CAUSAL RELATIONSHIP BETWEEN GOVERNMENT SIZE AND ECONOMIC GROWTH IN TURKEY:

EVIDENCE FROM THE TODA-YAMAMOTO APPROACH

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Abstract

The main objective of this paper is to test whether there exists a causal linkage between government size and economic growth for Turkey over the period 1961 and 2016. To this end, the ARDL bounds test and Toda-Yamamoto (1995) Granger-causality tests are used. Empirical findings show that there is a cointegration relationship between the two variables. The findings also yield different results changing in accordance with the proxy measure used for the size of government. Regarding government spending related proxy measures, there is a one-way causality running from government size to economic growth that confirm the validity of the Keynesian's view on the government spending-growth nexus. However, when tax related proxy measures are considered, the results partially differ. Accordingly, in case of direct taxes, there is one-way causality running from direct taxes to economic growth but when it comes to indirect taxes, this causal relationship reverses, running from economic growth to indirect taxes.

Keywords: Economic growth, government size, Toda-Yamamoto Granger-causality, Turkey

Jel Classification: H11, H50, C19

TÜRKİYE'DE KAMU KESİMİ BÜYÜKLÜĞÜ VE EKONOMİK BÜYÜME ARASINDAKİ NEDENSELLİK İLİŞKİSİ:

TODA-YAMAMOTO YAKLAŞIMINDAN BULGULAR

Öz

Bu makalenin temel amacı, 1961 ve 2016 döneminde Türkiye için kamu kesimi büyüklüğü ile ekonomik büyüme arasında bir nedensellik ilişkisi olup olmadığını test etmektir. Bu amaçla, ARDL sınır testi ve Toda-Yamamoto (1995) Granger-nedensellik testleri kullanılmaktadır. Ampirik bulgular, iki değişken arasında bir eşbütünleşme ilişkisi olduğunu göstermektedir. Bulgular ayrıca, kamu kesimi büyüklüğü için kullanılan temsili göstergelere göre değişen farklı sonuçlar da vermektedir. Kamu harcamalarına ilişkin temsili göstergelerle ilgili olarak, Keynesyenlerin kamu harcaması-büyüme bağına ilişkin görüşünün geçerliliğini doğrulayan, kamu kesimi büyüklüğünden ekonomik büyümeye doğru tek yönlü bir nedensellik vardır. Ancak vergiye ilişkin temsili göstergeler düşünüldüğünde sonuçlar kısmen farklılık göstermektedir. Buna göre, doğrudan vergiler söz konusu olduğunda, doğrudan vergilerden ekonomik büyümeye doğru tek yönlü nedensellik vardır, ancak dolaylı vergilere gelindiğinde bu nedensellik ilişkisi ekonomik büyümeden dolaylı vergilere doğru tersine döner.

Anahtar Kelimeler: Ekonomik büyüme, kamu kesimi büyüklüğü, Toda-Yamamoto Granger-nedensellik, Türkiye

Jel Sınıflaması: H11, H50, C19

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1. Introduction

The causality linkage between government size and economic growth has long been discussed in economics and public finance literature. In this respect, there are two main different arguments on the relationship between government size and economic growth in the literature. One of these arguments is the Keynesian view and the other is Wagner's law.

The point emphasized in the Keynesian view is that the direction of causal relationship is from government spending to economic growth. The Keynesian view argues that the main reason of the 1929 great depression was the lack of aggregate demand in the economy. Therefore, it emphasizes that the demand side of the economy should be focused on. Because increases in public spending stimulate aggregate demand, employment, investment and cause an increase in economic growth. Thus, the increase in the size of the government will positively affect economic growth through the Keynesian multiplier mechanism. In addition, as the government grows, it will be possible to provide a suitable investment environment for economic growth and thus encourage private investments. Because public investments are expected to encourage private investments by making the production sector more efficient and productive. Moreover, the government assumes a very important responsibility in producing the most reasonable solutions to ensure economic growth in case of public and private conflicts of interest (Zareen, 2015: 3). The public sector can make factor and product markets work more effectively by making infrastructure investments that can support private investments (Ghali, 1999: 976).

The opposite view to the above is that the direction of causality is from economic growth to the government spending which is Wagner Law. According to Adolph Wagner, economic growth is the essential determinant of government size growth. According to Wagner, as national income increases, the size of the government increases proportionally (Hillman, 2009: 744). Wagner claims that the income elasticity of the demand for public spending is greater than 1. (Koop and Poirier, 1995: 123). Wagner’s Law implies that the reason for the increase in government spending is the increase in economic growth (Wagner, 1890). In other words, it states that public spending has no significant effect on increasing economic growth, so using these spending as a policy tool will not have an effect on economic growth. Therefore, the direction of causality is from economic growth to government spending. According to the Wagner Law, government spending will increase as the economic growth rates in the countries increase. Therefore, the examination of these two entirely opposite arguments has comprised one of the major research topics in economics and public finance.

This study aims to analyze the direction of causal relationship between government size and economic growth in Turkey by using the Autoregressive Distributed Lag (ARDL) bounds test and Toda-Yamamoto (1995) Granger-causality test. Unlike other studies, this paper employs a total of 8 alternative indicators that include both spending and revenue data with an attempt to make a more detailed search and analysis. For this purpose, it examines the relationship of aggregated data on government spending and government revenues with economic growth, as well as the relationship between disaggregated data and economic growth.

The rest of the paper proceeds as follows: Section 2 introduces the review of the related empirical literature. Section 3 explains the data and methods used in the econometric analysis. Section 4 reports the econometric estimation results. And the final section, Section 5 concludes.

2. Review of the Related Empirical Literature

Speaking in general terms, empirical studies reveal that different results about the causality relation between government size and economic growth. For example, Holmes and Hutton (1990), Ghali (1999), Yüksel and Songur (2011), Gül and Yavuz (2011), Facchini and Melki (2011), and Arestis, Şen, and Kaya (2020) found a causality relation between government size and economic growth running from the government size to growth, whereas Islam (2001), Altunç (2011), Afonso and Jalles (2014), and Bayrak and Esen (2014) found the opposite.

