Wagner's Law in Saudi Arabia 1970 - 2012: An Econometric Analysis

Ageli, Mohammed Moosa

King Saud University, Riyadh, Saudi Arabia

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Mohammed Moosa Ageli

Assistant Professor of Economics, King Saud University, Riyadh, Saudi Arabia

ABSTRACT

Our goal in this paper is to explore the validity of Wagner's Law in Saudi Arabia during the period (1970-2012) for real oil GDP and Non-oil GDP. Wagner's Law investigated that fundamental economic growth is validity to the public sector growth. In the previous studies have been tested the six versions of Wagner's law to support the existence of long-run relationship between government expenditure and economic growth. We used a method as a time series econometrics techniques to examine how far Wagner's Law validity can be applied in Saudi economy. The results obtained from the analyses find that the Wagnerian proposition can explain the growth of government in Saudi Arabia, which holds for both the oil and non-oil income cases. The findings also note that the existence of strong causality for all of Wagner's law versions in the long run.

Keywords: Wagner's Law, Co-integration, Error Correction Model (ECM), Augmented Dickey Fuller (ADF), Government Expenditure, Economic Growth, Saudi Arabia

INTRODUCTION

In this paper will being the empirical testing the Wagner's Law in the case of Saudi Arabia. For this econometric time series analysis is utilized, for which annual data from 1970 to 2012 were collected. Thus, an attempt is made to test the relationship between government expenditures and economic growth by initially using Ordinary Least Square (OLS) for both real GDP and real Non-Oil GDP in relations to its impact on growing government and vice-versa.

In addition, as part of the time-series analysis, the stationary properties of the data using the ADF test for real GDP and real Non-Oil GDP and other variables were conducted. The next step in the time-series analysis is to test whether the variables in the six versions of Wagner's Law are co-integrated. Finally, we have used the Error Correction Model (ECM) to discuss the short run adjustment to equilibrium.

The rest of the paper is organized as follows: section one, presents some empirical results of relevant theoretical and empirical literature on the relationship between government expenditure and economic growth. In section two of this paper, the six versions of Wagner's law and their formal expressions presented. Section three, investigates the data and empirical results and analysis by using the identified methods. In addition, section four, presents the results of the analysis by using the time series techniques, while section five, concludes the paper and presents the finding.

SURVEYING THE EMPIRICAL STUDIES ON WAGNER'S LAW

Extensive works have examined the relationship between government expenditure and economic growth for all six versions of Wagner's Law. Early studies, including Abizadeh and Gray (1985), Ram (1987) and Abizadeh and Yousefi (1988), returned mixed results. The findings of these authors' empirical tests regarding the validity of Wagner's Law differed from country to country. Some of this research demonstrated that government expenditure growth was determined by national income growth in developed countries, but not in less developed countries. Recent studies, however, have concentrated on the long-term relationship between government expenditure and national income. Biswal *et al.* (1999) considered the relationship between national income and government expenditure in Canada from 1950 to 1995 using Wagner's Law. Their results supported the model. Furthermore, Lall (1969) examined cross-section data from 1962 to 1964 and found no support for Wagner's Law in 46 developing countries. Ram (1987), who also explored the relationship between government expenditures and GDP in 115 countries during the period 1950–1980, obtained mixed results for Wagner's Law.

In the case of Saudi Arabia, Al-Hakami (2002) explored the empirical-causal relationship between government expenditure and GDP over the period 1965–1996. He used time-series analysis to examine the statistical characteristics of the variables. The co-integration test – by examining the trend and pattern of the causal relationship between the two variables – showed that the two-time series co-integrated. The findings highlighted a causal relationship between GDP to government expenditure. Hence, the result implies that government expenditure in oil states based on GDP is ineffective as a policy tool, which supports Wagner's Law.

