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The Causal Nexus between Government Expenditure and Economic Growth: Wagner versus Keynes Hypothesis

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Abstract The causality between economic growth and government expenditure has long been a topic of interest among economists. Theoretically, Wagner's law claimed that economic growth (EG) contributes to government expenditure (GE), while the opposite causal nexus was claimed by Keynes. This study seeks to test the validity of these two theories by examining four versions of functional hypotheses and their reverse functions: Gupta, Peacock and Wiseman, Musgrave, and Mann. The main objectives include examining the nexus by comparing the developed versus developing countries, short-run versus long-run estimates, and the results between three estimators. The panel data regression applies the three estimators, which include pooled mean group (PMG), mean group (MG), and dynamic fixed effect (DFE). The datasets are collected from 1970 to 2018. The results detect both long-run and short-run relationships in the Gupta version and the Peacock and Wiseman version of Wagner's law, and also the reverse Gupta version and the reverse Peacock and Wiseman version of Keynes' theory. To sum up, the two-way relationship between GE and EG exists in developing countries. On the other hand, Wagner's law and Keynes' theory are not valid in developed countries. The results imply that economic level matters, which leads to different linkages between EG-GE across groups of countries. Since the nexus exists in developing countries, policymakers should adopt fiscal policies to stimulate economic growth. With no GE and EG relationship found in developed countries, policymakers should focus on other economic indicators other than government expenditure to foster economic growth.

Keywords Government expenditure; economic growth; Wagner hypothesis; Keynes theory; panel data

Mathematics Subject Classification 91B82, 91B62

1 Introduction

The nexus between government expenditure (GE) and gross domestic product (GDP) or economic growth (EG) has always been a hot topic in economic study. It brings valuable information for every country to know whether Wagner's law or Keynes' theory holds. The government can provide noteworthy solutions according to the theory and help in improving the economy. For example,

if a country is valid with Wagner's law but not with Keynes' theory, then the government should control its spending by reducing unnecessary expenditure and focusing more on social welfare instead. Interpreted differently, if the country is valid with Keynes' theory, then the policymaker can raise its expenditure when the economy is in recession to improve the economy.

According to Keynes' theory, GE causes changes in GDP. The government should increase spending during an economic recession and reduce its spending during economic prosperity because GE can increase EG by increasing GDP. On the other hand, Wagner's law proposed economic growth as a factor to foster government expenditure.

The nexus between EG and GE has long been studied. Empirical findings showed mixed results in which both theories (Wagner's law and Keynes' theory) might not hold in all cases. However, empirical studies mainly focused on testing one single theory using an individual country's data. Besides, the EG-GE relationship might vary across countries with different levels of development, which requires further examination. In filling up the gaps of earlier studies in examining the EG-GE relationship, this study conducts empirical analyses to examine the validity of both theories by comparing groups of economies (developed versus developing groups). This study utilizes the model of autoregressive distributed lag (ARDL), which enables results in short-run and long-run estimates. Since long panel data is subject to heterogeneous effects, this study applied three estimators (MG, PMG, and DFE) for robustness comparisons. Hausman test is applied to determine the best estimator. Four versions of equations covering absolute versus relative relationships are examined in testing both theories. Our results provide more informative findings on the nexus in terms of absolute versus relative versions, short-run versus long-run estimates, and developed versus developing groups.

2 Literature Review

As stated in Wagner's law, economic growth (EG) stimulates government expenditure (GE) for three reasons. First, as the economy grows, industrialization and modernization would occur, thus diminishing the role of the public sector in the private sector. Therefore, the government will spend more on regulating the private sector. Second, increases in real income would induce higher demand for basic infrastructure, in particular education and health facilities. This induces higher GE. And third, to remove a country's monopolistic tendencies besides enhancing the economic efficiency of the sector that requires heavy investment, the government should invest in this area, which will once again increase GE [1]. The hypothesis on the validity of Wagner's law has been examined empirically based on six different versions. Precisely, there are four absolute versions (Peacock & Wiseman, 1961; Gupta, 1967; Goffman, 1968; Pryor, 1969) and two relative versions (Musgrave, 1969; Mann, 1980), as stated in Ampah and Kotosz [2].

