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The Size of the Public Sector and the Armey Curve: The Case of Turkey

Abstract: The relationship between economic growth and public spending as a percent of GDP (government size) is a quite widespread issue in the literature. One of the important explanations of these debates is the Armey curve. The Armey curve is defined as a geometric expression that public spending below an optimal threshold level has an expanding effect, but that public spending above the threshold level affects economic growth adversely. The parabolic structure of the Armey curve is essential for estimating the optimal government size. This study aims to test the Armey curve using the ARDL bounds testing approach of time-series techniques between the years 1981–2018 in the Turkish economy. According to the coefficient values obtained in our study, the optimal level of public expenditure that maximizes economic growth is 16% of GDP. Between the years of 1981–2018 in Turkey, the actual rate varies from 12.1% to 33.5%, and the average rate is 20%. Accordingly, while the level of public expenditure between 1981 and 1992 remained below the optimal level, the level of public expenditure between 1993 and 2018 remained above the optimal level.

Keywords: Public Expenditures, Economic Growth, Armey Curve, Turkey

JEL Codes: E62, H11, H50, O40

1 Introduction

Economic growth is one of the objectives of fiscal policy. Just like in other purposes of fiscal policy, public expenditures stand out from the tools used in the provision of economic growth. This is because a fiscal economist must know at which level and within which components he or she must use public expenditures to reach the target for economic growth. The composition of public expenditures is important here. Expenditures that directly affect economic growth utilizing implementing the total demand are generally real expenditures. The multiplier effect that these expenditures will create in the economy is expected to influence economic growth positively.

The share of public expenditures within the Gross Domestic Product (GDP) also expresses the size of the government in an economy. However, when the size of the government comes into question, the differences between the paradigms grow deeper. What kind of effect was in the short term along with the expansive effects of the public expenditures in the long term should be discussed.

Those who say that there is a positive relationship between public expenditures and economic growth claim that the expansion of the public sector provides the function of private property insurance. Based on this, public expenditures encourage private investments that will lead to economic growth and also allow for the production of public goods that will improve the investment environment.

Those who assert that there is a negative relationship between public expenditures and economic growth claim that the expansion of the size of the government (public spending) has diminishing returns effect and that the oversize of the government has a crowding-out impact on private investments. Based on this, public expenditures can transform into inefficient expenditures that lead to deterioration in resource allocation along with corruption. At the same time, the government will need higher taxes as public expenditures widen, but increasing taxes will slowly lead to negative effects on the economy.

The Armey curve became one of the critical contributions brought to the debated relationship of the size of the government with economic growth. The geometric explanation that public expenditures have a widespread influence when beneath the optimal threshold level but negative impact over economic growth above the threshold level is expressed as the Armey curve (Armey, 1995). But the relationship between government size and economic growth can differ between economies and between periods, even in the same economy. The examination of this relationship based on the temporal and spatial distinctions still preserves its importance in the literature.

The purpose of our study regarding this importance was the testing of the Armey curve between the years 1981–2018 in the Turkish economy. Our study used the ARDL approach, a time-series technique, and aimed to create an Armey curve for Turkey and to determine the level of public expenditure that maximizes economic growth in Turkey. For this reason, primarily public expenditures and the economic growth relationship in our study were examined theoretically in the framework of the discussions on the Armey curve, and the empirical literature that tries to respond to these discussions was subsequently compiled. Finally, we tried to determine the Armey curve and the optimal government size for the Turkish economy.

2 Armey Curve and Optimal Public Sector Size

2.1 Theoretical Literature

The relationship between the size of the public sector and economic growth is a much-discussed topic certainly before it was explained with a curve. Solow (1956) and Swan (1956) don't see public expenditures as a determinant for economic growth in the neoclassic growth models, which explained output level with labor and capital as a production function and which accepted technology as an exogenous variable. Barro (1990) revealed that there was a relationship between public expenditures and economic growth in the explained endogenous growth model. However, this relationship was positive to a certain amount, while economic growth is negatively affected at levels of high public expenditure.

The first person who studied this relationship with the help of a graphic in a nonlinear extent was Armey (1995). Although there are studies that call this curve the BARS curve, based on the acronym of Barro (1989), Armey (1995), Rahn and Fox (1996), and Scully (1994), the frequent use in the literature is for Armey curve.