Payne and Ewing (1996) employed the error-correction model to determine Granger causality between government expenditure and economic growth, measured by GDP per capita. Their results supported Wagner's Law. Furthermore, Burney (2002) applied Wagner's Law when considering the relationship between government expenditure and economic development in Kuwait. He had available series data from 1969 to 1994, and his findings showed support for Wagner's Law over this period.
Courakis *et al.* (1993), (Ahsan *et al.*, 1996), Chletsos and Kollias (1997), and Kolluri *et al.* (2000) supported this long-term relationship, whereas, Burney (2002) found that the association described by Wagner's Law was not sufficient, accepting instead the Keynesian interpretation. The purpose of this thesis is to test the relationship between government expenditure and economic growth for all the six versions of Wagner's Law in Saudi Arabia, one of the fastest-growing developing countries.

FORMULATING THE VERSIONS OF WAGNER'S LAW FOR SAUDI ARABIA

There are seven versions of Wagner's law; as Wagner's general hypothesis has provided scope for a range of different interpretations in the existing literature. It is possible to identify at least seven of these interpretations: Peacock and Wiseman (1961), Gupta (1967), Goffman (1968), Pryor (1968), Musgrave (1969), and Mann (1980), which are depicted in (Table 1).

Table-1. Six Versions of Wagner's Law with Real GDP

No	Function	Version	Year
1	L(GE) = a + β L(GDP)	Peacock-Wiseman	1961
2	L(GEC) = a + β L(GDP)	Pryor	1968
3	L(GE) = a + β L(GDP / P)	Goffman	1968
4	L(GE/GDP) = a + β L(GDP / P)	Musgrave	1969
5	L(GE/P) = a + β L(GDP / P)	Gupta &Michas	1967 & 1975
6	L(GE/GDP) = a + β L(GDP)	Mann	1980

where:

Table-2. The variables definition

L	Natural logarithm
GE	Total Government Expenditure
GEC	Total Government Expenditure for consumption
GE / GDP	The share of real total Government expenditure in real GDP
GE / P	Total Government Expenditure per capita
GDP	Gross Domestic Product
P	Population

The variables (GDP), (Non-Oil GDP), (GE), and (GEC), are all in real terms (Table 2). The GDP has used to obtain real values of the variables; in addition, the data are examined in per capita terms, and government expenditure is used in the form of ratios to GDP, as required by some versions of Wagner's Law. The study will cover time periods for Saudi Arabia, it will be from 1970 to 2012, the data sources are from the (SAMA), (IMF), and (IFS).

In addition, we will examine the same variables for six versions of Wagner's Law using real non-oil Gross Domestic Product (Non-Oil GDP) instead of Real GDP to find out how real government expenditures affect oil activities compared with non-oil activities. In this study we will focus on testing six versions of Wagner's Law empirically for the relationship between the two independent variables and the other four dependent variables that we mentioned in this study.

METHODOLOGY

Ordinary Least Square (OLS)

The ordinary least square test (OLS) is employed to determine the parameters in the equations. R^2 reflects the regression equation's ability to determine the dependent variable's behaviour. The adjusted R^2 is for the degrees of freedom. We have to use the logarithm model because the parameters of the logarithm model have an explanation as elasticises.

Stationarity and Unit Root Tests

In testing Wagner's Law, the non-stationary property of the series must be considered first. There are many alternative tests available to examine whether the series are stationary or non-stationary. If the variables under investigation are stationary, this means that the variables do not have unit roots, then the series said to be 1(0). If the variables under investigation are non-stationary in its level form but stationary in its first-difference form, which means that the variables do have unit roots, then they are said to be 1(1). In recent years many macroeconomic time series are non-stationary which means that they contain unit roots that cause many econometric problems. To test the validity of Wagner's Law in the case if Saudi Arabia; we used Dickey Fuller (ADF) (1979) method to test the unit root (equation 1).

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{t-i}^{k} \Delta y_{t-i} + \varepsilon_t \qquad (1)$$

Co-integration Test

Co-integration tests used to test the relationship between economic growth and government expenditure. Granger (1980) was the first to propose a connection between non-stationary series and long-run equilibrium. The purpose of conducting co-integration is to explore whether the data exhibit a long-run relationship. Engle and Granger (1987) developed and introduced the theory of co-integration. Johansen (1988), and Johansen and Juselius (1990) presented that the variables under investigate are performed for each version of the Wagner's Law to search for the existence of a long-run equilibrium relationship between the two variables GE and GDP as well as for GE and Non-Oil GDP.