Holmes and Hutton (1990) scrutinized the relationship between government size and economic growth by using the Granger-causality test, The Multiple rank F test, Autoregressive conditional heteroscedastic (ARCH), Engle test, Goldfeld-Quandt test, Glejser test for India over the period 1950-1981. The findings indicated that the Wagnerian hypothesis is rejected, and the Keynesian theory is accepted. Additionally, Ghali (1999) used the Vector error correction model (VECM) for 10 OECD countries during the period 1970-1994, and he found that one-way causality from the government size to economic growth. Yüksel and Songur (2011) applied the Engle-Granger Cointegration technique and Granger-causality analysis for Turkey for the period 1980-2010, and they determined that there is a long-term one-way causal relationship from total government spending to economic growth. Another study by Gül and Yavuz (2011) explored the linkage between government size and economic growth by applying Granger-causality test for Turkey during the period 1963-2008 and obtain that there is a one-way causal relationship running from government spending to growth. Facchini and Melki (2011) carried out the causality relation between government size and economic growth by performed the Granger-causality technique in France for 1871-2008, and they found that there is a one-way causality from the government size to growth. A very recent study Arestis, Şen, and Kaya (2020) scrutinized the causality relation between government spending and output by employing linear and non-linear Granger-causality techniques for Turkey for the period 2006:q1-2019:q2. The authors provided evidence that output positively affected government spending. As opposed to the above studies, Islam (2001) used Johansen-Juselius cointegration and exogeneity tests for the USA for the period 1929-1996, and the findings of the study confirm that Wagner's hypothesis. Altunç (2011) employed the ARDL and Vector autoregressive (VAR) Granger-causality analyzes for Turkey over the period 1960-2009, and he stated that there is one-way causal relationship from growth to total government spending. In their study, Afonso and Jalles (2014) explored the causal relationship among government spending, revenue, and growth for the 155 countries during the period 1970-2010, and the outcomes of the paper approve that Wagner's law. Bayrak and Esen (2014) searched the relationship between public spending and growth for the 27 OECD economies over the period 1995-2012, and the empirical results of the study provided proof to the Wagner's law.

On the other hand, Cheng and Lai (1997), Aziz et al. (2000), Wu et al. (2010), Taban (2010), Oktayer (2011), and Esen and Bayrak (2015) found a two-way causality between government size and economic growth. Employing data from 1954 to1994, Cheng and Lai (1997) analyzed the direction of causal relationship among government spending and economic growth for South Korea by using VAR model within a trivariate framework. They concluded that there is a two-way causality relationship between government spending and growth. Aziz et al. (2000) examined the causal linkage between government revenue and spending for Malaysia. Using the Toda-Yamamoto approach for the period between 1960 and 1990, and detected a two-way causality relation between government revenue and spending. Wu et al. (2010) explored the causality relation between government spending and growth for 182 countries during the period between 1950 and 2004 by using the panel Granger-causality test. Research results revealed that the direction of the causal linkage between government spending and economic growth is two-way. Taban (2010) explored the linkage between government spending and economic growth for Turkey employing quarterly data during the period 1987:Q1 and 2006:Q4. Using the bounds testing cointegration procedure and Modified Wald (MWALD) Granger-causality test, he provided robust proof of two-way causality relation between total government spending and growth. Oktayer (2011) studied the causality linkage between total government spending and economic growth for Turkey over the period 1950-2009. Using the Granger-causality analysis, the authors revealed that there is a two-way causality relation between total government spending and growth. Esen and Bayrak (2015) examined the effects of public spending on growth for 5 Turkish Republics by using the panel Granger-causality test during the period 1990 and 2012. Their findings revealed the two-way causality relationship between public spending and economic growth.

Besides, Singh and Sahni (1984), Bağdigen and Beşer (2009), Rauf, Qayum, and Zaman (2012), Ulucak and Ulucak (2014) found no causality between government size and economic growth. Singh and Sahni (1984) determined the direction of causal relationship between national income and public spending (the aggregate and disaggregate spending data) in India. Applying the Granger-causality test for the period between 1950 and 1981, they found that no causality between public spending and national income. Bağdigen and Beşer (2009) researched the causality relation between total government spending and economic growth for Turkey during the period 1950-2005 and using Toda-Yamamoto Granger-causality analysis. The outcomes of the paper indicate that there is no causal relation between total government spending and growth. Rauf, Qayum, and Zaman (2012) investigated the causal linkage between national income and public spending growth for Pakistan over the period 1979-2009. Employing the ARDL bounds test to cointegration relationship and Toda and Yamamoto (1995) approach to causality, the findings of the study show that there is no causality relation between government spending and growth. In their study, Ulucak and Ulucak (2014) scrutinized the causal linkage between total government spending and economic growth in Turkey. Employing the Hacker Hatemi J bootstrap causality method, they determined that no causal linkage is found between total government spending and growth for the period 1950-2011.

Based on the aforementioned summary of the literature, the causal relation between government size and economic growth is still inconclusive. Most of these papers are carried out with aggregate data on government spending and government revenue rather than disaggregate data on specific items of government spending and government revenue. In other words, very few studies investigate how each sub-category of government spending and government revenue relates to economic growth as an indicator of government size. To fulfil this gap in the empirical literature, this paper scrutinizes the causal relationship among government spending, government revenue, and economic growth through 8 alternative indicators.

3. Data Description and Econometric Methodology

3.1. Data Description

In this paper, the models employed are based on the annual time series data for Turkey ranging the period from 1961 to 2016, which comprises 56 data points. In Turkey, in 1961, under the leadership of the government "planned development" policy was adopted. With the 1961 Constitution, preparation and implementation of development plans in Turkey have become a legal obligation. Therefore, this analyze started in 1961, which was an important turning point in terms of the role of the state in economic life. Data definitions and sources of data are presented in Table 1. All variables used in the paper are measured as a proportion of GDP. Besides, descriptive statistics and correlation matrix of the variables can be seen in Tables A1 and A2 of the Appendix. Also, the graphical representation of the series is presented in Figure 1. The Figure 1 shows the evolution of G_{RGdp}, S_{CenGov}, S_{HE}, S_D, S_{CI}; and R_{CenGov}, R_{NonT}, R_{DirT}, R_{IndT} from 1961 to 2016.

