THE IMPACT OF ECONOMIC GROWTH AND TOTAL INVESTMENTS ON PUBLIC DEBT: THE VAR ANALYSIS APPROACH

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Abstract:

The level of public sector debt varies according to the government's size, scope, and activities. Borrowing positively affects the level of production and employment in the country when it occurs in the right conditions. The benefits and damages of borrowing vary from country to country and may have different consequences. The emergence of opposing views for or against borrowing may be caused by the evidence. In this study, the effects of total investment and economic growth on borrowing were examined with the data of the period 1995-2021. Granger causality and VAR analysis methods were used in the analysis. According to Granger's evidence, there is a bidirectional relationship between economic growth and public debt. The results show that there is a causal relationship between economic growth and total investment. Affirming variance decomposition and impact-response analysis, most of the shock to government debt is because of economic growth. The impact of the total investment on government debt is also small. This result shows that policymakers should pay attention to the potential risks of public debt when implementing policies to promote economic growth. To keep sound debt management, future policies should emphasize budgetary discipline and they should make no compromises. Using borrowed funds for total investment and the promotion of high-value-added investments are also crucial for maintaining a healthy growth policy.

Keywords: public borrowing, economic growth, total ınvestments, variance decomposition, ımpulse-response analysis

1. Introduction

The willingness to borrow and the level of public sector debt have a meaningful impact on the size, scope, and activities of the government. When used under the right conditions, it can bring great benefits in raising the level of output in a country. Government debt has often been the subject of criticism by scholars, experts, and policymakers with differing views. Some economists argue for or against government

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debt, focusing on the economic benefits, economic pitfalls, and intergenerational equity of government debt. However, these arguments are largely unsatisfactory. The available evidence can lead to arguments both for and against government debt. Some views on this issue are based on ideology rather than empirical evidence (Zwalf and Scott, 2022). One of the most important reasons why the concept of government debt remains on the agenda and is debated is the impact of budget deficits on national economies. The budget deficit shows the imbalance between expenditure and income. Public debt is one of the most effective ways to close budget deficits (Yıldırım and Erdoğan, 2022: 363). Problems arising from public debt are nothing new to developed and developing countries. Problems arising from public debt have been studied using various approaches and methodologies (Asteriou et al., 2021). Borrowing is so critical to a country's investment and economic growth that it may encounter a series of debates about its positive, negative, or neutral impact on the economy (Butkus, 2018). According to the neoclassical view, increasing budget deficits raise interest rates. As a result, budget deficits force the private sector to borrow less at higher interest rates, excluding private expenditures. Therefore, it is the increase in interest rates that leads to exclusion. The crowding-out effect has a negative effect on economic growth. It hinders the growth of a private investment. A decrease in capital stock leads to growth in economic output and a decrease in the marginal productivity of labor. In a profit-maximizing environment, the decline in private investment can be negative as the marginal productivity of labor equals the real wage (Carrasco, 1998).

New Keynesians believe that as long as interest rates on public debt remain chronically below economic growth, debt is not a cause for concern as it relates to other economic factors (Blanchard, 2019). This view of the debt-growth relationship may ignore the underlying dynamics of current budget deficits and the upward pressure of rising debt (GDP to public debt) rates on long-term interest rates. These uncertainties are acknowledged by recent observations that higher debt-to-GDP ratios can lead to higher taxes, lower incomes, and generational inequalities (Boskin, 2020). Equally important is the threshold or nonlinear effects theory, which describes the relationship between government debt and growth. Therefore, although increasing debt has a small effect on growth, debt exceeding a certain threshold reveals a negative effect (Reinhart and Rogoff, 2010).

This study examines the impact of economic growth and investment in Turkey on public borrowing. It is found that the researches on public debt are limited and the studies conducted in this framework are insufficient to evaluate public debt and its practices. In this study, the impact of total investment and economic growth on public debt is evaluated using the most recent data. The study did not consider other internal and external factors that affect public debt. The objective of this study is to contribute to the literature by examining a) the impact of the increase in public spending, b) the direction of the relationship between economic growth and investment and public debt, and c) the causality relationship between the variables. The study is organized as follows. Part Two presents the literature examining the relationships between the variables and

their results. Chapter Three describes the data, the methodology of the study, and the empirical findings of the study. In the fourth chapter, the findings are discussed and the study is concluded by making political propositions.

2. Public Debt in OECD Countries and Turkey

2.1 Public Debt in OECD Countries

The ratio of public debt to GDP measures government gross debt as a percentage of GDP. It is a remarkable indicator of the sustainability of government finances. Debt, currency, and deposits, debt securities, loans. It is calculated as the total amount (where applicable) considering categories of obligations arising from insurance, pensions, standardized guarantee schemes, and other liabilities. Changes in government debt over time show the impact of past government deficits (OECD, 2022).

As government debt is an important issue not only for developing countries but for industrialized countries, debt management is very important for industrialized and developing countries. Among OECD countries, the countries with the highest general government debt to GDP ratio are Hungary, Austria, Israel, Colombia, and Finland. Lithuania, Slovenia, Australia, the United Kingdom, Spain, and France have the lowest general government debt-to-GDP ratios among OECD countries. But, the effects of the 2008 crisis and the COVID-19 crisis were effective in increasing the debt/GDP (%) rates of countries. Fiscal policies and instruments implemented to reduce the social impact of the pandemic-induced crisis increased short-run debts. The scale of public borrowing has increased. While the fiscal balance worsened by around 10% of GDP, the OECD economy contracted by 5.5%. The combination of widening fiscal deficits and shrinking economies has increased the public debt-to-GDP ratio (Figure 1).

