



Munich Personal RePEc Archive

# **Cointegration, causality and Wagner's law with disaggregated data: evidence from Turkey, 1968-2004**

Kucukkale, Yakup and Yamak, Rahmi

Karadeniz Technical University

19 February 2012

Online at <https://mpra.ub.uni-muenchen.de/36894/>

MPRA Paper No. 36894, posted 24 Feb 2012 15:27 UTC

# **Cointegration, Causality and Wagner's Law with Disaggregated Data: Evidence from Turkey, 1968-2004**

*Yakup Kucukkale, Ph.D., Prof. Dr., Member of Faculty*

*Department of Economics*

*Faculty of Economics and Administrative Sciences*

*Karadeniz Technical University*

Phone: +90-462-377 34 85

Email: [ykucukkale@hotmail.com](mailto:ykucukkale@hotmail.com)

*Rahmi Yamak, Ph.D., Prof. Dr., Member of Faculty*

*Department of Econometrics*

*Faculty of Economics and Administrative Sciences*

*Karadeniz Technical University*

Phone: +90-462-377 33 15

Email: [yamak@ktu.edu.tr](mailto:yamak@ktu.edu.tr)

## **Abstract**

Recent developments in time series analysis have encouraged the economists to re-examine their findings about the Wagner's Law. That is why, the aggregation in public expenditures may lead some contradictions, disaggregated analyses should perform to have more consistent results. In this paper, the cointegration and causal relationships have re-examined between public expenditure and economic growth by using disaggregated annual data over the period of 1968-2004 for Turkish economy. Obtained results show that there is no common trend between these variables in the long-run. In the short-run, however, there is a strong and bidirectional causal relationship between public investment expenditures and economic growth.

# Cointegration, Causality and Wagner's Law with Disaggregated Data: Evidence from Turkey, 1968-2004

## Abstract

Recent developments in time series analysis have encouraged the economists to re-examine their findings about the Wagner's Law. That is why, the aggregation in public expenditures may lead some contradictions, disaggregated analyses should perform to have more consistent results. In this paper, the cointegration and causal relationships have re-examined between public expenditure and economic growth by using disaggregated annual data over the period of 1968-2004 for Turkish economy. Obtained results show that there is no common trend between these variables in the long-run. In the short-run, however, there is a strong and bidirectional causal relationship between public investment expenditures and economic growth.

## 1. Introduction

In the public finance literature, the hypothesis that there is a long-run tendency for the government expenditure to rise relative to national income is known as Wagner's Law. The hypothesis has been tested on numerous studies (see, for example, Wagner and Weber [1977], Mann [1980], Heller [1981], Yaser and Rajan [1985], Abizadeh and Yousefi [1988], Murthy [1993], Courakis et al. [1993], Oxley [1994], Chletsos and Kollias [1997], Jackson et al. [1998], Asseery et al. [1999], Morley and Perdakis [2000], Ashipala and Haimbodi [2003], Tobin [2005], Jiranyakul [2007], Narayan et al. [2008], Liu et al. [2008]).

There are also a few studies to test the hypothesis for Turkish case (see, for example, Yamak and Kucukkale [1997], Demirbas [1999], Yamak and Yamak [2001], Halicioglu [2003], Cavusoglu [2005], Arisoy [2005]). These studies found a significant statistical association between growth rate of government expenditure and economic growth. Such findings have been used to support the validity of the law. In all these studies, however, the data set has been composed by using the aggregate public expenditure series. Because of aggregation problem, the obtained results in these studies are critical to the validity of the hypothesis. Moreover, there is a growing controversy in empirical literature about using aggregated or disaggregated data.

For example, Granger and Siklos (1995) have denoted that temporal aggregation may lead "*demodulation cointegration*". In a recent study, Granger (1987) has proved that generating process of aggregated variables is largely determined by the common factors in the generating mechanisms of disaggregated variables, and a component of aggregated variable

has not to be have the same mechanism with the other components' mechanisms. Additionally, Granger (1988) has reported that if any component of aggregated variable contains a unit root, then aggregated variable has to be contains a unit root. Let's suppose that an aggregated variable is I(1) and this variable has three components. In this case, researcher can not determine which component has lead to aggregated variable be I(1). So, further analysis may not be enough sensitive to investigate which component lead to occur a potential causal relation. Gulasekaran (2002) has also denoted the distortionary effects of aggregation on causal relations. Granger (1969) supposed decomposition (or disaggregating) in order to eliminate this problem. Pesaran et al. (1989) has dealt also aggregation problem and strongly preferred to use disaggregated data.

In this paper, the cointegration and causal relationships will re-examine between public expenditure and economic growth by using disaggregated annual data over the period of 1968-2004. Public expenditures have been functionally disaggregated as current expenditures, investment expenditures, transfer expenditures, and military expenditures. The data has been deflated by using related GNP deflators. ADF test method has been used to perform the stationarity tests. While cointegrating relations have investigated by using Johansen-Juselius Cointegration Test, the causal relations have examined by using the Granger Causality Tests.