Armey referred to Arthur Laffer, who explained the quadratic relationship between tax rates and total tax revenue and tried to explain with similar logic the relationship between government size and general welfare. According to Armey, the government is certainly necessary to ensure peace, prevent anarchy, and provide public services. This dimension of the government is similar to the constitutional description, such as guaranteeing the protection of freedom and increasing general welfare. However, if the government starts to grow after some point, it starts to erode the general welfare and liberty (Armey, 1995: 91–92). The Armey curve intercedes at this point.

The horizontal axis in Fig. 1 expresses the growth of the government and the decline of liberty. The vertical axis shows the general welfare of society. It is seen in the graphic; there is an upper boundary on the topic of being able to make something better in the economy. Economic progress takes place with the increase of this upper boundary over time. The capability of increasing this is tied to an optimal mixture of elements such as government, savings, and investment. There is no prosperity at the level in which the government is zero because there is chaos, no domestic or international security, no system of justice, and no contract law. There is no prosperity at the level in which the government is 100% because there is no reason to work if the government owns everything. As is seen from the graphic, the government serves the people and increases the prosperity up to a certain point. However, after this point, the government begins to reduce productivity and, concerning this, reduce prosperity. The "X" point in the figure shows an optimal mixture that includes the activities of the public and the private sector. And the attainable prosperity comes to the highest level at this point (Armey, 1995: 92–93).

It is understood from here that the Armey curve is a parabolic curve that demonstrates that government activities have the effect of increasing welfare up to a certain point but that the growth of the government beyond this certain level

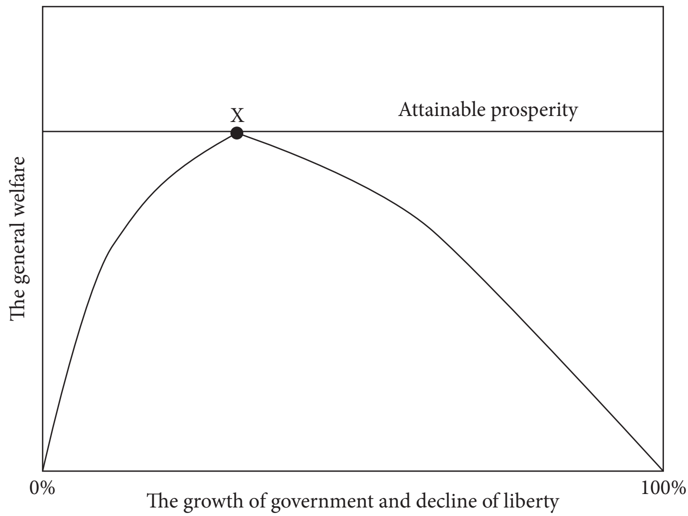

Fig. 1: Original Armey Curve. Source: Armey, 1995: 92.

reduces welfare. However, contrary to what is frequently used in the literature, Armey (1995) expressed the vertical axis in the original graph with the general welfare of society. The concept of welfare here has many determinant criteria. Vedder and Gallaway (1998) related this societal welfare to economic growth, and the Armey curve was expressed afterward in the literature with economic growth. As is known in addition to this, the size of the government is generally measured with the share of public expenditures within GDP. For this reason, the axes of the Armey curve today are expressed as economic growth and shares of public expenditures within GDP (government size), differently than the original version. The graphic below shows the version of the Armey curve used today.

In Fig. 2 as the size of the public sector, shown in the horizontal axis, increases from zero (from complete anarchy), the rate of economic growth, shown in the vertical axis, grows from the start. The curve has a concave form because of diminishing marginal return. In other words, a proportional increase in public expenditures is slower than a proportional increase in economic growth. Along with growing positive externalities, an additional percentage increase in the contributions of the government to economic activities still creates further economic productivity (meaning, a positive slope in the curve). At one point, however, the marginal benefit obtained from growing public expenditures is zero. When the contrary effect of the growth of the government concludes with a