Figure 1: General Public Debt (GDP-%- Total)
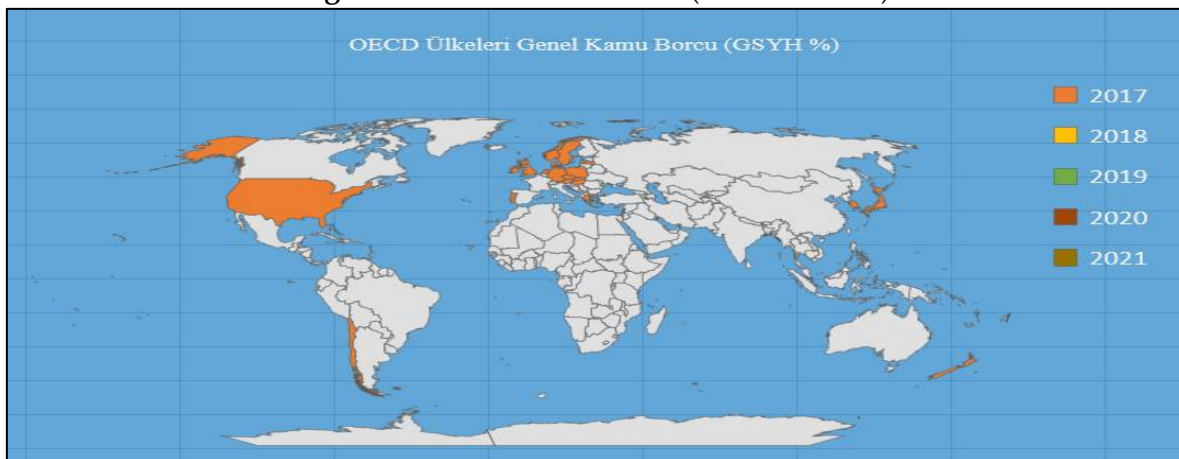
Source: OECD Data (2022).

While the long-term borrowing costs of OECD countries remain low, the course in the EURO region is negative. Considering these developments, legal and institutional arrangements that apply the objectives, strategies, and principles should be made in

OECD countries to ensure the effectiveness of public debt management. This indicates the need to borrow more competitively by creating an efficient market for debt instruments. Practices that contribute to the development of the debt instrument market, such as providing equal conditions to investors, increasing the liquidity of debt instruments, and reducing financial transaction costs, can help keep the volume and composition of debt at optimal levels.

Figure 2: Marketable Debt-GDP: 2008 Financial Crisis, and COVID-19 Shock (%)
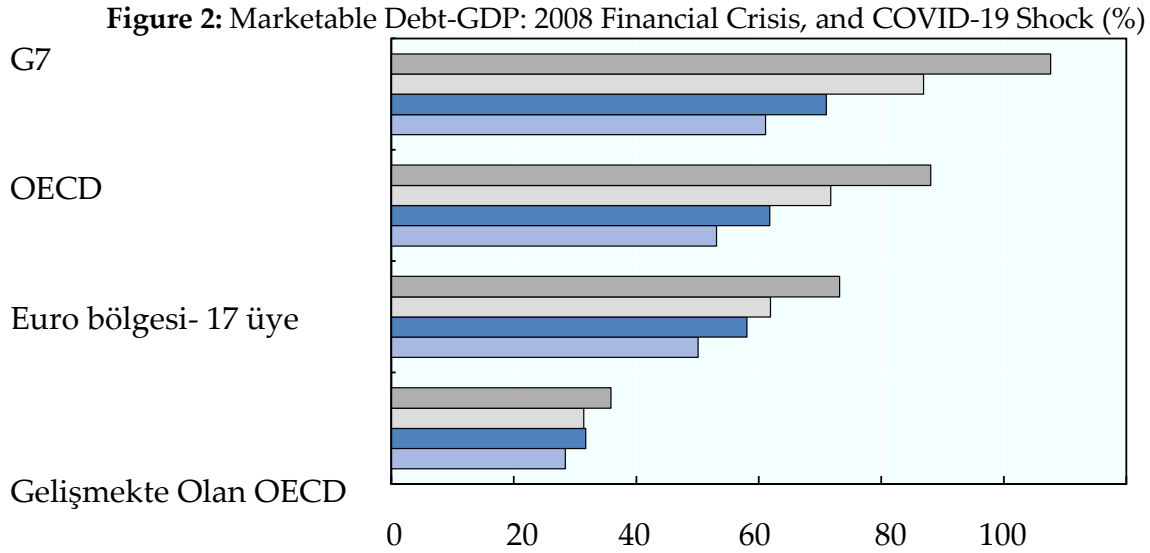
**Source:** OECD (2021). Sovereign Borrowing Outlook for OECD Countries

Historically, government bond prices, as measured by credit ratings, have been greatly influenced by the expected probability of default. During the 2008 crisis and after the Eurozone debt crisis, the credit ratings of some OECD countries declined significantly. Some of these downgrades are combined with securities sales, known as the "cliff effect." Except for a few countries such as Mexico, Turkey, and the United Kingdom, the increase in public debt burdens has not led to the downgrading of the credit ratings of OECD countries. Looking to the future, a slow economic recovery, high borrowing needs, low reserve buffers, and weak credit fundamentals are likely to put significant pressure on the country's ratings. Realization of this possibility, risks from high levels of government and corporate debt, may increase vulnerability (OECD, 2021).