## 2. Methodology and Data

There are five different specifications used widely in the literature to test the Wagner's Law. Dependent and independent variables in these specifications can be different from each other according to interpretation of the law. These specifications are as follows:

$$\text{Model 1: } \log RGE_t = \beta_0 + \beta_1 \log RGNP_t + \varepsilon_t$$

$$\text{Model 2: } \log RGE_t = \beta_0 + \beta_1 \log RGNPPC_t + \varepsilon_t$$

$$\text{Model 3: } \log SRGE_t = \beta_0 + \beta_1 \log RGNPPC_t + \varepsilon_t$$

$$\text{Model 4: } \log RGEPC_t = \beta_0 + \beta_1 \log RGNPPC_t + \varepsilon_t$$

$$\text{Model 5: } \log SRGE_t = \beta_0 + \beta_1 \log RGNP_t + \varepsilon_t$$

Model 1 is known as Peacock and Wiseman (1961) test version. This version claims that the Real Government Expenditures ( $RGE_t$ ) is a function of Real Gross National Product

(RGNP<sub>t</sub>). In this version, the higher real gross national product may lead the higher real government expenditures. Validity of the law depends on the income elasticity of the real government expenditures. If this elasticity is greater than 1, the law is valid. In all other circumstances, the law is not to be valid.

According to Goffman (1968), the validity of the law depends on the income elasticity of real government expenditures is greater than 1. In Model 2; RGE<sub>t</sub> is the real government expenditures at time t, and RGNPPC<sub>t</sub> is real gross national product per capita at time t.

In Model 3, the Musgrave (1969) test version can be seen. Musgrave asserts that the validity of the Wagner's Law depends on the elasticity of the share of the government expenditures in total economic activity to real income per capita is greater than zero. In Model 3, SRGE<sub>t</sub> is the share of real government expenditures in total economic activity at time t.

Michas (1975) Test Version is as seen in Model 4. According to Michas, if the elasticity of the real government expenditures per capita to real income per capita is greater than 1, the law is valid. In other circumstances there would not to be sufficient proof for the validity of the law.

Model 5 is the advanced version of the Peacock and Wiseman version in the Model 1. Authors acclaim that being the elasticity of the share of the real government expenditures in total economic activity to real income is greater than zero is sufficient to put forward the validity of the law.

Each of the five models above described has been separately used in this paper with aggregated and disaggregated data.

In cointegration and causality analysis, stationarity tests must be performed for each of the variables. There have been a variety of proposed methods for implementing stationarity tests (for example, Dickey and Fuller, 1979; Sargan and Bhargava, 1983; Phillips and Perron, 1988; Zivot and Andrews, 1992; among the others) and each has been widely used in the applied economics literature. However, there is a growing consensus that the stationarity test procedure (hereafter ADF) due to Dickey and Fuller (1979) has superior small sample properties compared to its alternatives. Therefore, in this study, ADF test procedure was employed for implementing stationarity tests. The ADF test procedure requires to run the following regression for both level and first difference of each variable, separately. If necessary, the ADF regression can be run for the higher levels of the variables.

$$\Delta LX_t = \alpha + \gamma Trend + \Phi LX_{t-1} + \sum_{i=1}^m \delta_i \Delta LX_{t-i} + w_i \quad (1)$$

where  $LX$  is the logarithmic form of the variable in question,  $\alpha$  and  $t$  are a constant term and a time trend, respectively, “ $\Delta$ ” is the first difference operator,  $w$  is the white noise residual and  $m$  is the lagged values of  $\Delta LX_t$  that are included to allow for serial correlation in the residuals. In the context of the ADF test, a test for nonstationarity of the series,  $LX$ , amounts to a t-test of  $\Phi=0$ . The alternative hypothesis of stationarity requires that  $\Phi$  be significant negative. If the absolute value of the computed t-statistic for  $\Phi$  exceeds the absolute critical value given in MacKinnon (1990), then the null hypothesis that the log level of  $X$  series is not stationary must be rejected against its alternative. If, on the other hand, it is less than the critical value, it is concluded that the logarithmic level of  $X$ , that is  $LX$ , is nonstationary. In this case, the same regression must be repeated for the first difference of the logarithmic value of the series. In estimating ADF regressions, the number of own lags of dependent variable ( $m$ ) was chosen using the “Schwartz Information Criterion” (SIC).

If the series under consideration turn out to be integrated of the same order, it is possible to proceed by testing for cointegration relationships between the integrated variables. In this paper cointegration tests were carried by means of the methods developed by Engel and Granger (1987), Johansen (1988), and Johansen and Juselius (1990). Engle and Granger cointegration test (hereafter EG) supposed a two step estimation procedure. If the unit root tests indicate that both of the variables in consideration are I(1), the long-run equilibrium relationship can be estimate by using the equation (2).

$$LY_t = \beta_0 + \beta_1 LX_t + \varepsilon_t \quad (2)$$

The second step in EG Test is to determine if these variables are cointegrated or not. If the residual series obtained from the equation (2),  $\hat{\varepsilon}_t$ , are found to be stationary, the  $LY_t$  and  $LX_t$  sequences are cointegrated CI(1,1). If the residual series are not to be stationary, the variables in consideration are not cointegrated.