On the other hand, the Keynesian theory provides a basic framework to examine the impact of government spending on economic growth. This theory claims that there is a long-run relationship between GE and income. In other words, increases in government spending stimulate economic activities and growth. However, an increase in government spending might cause inflation. Following the development of Keynesian economics and macro econometrics in the post-war era, there are arguments that GE contributes to the exogenous and major part of aggregate demand, which is influential in affecting economic output level and its growth. From the view of Keynesian economics, aggregate demand is the main factor that contributes to growth. The elements of aggregate demand include consumer and government spending, private investment, and net export. Changes in

government spending will affect aggregate demand, and the latter will affect the GDP [3].

There are three major principles from the Keynesian view in explaining how the economy works. First, the aggregate demand is impacted by many economic decisions, which include public and private decisions. Second, in terms of prices, slow wage responses to the change in supply and demand lead to surpluses and shortages over periods, particularly in terms of labor. Third, the change in aggregate demand, either anticipated or unanticipated, will have a short-run impact on real activities such as employment and real output rather than affect prices [4]. Furthermore, Keynes explains how the changes in national output react to a change in aggregate demand. The aggregate demand increase will cause an increase in GDP with the multiplier. However, it also applies when aggregate demand is decreasing. Thus, GE is the crucial indicator that induces the change in economic growth. The Keynesian theory proposes the expansion of GE through expansionary fiscal policies to enhance economic activity. As claimed by Keynes's theory, when aggregate demand is the driver of economic growth, it should be promoted through GE to foster economic growth [5].

In terms of empirical examination, there are four categories of results: Wagner's law holds, Keynes' theory holds, bi-direction relationship holds, and no relationship is found. In the first group, Wagner's law is valid, as reported in some studies, such as Eideh [6], Adil *et al.* [7], Rehman *et al.* [8], Kamasa and Ofori-Abebrese [9], Kasimu and Aggreh [10], Magazzino [11], Kalam and Aziz [12], Pahlavani *et al.* [13], Kumar *et al.* [14], and Thabane and Lebina [15]. For example, Rehman *et al.* [8] conducted a study in Pakistan from 1971 to 2006 using Granger causality. They found that an increase in GDP causes growth in GE. Another study conducted by Thabane and Lebina [15] in Lesotho from 1980 to 2012 found that the direction of long-run causality running from GDP to GE is valid.

Next, Keynes' theory is valid, as found in the studies of Babatunde [16], Ebaidalla [17], Karahan and Çolak [5], Pula and Elshani [18], Sanchez-Juarez *et al.* [19], and Wang *et al.* [20]. For instance, a study carried out by Ebaidalla [17] in Sudan from 1970 to 2008 found that only GE has a Granger causality to GDP in the short run. The next example is that Pula and Elshani [18] conducted a study in Kosovo for quarterly data from 2004 to 2016 and concluded the unidirectional causality from GE to GDP.

Besides, the bi-directional relationship holds in some studies like Balamurali and Sivarajasingam [21], Govindaraju *et al.* [22], Katrakilidis and Tsaliki [3], and Sagdic *et al.* [23]. For example, Katrakilidis and Tsaliki [3] carried out a study in Greece from 1958 to 2004 and reported a two-way causal relationship between GE and GDP. Taking another case, Sagdic *et al.* [23] conducted a study in Turkey from 1992 to 2013 and found bidirectional causality between GE and GDP, while no relationship was found as studied in Huang [24] and Ladan [25].

Previous empirical studies are constrained by some limitations. The majority of studies only applied the examination to a single country's case without making much comparison across groups of economies. To extend the examination of Wagner and Keynes' hypotheses, this study compares two groups of economic levels (developed versus developing countries) using panel data approaches.

3 Data and Methodology

The datasets are obtained from the World Bank's online database, covering 49 annual samples from 1970 to 2018 for each developed and developing country. All datasets are transformed into the natural logarithm form for the subsequent procedure of model estimation. The ten developed and

ten developing countries are chosen based on the classification of WESP [26]. Those developed countries include Australia, Canada, Germany, Finland, the United Kingdom, Iceland, Italy, Japan, Norway, and the United States; Developing countries are Brazil, Indonesia, India, Mexico, Malaysia, Thailand, South Africa, Peru, Colombia, and Pakistan. The data include nominal GDP (NGDP) (current US$), real GDP (RGDP) (constant 2010 US$), nominal government expenditure (NGE) (current US$), real government expenditure (RGE) (constant 2010 US$), and population (P). The nominal and real data series are distinguished by their measurement units, according to the ways that they are being measured. In particular, the GDP series in the current currency is represented by NGDP, while RGDP refers to GDP in the constant currency of 2010. The nominal data series is estimated in terms of money that comprises price changes due to inflation. By contrast, the real value is expressed in terms of goods or services that have been adjusted for inflation. The same explanations are applied to NGE and RGE.