2.2. Turkey's Public Debt, Total İnvestment, and Economic Growth

Stable growth is one of Turkey's most important issues. The post-crisis period the Turkish economy faced on April 5, 1994, was a year of high unemployment and inflation, as well as political and growing instability. In addition to the country's continued volatile economic and political developments, the political and economic turmoil that has occurred around the world has also had a negative impact on the Turkish economy. The crisis that started in Thailand in July 1997 spread to Malaysia, Indonesia, South Korea, the Philippines, Hong Kong, Singapore, and other regional countries, and the economic crisis gradually spread. With the effects of the resulting crisis, national currencies fell in

value against the US dollar, while the crisis deepened and financial markets collapsed (Turan, 2011: 60).

**Figure 3:** Real GDP in Turkey by Years (Current USD)
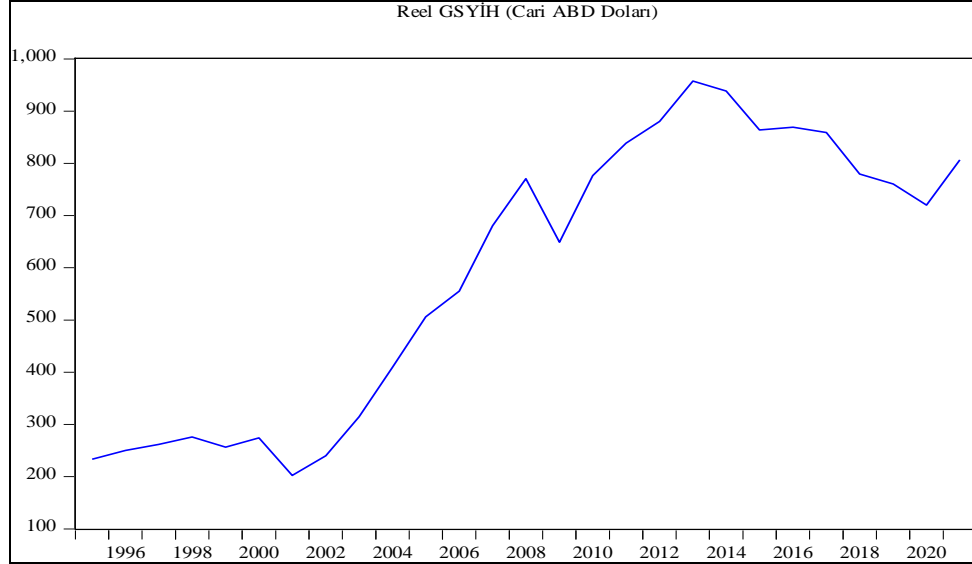
Source: IMF WEO Data (2022).

The effects of the Russian crisis, which emerged in the same year after the depression on February 28, 1998, caused a negative impact on the policies and measures put forward to recover the Turkish economy. While the effects of the crisis in November 2000, and February 2001 had devastating effects on the economy, the European Crisis that emerged in 2008 triggered problems in the Turkish economy. The downgrade in the growth rate of the Turkish economy, the global crisis, the failure of credit channels based on the international banking system in Turkey, and the decrease in capital inflows and foreign demand led to significant contractions in 2009, Volatility in the economy has also affected investment and employment, increasing the problems in the economy (Darıcan, 2013: 44). When the general structure of the Turkish economy is considered, it does not have favorable conditions for stable growth. Considering the breaks in the trend in Figure 3, we can say that it would be more appropriate for Turkey to focus on development-oriented policies rather than growth.

There has been a change in debt management since the economic policies. As of this date, the debt management approach based on external borrowing has been terminated because of the financial deficits in the social security system and the emergence of internal duty losses in public banks. In the next period, policies based on domestic borrowing began to be implemented. While public debt decreased until 2017, it continued to increase in the following years (Figure 4).

Figure 4: General Government Net Debt in Turkey (Real GDP-%)
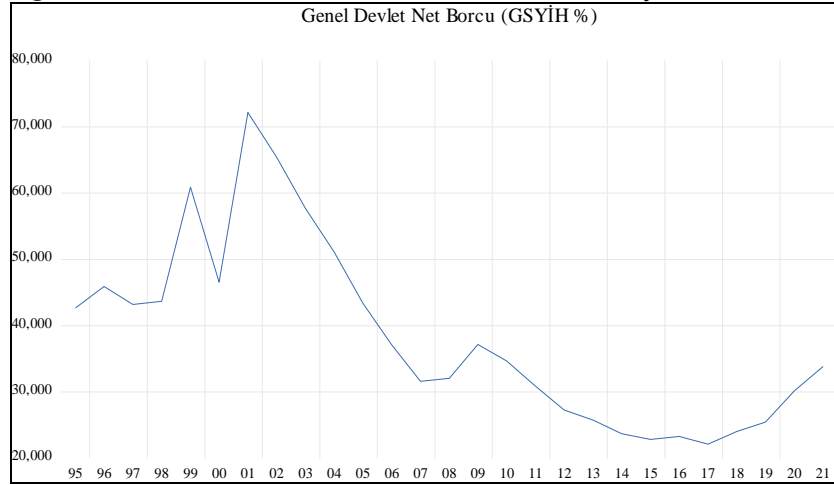
Source: IMF WEO Data (2022).

