Causality between Government Expenditure and GDP in the Libya Economy

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Abstract:

This paper used the recent advances in econometric techniques and examines Wagner Law of long–run relationship between government expenditure and gross domestic product (GDP) for the Libyan economy covering the period 1962-2008. Stationarity and unit roots tests indicate that government expenditure and GDP in our sample are non-stationary in the levels but are first – difference stationary. The cointegration test shows that the long-run relationship between the variables and cointegrated. Then the causality must run from GDP to public expenditure, the results indicate unidirectional causation running from GDP to public expenditure. Thus, our findings seem to support the existence of Wagner low in this study on some variables.

الملخص:

في هذه الورقة تم فحص العلاقة السببية بين الإنفاق الحكومي والناتج المحلي الإجمالي ومدى ملاءمة قانون فاقنير للاقتصاد الليبي وذلك للفترة من 1962–2008. وقد تم في هذه الدراسة اختبار هل البيانات مستقرة أم لا؟ وكذلك تم تحليل التكامل المشترك بين متغيرات الدراسة وأيضاً تم إجراء اختبار السببية.

وقد أظهرت النتائج وجود علاقة في المدى الطويل بين المتغيرات، كما أثبتت هذه الدراسة فاعلية هذا القانون على الاقتصاد الليبي على بعض متغيرات الدراسة.

Key words: government expenditure, GDP, Causality, cointegration.

1- Introduction:

The relationship between government expenditure (TGX) and gross domestic product (GDP) has been subject to research both in the public finance literature and in the literature dealing with macroeconomic modeling. The public growth has been subject for researchers to find out what causes or has effects on it.

Wagner (1883) introduces a model that public expenditures are endogenous to economic development, i.e. growth in the economy also causes public sector expenditures to expand.

Wagner's law and the Keynesian theory present two opposite perceptions in terms of the relationship between public expenditure and growth in community output. According to Wagner's law causality runs from gross domestic product to public expenditure, the Keynesian approach the causality runs from public expenditure to gross domestic product.

In this study, we consider Wagner's model for the case of Libya to analyses whether the date based on the period of 1962-2008 supports Wagner's suggestion or not.

For the purposes of this analysis, this paper classifies these studies into supporting studies, with results that suggest a tendency for government expenditure to increase along with economic development, which is consistent with Wagner's hypothesis. A more detailed review of these studies as follows:

- (Musgrave 1969), examines the course of public expenditure using time series data for the United Kingdom, the United States, and Germany, covering the period from 1890-1960. Over this period, per capita real income and total public expenditures as a percentage of GNP increased sharply in all three countries. His result in this study supports the Wagner's hypothesis.
- (Ram 1986), tests Wagner's hypothesis for 63 developed and developing countries for the period from 1950-1980 he has another study (1987), which covered the same time period but this time for a group of 115 countries. He found limited support for Wagner's hypothesis. The results, in both studies, indicated that while there is support for the proposition in some time-series data, such support is lacking in most cross-sectional estimates.
- (Henrekson 1992), tests Wagner's hypothesis using time series data for the period from 1861-1988 for Sweden. This study used cointegration techniques. Although very few time-series studies have failed to find strong support for Wagner's hypothesis, he claims that previous studies of Wagner's hypothesis suffer from various methodological shortcomings that make their results highly questionable. For example, he shows that these findings are likely to be spurious because they have been performed on non-stationary variables that are not cointegrated. (Henrekson 1992). He applied cointegration analysis to Swedish data on

Wagner's hypothesis. He was unable to find any long-run relationship between public expenditure as a share of GDP and GDP per capita.

- (Murthy 1994), investigates what determines the presence of a long-run link between the share of government expenditure in real GDP and real GDP per capita in the case of the Mexican economy for the period from 1950-1980. The findings show that the share of government in real GDP and real GDP per capita are cointegrated and thus there is a positive long-run relationship between the variables under investigation. However, this study looked only at one part of Wagner's hypothesis, which is the long-run relationship between the two variables, but did not employ the Granger-Causality procedure to determine the direction of this relationship. The Granger-Causality test is an important procedure to determine whether Wagner's hypothesis is suitable or not.
- (Islam 2001), tests Wagner's hypothesis on the relationship between the government sector and development of the economy for the USA using annual time-series data for the period from 1929-1996. The study used econometric techniques such as cointegration and exogeneity to test this relationship. The empirical results found strong support for the hypothesis for the USA, and the results found strong evidence of a long-run equilibrium relationship between per capita real income and the relative size of government.