Before the model estimation, preliminary tests, including panel unit-root and panel cointegration tests, are performed to check whether conditions are met for the succeeding procedures. Cointegration tests are conducted based on the eight equations shown in Table 1, which consists of four versions for testing Wagner's law and four versions of its reverse form to test Keynes's theory.

Table 1: Equations on Selected Versions of Wagner's Law and Keynes' Theory

Wagner's law	**Functional form**	**Model's validity**
Gupta	$\ln\left(\frac{RGE_t}{P_t}\right) = a_1 + b_1 \ln\left(\frac{RGDP_t}{P_t}\right) + u_t$	$b_1 > 1$
Peacock & Wiseman	$\ln(RGE_t) = a_2 + b_2 \ln(RGDP_t) + u_t$	$b_2 > 1$
Musgrave	$\ln\left(\frac{NGE_t}{NGDP_t}\right) = a_3 + b_3 \ln\left(\frac{RGDP_t}{P_t}\right) + u_t$	$b_3 > 0$
Mann	$\ln\left(\frac{NGE_t}{NGDP_t}\right) = a_4 + b_4 \ln(RGDP_t) + u_t$	$b_4 > 0$
Keynes' theory	**Functional form**	**Model's validity**
Reverse Gupta	$\ln\left(\frac{RGDP_t}{P_t}\right) = a_1 + b_1 \ln\left(\frac{RGE_t}{P_t}\right) + u_t$	$b_1 > 1$
Reverse Peacock & Wiseman	$\ln(RGDP_t) = a_2 + b_2 \ln(RGE_t) + u_t$	$b_2 > 1$
Reverse Musgrave	$\ln\left(\frac{RGDP_t}{P_t}\right) = a_3 + b_3 \ln\left(\frac{NGE_t}{NGDP_t}\right) + u_t$	$b_3 > 0$
Reverse Mann	$\ln(RGDP_t) = a_4 + b_4 \ln\left(\frac{NGE_t}{NGDP_t}\right) + u_t$	$b_4 > 0$

They are grouped by two different versions in terms of the model's validity, namely the absolute version ($b > 1$) and the relative version ($b > 0$), where b is the coefficient of the estimate. Specifically, the first two models under Wagner's law and Keynes' theory are absolute versions, while the remaining models in Table 1 are relative versions. It is followed by model estimations of ARDL with the pooled mean group (PMG), mean group (MG), and dynamic fixed effect (DFE) estimators. Hausman test is applied to select the most suitable estimator.

The equations in Table 1 are estimated using the ARDL (p, q) model [27]:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{it-j} + \sum_{j=0}^{q} \delta'_{ij} x_{it-j} + \varepsilon_{it},$$

where $i = 1, 2, ..., N$ is the indication of countries, $t = 1, 2, ..., T$ is the indication of periods, p is the lag number of dependent variable, q is the lag number of independent variable. The y_{it-j} and x_{it-j} are represented in $k \times 1$ vector, δ_{ij} is represented in $1 \times k$ coefficient vector, and λ_{ij} is the vector of scalars. The reparameterization of the equation to the error correction form is

$$\Delta y_{it} = \phi_i y_{it-1} + \beta_i' x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{it-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{it-j} + \varepsilon_{it},$$

where $\phi_i = -1\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$; $\beta_i = \sum_{j=0}^{q} \delta_{ij}$; $\lambda_{ij}^* = \sum_{m=j+1}^{p} \lambda_{im}$, $j = 1, 2, ..., p-1$; $\delta_{ij}^* = \sum_{m=j+1}^{q} \delta_{im}$, $j = 1, 2, ..., q-1$. The equation can be also written as:

$$\Delta y_{it} = \phi_i \left(y_{it-1} - \theta_i' x_{it}\right) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{it-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{it-j} + \varepsilon_{it}.$$

$\theta_i = -\beta_i/\phi_i$ indicates the long-run relationship between y_{it} and x_{it}, while λ_{ij}^* and δ_{ij}^* represent the short-run effects of y_{it} and x_{it}. The error-correction coefficient ϕ_i is used to measure the speed of adjustment on y_{it} due to changes in x_{it} which must be negative, indicating convergence to the long-run equilibrium. If ϕ_i is positive, it is not convergence to long-run equilibrium, and there is no long-run relationship in the model.