Figure 5: Total Investments in Turkey (Real GDP-%)
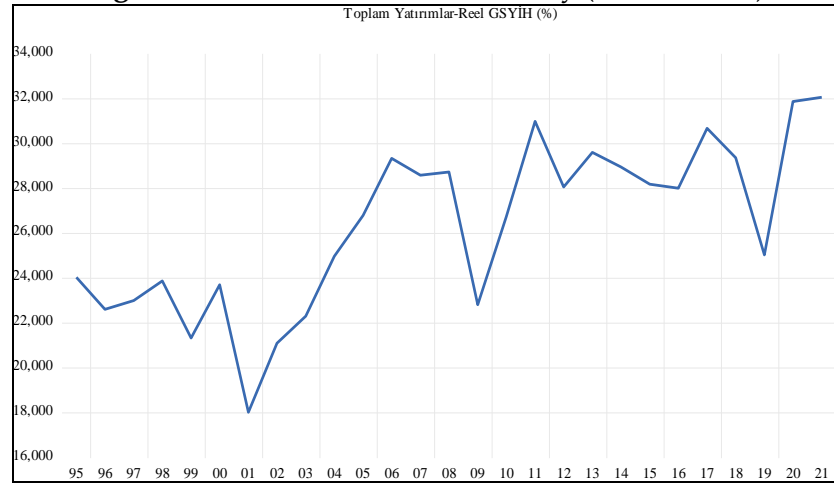
Source: IMF WEO Data (2022).

The increase in public sector deficits, coupled with high-interest rates and low exchange rates, has increased the dependence on hot money in the economy. In addition, it is seen that the effects of the economic crises caused a significant decrease in investments. In addition to the fact that the Turkish economy is foreign-dependent and affected by global economic crises, it creates the problem of stable growth arising from political and political instability. In addition, the crises encountered in the economy caused fluctuations in total investments. This situation causes increases and decreases in production depending on investments and affects economic growth. (Fig. 5). To ensure stable growth in the Turkish economy and to reduce the degree of being affected by crises, there is a need to strengthen the legal structure, encourage investments that will reduce foreign dependency with stable policies that will reduce foreign dependency, and to sustain exports, especially with high value-added goods and services, instead of sustaining growth depending on imports.

3. Lıterature Review

3.1. The Relationship Between Public Debt and Economic Growth

Based on their research on 52 African economies over the period 1950-2012, Vega et al. (2016) observed that public debt limits affect economic growth and that the relationship between economic growth and public debt is inversely U-shaped at a given level of debt. The highest average real and per capita growth rates occur when public debt reaches 60 percent of real GDP and average inflation reaches 8.2 percent. The average economic growth rate drops to 1.32 when the rate falls between 60-90% and to 1.64 when it exceeds 90%. The findings suggest that higher levels of public debt are reflected in lower economic growth rates and higher levels of inflation. Ghourchian and Yilmazkuday (2020) used the two-stage least squares methodology in a survey of 83 countries for the period 1960-2014 in which they found that a 1-unit increase in the ratio of public debt to GDP reduced real GDP growth by about 0.01 percentage point.

According to Sertkaya (2021), the VECM/VAR approach for the period 2002Q3-2020Q3 found that a decrease in public foreign borrowing leads to a decrease in GDP. According to Yıldız and Sağdıç (2021), aggregated average group (PMG) estimates for the period 1997-2019, the long-term impact of external debt, public external debt, and private sector external debt on BRICS economic growth is negative. Foreign debt is a strong negative impact on economic growth, according to the results. The empirical results of the study support the hypothesis of the "debt surplus", according to which the potential for economic growth will be limited in heavily indebted countries. The results of Yılmaz and Cural (2011) of 17 developing countries for the period 1980-2010 show that there is a positive relationship between domestic debt stock and GDP, and a negative relationship between budget deficit/GDP and inflation rate. In Mirzade's (2021) study it was figured out that the total governmental debt stock had a positive effect on economic growth between 2008-2019 and 2002-2019 and that economic growth had a positive effect on the public total debt stock in the long run. There is a causal link between total public debt and short-term economic growth, and public debt boosts short-term economic growth.

There is no long-term causal link between the stock of government domestic debt and the growth and stock of government foreign debt and growth over the period 2002-2019. Between 2002 and 2019, the stock of domestic public debt and the stock of external public debt had a positive effect on economic growth. Akpınar's (2019) research shows that the effect of public debt on Turkey's post-2000 economic growth may be positive or negative, and the result may vary depending on the relative status of the effect. Yanik (2019) shows there is long and short-term positive and bidirectional causality between Turkey's foreign debt and economic growth from the first quarter of 1990 to the fourth quarter of 2016. The results demonstrate that foreign debt has a positive impact on economic growth. According to Çadırcı (2022)'s research on Turkey for the period 2010-2021, public sector borrowing requirements and domestic and foreign borrowing ratios tend to decrease since 2010. The increase in growth rate in this period had effective on

the decrease in debts. The increase in the growth rate over this period resulted in a decline in debt. However, during the period under review, the external debt of the private sector is higher than the external debt ratios of the public sector. This is increased the likelihood of additional problems in the future.