Table 1: Definition of variables and data sources

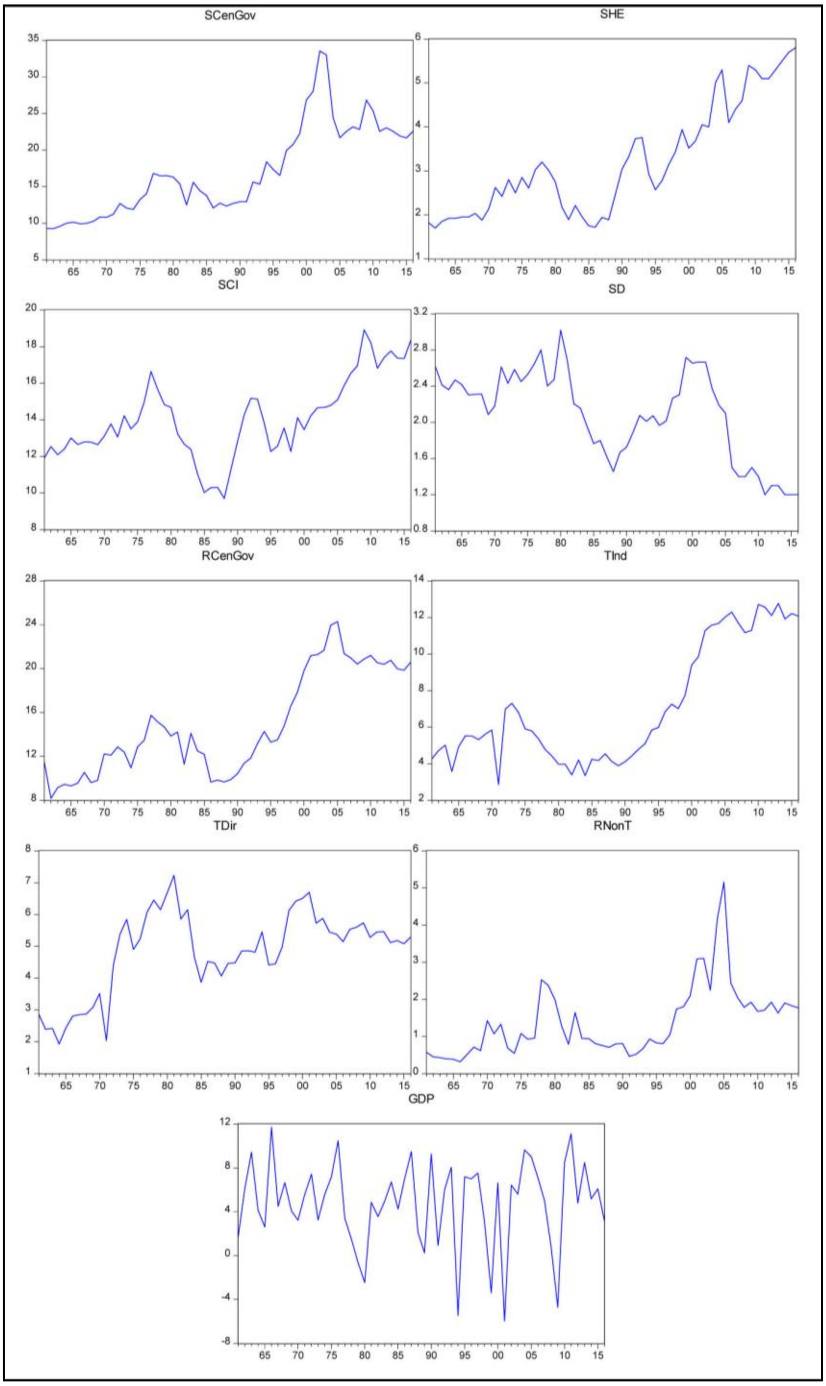
Variable	Definition	Data Source
$\mathbf{S_{CenGov}}$	Central Government Budget Spending *	General Directorate of Budget and Fiscal Control (GDBF)
$\mathbf{S_{HE}}$	Central Government Total Health and Education Spending **	GDBF
$\mathbf{S_D}$	Central Government Defense Spending **	GDBF
$\mathbf{S_{CI}}$	Central Government Total Consumption and Investment Spending **	World Bank, GDBF
$\mathbf{R_{CenGov}}$	Central Government Budget Revenue	GDBF
$\mathbf{R_{NonT}}$	Central Government Non-Tax Revenue	GDBF
$\mathbf{R_{DirT}}$	Central Government Direct Tax Revenue	GDBF
$\mathbf{R_{IndT}}$	Central Government Indirect Tax Revenue	GDBF
$\mathbf{G_{RGdp}}$	Real GDP Growth*** (Annual Percent Change)	Presidency of Turkey, Strategy and Budget Office

* http://www.bumko.gov.tr/TR,4461/butce-gider-gelir-gerceklesmeleri-1924-2016.html

** Data for 1961-1983 is calculated by me by using the "Realizations of Government Expenditures and Revenues (1924-1995)", Revised 2nd Edition and data for 1983-2016 is taken from annually budget justifications.