Error Correction Model (ECM)

Engle and Granger (1987) provide such a procedure. The procedure is known as the "Error-Correction Models". The aim of Error-Correction Models is to determine whether co–integration exists between two variables; there must be Granger causality in at least one direction, but the most valuable aspect is that co-integration does not reflect the direction of causality between the variables. The error correction models (ECM) are expected in equation (2) and (3):

$$\Delta Y_t = a_1 + \beta_1 ECT_{t-1} + \sum_{i=1}^{n} \delta_i \Delta Y_{t-1} + \sum_{i=1}^{n} \Omega_i \Delta X_{t-1} + e_t \qquad (2)$$

$$\Delta X_t = a_2 + \beta_2 ECT_{t-1} + \sum_{i=1}^{n} \mu_i \Delta Y_{t-1} + \sum_{i=1}^{n} \epsilon_i \Delta X_{t-1} + e_t \qquad (3)$$

Where: (ECT_{t-1}): The error correction term lagged one period, is equivalent to ($e_t = Y_t - \alpha - \beta X_t$), this represents the disequilibrium residual of a co-integration equation.

EMPIRICAL RESULTS

In this paper, the empirical results introduced strong evidence in support of Wagner's Law in the case of Saudi Arabia. The six most known versions of Wagner's Law in real GDP and non-oil real GDP are respectively depicted by Table 3 and Table 4.

Table-3. Regression Results of the Six Versions of Wagner's Law for (OLS) with Real GDP

Versions	D-Variable	Constant	In-Variable	T-test	Coefficient	R^2
Peacock-Wiseman	L(GE)	-2.836	L (GDP)	19.14	1.1078	0.9016
Pryor	L(GEC)	1.307	L (GDP)	15.39	0.8078	0.8555
Guffman	L(GE)	-3.119	L (GDP/P)	9.08	1.4156	0.6734
Musgrave	L(GE/GDP)	-1.7900	L (GDP/P)	0.36	0.3184	0.3200
Gupta	L(GE/P)	-1.7900	L (GDP/P)	11.58	1.0318	0.7703
Mann	L(GE/GDP)	-2.8366	L (GDP)	1.86	0.10789	0.3791

Table-4. Regression results of the six versions of Wagner's law for (OLS) test - Real Non-Oil GDP

Versions	D-Variable	Constant	In-Variable	T-test	Coefficient	R^2
Peacock-Wiseman	L(GE)	-2.2224	L (Non-Oil GDP)	85.43	1.0936	0.9945
Pryor	L(GEC)	1.8422	L (Non-Oil GDP)	25.62	0.79688	0.9426
Guffman	L(GE)	-4.7016	L (Non-Oil GDP/P)	26.08	1.6529	0.9445
Musgrave	L(GE/Non -Oil GDP)	-2.448	L (Non-Oil GDP/P)	8.40	0.1533	0.6382
Gupta	L(GE/P)	-2.4473	L (Non-Oil GDP/P)	63.19	1.1531	0.7703
Mann	L(GE/Non -Oil GDP)	-2.111	L (Non-Oil GDP)	7.31	0.0936	0.5719

In table 3, the results show that the elasticity of government expenditure with respect to GDP were greater than unity in these four versions, namely Peacock and Wiseman (1961), Pryor (1968), Goffman (1968), and Gupta (1967), and hence the findings in these cases are in accordance with Wagner's Law. The empirical results also indicate that the elasticity coefficient of government expenditure with respect to GDP is inelastic in the case of Musgrave (1969) and Mann (1980) and are statistically significant. Thus, these two versions namely Musgrave (1969) and Mann (1980) which measures the government size as a ratio of GDP found to be less significant, which leads to, poor evidence of supporting Wagner's predictions.