According to Pesaran *et al.* [27], MG and PMG are suggested for cases when both T and N are large. The PMG estimator is restricted so that the long-run coefficients are homogenous across the data unit, while no restriction is made on the short-run coefficients, intercept, and error variances [28]. On the other hand, the MG estimator provides a separate regression for each country. Then the coefficients are obtained from the unweighted mean of the estimated coefficients from each country's estimate. The MG estimator allows heterogeneity in all coefficients of the model [29]. The DFE estimator is mostly like the PMG estimator. The difference is that the DFE estimator restricts the coefficient of the speed of adjustment and the short-run coefficient to be equal across all panels. The DFE estimator assumes fixed slopes, but the intercept can vary across countries. The DFE estimator imposes the homogeneity of short- and long-run parameters. Similar to the PMG and MG estimators, all coefficients from the DFE estimate are properly signed [30]. In brief, MG takes the average value of estimates across countries with fewer restrictions, while DFE imposes the highest restrictions (only allows constants to differ across countries, but the slopes of estimates are the same in both the short and long runs) and seems to overestimate the slopes. PMG has the middle restriction, with the only restriction being on the long-run slope, which is the same for all countries. No restriction is imposed on the short-run estimates.

As these three estimators (MG, PMG and DFE) impose different restrictions on the parameters, one might need to determine which restriction is more efficient and proper. The Hausman-type test can be applied under the condition that one of the compared models is consistent and efficient while the other is consistent but not efficient (null hypothesis) against the hypothesis that one of the compared models is not consistent, but the other is consistent (alternative hypothesis). Usually, we compare the higher restricted estimator with the less restricted estimator. The general form of the Hausman test statistic is [31]:

$$H = \left(\hat{\beta}^I - \hat{\beta}^{II}\right)' \left[Var\left(\hat{\beta}^I\right) - Var\left(\hat{\beta}^{II}\right)\right]^{-1} \left(\hat{\beta}^I - \hat{\beta}^{II}\right),$$

in which its chi-square(k) is distributed under H_0, where k is the number of parameters.

Table 2: A Summary of the Best Estimators for Each Model Based on the Hausman Test Statistic

Model/Version	Developed countries		Developing countries		Best estimator	
	PMG vs MG	DFE vs MG	PMG vs PMG	DFE vs DFE	Developed countries	Developing countries
Wagner's law						
Gupta	0.00	0.00	1.55	0.00	PMG	PMG
Peacock & Wiseman	0.01	0.00	0.48	0.00	PMG	PMG
Musgrave	7.89***	0.00	1.17	0.01	DFE	PMG
Mann	4.99**	0.00	0.53	0.00	DFE	PMG
Keynes' theory						
Reverse Gupta	2.02	0.00	5.57**	0.00	PMG	DFE
Reverse Peacock & Wiseman	0.39	0.00	2.02	0.00	PMG	PMG
Reverse Musgrave	-	-	-	-	OLS	OLS
Reverse Mann	-	-	-	-	OLS	OLS

4 Results

Before conducting the estimation, all variables are tested for their stationarity using panel unit root tests, including the Levin, Lin and Chu (LLC) test, the Breitung test, and the Im, Pesaran and Shin (IPS) test. The results showed that all variables are stationary after the first difference, or integrated of order 1, $I(1)$. This permits the condition to be further examined with the cointegration test. Next, cointegration tests (Pedroni and Kao's tests) are conducted on a total of eight equations in Table 1. The variables are cointegrated in all four models of Wagner's law for both groups of countries, and hence, the long-run relationship from GDP to GE exists. For Keynes' theory, absolute versions show cointegration between variables, revealing a long-run relationship from GE to GDP. However, there is no cointegration between variables in relative versions of Keynes' theory, i.e., reverse Musgrave and reverse Mann models, for both groups of countries. Thus, there is no long-run relationship. As a result, only these two models do not satisfy the long-run relationship requirement for the ARDL model. Therefore, pooled OLS regression is applied to relative versions of Keynes' theory.