The Johansen method applies the maximum likelihood procedure to determine the presence of cointegrating vectors in nonstationary time series as a vector autoregressive (VAR):

$$\Delta Z_t = C + \sum_{i=1}^K \Gamma_i \Delta Z_{t-i} + \Pi Z_{t-1} + \eta_t \quad (3)$$

where  $Z_t$  is a vector of nonstationary (in log levels) variables and  $C$  is the constant term. The information on the coefficient matrix between the levels of the series  $\Pi$  is decomposed as  $\Pi = \alpha\beta'$  where the relevant elements of the  $\alpha$  matrix are adjustment coefficients and the  $\beta$  matrix contains the cointegrating vectors. Johansen and Juselius (1990) specify two likelihood ratio test statistics to test for the number of cointegrating vectors. The first likelihood ratio statistics for the null of exactly  $r$  cointegrating vectors against the alternative of  $r+1$  vectors is the maximum eigenvalue statistic. The second statistic for the hypothesis of at most  $r$  cointegrating vectors against the alternative is the trace statistic. Critical values for both test statistics are tabulated in Johansen and Juselius (1990). The number of lags applied in the cointegration test are based on the information provided by the multivariate generalization of the AIC<sup>1</sup>.

If the time series integrated of order one are not cointegrated, the relationships set up in Model (1, 2, 3, 4, 5) are estimated by utilizing the first differences of the series. On the other hand, there are two approaches in using of cointegrated nonstationary data. One is to estimate the model in terms of the levels of variables, without modeling the cointegrating relationships. An alternative to this approach is to estimate the model in the first differences with the addition of cointegrating terms (Vector Error Correction approach). In this study, the second approach has been followed. A typical VEC model is as seen in equation 4.

$$\begin{aligned}\Delta LX_t &= \beta_0 + \beta_1 \varepsilon_{t-1} + \sum_{j=1}^k \beta_{2j} \Delta LX_{t-j} + \sum_{j=1}^k \beta_{3j} \Delta LY_{t-j} + \tau_t \\ \Delta LY_t &= \alpha_0 + \alpha_1 \varepsilon_{t-1} + \sum_{j=1}^k \alpha_{2j} \Delta LY_{t-j} + \sum_{j=1}^k \alpha_{3j} \Delta LX_{t-j} + \omega_t\end{aligned}\tag{4}$$

where at least one of  $\beta_0$  or  $\alpha_0$  is non zero and  $\tau_t$  and  $\omega_t$  are white noise errors. The error correction term,  $\varepsilon_{t-1}$ , can be obtained by regressing  $LX$  on  $LY$  or  $LY$  on  $LX$ . The optimal lag length  $k$  is determined using one of the model selection criteria, for example Schwartz Information Criterion (SIC). The variable  $LX$  is deemed to cause  $LY$  if  $\beta_{3j}$  are significant as a group based on conventional F tests and/or  $\beta_1$  is statistically different from zero. Similarly,  $LY$  is deemed to cause  $LX$  if  $\alpha_{3j}$  are significant as a group and/or  $\alpha_1$  is statistically different from zero. In traditional tests for causality, the error correction terms can be omitted from

---

<sup>1</sup> The multivariate generalization of the AIC is  $AIC = T \log|\Sigma| + 2N$ . Where  $|\Sigma|$  is determinant of the covariance matrix of the residuals and  $N$  is total number of parameters estimated in all equations.

equations. But this omission is valid only if the two time series under question are not cointegrated.

The data used in this study have come from different sources. Aggregate government expenditure and its disaggregated components have collected from the web site of “The Central Bank of the Republic of Turkey – Electronic Data Delivery System” ([www.tcmb.gov.tr](http://www.tcmb.gov.tr)). Defense Spending has come from the various issues of the “Annual Report” of “Republic of Turkey Ministry of Finance” and “NATO-Russia Compendium of Financial and Economic Data Relating to Defense – 2007”. All variables have been deflated by using the GNP Deflator (1987=100).

### 3. Empirical Results

Table 1 and 2 present the ADF test results for the log levels as well as the first (logged) differences of the series, respectively.

**Table 1:** ADF Unit Root Test for the Level of the Series

Variable	Without Trend		With Trend	
	Optimal Lag Length	ADF Test Statistics	Optimal Lag Length	ADF Test Statistics
Reel GNP Series				
<b>LRGNP</b>	0	-0.902365	0	-2.692858
<b>LRGNP-PC</b>	0	-0.915109	0	-2.739730
Reel Public Expenditures Series				
<b>LRTOTEX</b>	0	-0.809569	0	-1.957266
<b>LRCUREX</b>	0	-1.381681	0	-1.654661
<b>LRINVEX</b>	0	-1.274356	0	-1.339084
<b>LRTRANEX</b>	0	-0.994245	0	-2.437154
<b>LMILEX</b>	0	-2.443728	0	-2.230448
Reel Public Expenditures Series Per Capita				
<b>LRTOTEX-PC</b>	0	-0.883556	0	-1.832200
<b>LRCUREX-PC</b>	0	-1.540948	0	-1.662815
<b>LRINVEX-PC</b>	0	-1.597236	0	-1.278546
<b>LRTRANEX-PC</b>	0	-1.070827	0	-2.285820
<b>LMILEX-PC</b>	0	-0.825397	0	-1.483969
Share of Reel Public Expenditures Series in Total Economic Activity				
<b>LSRTOTEX</b>	0	-1.173740	0	-1.856332
<b>LSRCUREX</b>	0	-1.942134	0	-1.818765
<b>LSRINVEX</b>	0	-1.463714	0	-1.030186
<b>LSRTRANEX</b>	0	-1.276398	0	-2.269248
<b>LSMILEX</b>	0	-1.069615	0	-2.043381

**Note:** Optimal lag lengths were chosen by using Swartz Information Criterion. Maximum lag length is 5. MacKinnon Critical Values are -3.626784 at 1%, -2.945842 at 5% and -2.611531 at 10% for the unit root test without trend. MacKinnon Critical Values for the unit root test with trend are -4.234972 at 1%, -3.540328 at 5% and -3.202445 at 10% significance level, respectively.



