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Government Expenditure and Economic Growth in Saudi Arabia

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ABSTRACT:- Adolph Wagner was an early scholar who recognized a positive correlation between economic growth and the growth of government activities. Wagner's law indicates that causality runs from economic growth (GDP) to government expenditure, while the Keynesian approach indicates the reverse. This paper hypotheses the validity of the five different versions of Wagner's Law as well as the Keynesian approach in Saudi Arabia by employing the annual time-series data over the period 1970-2017. The analysis examines the stationary properties, co-integration and Granger causality between government expenditure and economic growth. The autoregressive distributed lag (ARDL) approach of co-integration is utilized to validate the existence of the long-term relationship between the variables. The results confirm the long run validity of three models for both approaches, indicating that government expenditure, government consumption expenditure and government spending as a share of income significantly affect economic growth and vice versa. However, the study reveals that there is no significant statistical evidence for the impact between per-capita income and either government expenditure per capita or government expenditure in both Wagner's Law and the Keynesian approach. However, in the short run, we found that the Keynesian approach holds for all five models, whereas there is a violation of one model of Wagner's Law, where no evidence is found for the impact of economic growth on government spending in the short run. The analysis also confirms the feedback hypothesis for all the models except one, which shows a unidirectional hypothesis of causality running from economic growth to government consumption expenditure, and not vice versa.

Keywords: Co-integration, causality, Saudi Arabia, public expenditure, economic growth, Wagner's law, autoregressive-distributed lag
JEL classification codes: B22, C20, C23, C13, D2, D24, E11

I. INTRODUCTION

Adolph Wagner, a German economist, published *The Basic of Political Economy* in 1893, a book that emphasized the idea that the development of the national economy enhances the role of government . In the book, he documented a positive relationship between government spending and economic growth; in other words, he believed that economic growth is accompanied by government expenditure growth. This is referred to in the literature as Wagner's Law. Furthermore, he posited that the direction of causality runs from economic growth to government spending. Contrary to Wagner's perspective, the British economist, John Maynard Keynes published *The General Theory of Employment, Interest and Money* in 1936, in which he emphasized the crucial role of government expenditure in stimulating the economy. He basically believed that government spending enhances economic growth, a belief which was later called the Keynesian theory or approach. Several interpretations of Wagner's Law has been proposed and the five main versions are Peacock and Wiseman (1961), Pryor (1968), Goffman (1968) ,Gupta (1967), and Man (1980). They differ primarily in the measurement and the functional form of the relationship between the variables. For example, Gupta (1967) used government spending and economic growth as a ratio to population; thus he examined the government spending per capita and the per capita national income. Differing slightly from Gupta, Goffman (1968) suggested that it is the economic growth per capita and not necessarily the government spending per capita. Peacock-Wiseman (1961) posited that the level of government spending will increase by the increase of the size of the economy. Modifying Peacock-Wiseman's version, Mann's (1980) claimed that government spending as a share of income depends on economic growth, so he measured the government spending as a ratio of income. Differing from the previous interpretation, Payor (1968) believed that, when the economy grows, it is only the government consumption expenditure that increases, so he limited the definition of government spending to that of government consumption expenditure solely.

In considering the theoretical concept of the study, it is essential to take into account these differences for their new policy implications. With regard to the case of Saudi Arabia, the increase in government expenditure has mainly been attributed to industrialization, modernization, and natural monopolies. Examples of this include projects such as railroads, which need to be implemented by the government, as the private sector does not have the means to implement these big projects. However, in 2017, the government announced its intention to reduce its spending through adopting several techniques as well as the aim in reducing the dependency on government interference in the economy and allowing the private sector to take a lead in promoting economic growth. This raises the debate on whether government spending affects economic growth, or whether it is just a result of economic growth. Hence, the ultimate goal of this study is to examine the validity of the five versions of Wagner's Law as well as the Keynesian approach in the case of Saudi Arabia over the period 1970-2017. The results of this study have a crucial role in determining if it is suitable for Saudi Arabia to downsize government spending through examining the two main macroeconomic hypotheses: Wagner's Law and the Keynesian approach.