For the ARDL model, all three estimators (i.e., MG, PMG, and DFE) are examined and tested with the Hausman test in search of the best estimator. The Hausman test statistic and the preferred estimator are summarized in Table 2. Note that ***, **, and * indicate the significance at 1%, 5%, and 10%, respectively. This applies to the results in all tables.

In the first step, the test is to compare MG and PMG with the null hypothesis that PMG is more efficient. The test is stopped if the result fails to reject the null. If the null is rejected (MG is preferred), then our second step is to compare MG versus DFE with the null hypothesis that DFE is more efficient. Next, the estimation results for all panel ARDL models are reported based on the preferred estimators (see Table 3(a), Table 3(b), Table 4(a) and Table 4(b)). In all ARDL results, the speed of adjustment (ϕ_i) is negative and significant, implying a convergence of the dependent variable to the long-run equilibrium level, so the model is stable. It also signifies the existence of the long-run relationship in the model.

Table 3(a): Panel ARDL Model Results for Absolute Versions (Gupta and Peacock & Wiseman) of Wagner's law

Gupta			**Peacock & Wiseman**		
Dependent: $\Delta \ln\left(\frac{RGE}{P}\right)_{it}$	**Developed countries**	**Developing countries**	**Dependent:** $\Delta \ln (RGE)_{it}$	**Developed countries**	**Developing countries**
Long run			Long run		
$\ln\left(\frac{RGDP}{P}\right)_{it}$	0.3510***	0.9675***	$\ln (RGDP)_{it}$	0.5869***	0.9882***
ϕ_i	−0.0704***	−0.1267***	ϕ_i	−0.0926***	−0.1293***
Short run			Short run		
$\Delta \ln\left(\frac{RGE}{P}\right)_{it-1}$	0.2901***	0.0983*	$\Delta \ln (RGE)_{it-1}$	0.3181***	0.0968*
$\Delta \ln\left(\frac{RGE}{P}\right)_{it-2}$	−0.0130	0.1608***	$\Delta \ln (RGE)_{it-2}$	−0.0689	0.1625***
$\Delta \ln\left(\frac{RGDP}{P}\right)_{it}$	0.0228	0.5443***	$\Delta \ln (RGE)_{it-3}$	0.0610	-
$\Delta \ln\left(\frac{RGDP}{P}\right)_{it-1}$	0.0329	-	$\Delta \ln (RGDP)_{it}$	−0.0127	0.5214***
$\Delta \ln\left(\frac{RGDP}{P}\right)_{it-2}$	0.0588	-	$\Delta \ln (RGDP)_{it-1}$	0.0288	-
			$\Delta \ln (RGDP)_{it-2}$	0.0460	-
C	0.3836***	−0.2299***	C	0.9431***	−0.2253***
Model	ARDL (3,3)	ARDL (3,1)	Model	ARDL (4,3)	ARDL (3,1)
Estimator	PMG	PMG	Estimator	PMG	PMG

Table 3(a) and Table 3(b) summarizes the estimation results on four versions of relationships in examining the validity of Wagner's law. The results show that in all four versions of relationships in Wagner's law, there are significant effects from ln(*RGDP*) and ln(*RGDP/P*) on government expenditure in developing countries and developed countries in the majority of cases. However, the coefficients of the ln(*RGDP*) and ln(*RGDP/P*) in the long run and the sum of coefficients in the short run do not fulfill the requirement of positive >1 (absolute versions) and positive >0 (relative versions), therefore fail to validate the Wagner's theory. Wagner's theory only holds in Musgrave and Mann relative versions in developing countries in the long run.

In terms of absolute versions, although Gupta and Peacock & Wiseman versions do not hold for both developed and developing countries, ln(*RGDP*) and ln(*RGDP/P*) still have some positive impacts on government expenditure with coefficient values <1. Comparing the magnitude of impact, developing countries experience a larger impact of government expenditure on their absolute and relative forms of ln(*RGDP*) and ln(*RGDP/P*) in all four versions of relationships compared to developed countries. This is because developing countries still have a larger possibility to grow while developed countries have achieved their maximum growth.