**Table 2: ADF Unit Root Test for the First Differences of the Series**

Variable	Without Trend		With Trend	
	Optimal Lag Length	ADF Test Statistics	Optimal Lag Length	ADF Test Statistics
Reel GNP Series				
<b>LRGNP</b>	0	-6.506223 <sup>a</sup>	0	-6.485358 <sup>a</sup>
<b>LRGNP-PC</b>	0	-5.925209 <sup>a</sup>	0	-5.836321 <sup>a</sup>
Reel Public Expenditures Series				
<b>LRTOTEX</b>	0	-5.750850 <sup>a</sup>	0	-5.664340 <sup>a</sup>
<b>LRCUREX</b>	0	-4.266912 <sup>a</sup>	0	-4.284542 <sup>a</sup>
<b>LRINVEX</b>	0	-4.119909 <sup>a</sup>	0	-3.998605 <sup>b</sup>
<b>LRTRANEX</b>	0	-6.614930 <sup>a</sup>	0	-6.519576 <sup>a</sup>
<b>LMILEX</b>	0	-5.621876 <sup>a</sup>	0	-5.781725 <sup>a</sup>
Reel Public Expenditures Series Per Capita				
<b>LRTOTEX-PC</b>	0	-5.719193 <sup>a</sup>	0	-5.625896 <sup>a</sup>
<b>LRCUREX-PC</b>	0	-4.318352 <sup>a</sup>	0	-4.300815 <sup>a</sup>
<b>LRINVEX-PC</b>	0	-4.084288 <sup>a</sup>	0	-3.979162 <sup>b</sup>
<b>LRTRANEX-PC</b>	0	-6.583120 <sup>a</sup>	0	-6.482771 <sup>a</sup>
<b>LMILEX-PC</b>	0	-5.635707 <sup>a</sup>	0	-5.637714 <sup>a</sup>
Share of Reel Public Expenditures Series in Total Economic Activity				
<b>LSRTOTEX</b>	0	-5.886287 <sup>a</sup>	0	-5.780346 <sup>a</sup>
<b>LSRCUREX</b>	0	-4.402606 <sup>a</sup>	0	-4.336477 <sup>a</sup>
<b>LSRINVEX</b>	0	-4.134196 <sup>a</sup>	0	-4.054385 <sup>b</sup>
<b>LSRTRANEX</b>	0	-6.630590 <sup>a</sup>	0	-6.525332 <sup>a</sup>
<b>LSMILEX</b>	0	-5.665682 <sup>a</sup>	0	-5.736352 <sup>a</sup>

**Note:** Optimal lag lengths were chosen by using Schwartz Information Criterion. Maximum lag length is 5. MacKinnon Critical Values are -3.632900 at 1%, -2.948404 at 5% and -2.612874 at 10% for the unit root test without trend. MacKinnon Critical Values for the unit root test with trend are -4.243644 at 1%, -3.544284 at 5% and -3.204699 at 10% significance level. a and b denotes that the test statistics is significant at 1% and 5% percent significance level, respectively.

The third and the fifth columns in Table 1 and 2 record the ADF-t statistics for the levels and first differences of the variables. Critical values are given at the bottom of the tables. Obtained results show that all variables in question are stationary in their first logged differences. Thus, the evidence suggests that first differencing of the variables appears to be sufficient to achieve stationarity.

**Table 3: Engle-Granger Cointegration Test Results**

Dependent Variable	Independent Variable	Elasticity Parameter	ADF-t Statistics of Residuals
<i>Model 1 (Peacock-Wiseman)</i>			
LRTOTEX	LRGNP	1.601815 <sup>a</sup> (+)	-1.896749 (0)
LRCUREX		1.188807 <sup>a</sup> (+)	-1.941347 (0)
LRINVEX		0.213320	-1.426484 (0)
LRTRANEX		1.973970 <sup>a</sup> (+)	-2.228878 (0)
LMILEX		0.691496 <sup>a</sup>	-2.144437 (0)
<i>Model 2 (Goffman)</i>			
LRTOTEX	RGNP-PC	3.337001 <sup>a</sup> (+)	-2.331850 (0)
LRCUREX		2.509937 <sup>a</sup> (+)	-3.371609 (2) <sup>b</sup>
LRINVEX		0.463501	-1.376003 (0)
LRTRANEX		4.093737 <sup>a</sup> (+)	-2.523900 (0)
LMILEX		1.425194 <sup>a</sup> (+)	-2.160052 (0)
<i>Model 3 (Musgrave)</i>			
LSRTOTEX	RGNP-PC	1.245334 <sup>a</sup> (+)	-2.068430 (0)
LSRCUREX		0.418270 <sup>a</sup> (+)	-2.019718 (0)
LSRINVEX		-1.628166 <sup>a</sup>	-1.632965 (0)
LSRTRANEX		2.002070 <sup>a</sup> (+)	-2.393388 (0)
LSMILEX		-0.666473 <sup>a</sup>	-2.195681 (0)
<i>Model 4 (Michas)</i>			
LRTOTEX-PC	RGNP-PC	2.245334 <sup>a</sup> (+)	-2.068430 (0)
LRCUREX-PC		1.418270 <sup>a</sup> (+)	-2.019718 (0)
LRINVEX-PC		-0.628166 <sup>c</sup>	-1.632965 (0)
LRTRANEX-PC		3.002070 <sup>a</sup> (+)	-2.393388 (0)
LMILEX-PC		-0.141621 <sup>a</sup>	-2.507937 (0)
<i>Model 5 (Peacock-Wiseman)</i>			
LSRTOTEX	RGNP	0.601815 <sup>a</sup> (+)	-1.896749 (0)
LSRCUREX		0.188807 <sup>a</sup> (+)	-1.941347 (0)
LSRINVEX		-0.786680 <sup>a</sup>	-1.426484 (0)
LSRTRANEX		0.973970 <sup>a</sup> (+)	-2.228878 (0)
LSMILEX		-0.308504 <sup>a</sup>	-2.144437 (0)