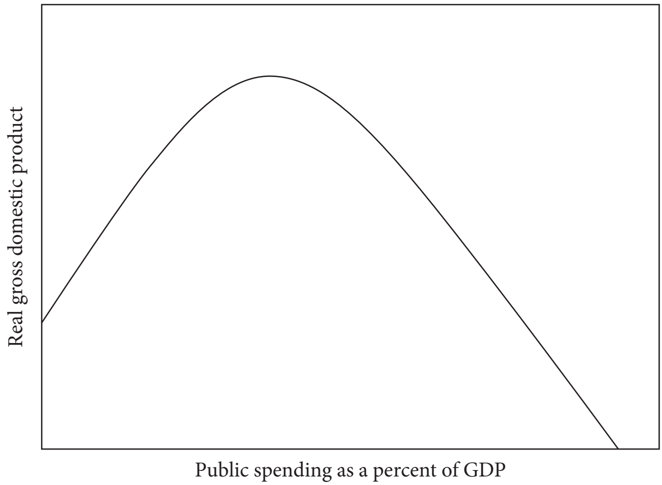

Fig. 2: Armey Curve. Source: Vedder ve Gallaway, 1998: 2.

decrease in the increase of output, the growth-increasing properties of the government begin to decrease (Alimi, 2014: 7).

The absence of the government will lead to a state of anarchy and a low level of output per capita because the lack of legal government rules and the failure to protect property rights presents an extraordinarily little incentive for savings and to make investments. Similarly, the output per capita will be low in situations when the government makes all input and output decisions. However, when the mixture of public-sector and private-sector decisions becomes relevant, the output is expected to be more significant. Based on this, output-increasing features are dominant when the government is exceedingly small. In addition to this, the functions of the government that increase growth subside after a point and the greater expansion of the government does not lead to the expansion of outputs (Vedder and Gallaway, 1998: 1–2). In other words, as public expenditures increase, government-financed additional projects gradually become less productive, and the taxes and debts that increase about this bring further burdens. At this point, the marginal benefit obtained from growing government expenditures is zero (Pevcin, 2004: 4).

The Armey curve does not mean that the government is entirely evil. It emphasizes that an excess of something accepted as a good thing may be harmful. For this reason, they assert that the government must be measured in the economy (Vedder and Gallaway, 1998: 2).

Facchini and Melki (2011) say that the positive effects of public expenditures can be explained with the benefits obtained from the correction of market failures, and their negative effects can be explained with the costs that the nature of the state failures create. For this reason, they express that the Armey curve is the combination of two different curves that show the shortcomings of the market and state.

According to Schaltegger and Torgler (2006), although there is a large empirical literature that has researched the relationship between government size and economic growth, the empirical evidence obtained is still insufficient. This is because the concept of a small or large government is not hypothetically a determinant on its own. While a negative relationship is only valid for rich countries with an expansive public sector, the growth in the size of the government in underdeveloped countries can lead to more secure property rights and the implementation of agreements. Analyses were conducted for this reason, considering the levels of development of the countries.

Many factors like countries' levels of development, levels of productivity, transaction costs, rates of corruption, bureaucratic unwieldiness, strength of rent-seeking operations, length of lags occurring in the observance results and the implementation of policies, and power of fiscal policy to penetrate conjuncture may be determinant in the effect of public expenditures on economic growth.

2.2 Empirical Literature

Numerous studies test the Armey curve for countries and periods. The objective of seeking answers to the question of what kind of relationship there is between economic growth and the size of the public sector constitutes the foundation of these studies.

Guseh (1997) concluded in an analysis for 59 middle-income, underdeveloped countries for the 1960–1985 period, and Fölster and Henrekson (1999) also completed a study they performed for 23 OECD countries for the 1970–1995 period that there was a negative relationship between public expenditure and economic growth. However, Ram (1986), in an analysis for four different groups of countries and the periods of 1960–1970 and 1970–1980, and Kormendi and Meguire (1986), for the 1931–1983 period, concluded that there was a positive relationship between public expenditures and economic growth.