Moving on to absolute and relative versions of Keynes' theory (Table 4(a) and Table 4(b)), the results show that Keynes' theory does not hold in developed and developing countries in terms of absolute and relative versions of relationships as the coefficients of estimates (short- and long-run)

Table 3(b): Panel ARDL Model Results for Relative Versions (Musgrave and Mann) of Wagner's Law

Musgrave			**Mann**		
Dependent: $\Delta \ln\left(\frac{NGE}{NGDP}\right)_{it}$	**Developed countries**	**Developing countries**	**Dependent:** $\Delta \ln\left(\frac{NGE}{NGDP}\right)_{it}$	**Developed countries**	**Developing countries**
Long run			Long run		
$\ln\left(\frac{RGDP}{P}\right)_{it}$	-0.0598	0.1949***	$\ln(RGDP)_{it}$	−0.0297	0.1045***
ϕ_i	−0.0871***	−0.1172***	ϕ_i	−0.0885***	−0.1242***
Short run			Short run		
$\Delta \ln\left(\frac{NGE}{NGDP}\right)_{it-1}$	0.2733***	0.0147	$\Delta \ln\left(\frac{NGE}{NGDP}\right)_{it-1}$	0.2794***	0.0129
$\Delta \ln\left(\frac{NGE}{NGDP}\right)_{it-2}$	−0.0787*	-	$\Delta \ln\left(\frac{NGE}{NGDP}\right)_{it-2}$	−0.0804*	-
$\Delta \ln\left(\frac{RGDP}{P}\right)_{it}$	−0.9087***	−0.2051	$\Delta \ln(RGDP)_{it}$	−0.9145***	-0.1989
$\Delta \ln\left(\frac{RGDP}{P}\right)_{it-1}$	0.3841***	-	$\Delta \ln(RGDP)_{it-1}$	0.4047***	-
$\Delta \ln\left(\frac{RGDP}{P}\right)_{it-2}$	0.0158	-	$\Delta \ln(RGDP)_{it-2}$	0.0238	-
C	−0.0787	−0.4271***	C	−0.0609	−0.5966***
Model	ARDL (3,3)	ARDL (2,1)	Model	ARDL (3,3)	ARDL (2,1)
Estimator	DFE	PMG	Estimator	DFE	PMG

do not fulfill positive >1 for the absolute versions and positive >0 for the relative versions. The only case where Keynes' theory holds is the reverse Peacock & Wiseman absolute version in the developing countries. In the other cases, the impacts of ln(*RGE*), ln(*RGE/P*) and ln(*NGE/NGDP*) are not sufficiently large or weakly significant.

In summary, findings reveal that both Wagner's and Keynes' hypotheses do not hold in developed countries in both the short and long run. On the contrary, both Wagner's and Keynes' hypotheses exist in developing countries in the long run but not in the short run. In developing countries, Wagner's law holds for Musgrave and Mann versions, while Keynes' theory holds for the reverse Peacock and Wiseman version. This study also shows a possible two-way relationship between GDP and GE for the two hypotheses in developing countries in different versions. The results are summarized in Table 5.

5 Conclusion

In this study, the panel data approach is applied to examine the relationship between GDP and GE in two ways, i.e., Wagner's law and Keynes' theory. This study involves not a single country but two groups of countries. GDP and GE are the components in macroeconomics that will influence national and regional economies. In an economy, the relationship between two variables is viewed in both the

Table 4(a): Panel ARDL Model Results for Absolute Versions (Reverse Gupta and Reverse Peacock & Wiseman) of Keynes' Theory