According to the results of the Heiberger (2021) research on meta-regression, an increase of 10 percentage points in public debt-GDP is associated with a decrease of 0.14 units in annual growth rates. Metaregressive analysis explains that the endogenous relationship between government debt and growth shows a negative trend. Test results examining non-linear effects do not explain a universal public debt-GDP threshold in which growth decreases. Threshold forecasts are sensitive to econometric data as well as selections. The findings show a lack of evidence of a lasting negative impact of government debt and GDP growth. De Soyres et al. (2022) analyzed gross public debt data for 178 countries from 1995 to 2020 and offered that the impact of an unexpected increase in public debt on real GDP is generally negative and varies depending on other key characteristics. In particular, an unexpected increase in the public debt to GDP ratio hurts the real GDP level for (i) countries with high debt levels or countries with an increasing debt trajectory over the previous five years. On the other hand, an unexpected rise in public debt raises real GDP for (iii) low-income countries or (iv) countries that have completed the HIPC Debt Relief Initiative. Saungweme and Odhiambo (2020) investigated the period 1970-2017 using the distributed lag (ARDL) technique and found that the effect of total public debt on South African economic growth was statistically significant and negative in both the short and long run. The results also show that domestic government debt has a statistically significant positive relationship to economic growth only for the foreseeable future. Moreover, in the long run, external debt shows a statistically significant negative correlation to economic growth. The researchers have shown that governments should manage their debt effectively and finance productive long-term investments that should result in economic growth.

3.2. Public Debt and Investment Relations

Mendonça and Brito (2021) examined 24 emerging markets in the 1996-2018 period with a panel data set and found the increase in the public debt/GDP ratio had a negative effect on investments. In his research using Vector Error Correction Model for South Africa for the 1983 – 2013 period, Oche (2016) offered evidence showing that the relationship between public debt and foreign direct investment, as well as the relationship between interest rate and foreign direct investment, is positive and statistically significant in the long run. According to the results of the research, there is an insignificant negative relationship between the exchange rate and foreign direct investments. Based on the long-term results, the researchers suggested the level of public debt and the interest rate should be increased in order to increase the level of foreign direct investment in the country. According to the results of Jalles and Medas' (2022) research on debt increases in 190 countries between 1970 and 2020, public debt increases are particularly associated with weaker private and public investment, although both private and public

consumption are negatively affected. Increases in corporate debt are followed by low private and public investments. However, both private and public consumption are adversely affected. According to Magud, and Pikennagura's (2022) research, following unexpected public spending adjustments (the classic Keynesian multiplier effect), investment at the firm level quickly rises above pre-shock levels, although the impact declines. Fiscal space, flexible exchange rates, and more predictable fiscal policy facilitate the recovery in investment. In addition, the composition of financial regulations is important for investment response. Compared to public investment adjustments, reductions in public consumption result in larger private investment contractions in effect but push private investment above pre-shock levels. Sánchez-Juárez and García-Almada (2022) examined 32 states in Mexican states over the period from 1993 to 2012. The results of the GMM method confirmed public debt is positively related to public investment, which in turn generates economic growth. However, according to the researchers, a 1% increase in the interaction between public investment and public debt variable causes a 0.0005% increase in economic growth, so it does not mean a good economic policy strategy is followed.

According to Altunöz's (2013) research, public domestic borrowing has a significant reducing and excluding effect on private sector investments in the Turkish economy in the 1989:1-2004:4 period. According to the results, the crowding-out effect of public domestic borrowing stems from the transfer of private funds to the public sector rather than interest rates. In addition, it had been determined another important exclusionary factor on private investments is public fixed capital investments. Depending on his findings, the researcher argued the more effective use of taxation instead of domestic borrowing in public sector financing, and the registration of the informal economy will increase tax revenues. According to Mayar's (2020) Turkey research, foreign debt, and foreign direct investments proclaims there is a positive relationship between economic growth in the short run. Industry-level declines show high levels of government debt are particularly damaging for industries that need more external financial resources. Huang et al. (2018) research results firm-level regression results reveal that government debt increases the sensitivity level of corporate investments to cash flow. The research results explain the relationship between public debt and investment can be causal and that public debt tightens credit restrictions and excludes institutional investments.

4. Definition of Data and Empirical Findings

4.1. Data and Method

To examine the relationship between public borrowing, investment, and economic growth, the explanatory information about the dependent and independent variables used in the study, in which the data for the period 1995-2021 were examined, is presented in Table 1.

Table 1: Data and Identifiers

Variables	Description	Unit/Scale	Source
GND	General Public Net Debt	Billion TL	IMF WEO Data
GDPd	Real GDP	Current USD	IMF WEO Data
TINV	Total Investment	Real GDP (%)	IMF WEO Data

In this study, the unified roots of the series had been controlling using the extended Dickey-Fuller (ADF) and Phillips-Perron tests, VAR analysis was used to determine the relationship between the series. VAR models simultaneously examine variables or magnitudes in econometric research and do not distinguish between internal and external variables as in economic theory. There are no restrictions on the relationship between variables. In this way, the negativity in the assumptions that economists make when modeling is largely eliminated. VAR analysis without economic constraints provides better results than classical structural models. The fact that variables in a VAR model are both internal and external variables ensures the correct construction of relationships between variables (Bahar, 2006: 143).

4.2. Empirical Findings

In research on the correlation relationship between the series, it was found that there is a strong negative relationship between public debt, total investment, and real GDP. Also, there is a strong positive relationship between real GDP and total investment (Table 2).

Table 2: Correlation Analysis

Variables	GND	TINV	GDPd
GND	1.000000		
TINV	-0.809211	1.000000	
GDPd	-0.870856	0.826816	1.000000

The general public net debt average is 38.52 billion on average, with a minimum of 22.11 and a maximum of 72.16 billion in the period under review. The real GDP average of total investments is around 26335%, with a minimum of 18025% and a maximum of 32074%. While the real GDP average is 590.0 current US dollars, it is a minimum of 202.2 and a maximum of 957.5 current US dollars. All of the series have a normal distribution (Table 3).