**Note:** a, b and c denotes the parameter is significant at 1%, 5% and 10% respectively. (+) indicates that the law is valid in conventional wisdom. Numbers in parenthesis show the optimal lag length which determined by using the Schwartz Information Criterion. ADF critical values are -3.626784 at 1%, -2.945842 at 5% and -2.611531 at 10%, respectively.

Table 3 reports the Engle-Granger Cointegration Test results. The numbers in the third column in Table 3 are the estimated  $\beta_l$  parameters in the models 1-5. According to these estimated elasticity parameters, the Wagner's Law is valid for total government expenditures, current expenditures and transfer expenditures in conventional wisdom. Although the estimated parameters are statistically significant, the law is not valid for investment expenditures and military expenditures.

The last column in Table 3 reports the ADF-t statistics of the residuals. All of the values in this column (except one) indicate that there is no long-run relationship between

public expenditure and economic growth. Engle-Granger test results do not support the idea that public expenditures and national income share the same trend in the long-run.

Johansen-Juselius cointegration test results are reported in Table 4.

**Table 4:** Johansen-Juselius Cointegration Test Results VAR(2)  
(linear deterministic trend in the data)

<b>Dependent Variable</b>	<b>Independent Variable</b>	<b>Likelihood Ratio (H<sub>0</sub>: None)</b> 5% cv = 15.41 1% cv = 20.04	<b>Likelihood Ratio (H<sub>0</sub>: At most 1)</b> 5% cv = 3.76 1% cv = 6.65
<i>Model 1 (Peacock-Wiseman)</i>			
<b>LRTOTEX</b>	<b>RGNP</b>	7.428178	0.675166
<b>LRCUREX</b>		8.099952	0.542834
<b>LRINVEX</b>		4.849237	1.621380
<b>LRTRANEX</b>		9.697490	0.654870
<b>LMILEX</b>		9.444612	0.201128
<i>Model 2 (Goffman)</i>			
<b>LRTOTEX</b>	<b>RGNP-PC</b>	14.19239	0.273736
<b>LRCUREX</b>		14.30209	0.773355
<b>LRINVEX</b>		4.547179	1.435355
<b>LRTRANEX</b>		15.58126 <sup>b</sup>	0.269924
<b>LMILEX</b>		9.161719	0.629920
<i>Model 3 (Musgrave)</i>			
<b>LSRTOTEX</b>	<b>RGNP-PC</b>	9.694306	0.385285
<b>LSRCUREX</b>		7.889215	0.612062
<b>LSRINVEX</b>		6.405922	1.709175
<b>LSRTRANEX</b>		12.79362	0.362982
<b>LSMILEX</b>		9.039615	0.190274
<i>Model 4 (Michas)</i>			
<b>LRTOTEX-PC</b>	<b>RGNP-PC</b>	9.694306	0.385285
<b>LRCUREX-PC</b>		7.889215	0.612062
<b>LRINVEX-PC</b>		6.405922	1.709175
<b>LRTRANEX-PC</b>		12.79362	0.362982
<b>LMILEX-PC</b>		9.039615	0.190274
<i>Model 5 (Peacock-Wiseman)</i>			
<b>LSRTOTEX</b>	<b>RGNP</b>	7.428178	0.675166
<b>LSRCUREX</b>		8.099952	0.542834
<b>LSRINVEX</b>		4.849237	1.621380
<b>LSRTRANEX</b>		9.697490	0.654870
<b>LSMILEX</b>		9.444612	0.201128

**Note:** b denotes the parameter is significant at %5.

Johansen-Juselius cointegration test results have approved the Engle-Granger cointegration test results. Either aggregated or disaggregated public expenditures series are not cointegrated with economic growth. In other words, aggregated or disaggregated public expenditures series and the economic growth are not linked in a common long-term

equilibrium. The nonexistence of the cointegration between the variables in question suggests that the causality test must proceed in traditional framework with the error correction term omitted. Causality test results are reported in Table 5.