With respect to real non-oil GDP, as in table 4, the results depicts that Peacock and Wiseman, Pryor, Musgrave and Gupta versions support Wagner's Law in the case of Saudi Arabia for the period in question. Regarding the Goffman version, since elasticity is greater than unity, it is also valid in the case of Saudi Arabia. It should, however, be noted that Mann's version does not support Wagner's Law in Saudi Arabia case. In the second section of paper, Unit-root tested for Augmented Dickey-Fuller test (ADF), as summarized in table 5. According to the results, each variable used in all six versions of Wagner's Law in Saudi Arabia for the period 1970–2012 indicates that the series are non-stationary in level but stationary after the first difference.

Table-5. Unit Root Tests for Real GDP and Non-Oil GDP

Variables	ADF (0)	ADF (1)
L(GDP)	-3.44	-2.746
L(GEC)	-3.16	-2.067
L(GE)	-3.09	-2.757
L(GE/GDP)	-3.38	-1.994
L(GE/P)	-3.37	-2.970
L(GDP/P)	-3.44	-2.535
L(GE/Non-oil GDP)	3.32	-2.571
L(Non-Oil GDP)	3.41	-3.291
L(Non-Oil GDP/P)	3.39	-3.894
5% C-Value	-3.49	-1.687

In the next step, the cointegration test is applied to examine a long-run relationship between the variables by using the OLS test, and the results of which are illustrated in Table 6 for real GDP and Table 7 for non-oil real GDP.

Table-6. Cointegration Results for Real GDP in Saudi Arabia, 1970–2012

Versions	Dependent Variables	Coefficient	T-Stat	Probability	R^2	DW
Peacock-Wiseman	LGE	1.034	11.12	0.026	0.932	0.912
Pryor	LGEC	1.157	10.86	0.041	0.863	0.920
Goffman	LGE	1.342	8.15	0.013	0.781	0.793
Musgrave	L(GE/GDP)	0.522	1.21	0.033	0.571	0.824
Gupta	L(GE/P)	1.081	12.01	0.004	0.825	0.844
Mann	(LGE/GDP)	0.287	1.92	0.029	0.497	0.885

Table-7. Cointegration Results for Non-Oil-Real GDP, 1970–2012

Versions	Dependent Variables	Coefficient	T-Stat	Probability	R^2	DW
Peacock-Wiseman	LGE	1.103	50.33	0.008	0.951	0.919
Pryor	LGEC	1.682	19.99	0.076	0.963	0.906
Goffman	LGE	1.571	22.21	0.044	0.932	0.834
Musgrave	L(GE/Non-Oil-GDP)	0.231	6.11	0.082	0.690	0.900
Gupta	L(GE/P)	1.097	42.01	0.012	0.758	0.724
Mann	(LGE/Non-Oil-GDP)	0.104	5.89	0.092	0.683	0.855

Tables 5 and 6 present the cointegration test results for the time-series data 1970–2012 used in this study. They show that there is a long-run relationship between government expenditure (GE) and economic growth (GDP) for real GDP and non-oil real GDP in Saudi Arabia. The variable used in all six versions of Wagner's Law for the period 1970–2012 indicates that the series are non-stationary in level, but stationary after the first difference, which suggests that is I (1). The estimated results given in Tables 5 and 6 can be regarded as reliable in explaining the long-run relationship between government expenditure and economic growth. The real income elasticity for all the versions is greater than zero (i.e. more than one in case of absolute versions and more than zero in case of relative versions for both real GDP and Non-Oil real GDP). This confirms the validity of Wagner's Law in relation to Saudi Arabia in the period in question. In the long-run, one per cent increase in GDP will lead to more than one per cent growth in total government expenditure. The following section tests and reports the findings after the cointegration test for real GDP and non-oil real GDP using Johansen cointegration test.

The existence of a cointegration vector is pointed out by a trace test since the t-test value exceeds the critical value of 5% level of significance. This means that cointegration tests are statistically significant at 5% level of significance for determining the long-run relationship between all variables. Otherwise, there is a long-run equilibrium relationship between real GDP and GE. All versions of Wagner's Law (Peacock and Wiseman, Pryor, Goffman, Musgrave, Gupta and Mann) are tested in this section and it is found that the trace test indicates a level of significance at 5% significance level. At the trace statistic value in Table 8, we can reject the null hypothesis of cointegration in all versions of Wagner's Law because the trace statistic values are greater than the critical value of 5%.

