Kweka, J.P. and Morrissey, O. (2000), "Government spending and economic growth in Tanzania, 1965-1996. Centre for research in economic development and international trade", University of Nottingham Research Paper No. 00/6.

Kyissima, K., Kossele, T.P. and Abeid, A. (2017), "Government expenditure and economic growth in Tanzania: a time-series analysis", *International Journal of Development and Economic Sustainability*, Vol. 5 No. 1, pp. 11-22.

Lamartina, S. and Zaghini, A. (2008), "Increasing public expenditures: Wagner's law in OECD countries", Center for Financial Studies Working Papers, Vol. 13.

Landau, D. (1983), "Government expenditure and economic growth: a cross-country study", *Southern Economic Journal*, Vol. 49 No. 3, pp. 783-792.

Loewe, M. (2013), "Industrial policy in Egypt 2004-2011", German Development Institute, Discussion Paper 13/2013, available at: http://edoc.vifapol.de/opus/volltexte/2014/5041/pdf/DP_13.2013.pdf

Magableh, I.K., Sawalha, N. and Elian, M.I. (2014), "Economic output and government expenditures: applicability of Wagner's law in Jordan", *International Journal of Economics and Finance*, Vol. 6 No. 12, pp. 244-255.

Magazzino, C., Giolli, L. and Mele, M. (2015), "Wagner's law and peacock and Wiseman's displacement effect in European Union countries: a panel data study", *International Journal of Economics and Financial Issues*, Vol. 5 No. 3, pp. 812-819.

Mann, A.J. (1980), "Wagner's law: an econometric test for Mexico 1926-1976", *National Tax Journal*, Vol. 33, pp. 189-201.

MTI (2017), "Industry and trade development strategy 2016–2020", Ministry of Trade and Industry, available at: www.mti.gov.eg/English/MediaCenter/News/PublishingImages/Pages/2017-Strategy/2017%20Strategy.pdf (accessed 10 December 2017).

Murthy, N.R. (1994), "Wagner's law, spurious in Mexico or misspecification: a reply", *Finances Publiques*, Vol. 49 No. 2, pp. 295-303.

Musgrave, R.A. (1969), *Fiscal Systems*, New Haven: Yale University Press.

Narayan, P.K., Nielsen, I. and Smyth, R. (2008), "Panel data, cointegration, causality and Wagner's law: empirical evidence from Chinese provinces", *China Economic Review*, Vol. 19 No. 2, pp. 297-307.

Österholm, P. and Hjalmarsson, E. (2007), "Testing for cointegration using the Johansen methodology when variables are near-integrated", International Monetary Fund Working Paper number: WP/07/141.

Peacock, A.T. and Wiseman, J. (1961), "Determinants of government expenditure", *In The Growth of Public Expenditure in the United Kingdom*, (pp. 12-34). Princeton University Press.

Perron, P. (1989), "The great crash, the oil shock and the unit root hypothesis", *Econometrica*, Vol. 57 No. 6, pp. 1361-1402.

Pryor, F.L. (1969), *Public Expenditures in Communist and Capitalist Nations*, George Allen and Unwin, London.

Ram, R. (1987), "Wagner's hypothesis in time-series and cross section perspectives: evidence from 'real' data for 115 countries", *The Review of Economics and Statistics*, Vol. 69 No. 2, pp. 194-204.

Rana, R.H. (2014), "Government expenditure and economic growth in Bangladesh: an empirical study", *The International Journal of Business and Management*, Vol. 2 No. 10, p. 271.

Richter, C. and Paparas, D. (2013), "The validity of Wagner's law in Greece during the last two centuries", *Applied Economics Quarterly*, Vol. 59 No. 4, pp. 331-360.

Salih, M.A. (2012), "The relationship between economic growth and government expenditure: evidence from Sudan", *International Business Research*, Vol. 5 No. 8, pp. 40-46.

Simandan, D. (2009), "Industrialization", in Kitchin, R. and Thrift, N. (Eds), *International Encyclopedia of Human Geography*, Elsevier, Oxford, Vol. 5, pp. 419-425.