*** http://www.sbb.gov.tr/ekonomik-veriler/#1540461995857-3570233a-09e6

Figure 1: A graphical representation of the series, 1961-2016



Source: Prepared by the author

3.2. Econometric Methodology

In this study, two models are estimated by using two different explanatory variable sets due to differences in determinants of government size to explore the linkage between the government size and economic growth in Turkey during the period 1961-2016. The first one is based on government spending while the second one is grounded on government revenue. In other words, in model 1, the impact of government size on economic growth for Turkey is examined in terms of the spending side. In model 2, the same relationship is examined in terms of the revenue side. While the variables of G_{RGdp}, S_{CenGov}, S_{HE}, S_{D}, S_{CI} are used for model 1, the variables of G_{RGdp}, R_{CenGov}, R_{NonT}, R_{DirT}, R_{IndT} are used for model 2. Three main steps have been followed in empirical methodology. As a first step, unit root tests are implemented both on the level form and first differenced form of the two models' variables to check the stationary, it is important that the time series should not have a unit root, because if the time series have a unit root, the regression analysis may be spurious results (Granger and Newbold, 1974). To this aim, as a first step, Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests have been used. According to the test results, it has seen that some time series are I(0), other I(1); but no I(2); in this case, as a second step, the ARDL cointegration test is applied to explore the existence of a long-term cointegration among the government size and the economic growth due to the series are stationary at different order. In addition to these aforementioned tests, as a third step, the Toda-Yamamoto (1995) approach is employed to determine whether there exists a causal linkage between government size and economic growth and to decide the direction of this causal relationship if it exists.

4. Empirical Findings

4.1. Unit Root Test

Empirically to analyze the stationary of all the variables that are used in this paper, first, the ADF and the PP tests are applied. The outcomes of the unit root tests of the variables are represented in Tables 2 and 3. Based on the results, presented in Table 2 and 3, S_{CenGov}, S_{HE}, S_{D}, S_{CI}, R_{CenGov}, R_{NonT}, R_{DirT}, R_{IndT} are stationary at level I(1) for both models which contain both constant and constant and trend. But G_{RGdp} is stationary at level I(0) for both models which contain both constant and constant and trend. That is to say that, given these results, series are stationary at different orders.

Table 2: Unit root test results, 1961-2016, level

	ADF unit root test						PP unit root test					
Series	Level Constant	Critical Values		Level Constant and Trend	Critical Values		Level Constant	Critical Values		Level Constant and Trend	Critical Values	
		5%	1%		5%	1%		5%	1%		5%	1%
G_{RGdp}	-7.41(0)***	-2.91	-3.55	-7.35(0)***	-3.49	-4.13	-7.41***	-2.91	-3.55	-7.35**	-3.49	-4.13
S_{CI}	-1.03(0)	-2.91	-3.55	-1.72(0)	-3.49	-4.13	-1.36	-2.91	-3.55	-2.10	-3.49	-4.13
S_{HE}	-0.39(0)	-2.91	-3.55	-2.21(0)	-3.49	-4.13	-0.01	-2.91	-3.55	-2.11	-3.49	-4.13
S_D	-1.20(0)	-2.91	-3.55	-2.53(3)	-3.49	-4.14	-1.48	-2.91	-3.55	-2.26	-3.49	-4.13
S_{CenGov}	-1.41(0)	-2.91	-3.55	-2.61(1)	-3.49	-4.13	-1.41	-2.91	-3.55	-2.48	-3.49	-4.13
R_{CenGov}	-0.79(0)	-2.91	-3.55	-2.08(0)	-3.49	-4.13	-0.74	-2.91	-3.55	-2.20	-3.49	-4.13
R_{NonT}	-2.59(0)	-2.91	-3.55	-3.09(0)	-3.49	-4.13	-2.47	-2.91	-3.55	-3.11	-3.49	-4.13
R_{DirT}	-2.20(0)	-2.91	-3.55	-2.30(0)	-3.49	-4.13	-2.12	-2.91	-3.55	-2.25	-3.49	-4.13
R_{IndT}	-0.24(1)	-2.91	-3.55	-1.48(1)	-3.49	-4.13	-0.34	-2.91	-3.55	-1.61	-3.49	-4.13

Note: The values in parentheses show the chosen lag length of the ADF models. Lags are selected based on AIC. (*), (**), (***) stand for statistical significance at 10%, 5% and 1% levels, respectively. E-Views 10 was used for computations. For PP Quadratic Spectral Kernel., Newey-West Bandwith are used.

Table 3: Unit root test results, 1961-2016, first difference

	ADF unit root test						PP unit root test					
Series	**First Difference Constant**	**Critical Values 5%**	**1%**	**First Difference Constant and Trend**	**Critical Values 5%**	**1%**	**First Difference Constant**	**Critical Values 5%**	**1%**	**First Difference Constant and Trend**	**Critical Values 5%**	**1%**
D(G_{RGdp})	-5.76(3)***	-2.91	-3.56	-5.69(3)***	-3.50	-4.14	-38.03***	-2.91	-3.55	-36.77***	-3.49	-4.13
D(S_{CI})	-6.56(0)***	-2.91	-3.55	-6.55(0)***	-3.49	-4.13	-6.60***	-2.91	-3.55	-6.59***	-3.49	-4.13
D(S_{HE})	-7.10(0)***	-2.91	-3.55	-7.09(0)***	-3.49	-4.13	-7.46***	-2.91	-3.55	-7.75***	-3.49	-4.13
D(S_D)	-3.31(2)**	-2.91	-3.56	-3.32(2)*	-3.49	-4.14	-7.04***	-2.91	-3.55	-7.01***	-3.49	-4.13
D(S_{CenGov})	-6.46(0)***	-2.91	-3.55	-6.41(0)***	-3.49	-4.13	-6.45***	-2.91	-3.55	-6.40***	-3.49	-4.13
D(R_{CenGov})	-8.28(0)***	-2.91	-3.55	-8.18(0)***	-3.49	-4.13	-8.27***	-2.91	-3.55	-8.18***	-3.49	-4.13
D(R_{NonT})	-7.44(1)***	-2.91	-3.56	-7.37(1)***	-3.49	-4.14	-8.27***	-2.91	-3.55	-8.20***	-3.49	-4.13
D(R_{DirT})	-8.25(0)***	-2.91	-3.55	-8.26(0)***	-3.49	-4.13	-8.30***	-2.91	-3.55	-8.41***	-3.49	-4.13
D(R_{IndT})	-9.47(0)***	-2.91	-3.55	-9.48(0)***	-3.49	-4.13	-9.56***	-2.91	-3.55	-9.62***	-3.49	-4.13

Note: The values in parentheses show the chosen lag length of the ADF models. Lags are selected based on AIC. (*), (**), (***) stand for statistical significance at 10%, 5% and 1% levels, respectively. E-Views 10 was used for computations. For PP Quadratic Spectral Kernel., Newey-West Bandwith is used. * denote statistical significance at 10% (-3.178578).