- (Al-Faris 2002), investigated the relationship between government expenditure and economic growth for the Gulf Cooperation Council (GCC) countries2, using data from the period 1970-1979. This article investigated this relationship empirically within the framework of the Wagner and Keynes hypotheses. He used cointegration and unit root tests for testing Wagner's hypothesis. The analysis gave evidence which supporting Wagner's hypothesis in the majority of these countries.
- (Chang 2002), examines five different versions of Wagner's hypothesis by employing annual time-series data on six countries, three of which are part of the emerging industrialized countries (South Korea, Taiwan and Thailand) and three industrialized countries (USA, Japan and United Kingdom), for the period 1951- 1996. The results of this study supported the existence of a long-run relationship between income and government expenditure for all countries studied with the exception of Thailand.
- (Al-Obaid 2004), investigated the long-run relationship between total government expenditure and real gross domestic product and its direction using time-series data for the period from 1970- 2001 for Saudi Arabia. The findings show that the share of government expenditure in real GDP and real GDP per capita are cointegrated and thus there is a positive long-run relationship between the variables under investigation this confirms the validity of Wagner's hypothesis in the case of the Saudi

Arabian economy during the period under investigation. This study is a very good example of applying the recent econometric methods, the co-integration technique and the Granger-Causality procedure, to detect the long-run relationship between the variables under investigation and to determine the causality that runs from GDP to TGX as Wagner hypothesised. We will apply this in this paper.

- (Yuk 2005), investigated the long-run relationship between economic growth and government spending by examining interactions among GDP. The study used the data for the share of government expenditure to GDP and the share of exports to GDP for the United Kingdom over the period from 1830-1993. The Granger-Causality procedure was used to analyse data in this relationship and the results of the study supported Wagner's hypothesis.
- (Quijano and Garcia 2005), investigated a long-run relationship between government expenditure and real gross domestic product for the Philippines covering the period from 1980-2004 to test Wagner's hypothesis for the Philippines. Their study used Johansen's co-integration and the Granger causality test to analyse the relationship between government spending and economic growth. The results of this study found support for Wagner's hypothesis in the short-run and long-run in the Philippines over this test period.

2- Wagner's Law:

Wagner was writing at a specific time and place; when many scholars in Germany became filled with nationalism and the desire for a strong state to heal the political and economic disorders affecting the German society" (Getzler, 2000). Writing between 1877 and 1893, Adolph Wagner law that as an economy developed, the level of government expenditure would increase. Wagner argued that public expenditure growth is a natural consequence of the growth and development of the economy.

He was the first scholar to recognize the existence of a positive correlation between the level of economic development and the size of the public sector. He hypothesized a functional relationship between the growth of an economy and the growth of government activities such that the government sector grows faster than that of the economy.

Wagner's Law can be interpreted as treating public expenditure as an outcome, or an endogenous factor. Wagner's Law requires the causality to run from gross domestic product (GDP) or GDP per capita to government expenditure in contrast to the Keynesian approach in which causality is seen to run from government expenditure to GDP (Keynes, 1936).

There are at least six versions of this hypothesis, which have been empirically investigated. As (Henrekson 1992) points out, a test of Wagner's hypothesis should focus on the time series behavior of public

expenditure in a country for as long a time period as possible. Therefore, this paper examines whether there is a long-run relationship between government expenditure and GDP, by Wagner's hypothesis, for Libya

Table (1) Six Versions of Wagner's Law with Real GDP

Equation	Functional form	Version
1	$LnTGX = f(LnGDP)$	Peacock-Wiseman [1967]
2	$LnTGXC = f(LnGDP)$	Pryor [1968]
3	$LnTGX = f(LnGDP/POP)$	Goffman [1968]
4	$Ln(TGX/GDP) = f(LnGDP/POP)$	Musgrave [1969]
5	$(LnTGX/GDP) = f(LnGDP/POP)$	Gupta [1967]
6	$(LnGDP/GDP) = f(LnGDP)$	Mann [1980

Notes:
- The symbol "ln" denotes the natural logarithm, • "GDP" stands for Real Gross Domestic Product.
• "TGX" stands for Real Total Government Expenditure,
• "TGXC" stands for Real Total Government Expenditure on Consumption, • "GDP/POP" stands for per capita GDP,
• "TGX/POP" stands for per capita TGX, • "TGX/GDP" stands for the Share of Real Total Government Expenditure in Real Gross Domestic Product,
• "POP" stands for Population.

