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The relationship between public expenditure and economic growth in Romania: Does it obey Wagner's or Keynes's Law?

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Abstract. *After joining the European Union, Romania began a harmonization process with European requirements and best practices in both the economic and political system. This new approach influenced policy making processes with implications in fiscal and budgetary areas in order to ensure durable economic growth. The purpose of this paper is to examine the relationship between public expenditure and economic growth from the perspectives of Keynes and Wagner's law on Romania.*
Five representations of both Wagner's and Keynes's Law are tested, using annual time series data covering the period 1991-2014 after the fall of the Iron Curtain. To estimate the long-run relationship between government expenditure and economic growth, ARDL (Auto-Regression Distributed Lag) approach and Bounds Test based on Unrestricted Error Correction Model (UECM) estimation are used. Empirical results indicate that there exists a unidirectional long-run relationship from government expenditures to economic growth in Romania, which means the economic growth could affect the government expenditure. In contrast, Keynes's Law does not hold for over the period.
Based on this result the government can determine the causality between economic growth and public expenditure and better formulate strategies for different faces of the economic conjuncture.

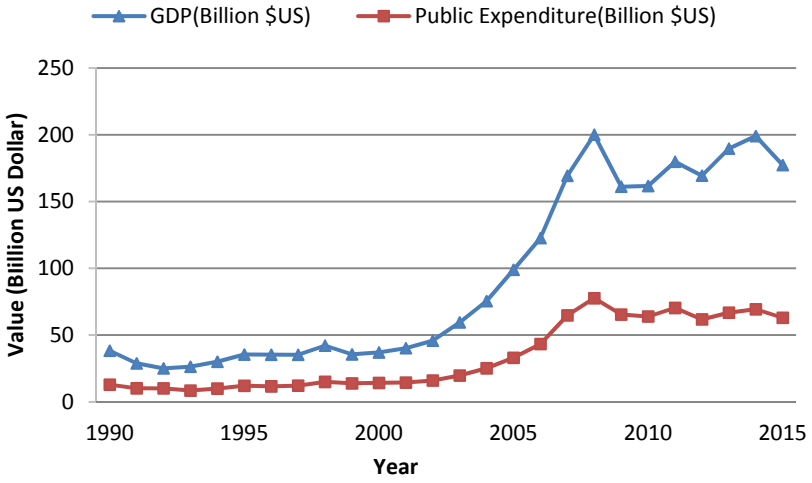
Keywords: Wagner's law, Keynes' law, Romanian public expenditure, economic growth, ARDL, bounds test.

JEL Classification: C22; E62; H50.

1. Introduction

After the revolution of December 1989, Romania has embraced capitalism as well as market economy gradually. As a result, the economy enjoyed a steady growth from 1990, especially during the ten years from 1999 to 2008. At the same time, just as graph 1, shows with the growth of the economy, government expenditure has also increased. In 2015, the government expenditure in Romania reached 62.94 billion, taking 35.5% of GDP (Eurostat Data).

Graph 1. *Romania government expenditure and GDP in Romania from 1991 to 2015*



Source: Authors' calculations based on Eurostat data.

Could the economic growth become the reason for the increase of the government expenditure? Nobody made such a formal assumption until Wagner started to realize the problem in the 1880s. After investigating the industrial process of the United States, United Kingdom, Germany, Japan and other industrial countries, Wagner found that industrialization made per capita income increase inducing the expansion of government activities to manage and regulate market economy (Wagner, 1912). Moreover, with the increase in economy, and government expenditure increasing accordingly, this was then first concluded as Wagner's Law by Bird (Bird, 1971).

On the other hand, before the popularity of Keynesianism, there is hardly any reason to consider financial policies as means to control the function of macroeconomic processes (Keynes, 1937, 2009). After World War II, in order to catch up with developed countries, more and more developing economies take financial policies as an important way to promote economic growth, deliberately increasing government spending in order to increase GDP. These governments follow Keynes's Law aiming to automatically increase the economy in accordance with the growth of government expenditure through multiplier effect.

Finally, the two alternative positions call for opposite directions of causality running from economic growth to government expenditure for Wagner, and from government expenditure to economic growth for the Keynesians.