**Table 5:** Granger Causality Test Results

Dependent Variable	Independent Variable	F-Test
<i>Model 1 (Peacock-Wiseman)</i>		
$\Delta$ LRTOTEX (1)	$\Delta$ LRGNP (1)	1.27416
$\Delta$ LRCUREX (1)	$\Delta$ LRGNP (3)	1.30816
$\Delta$ LRINVEX (1)	$\Delta$ LRGNP (3)	2.48383 <sup>c</sup>
$\Delta$ LRTRANEX (1)	$\Delta$ LRGNP (1)	2.31672
$\Delta$ LMILEX (1)	$\Delta$ LRGNP (1)	0.00174
$\Delta$ LRGNP (1)	$\Delta$ LRTOTEX (3)	2.04525
$\Delta$ LRGNP (1)	$\Delta$ LRCUREX (2)	2.04824
$\Delta$ LRGNP (1)	$\Delta$ LRINVEX (4)	2.37728 <sup>c</sup>
$\Delta$ LRGNP (1)	$\Delta$ LRTRANEX (3)	1.84979
$\Delta$ LRGNP (1)	$\Delta$ LMILEX (4)	2.09293
<i>Model 2 (Goffman)</i>		
$\Delta$ LRTOTEX (1)	$\Delta$ LRGNP-PC (1)	1.22175
$\Delta$ LRCUREX (1)	$\Delta$ LRGNP-PC (1)	0.02127
$\Delta$ LRINVEX (1)	$\Delta$ LRGNP-PC (3)	2.24695 <sup>c</sup>
$\Delta$ LRTRANEX (1)	$\Delta$ LRGNP-PC (1)	2.13711
$\Delta$ LMILEX (1)	$\Delta$ LRGNP-PC (1)	0.00169
$\Delta$ LRGNP-PC (4)	$\Delta$ LRTOTEX (2)	1.48988
$\Delta$ LRGNP-PC (4)	$\Delta$ LRCUREX (2)	1.70218
$\Delta$ LRGNP-PC (4)	$\Delta$ LRINVEX (2)	4.87898 <sup>b</sup>
$\Delta$ LRGNP-PC (4)	$\Delta$ LRTRANEX (2)	1.21963
$\Delta$ LRGNP-PC (4)	$\Delta$ LMILEX (4)	1.35658
<i>Model 3 (Musgrave)</i>		
$\Delta$ LSRTOTEX (1)	$\Delta$ LRGNP-PC (4)	2.23728 <sup>c</sup>
$\Delta$ LSRCUREX (1)	$\Delta$ LRGNP-PC (5)	1.88021
$\Delta$ LSRINVEX (1)	$\Delta$ LRGNP-PC (3)	2.38214 <sup>c</sup>
$\Delta$ LSRTRANEX (1)	$\Delta$ LRGNP-PC (4)	2.11114
$\Delta$ LSMILEX (1)	$\Delta$ LRGNP-PC (1)	0.07077
$\Delta$ LRGNP-PC (4)	$\Delta$ LSRTOTEX (2)	1.65358
$\Delta$ LRGNP-PC (4)	$\Delta$ LSRCUREX (2)	1.93071
$\Delta$ LRGNP-PC (4)	$\Delta$ LSRINVEX (2)	5.10746 <sup>b</sup>
$\Delta$ LRGNP-PC (4)	$\Delta$ LSRTRANEX (2)	1.27972
$\Delta$ LRGNP-PC (4)	$\Delta$ LSMILEX (4)	1.62300

Note: b and c denote the parameters are significant at %5 and %10, respectively.

**Table 5:** (Continue)

<i>Model 4 (Michas)</i>		
$\Delta$ LRTOTEX-PC (1)	$\Delta$ LRGNP-PC (1)	1.45567
$\Delta$ LRCUREX-PC (1)	$\Delta$ LRGNP-PC (1)	0.06608
$\Delta$ LRINVEX-PC (1)	$\Delta$ LRGNP-PC (3)	2.34462 <sup>c</sup>
$\Delta$ LRTRANEX-PC (1)	$\Delta$ LRGNP-PC (1)	2.42200
$\Delta$ LMILEX-PC (1)	$\Delta$ LRGNP-PC (1)	0.01990
$\Delta$ LRGNP-PC (4)	$\Delta$ LRTOTEX-PC (2)	1.65358
$\Delta$ LRGNP-PC (4)	$\Delta$ LRCUREX-PC (2)	1.93071
$\Delta$ LRGNP-PC (4)	$\Delta$ LRINVEX-PC (2)	5.10746 <sup>b</sup>
$\Delta$ LRGNP-PC (4)	$\Delta$ LRTRANEX-PC (2)	1.27972
$\Delta$ RGNP-PC (4)	$\Delta$ LMILEX-PC (4)	1.62300
<i>Model 5 (Peacock-Wiseman)</i>		
$\Delta$ LSRTOTEX (1)	$\Delta$ LRGNP (1)	1.75715
$\Delta$ LSRCUREX (1)	$\Delta$ LRGNP (3)	1.74853
$\Delta$ LSRINVEX (1)	$\Delta$ LRGNP (3)	2.69599 <sup>c</sup>
$\Delta$ LSRTRANEX (1)	$\Delta$ LRGNP (1)	1.96529
$\Delta$ LSMILEX (1)	$\Delta$ LRGNP (1)	0.08293
$\Delta$ LRGNP (1)	$\Delta$ LSRTOTEX (3)	2.32620 <sup>c</sup>
$\Delta$ LRGNP (1)	$\Delta$ LSRCUREX (2)	2.56761 <sup>c</sup>
$\Delta$ LRGNP (1)	$\Delta$ LSRINVEX (2)	3.06960 <sup>c</sup>
$\Delta$ LRGNP (1)	$\Delta$ LSRTRANEX (3)	1.93507
$\Delta$ LRGNP (1)	$\Delta$ LSMILEX (1)	0.09784