So, when all things considered, it can be concluded that Engle-Granger (1987), Johansen (1988), and Johansen and Juselius (1990) cointegration tests cannot be used because the series are stationary at different order. However, since I(2) data is not there, the ARDL bounds test can be used for cointegration.

4.2. Cointegration Test

In this paper, in order to empirically investigate a cointegration relationship among the variables is used by the Bounds test approach developed by Pesaran et al. (2001). This approach is basically based on the ARDL model. To find cointegration relationship among variables, Equation (1) is constructed as follows:

$$\Delta G_{RGdp_t} = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, \Delta G_{RGdp_{t-i}} + \sum_{i=0}^{n} \beta_{2i}\, \Delta S_{CI_{t-i}} + \sum_{i=0}^{n} \beta_{3i}\, \Delta S_{CenGov_{t-i}} + \sum_{i=0}^{n} \beta_{4i}\, \Delta S_{HE_{t-i}} + \sum_{i=0}^{n} \beta_{5i}\, \Delta S_{D_{t-i}} + \beta_6 G_{RGdp_{t-1}} + \beta_7 S_{CI_{t-1}} + \beta_8 S_{CenGov_{t-1}} + \beta_9 S_{HE_{t-1}} + \beta_{10} S_{D_{t-1}} + \mu_t \quad (1)$$

Equation (1) can be further converted to accommodate the one-period lagged error correction term (ECT1) as in equation (2):

$$\Delta G_{RGdp_t} = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, \Delta G_{RGdp_{t-i}} + \sum_{i=0}^{n} \beta_{2i}\, \Delta S_{CI_{t-i}} + \sum_{i=0}^{n} \beta_{3i}\, \Delta S_{CenGov_{t-i}} + \sum_{i=0}^{n} \beta_{4i}\, \Delta S_{HE_{t-i}} + \sum_{i=0}^{n} \beta_{5i}\, \Delta S_{D_{t-i}} + \lambda EC_{t-1} + \mu_t \quad (1a)$$

To find cointegration relationship among variables, Equation 2 is constructed as follows:

$$\Delta G_{RGdp_t} = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, \Delta G_{RGdp_{t-i}} + \sum_{i=0}^{n} \beta_{2i}\, \Delta R_{CenGov_{t-i}} + \sum_{i=0}^{n} \beta_{3i}\, \Delta R_{NonT_{t-i}} + \sum_{i=0}^{n} \beta_{4i}\, \Delta R_{DirT_{t-i}} + \sum_{i=0}^{n} \beta_{5i}\, \Delta R_{IndT_{t-i}} + \beta_6 G_{RGdp_{t-1}} + \beta_7 R_{CenGov_{t-1}} + \beta_8 R_{NonT_{t-1}} + \beta_9 R_{DirT_{t-1}} + \beta_{10} R_{IndT_{t-1}} + \mu_t \quad (2)$$

Equation (2) can be further converted to accommodate the one period lagged error correction term (ECT1) as in Equation (2a):

$$\Delta G_{RGdp_t} = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, \Delta G_{RGdp_{t-i}} + \sum_{i=0}^{n} \beta_{2i}\, \Delta R_{CenGov_{t-i}} + \sum_{i=0}^{n} \beta_{3i}\, \Delta R_{NonT_{t-i}} + \sum_{i=0}^{n} \beta_{4i}\, \Delta R_{DirT_{t-i}} + \sum_{i=0}^{n} \beta_{5i}\, \Delta R_{IndT_{t-i}} + \lambda EC_{t-1} + \mu_t \quad (2a)$$

where Δ is the first difference operator, β_0 defines the intercept component, βs identify the variables' coefficients, and μ is the error term, λ is the speed of adjustment parameter called as error correction coefficient. The ARDL model estimates the Equations (1) and (2) to get the optimal lag lengths for all variables. Optimal lag lengths of each variable are selected by employing the suitable AIC. Afterward, the subsequent hypotheses should be tested to decide the presence of a cointegration linkage among variables. According to Pesaran et al. (2001), the null hypothesis of no cointegration:

$H_0: \begin{bmatrix} \beta_6 \\ \beta_7 \\ \beta_8 \\ \beta_9 \\ \beta_{10} \end{bmatrix} = 0_{5\times 1}$ is tested against the alternative of cointegration, that is:

$H_1 : \beta_6 \neq 0$ or $H_1: \begin{bmatrix} \beta_7 \\ \beta_8 \\ \beta_9 \\ \beta_{10} \end{bmatrix} \neq 0_{4\times 1}$

Table 4: Lag order selection for model 1

Lag	LR	FPE	AIC	SC	HQ
0	NA	18.024	5.728	5.916*	5.800*
1	0.637	18.481	5.753	5.978	5.839
2	0.471	19.017	5.781	6.044	5.882
3	0.727	19.454	5.803	6.103	5.918
4	5.574*	17.778*	5.712*	6.050	5.841

*donates lag length chosen by the criteria.

Table 5: Lag order selection for model 2

Lag	LR	FPE	AIC	SC	HQ
0	NA	16.649	5.649	5.837*	5.721
1	0.631	17.074	5.674	5.899	5.760
2	0.869	17.414	5.693	5.956	5.794
3	0.985	17.710	5.709	6.009	5.824
4	7.419*	15.504*	5.575*	5.913	5.704*

*donates lag length chosen by the criteria.

The results for selecting lag order for Equation 1 are given in Table 4 for model 1 and Equation 2 is presented in Table 5 for model 2. According to the literature, up to a maximum of 4 lag length criteria are often used for annual data (see, Pesaran and Shin, 1999; Pesaran et al. 2001). Since the data set for this study is relatively large (56 observations for the annual data), maximum of 4 lag has employed to find cointegration between variables. Using AIC information criteria, ARDL (2,3,0,0,1) and ARDL (4,0,0,0,0,) are selected the optimal long-term models for the cointegration analysis for model 1 and model 2, respectively. Furthermore, diagnostic tests for autocorrelation, heteroscedasticity, and normality are conducted and the results are given in Tables 6 and 7, also. These results indicate that there is no evidence of a diagnostic problem in the long-run estimation for both models.