As noted, it remains unclear whether public expenditure and GDP increase in Romania between 1990 and 2014, are a consequence of Wagner's Law or Keynes's Law. In other words, did the growth of the economy affect government expenditure (Wagner's Law) or, in contrast, the fact that the economy grows could be attributed to some extent, to the expansion of government expenditure (Keynes's Law). This paper tests whether Wagner's Law or Keynes's Law has an effect in Romania with the application of the ARDL (Auto-Regression Distributed Lag) approach and bounds test.

Since the number of annual data in this study is less than 30, the spectrum of appropriate econometric methods with suitable stability and accuracy performance handling is limited. ARDL approach combined with bounds test is one of the most accepted approaches in finding data causality for small samples, and is applied to test the problem, whether Wagner's Law or Keynes's Law is suitable for Romania. However, not all kinds of time series can be used in this method, the variables used in ARDL model can only be either reposeful time series, I (0) or integrated of order one, I (1).

2. Literature review

Over the past decades, researchers studied the same issue on many countries and time periods, using different methods and approaches to test causality between government expenditure and economic growth. The researches could be classified into two general categories. First, each law was discussed separately, especially for Wagner's law. Actually, during 1960 to 1980, Gupta (1967), Goffman (1968), Musgrave (1969), Peacock-Wiseman (1979), and Mann (1980) all tried to verify and explain Wagner's law in their own ways.

Second, for Keynes's Law, since there are many connotations in Keynesian fiscal instruments and it is hard to conclude the Keynesian growth theory into one sentence, causality or one law, the same issue of how government expenditure itself affects economic growth has not been largely debated. A more, suitable approach is the comparison of Keynes's Law to Wagner's Law. Several researches consider both Wagner's Law and Keynes's Law as a whole to discuss the relationship between government expenditure and economic growth. During the past two decades, Granger tests and other econometric methods have been used to test different economies over different periods of time, only to find that Wagner's Law was applicable for some countries and economies, while Keynes's Law was for others. In other words, neither Wagner's Law nor Keynes's Law was proven to be valid in each country or economy. In this regard, table 1 shows the empirical findings of the test of Wagner's and Keynes's Law.

Table 1. *Selected Empirical Findings on Wagner's law and Keynes's Law*

Authors	Countries	Study periods	Methods	Result inconclusive
Chow et al. (2002)	UK	1948-1997	Granger causality test	Keynes; Wagner
Abu-Bader and Abu-Qarn (2003)	Israel, Syria	1963-1998	Granger causality test	Keynes; Wagner
Muhlis and Hakan (2003)	Turkey	1965-2000	Granger causality test	neither
Chiung-Ju Huang(2006)	China (including Taiwan)	1979-2002	Bounds test Toda-Yamamoto causality test	neither
M.Adetunji Babatunde(2007)	Nigeria	1970-2006	Bounds Test Toda-Yamamoto causality test	Keynes
Kumar et al. (2009)	New Zealand	1960-2007	ARDL	Wagner
Kalam, Aziz (2009)	Bangladesh	1976-2007	Granger causality test	Wagner
Abdullah, Maamor (2010)	Malaysia	1970-2007	ARDL Bounds test	Wagner
Govindaraju et al. (2010)	Malaysia	1970-2006	ARDL	Keynes
Jamshaid et al. (2010)	Pakistan	1971-2006	Toda-Yamamoto causality test	Wagner
Balamurali, Sivarajasingam(2010)	Sri Lanka	1977-2009	Granger causality tests	Keynes; Wagner
Sabri Azgun （2010）	Turkey	1980-2009	Granger causality test,	Wagner
Mosayeb Pahlavani, Davoud Abed and Farshid Pourshabi （2011）	Iran	1960-2008	Granger causality test Toda-Yamamoto causality test	Wagner
Cosimo Magazzino （2012）	Italy	1960-2008	Granger causality test	Keynes
Ebaidalla Mahjoub Ebaidalla (2013)	Sudan	1970-2008	Granger causality test	Keynes
Katrakilidis Constantinos (2013）	Greece	1833-1938	ARDL	Wagner
Suna Korkmaz （2013）	Turkey	1998-2013	Granger causality test	Wagner
Dhyani Mehta （2016）	India	1985-2013	Granger causality test	Wagner

Source: based on literature review (authors presented in the first column from the table).