Vedder and Gallaway (1998) testes the Armey curve for the U.S. economy for the period of 1947–1997 with the least-squares regression analysis and calculated the optimal size of the government as 17.45%. The Armey curve was tested further in five countries in the continuation of the study. Based on this, it was calculated that the optimal size of a government for Canada in the 1926–1988 period was 21.37%, for Denmark in the 1854–1988 period was 26.14%, for Italy in the 1862–1988 period was 22.23%, for Sweden in the 1881–1988 period was 19.43%, and for the United Kingdom in the 1830–1988 period was 20.97%.

Pevcin (2004) tested the Armey curve in a panel data analysis that covered 12 industrialized Western European countries for the 1950–1996 period and determined that the optimal size of the public sector ranged between 36.56–42.12%. The author found this rate to be high and tested the Armey curve with the time series method separately using country data in the continuation of the study. The author concluded that the optimal public sector size for eight countries whose results were statistically significant was between 37.09–45.96%. When referring to the year 1996, it was seen that only the size of the public sector in Ireland, from among these countries, was below the calculated optimal levels.

Chen and Lee (2005) concluded that there was a nonlinear Armey curve for the period of 1979–2003 in Taiwan. Based on this, the threshold regime for the total public expenditures was 22.83%, while the threshold regime for the public investment expenditures was 7.30%, and the threshold regime for public consumption expenditures was found to be 14.96%.

Schaltegger and Torgler (2006) tried to test the effect of the size of a subfederal government for a rich country on economic growth using panel data for 26 Swiss cantons for the period of 1981–2001. The general finding was that there was a strong negative relationship between the size of a government and economic growth.

Davies (2009) added a different dimension to the literature on the optimal size of the government and correlated the effect of government consumption expenditures on social welfare. Thus, using the United Nations' Development Programme's Human Development Index as an outcome variable, Davies shifted the criterion for optimal government size from productivity to social welfare. By conducting a panel data analysis for 154 countries for the 1975–2002 period, Davies concluded that the optimal size based on the humanitarian-development standards of the government was significantly greater than the optimal size.

Matuşcu and Miloş (2009) found the optimal public sector size to be 27.46% and 30.42% in the analysis they conducted in 12 old EU member states and 15 EU member states in the 1999–2008 period.

Samimi, Nademi, and Zbeiri (2010) tested a two-sector production model by measuring the threshold government size in eight Muslim countries for the 1980–2007 period. Based on this, a nonlinear relationship was found between the size of the government and economic growth. A significant, positive correlation between the two variables when the government is small and a meaningful negative relationship when the government was large (except for Jordan and Turkey) were determined.

Abounoori and Nademi (2010) used a two-sector production function to test the Armey curve for Iran with a threshold regression model. According to a study that found a nonlinear relationship between economic growth and public expenditures for the 1959–2005 period, the threshold value for total public spending was 34.7%, while public consumption expenditures were 23.6%, and public investment expenditures were 8%.

Facchini and Melki (2011) studied a long period of 1871–2008 in France and attained strong findings that the Armey curve had a relationship with the time series. According to this, the optimal government size in France for this period was at a rate of 30% of GDP.

Fallahi and Montazeri Shoorkchali (2012) tested the existence of the Armey curve using a smooth transition model for the 1961–2008 period in Greece. As a result of their analysis, they concluded that there was a nonlinear relationship between economic growth and public expenditures but that this relationship was positive. According to the study, which found that the threshold was 13.26% in Greece for this period, the existence of the Armey curve could not be verified.

Herath (2012) asserted that the Armey curve can be valid not only for developed nations but also for underdeveloped countries and tested the Armey curve for the Sri Lankan economy. The researcher performed an analysis using the least-squares method for the 1959–2009 period and found the level of public expenditures, which corresponds to the peak of the threshold of the Armey curve, to be about 27% of GDP.

Alimi (2014) tested the Armey curve in the Nigerian economy between 1970 and 2012 and acquired different optimal public sector sizes under different assumptions. Based on this, the optimal size of the public sector is 19.8% when there is a GDP-dependent variable, including the component of the government, while it is 12.58% when there is a GDP-dependent variable in which the government component is not included.

Ahmad and Othman (2014) concluded that the Armey curve was valid using the ARDL bounds test approach for the 1970–2012 period in Malaysia and determined that the optimal level of public expenditure was 16.32%. This rate is above the level of public expenditures that occurred in the year 2012.