**Note:** b and c denote the parameters are significant at %5 and %10, respectively.

As seen from the Table 5, there is a strong bidirectional causality between public investment expenditures and economic growth for all of the versions of the Law. Some of the versions, for example Musgrave Test Version, support a few unidirectional causalities between the variables. But, we can conclude that there is only one causal relationship between investment expenditures and economic growth, by taking care of all models as a whole.

#### 4. Conclusions

One of the main subjects debated by researchers in the public finance literature is whether the public expenditures accelerate the economic growth or *vice versa*. This question has answered by Wagner's pioneering study. Due to Wagner, there is a long-run tendency for the government expenditure to rise relative to national income. This hypothesis is known as Wagner's Law. On the other hand, the main criticism of government intervention for allocating resources is that it is not effective as much as market forces do. Because of this, it is very important how the government distributes its expenditures in different channels. If the government would distribute own expenditures in the right channels, the total economic activity could accelerate. That completely is about the amounts of the components of

aggregate public expenditures. How much investment expenditures or current expenditures should do in order to build a correct design? To find an answer for this question, a disaggregated analysis should do for the Wagner's Law.

On the other hand, there are some econometrics requirements for disaggregation. For example, Granger and Siklos (1995) have denoted that temporal aggregation may lead "*demodulation cointegration*". Granger (1987) has also proved that generating of aggregated variables is largely determined by the common factors in the generating mechanisms of disaggregated variables, and a component of aggregated variable has not to be have the same mechanism with the other components' mechanisms. And Gulasekaran (2002) has denoted "*the distortionary effects*" of aggregation on causal relations, etc.

In this paper, the cointegration and causal relationships have examined between public expenditures and economic growth by using disaggregated annual data over the period of 1968-2004. Public expenditures have been functionally divided as current expenditures, investment expenditures, transfer expenditures and military expenditures.

Obtained results from stationarity and cointegration tests indicated that the Wagner's Law is valid for Turkey in traditional approach (or conventional wisdom). There is absolutely not a long-term relationship between public expenditures and economic growth. This finding indicated that public expenditures and economic growth in Turkish economy follow the different long-term trends. Even all of the variables used in this study are  $I(1)$ , they are not cointegrated with each other.

Causality test results are not different so much from cointegration test results. Except a few and weak unidirectional causal relations, there is only one bidirectional and strong relationship between public investment expenditures and economic growth. This result suggests that if the policy makers' target is sustainable and fast economic growth, so they have to care about public investment expenditures. The results strongly put forward that higher public investment expenditures accelerate the economic growth in the short-run.

## References

Abizadeh S. and M. Yousefi, (1988), "An Empirical Analysis of South Korea's Economic Development and Public Expenditure Growth", *Journal of Socio-Economics*, 6(27), pp: 687-700.

- Arisoy I., (2005), "Wagner ve Keynes Hipotezleri Cercevesinde Turkiye'de Kamu Harcamalari ve Ekonomik Buyume Iliskisi", *CU Sosyal Bilimler Enstitusu Dergisi*, 14 (2), pp: 63-80.
- Ashipala J. and N. Haimbodi, (2003), "The Impact of Public Investment on Economic Growth in Namibia", *NEPRU Working Paper*, No: 88.
- Asseery A. A., Law D. and N. Perdikis, (1999), "Wagner's Law and Public Expenditure in Iraq: A Test using Disaggregated Data", *Applied Economics Letters*, 6, pp: 39-44.
- Cavusoglu A. T., (2005), "Testing the Validity of Wagner's Law in Turkey: The Bounds Testing Approach", *Ankara University SBF Review*, 60(1), pp: 73-88.
- Chletsos M. and C. Kollias, (1997), "Testing Wagner's law using disaggregated public expenditure data in the case of Greece: 1958-93", *Applied Economics*, 29, pp: 371-377.
- Courakis A. S., Moura-Roque F. and G. Tridimas, (1993), "Public Expenditure Growth in Greece and Portugal: Wagner's Law and Beyond", *Applied Economics*, 25, pp: 125-134.
- Demirbas S., (1999), "Cointegration Analysis-Causality Testing and Wagner's Law: The Case of Turkey, 1950-1990", *Annual Meeting of the European Public Choice Society*, April 7-10 1999, Lisbon.
- Dickey D. A. and W. A. Fuller, (1979), "Distribution of the Estimators for Autoregressive Series with a Unit Root", *Journal of the American Statistical Association*, 74, pp: 427-431.
- Dickey D. A. and W. A. Fuller, (1981), "Likelihood Ratio Statistics and Autoregressive Time Series with a Unit Root", *Econometrica*, 49, pp: 1057-1072.
- Engle R. F. and C. W. J. Granger, (1987), "Cointegration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55, pp: 251-276.