Table 3: Data and Descriptive Statistics

Variable	Observe	Mean	Standard Deviation	Minimum	Maximum	Jargue-Bera
GND	27	38.52	13.79	22.11	72.16	2.947282 (0.229090)
TINV	27	26335	3708	18025	32074	1.184760 (0.553010)
GDPd	27	590.0	269.2	202.2	957.5	3.097218 (0.212543)

Among the methods used to examine the stationarity of time series using test methods, the most widely used method in applied research is "Extended Dickey-Fuller" (ADF), developed by Dickey and Fuller (1979), Phillips Perron (PP) and Kwiatkowski, Phillips Perron (1988), KPSS unit root test was developed by Phillips, Schmidt, and Shin (1992) (Guvenek et al., 2010: 6). In this study, the unit-roots of the series were examined with extended Dickey-Fuller and Phillips-Perron tests to determine the stationarity of the series and to avoid spurious regression results. The values obtained by both ADF and PP test results reveal that the series is stationary at the first difference (Table 4).

Table 4: Unit Root Tests and Results

		ADF			PP		
	Level	LNGDPd	GND	TINV	LNGDPd	GND	TINV
C	t-Statistic	-1.2432	-1.4762	-1.9353	-1.2483	-1.4422	-1.7782
C+T	t-Statistic	-0.8533	-3.0991	-3.8619**	-1.1402	-2.1626	-3.8639**
	First Difference	d(LNGDPd)	d(GND)	d(TINV)	d(LNGDPd)	d(GND)	d(TINV)
C	t-Statistic	-4.0155***	-6.5380***	-6.9490***	-4.0062***	-6.3857***	-9.3716***
C+T	t-Statistic	-4.0355**	-6.3932***	-4.5126***	-4.0282**	-6.2542*1***	-9.0007***

After determining the stationarity of the series, the optimal lag length was determined according to the VAR lag criterion. In line with the results obtained from the VAR delay criterion, all of the Probability Ratio (LR) and Final Prediction Error (FPE), Akaike (AIC), Schwarz (SC), and Hannan-Quinn (HQ) criteria showed that the maximum lag length should be chosen as 1 and applied (Table 5).

Table 5: Determination of Optimal Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-480.4712	NA	1.26e+13	38.67769	38.82396	38.71826
1	-439.6452	68.58754*	9.95e+11*	36.13162*	36.71668*	36.29389*
2	-433.8530	8.340758	1.34e+12	36.38824	37.41210	36.67222

The Granger causality test presumes knowledge of the evaluation of the relevant variables is only usable in the time series data for these variables (Hamouda et al., 2020). Therefore, causality between each of the GND, LNGDPd, and TINV variables can be unidirectional or bidirectional. Based on this, the supporting null hypothesis is tested.

(GND, TINV) H_{01}: $\alpha_{31ik} = 0$ tüm i = 1,….n için ve H_{02} : $\gamma_{13ik} = 0$ tüm i : 1,…..,n için.
(GND, LNGDPd) H_{03}: $\beta_{32ik} = 0$ tümü için i = 1,….n ve H_{04} : $\gamma_{23ik} = 0$ tüm i için : 1,…..,n
(TINV, LNGDPd) H_{05}: $\beta_{12ik} = 0$ tümü için i = 1,….n ve H_{06} : $\alpha_{13ik} = 0$ tüm i için : 1,…..,n.

To ascertain the relationship between the series, it should do Granger causality analysis before the VAR analysis. According to the Granger causality procedure, if there is a causal relationship between two variables, it is possible to test the effects, such as the size and extent of the relationship between two variables through VAR analysis. Therefore, Granger analysis is a prerequisite for VAR analysis (Bahar, 2006: 146).

According to the Granger analysis applied to determine the causality relationship between the series, the hypothesis there is no relationship between public debt and economic growth rejects. According to the results, there is a strong bidirectional causality relationship between public indebtedness and economic growth. Granger rejects the hypothesis economic growth is not the cause of total investments at the 5% significance level. This result exposes economic growth and causes total investments. (Table 6).

Table 6: Granger Causality Analysis Results

H0	F Statistic	Prob.
The LNGDPd variable is not the cause of the GND variable.	7.13369	0.0046
The GND variable is not the cause of the LNGDPd variable.	5.68655	0.0111
The TINV variable is not the cause of the GND variable.	1.51374	0.2442
The GND variable is not the cause of the TINV variable.	0.47619	0.6280
The TINV variable is not the cause of the LNGDPd variable.	0.74796	0.4861
The LNGDPd variable is not the cause of the TINV variable.	4.78717	0.0200

Figure 5 shows the result for the stability conditions of the predicted VAR (1) model. Accordingly, the inverse roots of the autoregressive characteristic polynomial reveal that no situation destabilizes the model.
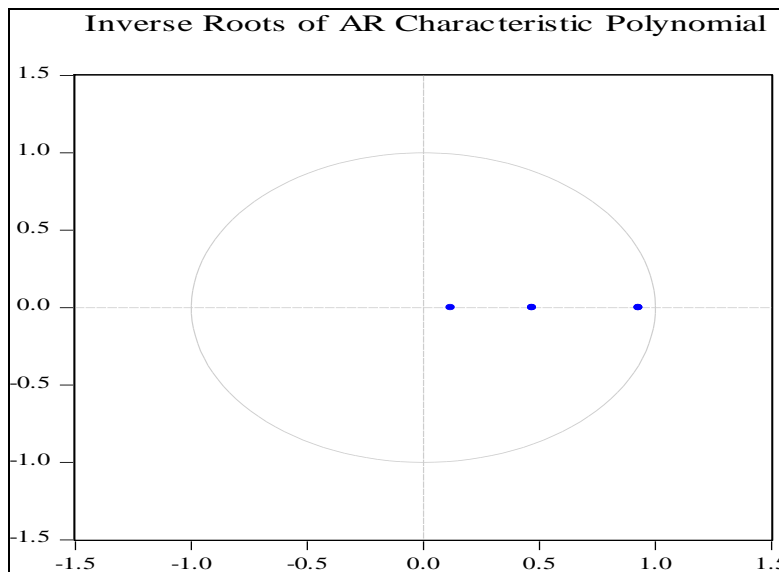
Figure 6: Inverted Roots of AR Characteristic Poliinom