Hok, Jariyapan, Buddhawongsa, and Tansuchat (2014) tested the Armey curve with the help of a panel data analysis in the 1995–2011 period for eight Asian countries (Brunei, Cambodia, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam) and concluded that the optimal rate was 28.5%.

Turan (2014) tested the validity of the Armey curve for different periods in Turkey and found significant results. Based on this, the optimal public expenditures ranged between 8.8–9.1% in the 1950–2012 period and between 15.4–17% in the 1970–2012 period. Considering non-interest public expenditures, the researcher found the optimal level to be 14.4% for the 1980–2012 period. The discovered values were below the realized values.

De Mendonça and Cacicedo (2015) tested the Armey curve with monthly data in the period of 2000–2013 in the Brazilian economy and found the optimal government size to range based on the established models, between 20.88–23.05%.

Pamuk and Dündar (2016) calculated the optimal public sector size to be 23.5% of GDP using the Scully time series method for the Turkish economy in the 1950–2006 period.

Varol İyidoğan and Turan (2017) tested the Armey curve with the threshold regression model for the period of 1998:1-2015:1 in Turkey, found strong findings that there was nonlinear relationship, and calculated the threshold values as 16.5% for the total public expenditures, 12.6% for the public consumption expenditures, and 3.9% for the public investment expenditures.

Tabaghua (2017) found the optimal government size in the Georgian economy in 2002–2014 to be at a rate of 21% and determined that the public expenditures were beneath the optimal level before 2006 and above the optimal level after 2006.

Bozma, Başar, and Eren (2019) tested the Armey curve with the ARDL cointegration model in G7 countries by dealing with different periods between the years of 1981–2014. Based on this, it was determined that the Armey curve in the United States, France, and Canada are valid and are not valid in other countries. Optimal public consumption expenditures were calculated as 12.46% in the United States, 23.57% in France, and 18.93% in Canada.

3 The Armey Curve and Optimal Public Sector Size in Turkey

The share of public expenditures within GDP in Turkey in the period of 1981–2018 ranges between 12.1% and 33.5%. This rate, which shows the size of the government, changes either based on fiscal policies implemented against conjuncture or based on the change in the understanding of the state. The economic growth rates are, on average, 3.9% in this period.

As is seen from Fig. 3, public expenditures and economic growth rate move in the same direction in this period, except for years of crisis.

The fundamental purpose of our study was to create an Armey curve that shows the relationship between economic growth and public expenditures based

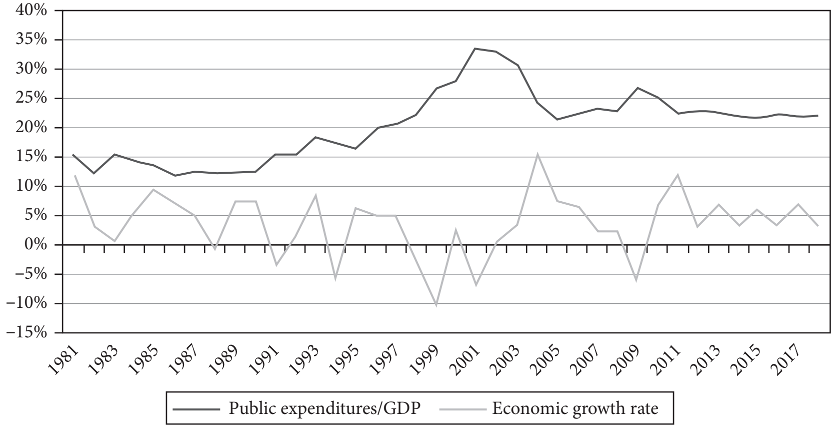

Fig. 3: The Size of Government and Economic Growth Rates in Turkey (1981–2018). Data Source: Ministry of Treasury and Finance, Republic of Turkey (2019).

on Turkish economic data from the period of 1981–2018 and to calculate the ratio of public expenditure level to GDP that maximizes economic growth in Turkey.