- Granger, C. W. J. (1969), "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods", *Econometrica*, 3(37), pp: 424-438.
- Granger, C. W. J., (1987), "Implications of Aggregation with Common Factors", *Econometric Theory*, 3, pp: 208-222.
- Granger, C. W. J., (1988), "Some Recent Developments in a Concept of Causality", *Journal of Econometrics*, 39, pp: 213-228.
- Granger, C. W. J., (1988), "Aggregation of Time Series Variables – A Survey", *Federal Reserve Bank of Minneapolis*, Discussion Paper, No: 1.
- Granger C. W. J. and P. Newbold, (1974), "Spurious in Econometrics", *Journal of Economics*, 2, pp: 111-120.
- Granger, C. W. J. and P. L. Siklos, (1995), "Systematic Sampling, Temporal Aggregation, Seasonal Adjustment, and Cointegration Theory and Evidence", *Journal of Econometrics*, 66, pp: 357-369.
- Gulasekaran, R., (2002), "The Distortionary Effects of Temporal Aggregation on Granger Causality", *Business Papers*, Bond University Schools of Business.
- Halicioglu F., (2003), "Testing Wagner's Law for Turkey: 1960-2000", *Review of Middle East Economics and Finance*, 2(1), pp: 129-140.
- Heller P. S., (1981), "Diverging Shares in the Nominal and Real Government Expenditure in GDP: Implications for Policy", *National Tax Journal*, 34, pp: 61-74.
- Jackson P. M., Fethi M. D. and S. Fethi, (1998), "Cointegration, Causality and Wagner's Law: A test for Northern Cyprus, 1977-1996", *Second International Congress on Cyprus Studies*; Eastern Mediterranean University, Gazimagusa, Turkish Republic of Northern Cyprus, 24-27 November, 1998.



- Jiranyakul K., (2007), "The Relation between Government Expenditures and Economic Growth in Thailand", *Working Paper*, National Institute of Development Administration, Thailand
- Johansen S., (1988), "Statistical Analysis of Cointegration Vector", *Journal of Economic Dynamics and Control*, 12, pp: 231-254.
- Johansen S. and K. Juselius, (1990), "Maximum Likelihood Estimation and Inference on Cointegration with Application to the Demand for Money", *Oxford Bulletin of Economics and Statistics*, 52, pp: 169-210.
- Liu L. C., Hsu C. E. and M. Z. Younis, (2008), "The Association between Government Expenditure and Economic Growth: Granger Causality Test of US Data, 1947-2002", *Journal of Public Budgeting, Accounting & Financial Management*, 20 (4), pp: 439-452.
- Mann A. J., (1980), "Wagner's Law: An Econometric Test for Mexico", *National Tax Journal*, 33, pp: 189-201.
- MacKinnon J. G., (1990), "Critical Values for Co-integration Tests", *UC San Diego Discussion Paper*, 90-4.
- Morley B. and N. Perdakis, (2000), "Trade Liberalization, Government Expenditure and Economic Growth in Egypt", *Journal of Development Studies*, 4(36), pp: 38-54.
- Murthy N. R. V., (1993), "Further Evidence of Wagner's Law for Mexico: An Application of Cointegration Analysis", *Public Finance/Finances Publiques*, 1(48), pp: 92-96.
- Narayan P. K., Nielsen I. and R. Smyth, (2008), "Panel Data, Cointegration, Causality and Wagner's Law: Empirical Evidence from Chinese Provinces", *China Economic Review*, 19, pp: 297-307.
- Oxley L., (1994), "Cointegration, Causality and Wagner's Law: A Test for Britain 1870-1913", *Scottish Journal of Political Economy*, 3(41), pp: 286-298.

- Pesaran, M. H., Pierse, R. G. and M. S. Kumar, (1989), "Econometric Analysis of Aggregation in the Context of Linear Prediction Models", *Econometrica*, 4(57), pp: 861-888.
- Philips P. C. B. and P. Perron, (1988), "Testing for a Unit Root in Time Series Regressions", *Biometrika*, pp. 335-346.
- Sargan J. D. and A. Bhargava, (1983), "Testing Residuals from Least Squares Regression for being Generated by the Gaussian Random Walk", *Econometrica*, 51, pp. 153-174.
- Sims, C. A., (1980), "Macroeconomics and Reality", *Econometrica*, 48, pp: 1-49.
- Tobin D., (2005), "Economic Liberalization, the Changing Role of the State and 'Wagner's Law': China's Development Experience since 1978", *World Development*, 5(33), pp: 729-743.
- Wagner R. E. and W. E. Weber, (1977), "Wagner's Law, Fiscal Institutions and the Growth of Government", *National Tax Journal*, 30, pp: 59-68.
- Yamak N. and Y. Kucukkale, (1997), "Turkiye'de Kamu Harcamalari Ekonomik Buyume Iliskisi", *Iktisat, Isletme ve Finans*, 131, pp: 5-14.
- Yamak N. and R. Yamak, (2001), "Cointegration, Causality and Wagner's Law: Evidence from Turkey: 1950-1994", *37<sup>th</sup> Annual Meeting of Missouri Valley Economic Association*, Kansas City, USA
- Yaser B. S. and T. R. T. Rajan, (1985), "Share of Government in Gross National Product", *METU Studies in Development*, 12, pp: 107-118.
- Zivot, E. and D. W. K. Andrews, (1992), "Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis", *Journal of Business and Economic Statistics* 10, 251-270.