The rest of the paper is divided into four sections and organized as follows: Section Two presents the literature review. Section Three provides the data and methodology, followed by the discussion of the empirical results in Section Four. Finally, Section Five is the main conclusion of the study.

II. LITERATURE REVIEW

In reviewing the literature on government spending and economic growth, we will find three major theories: 1) the public choice theory of bureaucracy, 2) the displacement effect hypothesis, and 3) Wagner's Law. Considering different interpretations of Wagner's Law, various studies have been conducted to verify the validity of these models (Wagner, 1883). The five versions are as follows:

(1) G=f (y) Peacock-Wiseman (1961)
(2) Gc=f(y) Pryor (1968)
(3) G=f (Y/N) Goffman (1968)
(4) G/N= f (Y/N) Gupta (1967) and Michas (1975)
(5) G/y = f (y) Mann's (1980) "Modified Peacock-Wiseman version,"

Where is:

G= Total government expenditure,
Gc= total Government consumption expenditure,
Y= gross domestic product.
N= population.

The above versions have been tested empirically and have widely different results and implications. Some empirical studies have used the hypothesis of Wagner's Law to establish the relationship between increasing public expenditure and GDP growth, while other empirical works have inferred that Wagner's Law does not hold for all countries. For example, Ram (1986) tested Wagner's Law on 63 countries and found limited support for Wagner's Law. It is notable that Wagner's Law does hold based on the structure of a country's economy, in that it is true for rich countries but not for poor countries (Abizadeh and Gray, 1985). For the case of Saudi Arabia, a few empirical works have tested Wagner's Law. For example, Al-Faris (2002) analyzed the relationship between government expenditure and economic growth in the Gulf Cooperation Council (GCC) countries and found significant evidence for national income being a predictive factor for government spending but not vice versa. Another work testing Wagner's Law has been done for Saudi Arabia by Albatel (2002) using time series data for the 1964 - 1998 period to examine the casual relationship between government spending and economic growth. He found that Wagner's Law holds true for this period. Furthermore, Ghali (1997) investigated the interactions between the share of government-spending in GDP and the per capita GDP growth rate for the case of Saudi Arabia for the period of 1960 through 1996. The result shows a statistical significant impact for the causality running from the per capital GDP to the government spending as a share of GDP, while no evidence for the causality running from government spending as a share of GDP to per capita GDP. Also, Ghali and Al-Shamsi (1997) investigated the relationship between government investment as well as government consumption and the economic growth in United Arab Emarites over the period of 1973 through 1995. The conclusion shows positive evidence for the causality running from government investment to economic growth, while no evidence was captured for the causality running from the government consumption to economic growth. Moreover, Alshahrani and Alsadiq (2014) investigated the relationship between government spending and economic growth rate, in terms of real non-oil per capita GDP. They found that public investment and expenditure on health care and education have a short-run impact on the growth rate of real non-oil per capita GDP. In addition, over the long run, capital expenditure and spending on health care both have an impact on the growth rate of real non-oil GDP. Finally, Ageli (2013) tested the validity of Wagner's Law for Saudi Arabia over the 1970-2012 period for both real oil GDP and non-oil GDP. Ageli concluded that there is strong evidence supporting Wagner's Law in the case of Saudi Arabia by showing that there is a long-term relationship between government expenditure and economic growth for both real GDP and non-oil GDP.

In this working paper, we will build on previous empirical works in three ways: First, we will use recent time series data which encompass various parts of the business cycle. Second, we will determine whether or not the previous studies implemented the appropriate econometric model based on the situations in the time-series data within Saudi Arabia. For instance, to confirm that the appropriate model has been used, we should use OLS estimation and ensure that all variables are stationary, which confirms that our data have a zero mean and a constant variance and that any relationship is not spurious. Also, to differentiate each series, we should estimate a standard regression model by using OLS. We know that all variables are integrated in the same order; in other words, they are integrated for the same order, in this case at first difference l(1) but are not co-integrated. If we know that all series are integrated in the same order but are also co-integrated, then we can employ two types of models. The first is the OLS regression model using the levels of data at hand; this will establish the long-run equilibrating relationship between the variables. Or, the second option is employing an Error-Correction Model (ECM), which can be estimated by OLS and will infer the short-run dynamics of the relationship between the variables at hand.