3- The Econometric Methodology and Statistical Results

3-1 The Methodology:

Our methodology in this study employed: the unit root tests for stationarity, Cointegration test, and Granger causality test we used

annual data for Libya over the period 1962-2008, and investigate the evidence of Wagner's law over this period.

Test Cointegration analysis which has emerged as a recent econometric development, is utilised to examine the long-run relationship equilibrium between integrated time series. Our cointegration analysis using the residual based Engle and Granger. (Brooks, 2008).

The study also uses the Granger causality test to examine the validity of Wagner's hypothesis for Libya. The law hypothesises that the causality runs from gross domestic product (GDP), to the share of total government expenditure (TGX). In this methodology, the paper investigates and examines at least six versions of this law with real (GDP).

3.2 Stationarity and Cointegration Tests:

We use the Augmented Dickey-Fuller (ADF) and (Phillips-Perron 1988) tests to assess the degree of integration of the two series (Ugur and Ramazan, 2003).

In this paper we employ the most widely used methods to test the time series data in our study for unit roots, which are the Augmented Dickey Fuller (ADF) test (Dickey- Fuller 1981) and (Phillips-Perron (PP) test 1988).

In general, if the series of Yt is stationary after differencing (d) times, then (Yt) is integrated of order d, or I(d) where d represents the number of unit roots the series (Yt) contains. This study uses the Augmented Dickey Fuller (ADF) statistic test (Dickey and Fuller, 1981). In general, the tests are derived from OLS estimation of the following:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{i=1}^{n} \beta_i \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

Where Δ is the first difference of the series and n is the number of lags and n (i =1, 2, 3……, n), α_0 is a constant, α_1 and β_i are parameters and ε_t denotes a stochastic error term, Y_t is the relevant time-series. The study will test the null hypotheses as follows:

H0: $\alpha_1 = 0$ H1 $\alpha_1 \neq 0$

We test the null hypothesis that α_1 is zero against the hypothesis that α_1 is less than zero and statistically significant. If $\alpha_1 = 0$, then the series is said to have a unit root and is no stationary. Hence, if the hypothesis, $\alpha_1 = 0$, is rejected for the above equation it can be concluded that the time series does not have a unit root and is integrated of order zero I(0). These tests are carried out for all variables by replacing with the variables under study in both tests (the ADF test and PP test), (Enders, 1995).

The results of the (ADF) unit root test and (PP) test are reported in the tables (2) and (3). In the case of the levels of the six variables, the

t-values on the level obtained from ADF tests are clearly less negative than the critical values and therefore the null hypothesis of a unit root cannot be rejected for each variable used in all of the six versions of Wagner's law.

Table (2) ADF Unit Root Tests

Variables	Level	First Difference	Lag Lengths	Order of Integration
	trend	No trend		
ln GDP	-2.533	-4.604*	1	I(1)
ln GDP/POP	-2.554	-4.710*	1	I(1)
Ln TGX	-2.164	-4.158*	0	I(1)
ln TGXC	-2.138	-3.731*	0	I(1)
Ln TGX/GDP	-2.258	-3.359*	3	I(1)
Ln TGX/POP	-2.157	-2.985*	2	I(1)

All regression estimations and test results are obtained by using Eviews 4 econometric software.
* Significant at 5% level.
Critical value in level at 5% is -2.933.

The results show that the calculated t-values are greater than the critical t-values at the 5% level of significance. This implies that the null hypothesis that the series have unit roots in their first differences are rejected which means that the variables are stationary in their first differences.