3.1 Model and Data Set

Our study aims to calculate the size of optimal public expenditures by testing the Armey curve in Turkey. The analysis in which the time series techniques were used took place based on the following model.

$$Y_t = \beta_0 + \beta_1 G_t + \beta_2 {G_t}^2 + \varepsilon_t \tag{1}$$

In the model, Y_t expresses the rate of economic growth, G_t expresses the percentage of total public expenditures for GDP, and ε_t expresses the error term.

The data set used in the model was obtained from the Republic of Turkey Ministry of Treasury and Finance and comprised data belonging to the period of 1981–2018. The dependent variable, Y_t, were deflated data of nominal GDP based on the CPI (1987=100) procured from the Turkish Statistical Institute and were obtained with the logarithmic difference. All public expenditure values were prepared by dealing with consolidated budget data from 1981 to 2005 and central government budget data for the period of 2006–2018.

By creating a quadratic equation, the presence of the Armey curve was accepted. The purpose here is to determine the optimal level of public expenditure for Turkey regarding the preliminary acceptance in which the Armey curve exists. For this to

Tab. 1: ADF Unit Root Test Results

Variables	ADF-Test Statistic	MacKinnon Critical Value (5%)	Lag Length (k)
Y	-5.446***	-2.943	0
G	-1.533	-2.943	1
G^2	-1.890	-2.943	1
ΔG	-5.109***	-2.943	0
$ΔG^2$	-4.635***	-2.943	0

Notes: Δ expresses the first-degree difference processor. Results were obtained based on the Akaike Information Criterion in the unit root test. Maximum lag lengths were taken as 4. Only the model with constant was used. *** expresses the level of statistical significance at the level of 1%.

occur, the first independent variable coefficient is expected to be positive, and the second independent variable coefficient is expected to be negative.

3.2 Method and Findings

The stationary of the variables was tested in the analysis through a unit root test, and the long-term coefficients were obtained afterward by testing the cointegration relationship with the ARDL bounds test approach.

3.2.1 Unit Root Analysis

The Augmented Dickey-Fuller (ADF) (1981) unit root test was used to research the unit root properties of the variables discussed in our study. As is known, if the ADF test statistic is smaller than the specified critical value, the null hypothesis in which the series is not stationary is rejected.

As is understood from Tab. 1, the Y series is stationary at level, while the other series include the unit root at the level. But when the difference is taken, these become stationary at a scale of 1% significance. Because of the differences in the degree of integration in the series, the ARDL bounds test approach that considers this situation was used.

3.2.2 Bounds Test (ARDL) Approach

The ARDL (Autoregressive Distributed Lag) bound test approach was used to research whether there was a long-term cointegration relationship between the variables in our study. The use of the ARDL approach means to test whether the lags of the variables are statistically significant by estimating a dynamic limited VAR model. Our study estimated equation number (1) to determine the

Tab. 2: (2) Numbered Equation Bound Test Results

Dependent Variable	Lag Length (k)	F-statistic	Critical Values (Lower Bound - Upper Bound)
$F_Y\left(Y \mid G,\ G^2\right)$	2	14.377	3.10 - 3.87

Notes: The critical values were given based on a significance level of 5%. The maximum lag length was taken as 4, and the lag length was specified based on the Akaike Information Criterion.

long-term relationship with the ARDL unrestricted error correction model (UECM), which is expressed in equation number (2).

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 G_{t-1} + \beta_3 {G_{t-1}}^2 + \sum_{i=1}^{p} \lambda_{1i} \Delta Y_{t-1} + \sum_{i=0}^{p} \lambda_{2i} \Delta G_{t-1} + \sum_{i=0}^{p} \lambda_{3i} \Delta {G_{t-1}}^2 + \varepsilon_t \quad (2)$$

By estimating equation number (2) with the least-squares method, the null hypothesis was tested in which the coefficients of the lagged variables are equal to zero (there is no cointegration relationship between the variables), and the alternative hypothesis was tested in which the coefficients of the lagged variables are not equal to zero (there is a cointegration relationship between the variables). Accordingly, if the F-statistic value exceeds the upper critical value, it can be said that there is cointegration between variables.

As is understood from Tab. 2, the F-statistic is found above the upper critical value at a significance level of 5%. In this situation, the null hypothesis, which expresses that there is no cointegration relationship between the variables, is rejected. In other words, there is a long-term relationship between public expenditures and economic growth in the period of 1981–2018.