This complicated situation involves the need to test for co-integration and estimate long and short run dynamics, where the variables within the problem may include a mixture of a stationary and non-stationary time series when they are tested at level. In this case, we cannot use the traditional Johansen co-integration (1988) test that has been used in most of the previous Saudi cases, due to the violation of the precondition for the use of the Johansen co-integration test, which requires the time series variables to be non-stationary at level and stationary once it is transformed into first difference. Hence, we shall use the Autoregressive Distributed Lagged Model (ARDL), which has the advantage of its ability to be used when the variables happen to be a mixture of several orders of integration; thus, the Johansen co-integration condition of the time series variables being non-stationary at level does not hold when using the ARDL model. Another advantage of utilizing the ARDL model is that different variables can be assigned with different lag lengths within the model.

III. DATA AND METHODOLOGY

Model Specification

The theoretical framework discussed in this study is premised on the endogenous growth theory, which analyzes the nature of the relationship between fiscal policy variables and economic growth in the Saudi economy. In line with this, the relationship between output and economic expenditure to be used for this study is specified in a general form by the following equation:

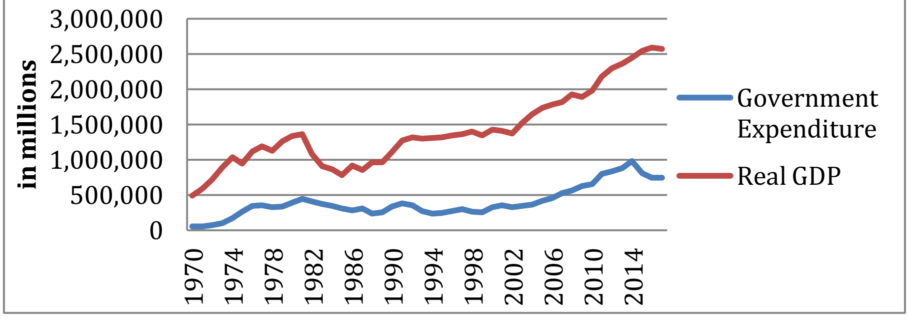
$$G=f(y) \qquad (1)$$

a. Source of Data

The data utilized for all the Saudi variables in this study are annual from 1979-2017 and are collected from the Saudi Arabian Monetary Authority (SAMA) Annual Statistics 2017. Since the 1990 and 1991 data for the government consumption expenditure were accumulated in one year, a Hodrick-Prescott Filter interpolation method has been used to estimate the data for each year. In addition, the government consumption expenditure variable was converted into real terms using the Consumer Price Index, with a base year of 2013.[1] The natural log for all variables has been taken.

Visually examining the trend of the data, as shown in figure 1 and figure 2 respectively, we can see in figure 1 that there is association between the trend of government spending and real GDP over the period of 1970-2017. In context, these two variables were moving in the same relative direction, as we can see an upward trend for both variables since the early 1970s. Moreover, they both started to decline at the beginning of the 1980s. This decline can be explained by the oil crisis at that time. However, at the beginning of the 1990s, the GDP started to increase again and since then it has not significantly decreased until 2015.