Table 6: Diagnostic test results for model 1

Autocorrelation (LM)	2.799(0.592)
Heteroscedasticity (White)	11.926(0.290)
Normality (Jarque-Bera)	0.495(0.780)
F-statistic	3.237(0.003)

Source: Author's computations

Table 7: Diagnostic test results for model 2

Autocorrelation (LM)	4.568 (0.334)
Heteroscedasticity (White)	4.905 (0.767)
Normality (Jarque-Bera)	1.728 (0.421)
F-statistic	2.646(0.018)

Source: Author's computations

On the other hand, the time series are cointegrated if the computed F-statistics is higher than the appropriate upper limit values I(1), and not cointegrated, if the calculated F-statistics is less the lower limit values I(0) of Pesaran et al. (2001). If, however, the computed F-statistics lies between lower and upper critical limits, the results are inconclusive. According to the Bounds test results, presented in Table 8 and Table 9, computed F-statistics of the model 1 is found to be 9.047, model 2 is 9.138. When these values are evaluated with the bounds of Pesaran et al. (2001), it is seen that the F statistics computed for cointegration exceed the limit values of 5% and 1% statistical significance levels of Pesaran et al (2001). Thus, the findings clearly indicate that there exists a cointegration relationship among independent variables (S_{CenGov}, S_{HE}, S_{D}, S_{CI}) and G_{RGdp} for model 1; and (R_{CenGov}, R_{NonT}, R_{DirT}, R_{IndT}) and G_{RGdp} for model 2.

Table 8: ARDL Bounds test results to cointegration for model 1

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic : n=1000	
F-statistic	**9.047**	5%	2.86	4.01
k	4	1%	3.74	5.06

Source: Author's computations

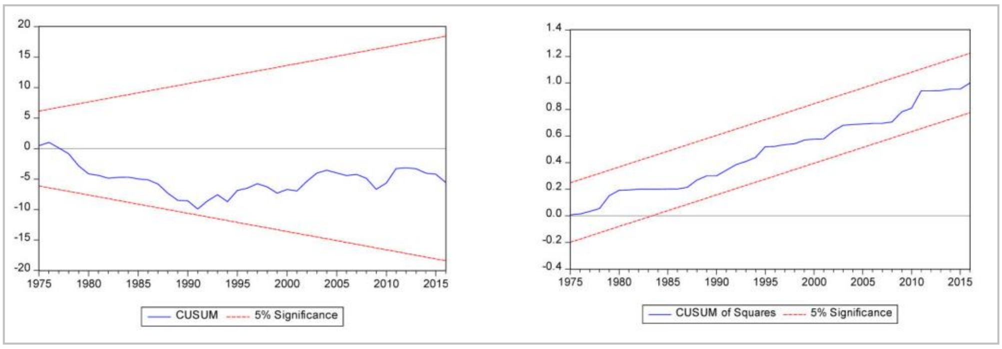
Table 9: ARDL Bounds test results to cointegration for model 2

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic : n=1000	
F-statistic	**9.138**	5%	2.86	4.01
k	4	1%	3.74	5.06

Source: Author's computations

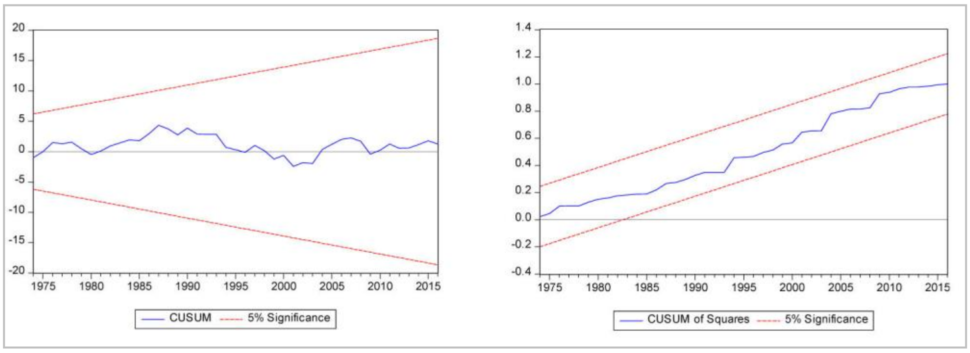
Besides, Pesaran et al. (1995, 2001) advised the consistency test of estimated parameters on estimated models of Brown et al. (1975) called as the cumulative sum of recursive residuals (CUSUM) and cumulative square sum of recursive residuals (CUSUMS Q). The plots of CUSUM and CUSUM Q tests are applied to approve the consistency of the estimated models. The results are given in Figure 2. Both CUSUM and CUSUM Q are within critical limits.

Figure 2: The plots of CUSUM and CUSUM Q test results for model 1



Source: Prepared by the author

Figure 3. The plots of CUSUM and CUSUM Q test results for model 2



Source: Prepared by the author

4.3. Toda-Yamamoto (1995) Granger-Causality Test

To examine the causal linkage between government size and economic growth in Turkey, this paper has been used the Toda-Yamamoto (1995) Granger-causality. The Toda-Yamamoto is the revised form of the Ordinary Granger-causality, and it has been used in this study for it is suitable in the case of series are stationary at different orders. As presented in Tables 12, and 13, the lag length chosen by the different choice criteria shows the lag length of 1 for both models.

Toda-Yamamoto's (1995) Granger-causality approach comprises of three main steps. The first step is the detection of the maximum order of integration of series. This step includes the testing of the series to a selection of the maximum order of integration (d_{max}) for the variables in the model employing the ADF and PP unit root tests. Then, the second step is the determination of the optimal VAR lag length (m). The m can be determined comparing various lag length criteria like the cointegration tests. The last step is to test the series for causality. This step is employed by the MWALD approach to test for the VAR (k). The optimal lag order is equal to k= (m+ d_{max}). The MWALD approach has an asymptotic chi-squared distribution with m degrees of freedom in the limit when a VAR (m+ d_{max}) is forecasted (Amiri and Ventelou, (2012); Dembure and Ziramba, 2016).