As observed from Table 6, the lag value of LRE is 8.88, p=0.4481, and the Rao value is 1.006330, p=0.4505. So, both tails are greater than the 5% level in the VAR(1) model, there is no autocorrelation problem in the model. The test statistic for White's variance test is chi-square = 77.98713 (p = 0.311). This result indicates no variance issues at the 5% significance level. The Jarque-Bera test statistic for the expected VAR model (1) had calculated to be 5.636250 (p=0.0597). With p > 0.05, the residuals of the model show normal scatter.

Table 7: Diagnostic Tests and Results

H0: There is no serial correlation.						
Lag	LRE statistics	Df	Probability	Rao F statistics	Df	Probability
1	8.883411	9	0.4481	1.006330	(9, 41.5)	0.4505
2	9.712056	9	0.3743	1.110723	(9, 41.5)	0.3767
H0: The series is not normally distributed.						
Component		Jarque-Bera		Df		Probability
1		5.636250		2		0.0597
2		0.306959		2		0.8577
3		9.277809		2		0.0097
Unified		15.22102		6		0.0186
H0: There is no changing variance						
Combined testing:						
Chi-sq				Df		Probability
77.98713				72		0.2943

After it was determined that there was no problem in the model with the diagnostic test results, the research continued with the analysis of variance to examine the relationship between the series. Variance decomposition explains the effect of shocks on the variables proportionally by sharing the variance of the estimation error for each variable in the system separately with the variables. In other words, variance decomposition shows what percentage of the estimated error variance of a variable in the system is due to itself and what percentage is due to shocks in other variables (Daştan and Karabulut, 2021: 140).

Table 7 shows the variance decomposition results. While GND (public debt) is the dependent variable, all shocks in the first period are caused by itself. However, it is observed that the shocks arising from public debt decreased in the following period and in the tenth period, 44.33% of the shocks stemmed from itself, 53.15% from real GDP and 2.52% from total investments.

Table 7: Variance Decomposition Results

| Period	S.E.	GND	GDPd	TINV
1	6.837510	100.0000	0.000000	0.000000
2	7.623445	93.71508	6.282238	0.002682
3	8.210984	82.66973	17.09789	0.232380
4	8.810620	71.99745	27.30209	0.700454
5	9.375854	63.58208	35.23375	1.184168
6	9.876135	57.31185	41.09554	1.592618
7	10.30588	52.65311	45.43100	1.915888
8	10.67068	49.14046	48.69173	2.167805
9	10.97929	46.44204	51.19323	2.364727
10	11.24045	44.33167	53.14817	2.520156

After variance decomposition analysis, the research was continued with impulse-response analysis in order to examine the effects of shocks. Variance decomposition provides information about the effect rates of the variables on change. Action-response

analysis gives information about the sign, duration and magnitude of the change in the series (Demirci, 2017: 175). Action-response analysis and its features can be explained as follows. Many systems can (at least approximately) be represented as convolutions with outputs.

$$y(t) = \int_0^\infty \beta(\tau) x(t-\tau) d\tau$$

y(t) depends on the input. x (t-τ), over the (possibly infinite) historical delay interval τ, is weighted by the delay function β(τ) and represents the relative influence of the input at each delay. The lag function β (τ) is sometimes expressed as a convolution kernel, transfer function, or Green's function. This is also referred to as the impulse response function, as it indicates how the output of the system works. Unlike idealized linear time-invariant systems, real-world systems can appear non-linear, non-stationary, or both. In this case, the impulse response function will not be a complete description of the system response, but it can still be a useful indicator of its average behavior. Exactly how the impulse response function averages the behavior of such a system will depend on the system characteristics and how they are predicted (Kirchner, 2022). In impulse-response function graphs, the horizontal axis (X-axis) shows the duration of the response divided into quarters, and the vertical axis (Y-axis) shows the degree of response in standard error. The graph consists of two dashed red lines and one solid blue line. The solid blue line represents the response of the dependent variable over time to 1 standard error shock occurring in the error terms of the model. The dashed red lines are the confidence intervals for ± 2 standard errors. Statistically, the range of (s.e.) ± 2 (s.e.) to a standard error can also be explained as an indicator of the response. It is understood that the response is statistically significant if the dashed red lines are in the positive or negative area at the same time for a certain period of time. If one of the dashed red lines, that is, the confidence intervals, is in the positive and the other negative area, it is decided that the results are statistically insignificant (İslamoğlu, 2018: 127).