Table (3) the (PP) Tests

Variables	Level	First Difference	Lag Lengths	Order of Integration
	trend	No trend		
ln GDP	-3.348	-5.446*	1	I(1)
ln GDP/POP	-3.331	-5.526*	1	I(1)
ln TGX	-1.848	-4.191*	2	I(1)
ln TGXC	-1.604	-3.744*	2	I(1)
ln TGX/GDP	-1.920	-4.929*	1	I(1)
ln TGX/POP	-1.856	-4.155*	2	I(1)

*, indicate significant at 1%.
Critical value in level at 1%, is -3.593

The results show that the null hypothesis of non stationarity cannot be rejected when variables are in levels. However, after taking first differences, all variables become stationary.

3-3 Testing for Cointegration:

A Cointegration test can be applied to determine the existence of a long-run relationship between the variables when the variables are integrated at the same level of integration. The concept of Cointegration was first introduced into econometrics by (Granger 1981) and further developed by (Engle and Granger 1987).The Engle and Granger two-step procedures involve firstly running the following Cointegration regression. To establish the stationarity of the following equation is estimated.

$$TGX_T = \alpha + \beta GDP_t + \varepsilon_t \qquad (2)$$

We found that each of the variables used in all six versions of Wagner's law are I(1) in the real GDP variables. Since all series are integrated of the same order, the series can be tested for the existence of a long-run relationship between them. The result of this test is shown in the table (4).

Table (4) Cointegration-based ADF test)

	Co integrating Regression	β	Residual coefficient	R^2
1	$LnTGX = f(LnGDP)$	1.35 (22.96)	-0.337 (-2.625*)	0.92
2	$LnTGXC = f(LnGDP)$	1.34 (15.13)	-0.077 ((-1.169)	0.85
3	$LnTGX = f(LnGDP/POP)$	1.78 (9.97)	-0.068 (-0.879)	0.70
4	$Ln(TGX/GDP) = f(LnGDP/POP)$	1.35 (9.13)	-0.071 (-1.071)	0.66
5	$(LnTGX/GDP) = f(LnGDP/POP)$	1.38 (13.17)	-0.208 (-1.860 ***)	0.80
6	$(LnGDP/GDP) = f(LnGDP)$	1.06 (24.68)	-0.333 (-2.744 *)	0.93

*, ** and*** indicate significance at 1%, 5% and 10% levels respectively.
Critical values in level at 1%, 5% and 10% are -2.618, -1.948, -1.619 respectively.

The results of the ADF test for the residual series from the six co integrating Wagner's law regressions. We conclude that we must reject the null hypothesis of no Cointegration in three versions of Wagner's law with respect to real GDP because the ADF statistic values are more negative than the critical values at the 1% or 10% levels with the

Peacock-Wiseman version (No.1), the Gupta and Michas version (No.5) and the Mann version (No.6).

The results show evidence that the real total government expenditure and real gross domestic product are subject to an equilibrium relationship in the long run in three versions (1, 5 and 6)

Also, we have another technique which can be used to check for Cointegration using the residual namely the Phillips-Perron unit root test (PP). The results are presented in Table (5), We found results if we compare these results with ADF results indicating that the four versions are co integrated, see Table (5). Two versions show no Cointegration in the PP test. The results indicate that the total government expenditure on consumption and gross domestic product are not subject to an equilibrium relationship in the long run in versions 3 and 4.

Table (5) Cointegration – (based PP test)

No.	Co integrating Regression	β	Residual coefficient	R
1	$LnTGX = f(LnGDP)$	1.35 (22.96)	-0.336 (-3.068*)	0.92
2	$LnTGXC = f(LnGDP)$	1.34 (15.56)	-0.105 (-1.693**)	0.85
3	$LnTGX = f\left(LnGDP/POP\right)$	1.78 (9.97)	-0.078 (-0.854)	0.70
4	$Ln\left(TGX/GDP\right) = f\left(LnGDP/POP\right)$	1.35 (9.13)	-0.072 (-0.883)	0.66
5	$\left(LnTGX/GDP\right) = f\left(LnGDP/POP\right)$	1.38 (13.17)	-0.212 (-2.080*)	0.80
6	$\left(LnGDP/GDP\right) = f(LnGDP)$	1.06 (24.68)	-0.340 (-3.082*)	0.93

*, ** indicate significance at 1%, 10% levels respectively.
Critical values in level at 1%, 5% and 10% are -2.618, -1.948, -1.619 respectively

3-4 Testing for Causality:

Since we applied cointegration tests earlier in chapter six and found evidence of a co integrating relationship in most versions of Wagner's law, it is now possible to apply causality testing.