However, many researches had inconclusive results in asserting the relationship between government expenditure and economic growth only because of lack of significance (Ba digen, Cetinta (2004), Saten Kumar (2009), Chimobi (2009), Afzal, Abbas (2010), Magazzino (2012)).

There are three main reasons for the heterogeneity of the results:

- The various forms of Wagner's Law proposed by Gupta (1967), Goffman (1968), Musgrave (1969), Peacock-Wiseman (1979), and Mann (1980) make Wagner's Law difficult to understand and apply. Actually, Wagner considered the domestic income at that time rather than GDP or GDP per capita. These newer forms of the law are therefore corollaries of Wager's Law. Moreover, Wagner attributed the increase of government expenditure to the industrialization during the investigated period. However, some of the modern research did not distinguish whether the industrialization is on-going or not in the investigated countries. In other words, some researchers may have chosen the wrong period to test Wagner's Law. Also, Keynes's Law could have been applied in various forms and incorrect conditions.
- Several inappropriate econometrics methods were used in different researches. Some methods, which could not be used in small samples, were wrongly applied research whose data was insufficient.
- It is possible for big governments to pay more attention to promoting economic growth using different fiscal policies including enlargement of public expenditure, while for relatively small governments, a Wagnerian approach could be more adequate.

In this study, all versions of the law will be tested in order to deliver an objective final result. Furthermore, the period from 1991 to 2014 is a relatively optimal time period. Additionally, since there are 25 samples in the time series, which to some extent is quite small sample, ARDL bounds test was applied to do the empirical research.

3. Model and data

In order to determine the relationship between government expenditure and economic growth, it is necessary to define the right variables which represent government expenditure and/or economic growth. For example, Peacock-Wiseman (1979) used public expenditure to directly represent government expenditure, and GDP for economic growth. On the other hand, Gupta (1967) made a multidimensional comparison relying on per capita value. Based on Gupta's innovation, Goffman chose general government expenditure to represent government expenditure and per capita GDP to represent the economic growth because government expenditure affects society as a whole, while raising every person's life quality is an individual problem. Preferring ratio variables Musgrave chose general government expenditure as a percentage of GDP to replace government expenditure and per capita GDP as well to represent economic growth. Based on Musgrave's proposing, Mann also took ratios to represent government expenditure and GDP to represent economic growth.

In theory, both Wagner's Law and Keynes's Law describe the relation between government expenditure and economic growth in the long run. The mathematical model used to test the causality between government expenditure and economic growth employs two proxies A and B to represent the statistic variables associated with expenditure and growth. However, there are three proxies included into Proxy A to represent the government expenditure: government expenditure, government expenditure as a percentage of GDP, and per capita government expenditure. Moreover, there are two proxies included into Proxy B to represent the economic growth: GDP and per capita GDP.

In this study, five groups of Proxy A and Proxy B are chosen according to literature as shown below in table 2, Proxy A means the variables that can represent government expenditure and Proxy B means variables that can represent economic growth:

Table 2. *Variables to Test the Relationship between Government Expenditure and Economic Growth*

	Proxy A: Government Expenditure	Proxy B: Economic Growth	Initiator	Condition for the law
Group 1	LnG	LnY	Peacock-Wiseman(1979)	Elasticity＞1
Group 2	Ln(G/P)	Ln(Y/P)	Gupta(1967)	Elasticity＞1
Group 3	LnG	Ln(Y/P)	Goffman(1968)	Elasticity＞1
Group 4	Ln(G/Y)	LnY	Mann(1980)	Elasticity＞0
Group 5	Ln(G/Y)	Ln(Y/P)	Musgrave(1969)	Elasticity＞0

Where:

- *G represents general government expenditure;*
- *Y represents GDP,*
- *G/Y represents general government expenditure as a percentage of GDP;*
- *G/P represents per capita government expenditure;*
- *Y/P represents per capita GDP.*

Furthermore, all indicators are represented as logarithms not only to ensure a relative stability of the sequences, but also, since the regression coefficient of the double logarithmic model expresses the elasticity between the two indicators (variables), results show higher expressivity in this form.