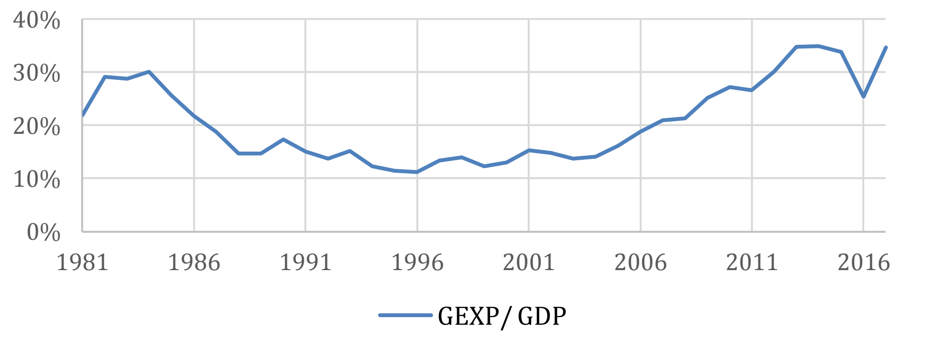
Figure 1: Real GDP and Government Expenditure Trend in Saudi Arabia (1970-2017)



[1] We obtained these converted variables by using a chaining method; i.e. we chained the old index (with a 2007 base year) and the new index (2013). By doing so we created an index that preserves the old inflation rates for the earlier years, while rebasing the index to the new 2013 base.

Viewing figure 2, we can see that the share of government spending to GDP has changed over the 1981-2017period. Between 1984 and 1988, the share of government spending to GDP declined by half; i.e., it dropped from 30 percent to 15 percent. It then fluctuated between 10 and 20 percent until 2006, when it started to rise again, reaching 35 percent in 2014. However, within two years only it went down sharply to hit 25 percent in 2016, and then increased back to approximately 35 percent in 2017.

Figure 2:Share of Government spending to GDP (%) (1981-2017)



b. Methodology

The procedure to conduct the empirical analysis has followed different steps. We first implemented the Augmented Dickey–Fuller (ADF)(1979) unit root tests to make sure that all the variables are stationary at level or first difference. This means that variables are either integrated of order zero, I(0), or integrated of order 1, I(1). Phillips (1986) warned that non-stationary variables may produce misleading and spurious regression analysis. Afterwards, we implemented the ARDL bound test approach of co-integration as indicated in Pesaran and Shin (1999) and Pesaran et al. (2001) to test for the long-run relationship among the variables and also estimate the long-run and short-run parameters. This approach has the advantage of being flexible since it does not require that the variables be integrated of the same order like other co-integration approaches. Thus, it can be used with a mixture of I(0) and I(1) variables. In addition, different variables can be assigned in different lag lengths as they enter the model. The study has implemented two main models: the Wagner and Keynes models. Each of these has five versions, as illustrated below:

Wagner Law:

1) $\Delta G_t = c_0 + \Sigma \alpha_j \Delta Y_{t-j} + \mu_t$
2) $\Delta Gc_t = c_0 + \Sigma \alpha_j \Delta Y_{t-j} + \mu_t$
3) $\Delta G_t = c_0 + \Sigma \alpha_j \Delta Y/N_{t-j} + \mu_t$
4) $\Delta G/N_t = c_0 + \Sigma \alpha_j \Delta Y/N_{t-j} + \mu_t$
5) $\Delta G/y_t = c_0 + \Sigma \alpha_j \Delta Y_{t-j} + \mu_t$

Keynes Hypothesis:

1) $\Delta Y_t = c_0 + \Sigma \alpha_j \Delta G_{t-j} + \mu_t$
2) $\Delta Y_t = c_0 + \Sigma \alpha_j \Delta GC_{t-j} + \mu_t$
3) $\Delta Y/N_t = c_0 + \Sigma \alpha_j \Delta G_{t-j} + \mu_t$
4) $\Delta Y/N_t = c_0 + \Sigma \alpha_j \Delta G/N_{t-j} + \mu_t$
5) $\Delta Y_t = c_0 + \Sigma \alpha_j \Delta G/Y_{t-j} + \mu_t$

where $\mu_t \approx$ i.i.d. $(0,\Omega)$ for all the models, μ_t is the error term, which is independently and identically distributed (i.i.d), Ω is the variance-covariance matrix, indicating no heteroskedasticity. Δ is the first difference operator, C is the constant and α_j, j=1,2,3, are the long-run parameters.