After finding a long-term relationship between the variables, the ARDL long-term model was estimated. Based on this, ARDL long-term estimation for equation number (1) is obtained with equation number (3).

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta Y_{t-i} + \sum_{i=0}^{r} \beta_2 \Delta G_{t-i} + \sum_{i=0}^{k} \beta_3 \Delta {G_{t-i}}^2 + \varepsilon_t \quad (3)$$

As a result of the estimation of equation number (3) with the least-squares method, the long-term coefficient estimations belonging to the ARDL (3,4,2) model whose lengths of lag are specified based on the Akaike Information Criterion are shown in Tab. 3.

Tab. 3: ARDL (3,4,2) Model Long-Term Coefficient Estimations

Variable	Coefficient	Standard Error	t-statistic	Prob.
C	0.010	0.025	0.398	0.694
G	0.513	0.252	2.035	0.053*
G^2	-1.606	0.605	-2.653	0.014**

Note: * and ** express the level of statistical significance at the level of 10% and 5%, respectively.

As is seen in Tab. 3, the variable of public expenditures is positive and significant at a level of 10% while the variable of the square of the public expenditures is negative and significant at a scale of 5% in the long-term. This situation is a result that is expected theoretically, and that supports the Armey curve.

Finally, the error correction coefficient (η) and the short-term dynamic parameters were estimated. This situation is shown with equation number (4).

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta Y_{t-i} + \sum_{i=0}^{r} \beta_2 \Delta G_{t-i} + \sum_{i=0}^{k} \beta_3 \Delta G_{t-i}{}^2 + \eta ecm_{t-1} + \varepsilon_t \tag{4}$$

Here, the ecm_{t-1} variable (error-correction term) expresses the one-period lagged value of a series of error terms found in equation number (3). The error-correction coefficient (η) shows the short-term imbalance that might be corrected in the long term and is expected to has a negative sign and be statistically significant.

As is seen from Tab. 4, the error-correction coefficient was found to be negative-signed and statistically significant at a level of 1%. The F-statistic was found to be statistically significant at a scale of 1%. According to the Jarque-Bera test, the error terms are distributed normally. According to the Breusch-Pagan-Godfrey heteroscedasticity test, there is no heteroscedasticity problem. There is no autocorrelation problem based on the Breusch-Godfrey autocorrelation test.

It is possible to calculate the optimal public expenditure level from the long-term coefficients that we obtained based on the ARDL approach. Based on this, as a result of equalizing the derivative of the equation number (1) to zero $\left[\frac{dY}{dG} = 0\right]$, the level of optimal public expenditure can be found with formula $\left[-\frac{\beta_1}{2\beta_2}\right]$. Thus, the level of public expenditures corresponding to the peak of the Armey curve will have been found. According to the coefficient values that we obtained in

Tab. 4: ARDL Model Error Correction Coefficient Estimations

Variable	Coefficient	Standard Error	t-statistic	Prob.
ΔY(-1)	1.076	0.231	4.669	0.000***
ΔY(-2)	0.331	0.131	2.521	0.019**
ΔG	0.121	0.990	0.122	0.904
ΔG(-1)	-4.591	0.942	-4.873	0.000***
ΔG(-2)	-1.218	0.291	-4.186	0.000***
ΔG(-3)	-0.887	0.278	-3.192	0.004***
ΔG^2	-4.501	1.955	-2.303	0.031**
ΔG^2(-1)	7.449	1.913	3.894	0.000***
ecm_{t-1}	-2.619	0.325	-8.063	0.000***
$ecm_{t-1} = Y - (0.513 * G - 1.606 * G^2 + 0.010)$				
R^2	0.830	**Adjusted R^2**	0.748	
AIC	-4.113	**F-statistic**	10.182 [0.000]	
DW-statistic	2.078	χ^2_{BG}	2.042 [0.155]	
Jarque-Bera	2.069 [0.355]	χ^2_{BPG}	10.540 [0.482]	

Notes: *, **, and *** express the level of statistical significance at the level of 10%, 5%, and 1%, respectively. AIC: the Akaike Information Criterion, DW-statistic: the Durbin-Watson statistic, χ^2_{BG} the Breusch-Godfrey LM serial correlation test, and χ^2_{BPG}: the Breusch-Pagan-Godfrey heteroscedasticity test.

our study, the (optimal) level of public expenditures that maximizes economic growth constitutes 16% of GDP. This rate varies between 12.1% - 33.5% for the years 1981–2018 in Turkey, and its average value is 20%. Based on this, the level of public expenditure that occurred between 1981 and 1992 was under the optimal level, while the level of public expenditure that occurred between 1993 and 2018 was above the optimal level.