As mention earlier, the study covers the period from 1990 to 2014 in Romania, because it is only after the Revolution of December of 1989 that a market economy was adopted. Since, Romania was ruled before 1990 by a socialist regime, it does not make any sense to discuss Wagner's Law or Keynes's Law, because Wagner's Law does not apply in planned economies. The following statements are valid for the source and processing of the raw data:

- all raw data was from the World Bank Database;
- GDP deflator is used to acquire real GDP and real government expenditure which are used in this study;
- GDP and government expenditure are denominated in US dollars.
- General government expenditure was chosen.

4. Methodology and results

Autoregressive Distributed Lag（ARDL）which was first mentioned by Charemza and Deadman (1997) is a relatively new model of cointegration test comparing the Granger test or Johansen test. The main idea of this approach is to determine whether there is a long-term and stable relationship between the variables by use of bounds test (Pesaran, 2007), and then estimate the correlation coefficient between the variables only if a cointegration relationship exists.

Comparing to Engle-Granger approach and Johansen cointegration test, the most significant advantage of the ARDL approach is that regardless of whether the time series is I (1) or I (0), and whether there is cointegration relation between the series, that kind of time series even in different orders are all applicable to the ARDL approach. Moreover, ARDL method is more robust and more suitable for the estimation of small samples (Pesaran and Shin, 2001). In addition, the traditional approaches of cointegration only make sure that there are long-term relationships between variables, but cannot tell the direction of a long-term relationship. However, by swapping independent and dependent variables to process the bounds test, ARDL approach can test the bidirectional causality of the variables.

There are mainly three steps to accomplish the ARDL approach:

- Unit root test is necessary to guarantee that all time series are I (0) or I (1);
- Bounds tests check if there is bidirectional causality or unidirectional causality of the two series;
- If there is causality between the two series, long run test is needed to finally find the coefficient which means the quantitative relationship between the two variables.

Unit root test

Time series applied to ARDL approach have to be no more than one-order integration time series according to Perasan (2001). In this regard, unit root test are necessary. Unlike other cointegration techniques (e.g. Johansen's procedure) which require certain pre-testing for unit roots, and the underlying variables to be integrated, ARDL approach can test the long-run relationship regardless of whether the underlying variables are I(0), I(1), or fractionally integrated. Therefore it is also necessary to do the unit root test for every underlying variable. The widely used ADF test as well as AIC criterion was applied in this study to test unit root. At the same time, from dot plot graphs, all the series of variables have trends and intercepts which are set in the test progress. Using E-views9, results are acquired as follows:

Table 3. *Results of Unit Root Tests*

Series	AIC (lag length)	ADF t-statistics	P-value	Integration order
LnG	-1.947*** (9)	-6.793	0.0000	I(1)
Ln(G/P)	-9.310*** (11)	-5.509	0.0028	I(0)
Ln(G/Y)	-7.961** (10)	-4.289	0.0208	I(1)
LnY	-9.291*** (10)	-19.872	0.0001	I(0)
Ln(Y/P)	-9.980*** (10)	-34.782	0.0001	I(0)

Note: *** and ** indicate statistical significance at the 1% and 5% level, respectively.

According to the results, null hypothesis of having a root unit are rejected in the significance level of 5%. LnG and Ln (G/Y) are first-order integrated, while Ln (G/P), LnY, and Ln(Y/P) are integrated of order 0. In other words, all the underlying variables are in accordance with the application condition of ARDL approach.

Bounds test

According to ARDL approach, which can be applied to series regardless of whether they are I(0), I(1), or mutually co-integrated, (Pesaran, 2001), F-statistics test is to make sure that there is a long-run relation between the variables. Referring to the basic approach given by Pesaran, the ARDL models to test Wagner's Law and Keynes's Law are set as follows:

$$dLnA_t = \alpha_0 + \sum_{i=1}^{K} \alpha_{1i} dLnA_{t-i} + \sum_{i=1}^{K} \alpha_{2i} dLnB_{t-i} + \alpha_3 LnA_{t-1} + \alpha_4 LnB_{t-1} + \mu_t$$

$$dLnB_t = \beta_0 + \sum_{i=1}^{K} \beta_{1i} dLnB_{t-i} + \sum_{i=1}^{K} \beta_{2i} dLnA_{t-i} + \beta_3 LnB_{t-1} + \beta_4 LnA_{t-1} + \nu_t$$