Reverse Gupta			**Reverse Peacock & Wiseman**		
Dependent: $\Delta \ln\left(\frac{RGDP}{P}\right)_{it}$	**Developed countries**	**Developing countries**	**Dependent:** $\Delta \ln(RGDP)_{it}$	**Developed countries**	**Developing countries**
Long run			Long run		
$\ln\left(\frac{RGE}{P}\right)_{it}$	0.8722***	0.8544***	$\ln(RGE)_{it}$	0.8785***	1.0667***
ϕ_i	−0.0768 ∗ **	−0.0245**	ϕ_i	−0.0661***	−0.0271*
Short run			Short run		
$\Delta \ln\left(\frac{RGDP}{P}\right)_{it-1}$	0.3036***	0.2328***	$\Delta \ln(RGDP)_{it-1}$	0.2876***	0.1495**
$\Delta \ln\left(\frac{RGE}{P}\right)_{it}$	0.1005	0.1796***	$\Delta \ln(RGE)_{it}$	0.0813	0.2277***
$\Delta \ln\left(\frac{RGE}{P}\right)_{it-1}$	−0.0348	0.0359	$\Delta \ln(RGE)_{it-1}$	−0.0402	0.0308
$\Delta \ln\left(\frac{RGE}{P}\right)_{it-2}$	-	−0.0458**	$\Delta \ln(RGE)_{it-2}$	-	−0.0634*
$\Delta \ln\left(\frac{RGE}{P}\right)_{it-3}$	-	−0.0547**	$\Delta \ln(RGE)_{it-3}$	-	−0.0752**
C	0.2200***	0.0868**	C	0.3268***	0.0446***
Model	ARDL (2,2)	ARDL (2,4)	Model	ARDL (2,2)	ARDL (2,4)
Estimator	PMG	DFE	Estimator	PMG	PMG

Table 4(b): Pooled OLS Model Results for Relative Versions (Reverse Musgrave and Reverse Mann) of Keynes' Theory

Reverse Musgrave			**Reverse Mann**		
Dependent: $\Delta \ln\left(\frac{RGDP}{P}\right)_{it}$	**Developed countries**	**Developing countries**	**Dependent:** $\Delta \ln(RGDP)_{it}$	**Developed countries**	**Developing countries**
Model	Pooled OLS		Model	Pooled OLS	
$\Delta \ln\left(\frac{NGE}{NGDP}\right)_{it}$	−0.3098***	−0.0170	$\Delta \ln\left(\frac{NGE}{NGDP}\right)_{it}$	−0.3006***	−0.0182
C	0.0205***	0.0238***	C	0.0273***	0.0427***

Table 5: A Summary of Results on Wagner's and Keynes' Hypotheses

Countries Group	**Wagner's law**			
	Gupta	**Peacock & Wiseman**	**Musgrave**	**Mann**
Developed countries	No	No	No	No
Developing countries	No	No	Yes (Long run)	Yes (Long run)
Countries Group	**Keynes' theory**			
	Reverse Gupta	**Reverse Peacock & Wiseman**	**Reverse Musgrave**	**Reverse Mann**
Developed countries	No	No	No	No
Developing countries	No	Yes (Long run)	No	No

long run and the short run. It is also related to homogenous (short panel) and heterogeneous (long panel) relationships. Most of the studies assume the relationship is homogenous. For this study, it is not appropriate to assume a homogenous relationship for a longer time. Therefore, this study uses the heterogeneous panel approach with MG, PMG, and DFE estimators in each model.

In developing countries, Wagner's law is evident in relative forms, signifying that GDP might be a key source of GE. In other words, developing countries depend on GDP to fund their GE. On the other hand, GE could also boost GDP growth since Keynes' theory holds. Therefore, it is recommended that policymakers in developing countries improve GE policies or co-implement them with other fiscal and economic planning tools to increase the effectiveness of fiscal policies. It is also essential to prevent debt from growing as GE rises for a country with a high debt-to-GDP ratio. Then, the government can increase its spending to promote economic growth.

In contrast, since Wagner's law and Keynes' theory do not hold for developed countries, GE and GDP are not the main contributors to each other. There might be other indicators such as productivity, education, and technological progress since their economies are well-developed and stable. Meanwhile, GE is also less effective at boosting GDP growth in developed countries. Perhaps developed countries have limited room for growth as their economies have already achieved high and stable growth. Therefore, policymakers in developed countries are recommended to focus more on aspects other than GDP and GE to ensure the economy grows steadily. Although both hypotheses do not hold in developed countries, there are some cases where the relationship is significant. Among the comparable relationships between developed and developing countries, this study reveals that developing countries have larger impacts than developed countries. This shows that developing countries have the potential to develop their economies further by increasing GDP to stimulate GE and increasing GE to boost GDP.

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