Sutherland, D. (2018), "Egypt Re-Energized: an industry report. Retrieved on 17 Feb. 2018 from the Cairo review website", www.thecairoreview.com/essays/egypt-re-energized-an-industry-report/.

Varelas, E., Agorastos, K. and Kostopoulos, T. (1998), "Regional differences between North and South Greece at the turn of the century", ERSA Conference Paper, available at: www-sre.wu.ac.at/ersa/ersaconfs/ersa98/papers/105.pdf (accessed 5 January 2018).

Wagner, A. (1883), "Three extracts on public finance", in Musgrave R.A. and Peacock (eds) *(1958), Classics in the Theory of Public Finance*, London: Macmillan.

Wagner, A. (1893), *Grundlegung Der Politischen Ökonomie*, Erster Teil. Leipzig: Grundlegung der Volkswirt Schaft.

World Bank (2017a), "Data bank: World development indicators. Retrieved 15 Sept. 2017, from world bank website", http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#

World Bank (2017b), "Third fiscal consolidation, sustainable energy, and competitiveness programmatic development policy financing, report no. 119846-EG. Retrieved 5 Jan. 2018, from world bank website", http://documents.worldbank.org/curated/en/254401512702112528/pdf/EG-P164079-DPF3-Program-Document-Nov-7-11142017.pdf

World Bank (2020), "Data bank: World development indicators. Retrieved 27 April 2020, from world bank website", http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#.

Yuk, W. (2005), "Government size and economic growth: time-series evidence for the United Kingdom", 1830-1993. Econometrics Working Paper EWP0501.

Zivot, E. and Andrews, D. (1992), "Further evidence on the great crash, the oil-price Schock, and the Unit-Root hypothesis", *Journal of Business and Economic Statistics*, Vol. 10 No. 3, pp. 251-270.

Further reading

Demirbas, S. (1999), "Cointegration analysis-causality testing and Wagner's law: the case of Turkey, 1950-1990", *Annual meeting of the European public choice society, Lisbon, (April: 7-10, 1999)*.

Corresponding author
Hebatallah Ghoneim can be contacted at: hebatallah.ghoneim@guc.edu.eg

Appendix: cointegration equations

Table A1. Pryor cointegration equation with LGC as the dependent variable

Cointegration equation	CointEq1
LGC(−1)	1.000000
LGDP(−1)	−0.728495
	(0.03247)
	(−22.4329)
C	−5.329710

Note: The number in the () in the standard error and the number in the [ ] is the *t*-statistic

This is the long-run equilibrium relation. CointEq1 is the cointegration equation that is estimated as LGC(−1) –0.728495 LGDP(−1) –5.329710 = 0. This equation can be re-written as: LGC(−1) = 0.728495 LGDP(−1) + 5.329710.

Table A2. Gupta cointegration equation with LGC as the dependent variable

Cointegration equation	CointEq1
LGCP(−1)	1.000000
LGDPP(−1)	−0.582617
	(0.05263)
	(−11.0708)
C	−1.925071

Note: The number in the () in the standard error and the number in the [ ] is the *t*-statistic

This is the long-run equilibrium relation. CointEq1 is the cointegration equation that is estimated as LGCP(−1) –0.582617 LGDPP(−1) –1.925071 = 0. This equation can be re-written as: LGCP(−1) = 0.582617 LGDPP(−1) + 1.925071

Table A3. Goffman cointegration equation with LGC as the dependent variable

Cointegration equation	CointEq1
LGC(−1)	1.000000
LGDPP(−1)	−1.215195
	(0.07754)
	(−15.6715)
C	−13.53042

Note: The number in the () in the standard error and the number in the [ ] is the *t*-statistic

This is the long-run equilibrium relation. CointEq1 is the cointegration equation that is estimated as LGC(−1) –1.215195 LGDPP(−1) –13.53042 = 0. This equation can be re-written as: LGC(−1) = 1.215195 LGDPP(−1) +13.53042.