In these models:

- A represents the variables of Proxy A, including government expenditure, government expenditure as a percentage of GDP, and per capita government expenditure;

- *B* represents variables of Proxy *B*, including GDP and per capita GDP.
- α_0 and β_0 represent constant terms;
- α_{1i}, α_{2i}, β_{1i} and β_{2i} are short-term correlation coefficients;
- α_3, α_4, β_3 and β_4 are long-term correlation coefficients;
- *K* represents the maximum of lag order;
- u_t or v_t presents the residual.

The null hypothesis of no cointegration is to test there is no relationship in the long run, which were presented as follows.

- For Wagner's Law:

$$Null\ hypothesis\ H_0 : \alpha_3 = \alpha_4 = 0$$

$$Alternative\ hypothesis\ H_1 : \alpha_3 \neq 0\ or\ \alpha_4 \neq 0$$

- For Keynes's Law:

$$Null\ hypothesis\ H_0 : \beta_3 = \beta_4 = 0$$

$$Alternative\ hypothesis\ H_1 : \beta_3 \neq 0\ or\ \beta_4 \neq 0$$

In the hypothesis, the jointly significant F-statistic whose upper and lower boundary values are given by Perasan is used to make the following judgment: If the real F value is more than the upper boundary value, then null hypothesis H0 of "no cointegration" is rejected. However, if the real F value is less than the lower boundary value, then null hypothesis H0 of "no cointegration" is accepted. If the real F value is between the upper boundary value and the lower boundary value, the test is inconclusive. Since annual data is used and 25years are tested, we assign K=3 which means the maximum of lag order is three. Besides, Case III of the asymptotic critical value bounds for the F-statistic was applied which means there would be unrestricted intercept and no trend of the bounds test and results are achieved as follows:

Table 4. *Results of Bounds Tests*

	Group	Dependent Variable	Independent Variable	F-statistics	Bounds I(0)~I(1) 5% significance	Results
Wagner's law	1-W	LnG	LnY	10.336	4.94~5.73	Yes
	2-W	Ln(G/P)	Ln(Y/P)	6.183	4.94~5.73	Yes
	3-W	Ln(G/Y)	Ln(Y/P)	6.183	4.94~5.73	Yes
	4-W	Ln(G/Y)	LnY	10.336	4.94~5.37	Yes
	5-W	LnG	Ln(Y/P)	3.551	4.94~5.37	No
Keynes's law	1-K	LnY	LnG	11.596	4.94~5.37	Yes
	2-K	Ln(Y/P)	Ln(G/P)	7.017	4.94~5.37	Yes
	3-K	Ln(Y/P)	Ln(G/Y)	9.725	4.94~5.37	Yes
	4-K	LnY	Ln(G/Y)	11.240	4.94~5.37	Yes
	5-K	Ln(Y/P)	LnG	3.753	4.94~5.37	No

Based on the groups and variables shown in Table 2, Table 4 respectively gives the result of bounds test of the relationships between dependent variables and independent variables belonging to the five groups. Additionally, 1-W means the couple of variables in Group 1 used to test Wagner's law and 1-K means the couple of variables in Group 1 used to test Keynes's law. The other groups are nominated in the same way.

As is revealed in table 4, the F-statistics of the first four groups all surpassed the right side bounds, which meant that Groups 1, 2, 3 and 4 passed the bounds test. Group 5 which includes LnG and Ln(Y/P) do not pass the F test because its F test value is 3.753, not rejecting the hypothesis of bounds test. As a result, we delete Group5 from our research in the following step. Except for Group5, the F-statistics values of other groups are higher than the upper boundary of 5% significant level which was provided by Perasan. In other words, the eight pairs of variables have long-run relations.