Table 10: Lag order selection for model 1

Lag	LR	FPE	AIC	SC	HQ
0	NA	60.69834	18.29528	18.47945	18.36631
1	344.3353*	0.117982*	12.04755*	13.15255*	12.47371*
2	30.42038	0.150400	12.26603	14.29185	13.04731

*indicates lag length chosen by the criterion

Table 11: Lag order selection for model 2

Lag	LR	FPE	AIC	SC	HQ
0	NA	113.1261	18.91787	19.10203	18.98889
1	263.2228*	1.191492*	14.35998*	15.46498*	14.78614*
2	18.81227	1.989592	14.84842	16.87423	15.62969

*indicates lag length chosen by the criterion

Table 12: Autocorrelation and heteroscedasticity test results for model 1

Autocorrelation (LM)		
Lag Length	**LM Test Statistic**	**P-Value**
1	1.182	0.267
Heteroscedasticity (White)		
Lag Length	**Test Statistic**	**P-Value**
1	319.163	0.213

Source: Author’s computations

Table 13: Autocorrelation and heteroscedasticity test results for model 2

Autocorrelation (LM)		
Lag Length	**LM Test Statistic**	**P-Value**
1	0.969	0.512
Heteroscedasticity (White)		
Lag Length	**Test Statistic**	**P-Value**
1	296.827	0.540

Source: Author's computations

The causal relationship between two variables can ensue as one-way causality, two-way causality, or lack of causality. The empirical consequences of the Granger-causality procedure based on Toda and Yamamoto (1995) approach is estimated through MWALD methodology and given in Tables 14 and 15.

Table 14: Toda-Yamamoto (1995) Granger-causality test results

Direction of Causal Relationship	**Null Hypothesis**	**Chi-sq.**	**Prob.**	**Granger-causality**
$\mathbf{S_{CI} \rightarrow G_{RGdp}}$	S_{CI} does not granger cause G_{RGdp}	3.458	0.062*	One-way Causality $S_{CI} \rightarrow G_{RGdp}$
$\mathbf{G_{RGdp} \rightarrow S_{CI}}$	G_{RGdp} does not granger cause S_{CI}	0.271	0.602	
$\mathbf{S_{CenGov} \rightarrow G_{RGdp}}$	S_{CenGov} does not granger cause G_{RGdp}	3.430	0.064*	One-way Causality $S_{CenGov} \rightarrow G_{RGdp}$
$\mathbf{G_{RGdp} \rightarrow S_{CenGov}}$	G_{RGdp} does not granger cause S_{CenGov}	1.665	0.1969	
$\mathbf{S_{CI} \rightarrow S_{HE}}$	S_{CI} does not granger cause S_{HE}	4.848	0.027**	One-way Causality $S_{CI} \rightarrow S_{HE}$
$\mathbf{S_{HE} \rightarrow S_{CI}}$	S_{HE} does not granger cause S_{CI}	0.602	0.4378	

Source: Own elaboration based on E-Views 10 results

(*), (**), (***) denote statistical significance at 10%, 5% and 1% levels, respectively.

As presented in Table 14, the Toda-Yamamoto Granger-causality test results reveal that the null hypothesis that G_{RGdp} does not granger cause S_{CI} cannot be reject but the null hypothesis that S_{CI} does not granger cause G_{RGdp} can reject at 10% level of significance. Thus, it can be decided that there is one-way causality among S_{CI} and $G_{RGdp.}$ At the same time, the results also reveal that the null hypothesis that G_{RGdp} does not granger cause S_{CenGov} cannot be reject but the null hypothesis that S_{CenGov} does not granger cause G_{RGdp} can reject. So, it can be decided that there is one-way causality between S_{CenGov} and G_{RGdp}. To sum up, according to the Toda-Yamamoto Granger-causality test results, presented in Table 14; there is a one-way causality between S_{CI} and G_{RGdp}, $S_{CenGov,}$ and G_{RGdp} which run strictly from S_{CI} to G_{RGdp}, S_{CenGov} and G_{RGdp} respectively. However, the rest show no causality results.

Table 15: Toda-Yamamoto (1995) Granger-causality test results

Direction of Causal Relationship	**Null Hypothesis**	**Chi-sq.**	**Prob.**	**Granger-causality**
$\mathbf{R_{DirT} \rightarrow G_{RGdp}}$	R_{DirT} does not granger cause G_{RGdp}	3.057	0.080*	One-way Causality $R_{DirT} \rightarrow G_{RGdp}$
$\mathbf{G_{RGdp} \rightarrow R_{DirT}}$	G_{RGdp} does not granger cause R_{DirT}	1.439	0.230	
$\mathbf{G_{RGdp} \rightarrow R_{IndT}}$	G_{RGdp} does not granger cause R_{IndT}	2.740	0.097*	One-way Causality $G_{RGdp} \rightarrow R_{IndT}$
$\mathbf{R_{IndT} \rightarrow G_{RGdp}}$	R_{IndT} does not granger cause G_{RGdp}	2.138	0.143	
$\mathbf{R_{CenGov} \rightarrow R_{IndT}}$	R_{CenGov} does not granger cause R_{IndT}	2.787	0.095*	One-way Causality $R_{CenGov} \rightarrow R_{IndT}$
$\mathbf{R_{IndT} \rightarrow R_{CenGov}}$	R_{IndT} does not granger cause R_{CenGov}	0.031	0.859	
$\mathbf{R_{CenGov} \rightarrow R_{NonT}}$	R_{CenGov}does not granger cause R_{NonT}	3.651	0.056*	One-way Causality $R_{CenGov} \rightarrow R_{NonT}$
$\mathbf{R_{NonT} \rightarrow R_{CenGov}}$	R_{NonT}does not granger cause R_{CenGov}	0.492	0.482	
$\mathbf{R_{NonT} \rightarrow R_{DirT}}$	R_{NonT} does not granger cause R_{DirT}	2.905	0.088*	One-way Causality $R_{NonT} \rightarrow R_{DirT}$
$\mathbf{R_{DirT} \rightarrow R_{NonT}}$	R_{DirT} does not granger cause R_{NonT}	0.034	0.852	
$\mathbf{R_{IndT} \rightarrow R_{DirT}}$	R_{IndT} does not granger cause R_{DirT}	2.880	0.089*	Two-way Causality $R_{IndT} \leftrightarrow R_{DirT}$
$\mathbf{R_{DirT} \rightarrow R_{IndT}}$	R_{DirT} does not granger cause R_{IndT}	5.457	0.019**	

Source: Own elaboration based on E-Views 10 results
(*), (**), (***) denote statistical significance at 10%, 5% and 1% levels, respectively.