Table-8. Johansen Cointegration Test Results with Real GDP

Versions	Hypothesized No. of CE(s)	Eigen value	Trace Statistic (Long Run)	Critical Value 5%	Prob
Peacock-Wiseman	None	0.29806	22.5771	15.41	0.0000
	At most 1	0.18983	8.4206	3.76	0.0000
Pryor	None	0.28467	19.8538	15.41	0.0016
	At most 1	0.14899	6.4532	3.76	0.0004
Goffman	None	0.28090	21.6521	15.41	0.0000
	At most 1	0.08098	8.1780	3.76	0.0041
Musgrave	None	0.28622	21.7785	15.41	0.0000
	At most 1	0.18721	8.2911	3.76	0.0008
Gupta	None	0.28624	21.7771	15.41	0.0000
	At most 1	0.19021	8.2061	3.76	0.0015
	None	0.29806	22.5771	15.41	0.0000
Mann	At most 1	0.18983	8.4206	3.76	0.0000

The results are definitive evidence that the real total government expenditure (GE) and real GDP are subject to an equilibrium relationship in the long-run.

In the case of non-oil real-GDP, Table 9 shows that there is a long-run equilibrium relationship between non-oil real GDP and government expenditure as found in all versions (Peacock and Wiseman, Pryor, Goffman, Musgrave, Gupta and Mann) of Wagner's Law at 5% levels. Thus, the null hypothesis of cointegration is rejected in all versions with respect to non-oil real GDP because the trace statistics values are greater than the critical value of 5%. Co-integrated relationships exist for all six versions of Wagner's Law with respect to real non-oil GDP in the case of Saudi Arabia, an even stronger result indicating that the real total government expenditure and real non-oil GDP are subject to an equilibrium relationship in the long-run.

Table-9. Johansen Cointegration Test Results with Non-Oil Real-GDP

Versions	Hypothesized No. of CE(s)	Eigen value	Trace Statistic	Critical Value 5%	Prob
Peacock - Wiseman	None	0.26793	21.0726	15.41	0.0000
	At most 1	0.19341	8.5974	3.76	0.0000
Pryor	None	0.24684	18.2635	15.41	0.0000
	At most 1	0.15895	6.9244	3.76	0.0002
Goffman	None	0.33040	17.2814	15.41	0.0000
	At most 1	0.03049	1.2386	3.76	0.0007
Musgrave	None	0.29277	25.0288	15.41	0.0083
	At most 1	0.24370	11.1726	3.76	0.0201
Gupta	None	0.29277	25.0288	15.41	0.0083
	At most 1	0.24370	11.1726	3.76	0.0201
Mann	None	0.26793	21.0729	15.41	0.0026
	At most 1	0.19341	8.5974	3.76	0.0066

The Johansen and Juselius (1990) test reveals a cointegration relationship in all versions. Therefore, Granger-Causality in the framework of the Error Correction Model is applied. For supporting six versions of Wagner's Law versions for real GDP and Non-Oil GDP, causality analysis is considered to apply for testing the directions of the variables in these six versions. Granger causality tests used to confirm the causality direction between the variables. In the long run, we found statistically significant evidence in favour of GDP Granger-causing the share of government expenditures in GDP, which is consistent with Wagner's Law. The result of causality test indicated that the existence of strong feedback causality for all of Wagner's law versions in the long run. In relation to the aims of the research, the analysis showed clear evidence and consistent results across the six versions of Wagner's Law that there is a significant or causal relationship between, government expenditure and GDP in all six versions, in the case of Saudi Arabia. It can be concluded that most variants of Wagner's Law produced positive results for Granger causality testing between economic growth and government expenditure variables. The results in most variants of Wagner's Law are also established for the causality from government expenditures to economic growth. Therefore, in such cases, bi-directional causality is found. The next section extends the analysis into Error Correction Mechanism (ECM) in order reveal the short-run adjustment. Thus, six versions of Wagner's Law have found to hold for both GDP in Table 10 and non-oil-GDP in table 10 in the case of Saudi Arabia.