If the null hypothesis of cointegration between Y_t (government expenditure TGX), and X_t (gross domestic product GDP) cannot be rejected then the standard Granger causality test can be employed to examine the causal relationship between the series using the variables in first differences. The regressions used to examine the causality are.

$$\Delta LnTGX = \alpha_0 + \sum_{i=1}^{m} \beta_i \Delta LnTGX_{t-i} + \sum_{i=1}^{n} \delta_i \Delta LnGDP_{t-i} + u_t \qquad (3)$$

$$\Delta LnGDP = \alpha_0 + \sum_{j=1}^{s} \beta_i \Delta LnGDP_{t-j} + \sum_{j=1}^{r} \delta_j \Delta LnTGX_{t-j} + u_t \qquad (4)$$

Where u_t are white-noise series and m, n and s, r is the maximum number of lags. Equation (3) is used to examine that causality runs from GDP to TGX (Wagner's Law), where equation (4) is used to examine that causality runs from government expenditure to GDP (the Keynesian hypothesis). The results from the standard Granger causality tests for the six versions of Wagner's Law with total real GDP are shown in Table 6.

Table (6) Results of Granger Causality Tests for

version	Hypothesis	lag	P-value	Decision	Conclusion
(1,1)	H_0: ln GDP does not cause ln TGX	1	0.063	Reject H0 at 10%	ln GDP → ln TGX
(1.2)	H_0: ln TGX does not cause ln GDP	1	0.214	Accept H 0	ln TGX ln GDP
(2,1)	H_0: ln GDP does not cause ln TGXC	1	0.060	Reject H0 at 10%	ln GDP → ln TGXC
(2,2)	H_0: ln TGXC does not cause ln GDP	1	0.782	Accept H 0	ln TGXC ln GDP
(3,1)	H_0: ln GDP/POP does not cause ln TGX	1	0.134	Accept H 0	ln GDP/POP ln TGX
(3.2)	H_0: ln TGX does not cause ln GDP/POP	1	0.528	Accept H 0	ln TGX ln GDP/POP
(4,1)	H_0 ln GDP/POP does not cause ln TGX/GDP	4	0.00	Reject H_0 at 5%	ln GDP/POP ln → TGX/GDP
(4,2)	H_0: ln TGX/GDP does not cause ln GDP/POP	4	0.185	Accept H 0	ln TGX/GDP ln GDP/POP
(5,1)	H_0: ln GDP/POP does not cause ln TGX/POP	1	0.052	Reject H0 at 10%	ln GDP/POP ln → TGX/POP
(5,1)	H_0: ln TGX/POP does not cause ln GDP/POP	1	0.960	Accept H 0	ln TGX/POP ln GDP/POP
(6,1)	H_0: ln GDP does not cause ln TGX/GDP	4	0.00	Reject H_0 at 5%	ln GDP ln → TGX/GDP
(6.2)	H_0: ln TGX/GDP does not cause ln GDP	4	0.286	Accept 5%	ln TGX/GDP ln GDP

We using Akaike's Information criterion (AIC) and the Schwarz information criterion (SIC) for the chosen lag lengths.
→ Unidirectional causality

The results show in the table (6) that Granger causality running in one direction, i.e. unidirectional causality, from GDP to government

expenditure in almost variables in this study. This result is consistent with Wagner's law, because he said unidirectional causality would run from GDP to government over the period (1962-2008).

4- Conclusion:

The expansion of government spending is one of the most lasting issues in public economics literature. The main objective of this paper has been to examine the relationship between government expenditure and economic growth in Libya over the period 1962-2008 using modern time series techniques. In this paper, we have examined the validity of Wagner's law for the Libya. The study uses resent advances in time-series analysis to examine the statistical characteristics of both variables. For this purpose, stationarity test indicate that government expenditure and GDP in our sample are non-stationary in the levels but are first-difference stationary.

The study applied co-integration test to all versions of the regression models. The results of co-integration of the six versions of Wagner's law we found cointegrated. It means that there is long-run relationship between government expenditure and GDP in some versions for Libya. The study examines the direction of the causal relationship between the two variables. The results indicate a unidirectional causation running from GDP to TGX. Thus, our findings seem to support the existence of Wagner's law for Libya in four versions.

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