Long run test

Once a long run relation between government expenditure and economic growth is found, the next step is to acquire the long run coefficients that can show the relationship between the real government expenditure and the real economic growth. According to Table 2, for the first 2 variables, if the coefficient is significantly greater than 1, the respective law can be proven (Keynes's or Wagner's). However if the coefficient is not significantly greater than 1, then the respective law cannot be proven. Also, for the fourth and fifth group the same criterion applies with the difference that the coefficient must be greater than 0. As a reminder, group 3 was discarded after performing the Bounds test. Constant terms do not have any real meaning, only to become auxiliary terms to see the significance of each regression. ARDL approach is also used to test the long run coefficients to finally get the results as follows:

Table 5. *Results of ARDL Regression*

	Model	Dependent Variable	Variable	Constant	Coefficient	Results
Wagner's law	1-W	LnG	LnY	-0.896*** (-5.353)	1.175*** (18.107)	Coefficient＞1
	2-W	Ln(G/P)	Ln(Y/P)	-0.689*** (-3.170)	1.074*** (15.988)	Coefficient＞1
	3-W	Ln(G/Y)	Ln(Y/P)	1.158*** (5.868)	0.121* (2.006)	Coefficient＞0
	4-W	Ln(G/Y)	LnY	1.103*** (6.594)	0.174** (2.695)	Coefficient＞0
Keynes's law	1-K	LnY	LnG	0.803*** (7.483)	0.832*** (16.563)	Coefficient＜1
	2-K	Ln(Y/P)	Ln(G/P)	0.792*** (5.789)	0.876*** (17.974)	Coefficient＜1
	3-K	Ln(Y/P)	Ln(G/Y)	1.072 (0.478)	1.399 (0.972)	Coefficient Not significant
	4-K	LnY	Ln(G/Y)	0.691 (0.336)	1.216 (0.922)	Coefficient Not significant

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

As is revealed from the long run test, all the tests about Wagner's Law are significant under the level of 5%. For *Model 1-W*, the coefficient is 1.175 which means if the GDP of

Romania grows by 1% then, the government expenditure will grow by 1.17%. For *Model 2-W*, the coefficient is 1.074 which means if the per capita GDP of Romania grows by 1%, then, the government expenditure will grow by 1.07%. The *Model 1-W* and *Model 2-W* means for economic growth, the government expenditure growth is elastic. For *Model 3-W*, the coefficient is 0.121 which means if the per capita GDP of Romania grows by 1%, then, government expenditure as a percentage of GDP will grow by 0.12% which is above zero and can prove the Wagner's Law according to Musgrave (1979). For *Model 4-W*, the coefficient is 0.174 which means if the GDP of Romania grows by 1%, then, government expenditure as a percentage of GDP will grow by 0.17% which is above zero and can also prove the Wagner's Law according to Mann (1979).

The results of all four models above prove that public expenditure grows because of the growth of Romanian economy, which means Wagner's Law really makes sense for Romania to some extent in the long run.

On the contrary, the results hardly prove the Keynes's Law plays a role in Romania. On one hand, the coefficients of both *Model 1-K* and *Model 2-K* are less than 1, which means the influence of government expenditure towards the growth of economy is inelastic. On the other hand, the coefficients of *Model 3-K* and *Model 4-K* are not significant even in the level of 10%. All the evidences indicated that the Keynes's Law is not applicable in Romania for the past 25years.

5. Conclusions

From the literature review, Wagner's Law and Keynes's Law are not totally antithetic. Both of them, each of them or even none of them could be established in one country at the same time. For Romania, in the study on the relationship between government expenditure and economic growth, different approaches were used to test the validity of Wagner's Law (G→Y) as well as Keynes's Law (Y→G), only to find that the conclusion is not consistent in different countries and economies. From the experience of Romania during the time period of 1991 to 2014, ARDL approaches and bounds tests are applied to test five different representations of Wagner's Law or Keynes's law.

Final conclusions are made as below:

- No matter what kind of the representation except for the group 3 (G/Y: government expenditure as a percentage of GDP and Y/P: represents per capita GDP) which is not significant through bounds test, from 1991-2014, Wagner's Law was proved.
- On the contrary, there is little evidence to demonstrate Keynes's Law from the research.
- Bounds tests show that there is long-term and stable relationship between Romanian government expenditure and economic growth which is unidirectional from government expenditure to economic growth.

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