The results of ECM with real GDP in Table 10 show that there is a bi-directional causality that runs from GDP to GE (Peacock & Wiseman); GDP to GEC (Pryor); GDP/P to GE (Goffman); GDP/P to GE/GDP (Musgrave); GDP/P to GE/P (Gupta); and GDP to GE/GDP (Mann). The products of the process (GE, GEC, GE/GDP, and GE/P) are all statistically significant at the 5% level. Thus, six versions of Wagner's Law are found to be valid in the case of Saudi Arabia. The ECM (EC_{t-1}) shows that the significant results indicate the speed of adjustment to the long-run equilibrium, and reveal the direction of causality, which runs from Economic Growth (GDP) to Government Expenditure (GE).

Table-10. Causality with ECM Test with Real GDP

Versions	Variables	ECT_{t-1}	t-stat
Peacock - Wiseman	L(GE)	-0.32	-2.92
	L(GDP)	0.501	1.19
Pryor	L(GEC)	- 0.57	- 3.62
	L(GDP)	0.50	1.19
Goffman	L(GE)	-0.21	-2.39
	L(GDP/P)	0.51	2.09
Musgrave	L(GE/GDP)	-0.90	-2.28
	L(GDP/P)	0.59	1.38
Gupta	L(GE/P)	-0.31	-2.77
	L(GDP/P)	0.59	1.38
Mann	L(GE/GDP)	-0.82	-2.59
	L(GDP)	0.50	1.19

An attempt was also made to find the ECM test results for non-oil real-GDP. Table 11 shows a bi-directional causality that runs from Non-Oil-GDP to GE (Peacock & Wiseman); non-oil-GDP to GEC (Pryor); non-oil-GDP/P to GE (Goffman); non-oil-GDP/P to GE/ non-oil-GDP (Musgrave); non-oil-GDP/P to GE/P (Gupta); and non-oil-GDP to GE/non-oil-GDP (Mann's Version of Wagner's Law). This product of empirical analysis indicates that the variables used in each of the models GE, GEC, GE/Non-Oil-GDP and GE/P is statistically significant at the 5% level. Thus, in Saudi Arabia, six versions of Wagner's Law are found to hold for non-oil-GDP.

Table-11. Causality with ECM Test with Non-Oil Real GDP

Versions	Variables	ECT_{t-1}	t-stat
Peacock - Wiseman	L(GE)	-0.58	-3.52
	L(Non-Oil GDP)	-0.21	-1.67
Pryor	L(GEC)	-0.03	-0.42
	L(Non-Oil GDP)	0.09	2.95
Goffman	L(GE)	0.05	3.40
	L(Non-Oil GDP/P)	0.04	3.96
Musgrave	L(GE/ Non-Oil GDP)	-0.01	-0.95
	L(Non-Oil GDP/P)	-0.01	-3.69
Gupta	L(GE/P)	-0.00	-3.07
	L(Non-Oil GDP/P)	-0.02	-3.69
Mann	L(GE/ Non-Oil GDP)	-0.38	-3.09
	L(Non-Oil GDP)	-0.21	-1.67

CONTEXTUALISING THE RESULTS

Various studies have aimed to explain and validate Wagner's Law in many countries either through time-series or cross section methods. Wagner (1958) noted, "There is a proportion between public expenditure and national income which may not be permanently overstepped". In our findings, the cointegration results suggest that Wagner's Law holds in Saudi Arabia, and that there is strong feedback causality for all versions. Moreover, the Error Correction Model (ECM) establishes that all six versions of Wagner's Law are found to be significant for both real GDP and non-oil-GDP in the case of Saudi Arabia, implying short-run adjustment process towards long-run equilibrium. From a different perspective, Asutay and Al-Fazari (2007) investigated but provided no evidence for the impact of government spending on GDP in Oman by using time-series data from 1971 to 2002. Their results supported causality between government expenditure and GNP per capita.