Illustrating the procedure of the ARDL approach, there are two main steps to be followed as described by Pesaran (1997). First is examining the long-run association among the variables using the *F*-test of overall significance. This step is implemented by testing the null hypothesis of no co-integration through a joint test of all the coefficients of the variables being equal to zero (H0: $\alpha_1 = \alpha_2 = \alpha_3 = 0$) against the alternative hypothesis (H1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq 0$). We then compare the estimated *F*-statistics based on a 5% level of significance of the respective bound critical values; lower bound values I (0) values, and upper bound values I (1) from the tables given in the appendix of Narayan (2005) paper. If the value of the *F*-statistic is greater than the upper bound value, we reject the null hypothesis of no co-integration, which means there is evidence of a long-run association among the variables, whereas, if the value of *F*-statistic is below the lower bound, then we fail to reject the null hypothesis of no co-integration. This means that there is no evidence of a long-run association between the variables. Inconclusive results would result if the value of *F*-statistic falls in between the upper bound and the lower bound.

The second step is to estimate the coefficients of the model after ensuring the existence of co-integration among the variables. We use Akaike information criteria (AIC) to choose the optimal lag selection, which are shown between the parentheses for each model. The models are then estimated by ordinary least squares (OLS). After that, the short-run elasticity of the variables will be estimated via the error-correction model (ECM) (Pahlavani and Wilson, 2005) where the lagged error correction term, ECT_{t-1}, is used to capture the short-run disturbances. Finally, a Granger Causality Test (1969) is performed to show the directions of causality between government expenditure and economic growth. Actually, the direction of causality relationship between government spending and economic growth can be categorized into four types and each type has essential implication for economic policy:

- Neutrality hypothesis: no causality between public spending and GDP.
- Wagnerian hypothesis: unidirectional causality running from income growth to public spending.
- Keynesian hypothesis: unidirectional causality running from public spending to income growth.
- Feedback hypothesis: a bi-directional causality between both variables exists.

Empirical Results:

The empirical result of the study is presented in this section. Table 1 shows the results of unit root tests using the Augmented Dickey–Fuller (ADF) approach for each variable. We found that some variables are stationary at the level, such as government expenditure *(G)*, government expenditure per capita *(G/N)*, GDP per capita *(Y/N)* and government expenditure as a share of GDP *(G/Y)*, while the GDP *(Y)* is non-stationary at level. Transforming the variables into first difference, all of them became stationary.

Table 1: Augmented Dickey-Fuller Unit Root Tests for 1979-2013

Variable	Test Statistic at level	Variable	Test Statistic at the first difference
Ln(G)	-4.207350 (.00)	**Δ Ln(G)**	-3.649564 (.00)
Ln(Y)	-1.454228 (0.54)	**ΔLn(Y)**	-5.524271 (.00)
Ln (Y/N)	-3.024147 (0.04)	**ΔLn (Y/N)**	-5.024697 (0.00)
Ln (G/N)	-4.087962 (.00)	**Δ Ln(G/N)**	-3.671577 (.00)
Ln (G/Y)	-3.996038 (0.00)	**Δ Ln (G/Y)**	-4.871514 (0.00)

-The optimal lags for the ADF tests were selected based on Akaike's information Criteria (AIC).
- The probabilities are shown between the parentheses.
-The critical values for the variables at their levels and at their first differences are -2.93 and -2.92, respectively.

Due to the mixture of order of integration and stationary of the variables, the ARDL approach is appropriate for testing the co-integration relationship. For each equation in both Wagner and Keynes models, the *F*-statistics is greater than the upper bound at the 5% level as indicated in Table 2, which means that there is a long-relationship between the variables in each model.