According to the findings we obtained in our study, the Armey curve belonging to the period of 1981–2018 in Turkey was shown in Fig. 4. By placing the values of the coefficients in the model we estimated and the value of public expenditures that grow with certain intervals into the equation, we can geometrically demonstrate the relationship between public expenditure and economic growth. Indeed, as is to be understood from Fig. 4, the optimal public expenditure level for the relevant period in Turkey (the level of public expenditure that demonstrates the peak point for the Armey curve) is 16%, and the red

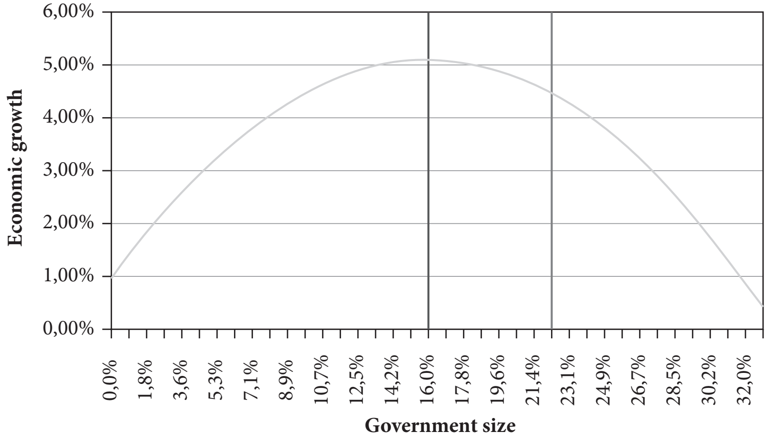

Fig. 4: The Armey Curve in Turkey

line shows it. The green line is the level of public expenditures that occurred in Turkey in 2018 (22.2%) and is to the right of the red line. In this situation, it is possible to say that the level of public expenditure in the year 2018 was above optimal.

4 Conclusion

The Armey curve tries to explain the hypothesis that the rate of public expenditures to GDP, or in other words the size of the government, will contribute positively to economic growth up to a certain level but will negatively affect economic growth after this certain level, and it is an important topic that is discussed in the fiscal economics literature. Based on studies that provide different results in different periods, different countries, and various economic structures, it is not possible to express an optimal size of government that is de facto. Therefore, the Armey curve in the Turkish economy was tested for the 1981–2018 period in our study, and we attempted to determine the level of government that maximized economic growth.

It was seen in the model for which the bound test (ARDL) approach, a time series technique, was used based on yearly data from these periods that the Armey curve provided statistically significant results and met theoretical expectations. Based on this, the rate of public expenditure to GDP that maximizes economic growth was calculated as 16%. While there is information that the levels of public expenditure that occurred in the Turkish economy in the 1981–2018 period were in a range of 12.1 - 33.5% and the average value obtained was 20%, we can say that the actual level mostly remained above the optimal level. Reviewing based on year, we can say that the level of public expenditure that occurred between 1981 and 1992 was below the optimal level and between 1993 and 2018 was above the optimal level.

Our study only aimed to test the Armey curve with the presupposition that accepted economic growth as a dependent variable. But economic growth is only one of the objectives of fiscal policy. Therefore, public expenditures are also expected to serve purposes like price stability, development, and equity in income distribution. For this reason, the determinant of optimal government size is not only economic growth. It is a fact that the size of the government that maximizes each objective of the fiscal policy may be different and that each type of public expenditure contributes to different objectives at different levels. For this reason, determining an optimal level of public expenditure (or types of public expenditure), that will maximize the overall set of fiscal policy objectives will advance the literature toward a wider discussion.

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