As given in Table 15, the Toda-Yamamoto (1995) test results also reveal that the null hypothesis that G_{RGdp} does not granger cause R_{DirT} cannot be reject but the null hypothesis that R_{DirT} does not granger cause G_{RGdp} can reject. Therefore, it can be decided that there is one-way causality relation between R_{DirT} and G_{RGdp} which runs from R_{DirT} to G_{RGdp}. Concurrently, the results also reveal that the null hypothesis that R_{IndT} does not granger cause G_{RGdp} cannot be reject but the null hypothesis that G_{RGdp} does not granger cause R_{IndT} can reject. So, it can be decided that there is one-way causality relation among G_{RGdp} and R_{IndT} which runs from G_{RGdp} to R_{IndT}.

5. Concluding Remarks

In this paper the causality relation among government size and economic growth by employing annual data from Turkey over the period 1961 and 2016 has been examined. The Bounds test and Toda-Yamamoto (1995) Granger-causality tests are used as econometric estimation methods.

According to the bounds test results, a cointegration linkage has been found between government size and growth. From the outcomes of Toda-Yamamoto (1995) Granger-causality test, this study confirms that the causal relationship runs from S_{CI} to G_{RGdp} and $S_{CenGov} \rightarrow G_{RGdp}$ in terms of spending side. The results validate the Keynesian Hypothesis which is consistent with findings by Holmes and Hutton (1990), Ghali (1999), Yüksel and Songur (2011), Gül and Yavuz (2011), Facchini and Melki (2011), and Arestis, Şen, and Kaya (2020). On the other hand, the causal relationship runs from R_{DirT} to G_{RGdp} while the same relationship runs from G_{RGdp} to R_{IndT} in terms of the revenue side. In this case, it can be said that the result of the causality relationship between R_{DirT} and $G_{RGdp,}$ confirms the Keynesian Hypothesis while the causality relationship between R_{IndT} and G_{RGdp} confirms the Wagner's Law which is consistent with results by Islam (2001), Altunç (2011), and Afonso and Jalles (2014).

When the results of the article are evaluated in terms of government spending—central government budget spending, central government total consumption and investment spending—, it is clear that a change in the size of the government will affect economic growth; however, it is possible to conclude that a change in economic growth will not lead to a change in government size. In this context, it can be suggested that public expenditures should be used by the public authority as a stabilization policy tool in order to provide economic growth. From the perspective of taxes, it is seen that indirect tax revenues affected by economic growth; on the other hand, direct tax revenues seem to affect economic growth. In this direction, it can be suggested that direct taxes should be used as a stabilization policy tool, as they have a significant effect on economic growth. However, since the effect of a change in indirect taxes will not reflect on economic growth, it is not possible to make the same inference for indirect taxes.

As a result, it can be said that the public authority can be a guide on economic growth by using fiscal policy tools such as government spending and government revenues. Also, issues such as determining the magnitude and sign of the impact of government size on economic growth and even calculating the growth-maximizing government size should be considered for future research.

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Appendix:

Table A1: Descriptive statistics

	G_{RGdp}	S_{CI}	S_{HE}	S_D	S_{CenGov}	R_{CenGov}	R_{NonT}	R_{DirT}	R_{IndT}
Mean	4.74	14.04	3.20	2.08	17.10	14.87	1.39	4.83	7.10
Median	5.36	13.79	2.89	2.18	15.61	13.50	1.05	5.13	5.81
Maximum	11.71	18.91	5.80	3.01	33.54	24.28	5.15	7.22	12.77
Minimum	-5.96	9.70	1.70	1.20	9.24	8.17	0.31	1.93	2.86
Std. Dev.	4.00	2.20	1.25	0.49	6.18	4.63	0.95	1.30	3.25
Skewness	-0.84	0.27	0.63	-0.38	0.72	0.44	1.64	-0.63	0.62
Kurtosis	3.54	2.53	2.14	2.04	2.77	1.80	6.50	2.63	1.79
Jarque-Bera	7.36	1.21	5.47	3.49	5.06	5.16	53.74	4.03	7.02
Probability	0.02	0.54	0.06	0.17	0.07	0.07	0.00	0.13	0.02
Sum	265.84	786.44	179.43	117.00	957.83	833.06	78.05	271.03	398.07
Sum Sq. Dev.	881.52	267.94	87.05	13.37	2102.35	1179.49	50.01	93.21	581.42

Source: Author’s computations

Table A2: Correlation Matrix of the Variables

	G_{RGdp}	S_{CI}	S_{HE}	S_D	S_{CenGov}	R_{CenGov}	R_{NonT}	R_{DirT}	R_{IndT}
G_{RGdp}	1								
S_{CI}	-0,07	1							
S_{HE}	0,00	0,86	1						
S_D	-0,17	-0,34	-0,52	1					
S_{CenGov}	-0,11	0,61	0,78	-0,24	1				
R_{CenGov}	-0,04	0,73	0,88	-0,31	0,91	1			
R_{NonT}	-0,06	0,44	0,64	-0,05	0,72	0,83	1		
R_{DirT}	-0,28	0,42	0,48	0,00	0,64	0,60	0,54	1	
R_{IndT}	0,11	0,74	0,88	-0,49	0,81	0,89	0,64	0,37	1

Source: Author’s computations