Moreover, Abizadeh and Yousefi (1998) used Wagner's Law to examine the effect of government expenditure on economic development in South Korea by modeling the relationship through causality tests. Their research supported Wagner's Law, as it studies. Furthermore, they confirmed the finding of Al-Hakami (2002) in a trivariate model, when GDP was added. However, the results are in contrast with Al-Hakami (2002) and Al-Batel (2002), who, in the case of Saudi Arabia, found that there is a strong feedback causality that runs from government revenues to government expenditure.

CONCLUSION

This paper analyzed empirically the relationship between government expenditure and economic growth. Wagner's Law was examined – six versions that were developed over the years – in the case of Saudi Arabia by using time-series annual data for the period 1970–2012. In the empirical analysis, three distinct time-series techniques were applied to test the six versions of Wagner's Law by using Ordinary Least Square (OLS) for real GDP and non-oil GDP. The unit root tests were utilized using the Augmented Dickey-Fuller for determining the existence of stationary for real GDP and non-oil GDP. The Cointegrating test for real GDP and non-oil GDP was also utilized. Finally, it was considered the Granger causality tests and the Error Correction Model (ECM). The results of the regression analysis – for six versions of Wagner's Law using OLS for real GDP and non-oil real GDP – show that the elasticity coefficient of government expenditure, with respect to GDP, was greater than unity in Peacock and Wiseman (1961), Pryor (1968), Goffman (1968), and Gupta (1967). Thus, the findings in the case of these four versions are in accordance with Wagner's expectation. The empirical results also indicate that the elasticity coefficient of government expenditure, with respect to GDP, is inelastic in the case of Musgrave (1969) and Mann (1980) versions of Wagner's Law, although their independent variable is still statistically significant. Nagarajan and Spears (1990), furthermore, stated that in order to verify Wagner's Law, the income elasticity needs to be $E>1$, i.e. greater than unity, and the ratio income elasticity needs only be $E>0$, i.e. greater than zero. According to this rule, Mann's version of Wagner's Law does not hold in the case of Saudi Arabia.

As regards non-oil real GDP – the independent variable in the versions of Wagner's Law – Peacock and Wiseman provide support for Wagner's Law, whilst Pryor's, Musgrave's and Mann's versions do not hold for Saudi Arabia. In addition, since elasticity is greater than unity in the results of Goffman's model, this version of Wagner's Law is consistent for Saudi Arabia. Moreover, Gupta provides evidence for Wagner's Law in the case of Saudi Arabia; the expected elasticity is higher than a unit, i.e. E>1. Moreover, since the income elasticity needs to be higher than a unity (E > 1), and the ratio income elasticity is expected to be higher than zero (E > 0), Mann's version does not provide evidence for Wagner's Law in Saudi Arabia. In extending the analysis, the unit root test in the form of Augmented Dickey-Fuller is utilized to examine stationary of the time-series of all the variables. The results indicate that the levels of all series are non-stationary, and hence all the variables are cointegrated at first order [I (1)]. The results suggest that there is a co-integrating relationship between government expenditure and GDP per capita, and Wagner's Law holds in the case of Saudi Arabia through the cointegration analysis. Therefore, the equilibrium relationship indicates that the major determinant of government expenditure in Saudi Arabia, in the long run, is national income.

The econometric analysis further employs the Granger causality test in order to verify the causality and its direction between the variables. The results demonstrate statistically significant evidence in favor of per capita GDP for the long-run relationship. In addition, it is found that Granger-causing the share of government expenditure in GDP. This finding is consistent with the expectation of Wagner's Law. Thus, the result of the causality test indicates the existence of strong feedback causality for all versions of Wagner's Law in the long run. Lastly, by using the Error Correction Model (ECM), it is established that all the six versions of Wagner's Law are significant for both real GDP and non-oil-GDP in the case of Saudi Arabia. This suggests a short-run adjustment process towards long-run equilibrium.

REFERENCES

Abizadeh, S. and J. Gray, 1985. Wagner's law: A pooled time series, cross- section comparison. National Tax Journal (38): 209-218.

Abizadeh, S. and M. Yousefi, 1988. An empirical re-examination of wagner's law. Economic Letters (29): 169-173.