Table 2: ARDL Co-integration test

Wagner's model	F-stat.	Keynes model	F-stat.
Ln(G) and Ln(Y)	6.06	Ln(Y) and Ln(G)	5.36
Ln(GC) and Ln(Y)	6.41	Ln(Y) and Ln(GC)	11.66
Ln (G) and Ln(Y/N)	8.79	Ln (Y/N) and Ln(G)	6.49
Ln(G/N) and Ln(Y/N)	4.81	Ln(Y/N) and Ln(G/N)	4.42
Ln(G/Y) and Ln(Y)	4.31	Ln(Y) and Ln(G/Y)	6.12

The critical values for the F-statistics at the 5% level are (3.62, 4.16)

Tables 3 and 4 show the long-run and short-run coefficients, respectively. In the long run, Wagner's law holds for all the models, which confirms a significant relationship, except for models (3) and (4), $G = Y/N$ and $G/N=Y/N$, which means that an average unit of increase in the income per-capita neither significantly increases the government spending nor the government spending per-capita. Moving to the short-run results, all the models show significant and negative error-correction terms. In addition, most of the models show a positive and significant impact, except for the first model, $G = Y$, which means that, in the short run, an average unit increase in economic growth does not significantly increase the government spending.

Table 3: Estimated long-run coefficients (Wagner model)

Model	Parameter	Coefficient	T-Stat.
G=f (Y) (1,0)	Y C	1.86* -5.23*	6.86 -3.38
GC=Y (1,0)	Y C	0.99* -0.09	8.82 -0.13
G=y/n (3,4)	Y/n C	27.32 -115.93	0.33 -0.31
G/n=Y/n (3,2)	Y/n C	4.48 -16.06	1.58 -1.25
G/Y=Y (1,2)	Y C	0.66* -4.18*	1.86 -2.06

-* represents significance at 5% level

Table 4: Error Correction Representation for the ARDL approach (Wagner model)

Model	Parameter	Coefficient	T-Stat
G=Y	DY ECT	0.66 -0.31*	1.44 -3.00
GC=Y	DY ECT	0.35* -0.29*	1.74 -4.12
G=Y/n	D(Y/n) ECT	1.02* -0.01*	2.63 -5.31
G/n=Y/n	D(Y/n) ECT	1.23* -0.12*	2.69 -3.93
G/Y=Y	D(Y) ETC	0.99* -0.23*	2.14 -1.96

- * represents statistical significance at 5% level

Table 5 displays the long-run coefficients for the Keynes hypothesis, where it is valid for model (1), (2) and (5), as they show positive and significant coefficients. This means that an average unit of increase in government spending would have a significant increase in economic growth. In the same manner, an average unit of increase in government consumption expenditure and the share of government spending to GDP would have significant impact of economic growth. However, analyzing model (3) and (4), we can say that an average unit of increase in either government spending or government spending per-capita would not significantly increase the income per-capita. Table 6 shows the short-run coefficients for Keynes hypothesis, where a significant and positive effect for all the five models can be clearly noticed. This indicates that, in the short-run, an average unit increase in government spending, government consumption expenditure and the share of government spending to GDP would have a significant impact on economic growth in Saudi Arabia. Similarly, an average unit of increase in government spending or government spending per-capita would have a positive effect on per capita economic growth.

Table 5: Estimated long-run coefficients (Keynes model)

Model	Parameter	Coefficient	T-Stat
Y=G (1,2)	G C	0.58* 2.55*	3.88 3.14
Y=GC (4,3)	GC C	1.06* -0.17	13.78 -0.40
Y/n=G (1,2)	G C	0.10 3.90*	0.97 6.47
Y/n=G/n (1,2)	G/n C	0.13 3.95*	0.74 5.23
Y=G/Y (1,2)	G/Y C	1.22* 6.11*	2.80 37.58

-* represents the statistical significance at 5% level.

Table 6: Error Correction Representation for the selected ARDL approach (Keynes model):

Model	Parameter	Coefficient	T-Stat.
Y=G	D(G) ECT	0.12* 0.10*	2.87 2.75
Y=GC	D(GC) ECT	0.21* -0.41*	2.39 -6.16
Y/n=G	D(G) ECT	0.12* -0.14*	3.31 -4.55
Y/n=G/N	D(G/n) ECT	0.14* -0.15*	3.45 -3.76
Y=G/Y	D(G/Y) ECT	0.14* 0.08*	2.66 4.42

- *
represents significance at 5% level

Finally, the Granger causality results can be seen in Table 7. A bi-directional causality is confirmed for almost all relations under consideration. In other words, a feedback hypothesis has been confirmed, since we found that there is evidence of causality running from government spending to economic growth, government spending to GDP per-capita, government spending per-capita to GDP per-capita and the share of government spending of GDP to economic growth and vice versa.