The responses of the public debt series to the standard deviation shocks occurring in the variables are shown in Figure 6. Therefore, the public debt series reacts negatively to standard deviation shocks over the lifetime of the economic growth and aggregate investment series. In addition, the reaction of public debt to the emerging standard deviation shock is positive in the first six periods and negative in the following periods. Against the standard deviation shock of the total investment series, the response of the economic growth series in the usage period is positive. For the standard deviation shock of the public debt series, the response of the total investment series is negative in the first three and five periods, and positive in the other periods. In addition, the response of total investment to a single standard deviation shock to the economic growth series is positive in all periods. On the other hand, the reaction of the total investment series to the standard deviation shock is negative in the third period and positive in the other periods.
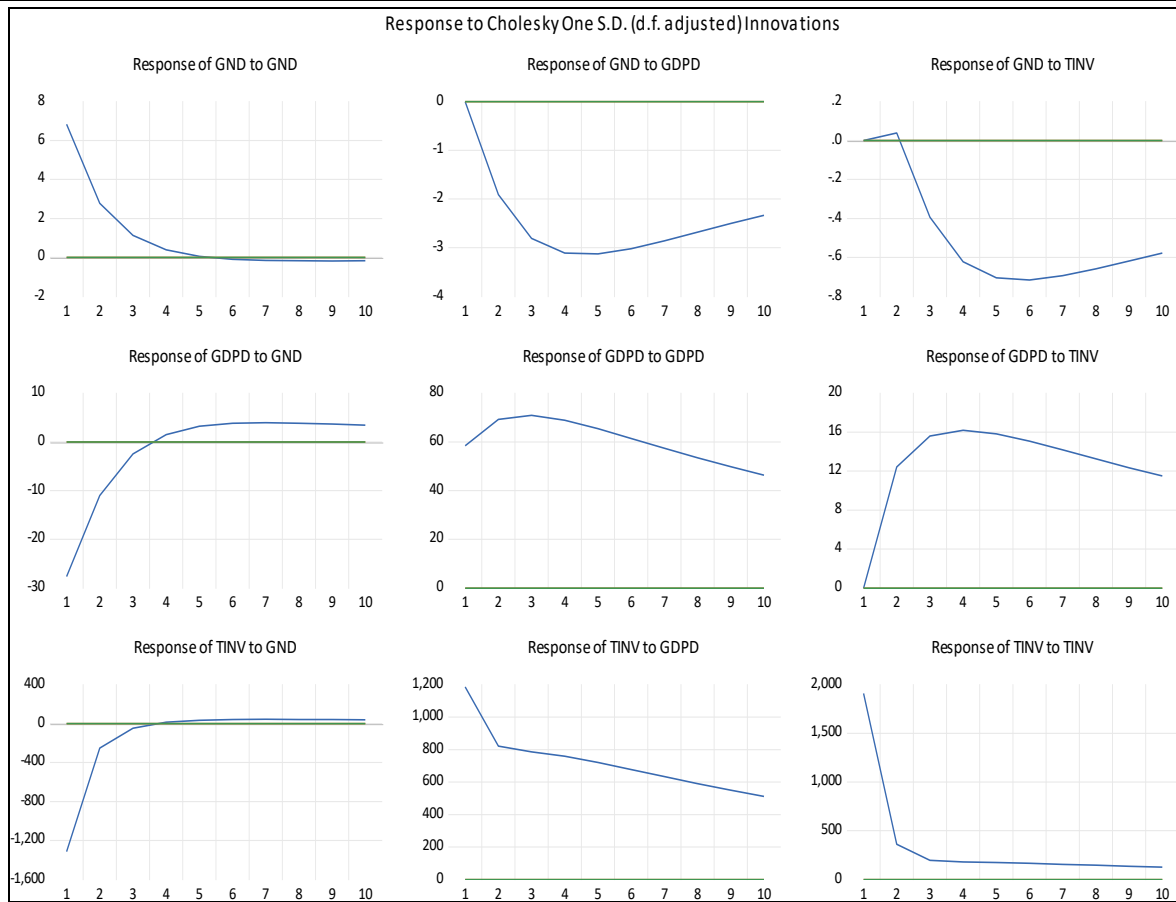
Figure 7: Impact-Response Analysis Results

5. Discussion and Conclusion

Public debt has been at the center of political and economic debate since the 1970s. In addition, public debt is an important issue not only in developing countries but also in developed countries. There is no consensus on the impact of public debt on the economy. The national debt is often criticized by scientists, experts and bureaucrats with different views. However, borrowing appears to have a significant impact on public sector debt levels and the size, scope and activities of governments. In addition, a country, taking into account its own national conditions, may have the opportunity to borrow to increase its national production level and can achieve important and beneficial results by expanding its level of welfare. This study uses VAR analysis to examine government debt, investment and economic growth using data for the period 1995-2021.

According to Granger's analysis, economic development is an important cause of public debt. When the results of the variance decomposition are analyzed, it is revealed that the policies implemented within the framework of economic growth affect the debt growth by 53.15%. On the other hand, total investment has a small impact on government debt (2.52%). This result shows that the realized government debt does not represent the risk associated with the total investment. In addition, weak evidence is provided that public debt has a negative impact on economic growth in the short run. This indicates the necessity of prudent debt management in short-term economic policy implementations

since financing is met through borrowing. In addition, it has been observed that economic growth has a positive effect on total investments. This result shows that borrowing is beneficial as investment has a positive effect on economic growth. The positive effect of investment on growth points to the need to focus on policies that encourage investment. In other words, measures implemented as part of economic growth should be encouraged as they positively affect total investments. On the other hand, from the perspective of sound public debt management, it is necessary to take measures to reduce risks to economic growth and to emphasize fiscal discipline in order to reduce the risks that public borrowing may bring.

Conflict of Interest Statement
The author declares no conflicts of interest.

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