Abizadeh, S. and M. Yousefi, 1998. An empirical analysis of south korea's economic development and public expenditure growth. Journal of Socio-Economics (27): 687-700.

Ahsan, S.M., A.C. Kwan and B.S. Sahni, 1996. Co-integration and wagner's hypothesis: Time series evidence for canada. Applied Economics (28): 1055-1058.

Al-Batel, A.H., 2002. The relationship between government revenue and expenditures in saudi arabia. Journal of the Gulf and Arabian Peninsula.

Al-Hakami, A.O., 2002. Analyzing the causal relationship between government expenditure and revenues in saudi arabia, employing co-integration and granger causality models. Public Administration (42): 475-493.

Asutay, M. and K. Al-Fazari, 2007. Government expenditure and economic growth in oman: Testing wagner's law and keynesian relation. In: PC 2007 Conference.

Biswal, B., U. Dhawan and H.Y. Lee, 1999. Testing wagner versus keynes using disaggregated public expenditure data for canada. Applied Economics (31): 1283-1298.

Burney, N.A., 2002. Wagner's hypothesis: Evidence from kuwait using co-integration tests. Applied Economics (34): 49-57.

Chletsos, M. and C. Kollias, 1997. Testing wagner's law using disaggregated public expenditure data in the case of greece: 1953-1993. Applied Economics (29): 371-377.

Courakis, A.S., F. Moura-roque and G. Tridimas, 1993. Public expenditure growth in greece and portugal: Wagner's law and beyond. Applied Economics (25): 125-132.

Dickey, D. A. and W. A. Fuller. (1979). "Distribution of the Estimators for Autoregressive Time Series with a Unit Root", Journal of the American Statistical Association, (74): 427-431.

Engle, R.F. and C.W.J. Granger, 1987. Co-integration and error correction: Representation, estimation and testing,. Econometrica (55): 251-276.

Goffman, I.J., 1968. On the empirical testing of wagner's law: A technical note. Public Finance (23): 359-364.

Granger, C.W., 1980. Testing for causality. Journal of Economic Dynamics and Control (2): 29-352.

Gupta, S.P., 1967. Public expenditure and economic growth: A time-series analysis. Public Finance Review(22): 423-471.

IFS, International Financial Statistics (IFS). Yearbook, World Bank.

IMF, I.M.F., Government financial statistics yearbook. Washington: International Monetary Fund, 1980 to 2010.

Johansen, S., 1988. Statistical analysis of co-integration vectors. Journal of Economic Dynamic and Control (12): 231-254.

Johansen, S. and K. Juselius, 1990. Maximum likelihood estimation and inference on co-integration-with application to the demand for money. Oxford Bulletin of Economics and Statistics (54): 325-364.

Kolluri, B.R., M.J. Panik and M.S. Wahab, 2000. Government Expenditure and Economic Growth: Evidence from g7 countries,. Applied Economics (32): 1059-1073.

Lall, S., 1969. A note on government expenditures in developing countries. The Economic Journal(79): 413-417.

Mann, A.J., 1980. Wagner's law: An econometric test for mexico: 1925-1976. National Tax Journal (33): 189-201.

Michas, N. A. (1975). "Wagner’s Law of Public Expenditures: What Is the Appropriate Measurement for a Valid Test?," Public Finance/ Finances Publiques (30), pp. 77-85.

Musgrave, R.A., 1969. Fiscal systems. New Haven and London: Yale University Press.

Nagarajan, P. and A. Spears, 1990. An econometric test of wagner's law for mexico: A re-examination. Public Finance (45): 165-168.

Payne, J.E. and B.T. Ewing, 1996. The international evidence on wagner's hypothesis: A co-integration analysis. Public-Finance (51): 258-274.

Peacock, A.T. and J. Wiseman, 1961. The growth of public expenditure in the united kingdom. Princeton: Princeton University Press.

Pryor, F.L., 1968. Public expenditures in communist and capitalist nations. London: George Allen Unwin Ltd.

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 (69): 194-204.

SAMA, Annual report, the saudi arabia monetary agency.

Wagner, A., 1958. Three extracts on public finance. London: Macmillan.