However, it is only the second case, *Gc=y* that has confirmed a unidirectional causality, since there is no evidence of causality from government consumption expenditure to economic growth, while the reverse case does show evidence.

Table 7: Granger Causality Tests (1970-2017):

Cause	Effect	Test Stat.
ΔLn (G)	ΔLn (Y)	3.32183*
ΔLn (Y)	ΔLn (G)	8.48814*
ΔLn (GC)	ΔLn (Y)	1.73346
ΔLn (Y)	ΔLn (GC)	5.37830*
ΔLn (G)	ΔLn (Y/N)	4.56883*
ΔLn(Y/N)	ΔLn (G)	8.89931*
ΔLn (G/Y)	ΔLn (Y)	5.90753*
ΔLn (Y)	ΔLn (G/Y)	4.79481*
ΔLn (G/N)	ΔLn (Y/N)	5.42575*
ΔLn(Y/N)	ΔLn (G/N)	9.32903*

- * represents significance at 5% level

IV. CONCLUSION

This study has shown the nature of the relationship between economic growth and government spending in Saudi Arabia, utilizing recent time series data over the period from 1979-2017. The focus of the study is to test the validity of five models of Wagner's Law and Keynes' approach. Examining the nature of the variables showed evidence of them being in different order of integration, some are stationary at level, while others are at first difference. This leads us to the application of the Autoregressive Distributed Lag approach to co-integration (ARDL), since the precondition for using the traditional Johansen Multivariate Co-integration test (JMCT) does not hold, even though it has been used in almost all of the previous Saudi studies. Basically, the results show the existence of a co-integration between the variables. In the long run, three models for both approaches were confirmed indicating that government expenditure; government consumption expenditure and the government spending as a share of income significantly affect economic growth and vice versa. However, the study reveals that there is no significant evidence for any correlation between the per-capita income and either government expenditure per capita or the government expenditure for both Wagner's Law and the Keynesian approach.

Investigating the short run validity of the models, we conclude that Keynesian approach holds for all models, which strongly suggests that government spending has a significant positive impact on economic growth generally. Similar to the Keynesian approach, we found out that in the short run, Wagner's law holds for most of models indicating a positive impact of economic growth on government consumption expenditure, and the share of government spending per GDP.[2] Moreover, the study has found that in the short run, economic growth per-capita has a positive impact on government spending as well as government spending per-capita. In short, in all measures, an increase in economic government spending does necessarily increase economic growth. Therefore, the study emphasizes on the key role of government spending to enhance economic growth in Saudi Arabia, especially when it comes to government capital spending, which has a considerable impact on economic growth in the long run as has been indicated in the study.

Our analysis has mainly focused on investigating the relationship between government spending and economic growth from the perspective of two approaches: Wagner's Law and the Keynesian approach. Since the current study focuses on the aggregate level of government spending and economic growth, future studies may incorporate economic sectoral level analysis and compare oil and non-oil GDP for both Wagner's Law and Keynesian approach.

For future research, it would be an essential to do the same approach considering the non-oil GDP instead of using total GDP. In addition, it might be useful to investigate the government fiscal balance to be able to explore the causes and solutions for the government deficit. Moreover, seeking to extend the scope of the paper in terms of robustness checks, researchers would be advised to perform some diagnostic tests of the robustness such as the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). These tests can be applied, along with some of structural break tests, as a contribution to the previous papers and literature review. It might also be quite interesting to assess the relationship between government spending and economic growth using non-linear econometric models such as threshold models.

[2] Only one of the models does not hold for Wagner's law in the short-run, which shows that there is no significant impact of economic growth on government spending meaning that the increase in economic growth does not necessarily increase government spending.

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