Türkiye'de Dış Borçlanmanın Belirleyicileri: Bazı Kritik Makroekonomik Göstergelerin Rolü

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Özet

Çalışmada, Vektör Otoregresif (VAR) ve Bağıl Duyarlılık (RSA) analizi kullanılarak, 1991-2010 döneminde Türkiye'de dış borçlanmanın nedenleri incelenmektedir. VAR ve RSA analizi sonuçları göstermiştir ki, ekonomik büyüme ile dış borçlanma arasındaki ilişki güçlüdür. Bununla birlikte, yüksek bütçe ve cari açıkların olduğu ekonomik kriz dönemlerinde, dış borçlanma ile tüm değişkenler arasındaki duyarlılık katsayıları yükselmiştir. Bu sonuçlar Keynesyen yaklaşımı desteklemektedir. Bununla birlikte, 2002 yılı sonrası yurtiçi faiz oranı ile dış borçlanma arasındaki duyarlılık katsayısı ise sıfıra yaklaşımştır. Dolayısıyla, yurtiçi faizlerin dış borçlanma üzerindeki etkisi gerilemiştir. Bunun yanı sıra, yurtdışı faiz oranı ve dış borçlanma arasındaki bağıl duyarlılık ekonomik kriz yılları başta olmak üzere, yurtiçi faiz oranına göre daha yüksektir. Yurtiçi faiz oranına benzer şekilde dış ticaret hadleri ile dış borçlanma arasındaki ilişki 2002 yılından itibaren diğer yıllara oranla zayıftır.

Anahtar Kelimeler: *Toplam dış borç stoku, Bağıl Duyarlılık Analizi, VAR.*

Determinants of Foreign Debt in Turkey: The Role of Some Critical Macroeconomic Indicators

Abstract

In this study, the determinants of foreign borrowing in Turkey are investigated for the period of 1991-2010 using Vector Auto Regressive (VAR) and Relative Sensitivity Analysis (RSA) methods. The results of VAR and RSA show that the relationship between economic growth and foreign borrowing is strong. In addition, during economic crisis periods with high budget and trade deficits, the sensitivity coefficients of all parameters on foreign borrowing increases. These results support Keynesian approach. Moreover, the sensitivity coefficient of the internal interest rate on foreign borrowing approaches zero. Therefore, the effects of the internal interest rates on foreign borrowing decrease. On the other hand, the sensitivity of the foreign external interest rate on foreign borrowing is high especially during economic crisis periods. Similarly, the relation between foreign trade stock and foreign borrowing is shown to be weak.

Keywords: *Total foreign debt stock, Relative Sensitivity Analysis, VAR.*

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1. INTRODUCTION

External debt are the resources that countries lend from foreign countries and international agencies and that are repaid with its interest. Developing countries need external borrowing for some economic reasons such as saving deficiencies, foreign trade deficiencies, internal high interests, natural disasters and wars.

A country using external debt uses resources in addition to its own resources. This resource is supposed to increase investment and then accelerate economic growth and development. The increase in economic growth would then lead to internal capital savings, the proper repayment of external debt and the decrease of the need of foreign financing. External debt is also used in public financing which in effect decreases the budget deficits. In addition, the use of external debt in foreign currency saving investment would lead to the decrease in currency deficit.

There are various views on the relationship between external borrowing and economic growth. According to some economists, the impact of foreign debt on economic growth is positive and according to others it is negative. Foreign borrowing increase national savings at first. New resource animates economic life and economic growth is triggered. However if foreign debts are used in unrelated spendings, economic growth rate decreases. The reason of this is the external resource transfer. As a vicious circle, there is more need for external resource which leads to more borrowing.

In which areas is foreign debt used in Turkey? How does it affect economic growth? What is the relationship between the internal and external deficits and foreign debt? Do the fluctuations of interest limits and currencies affect external debt? The aim of this study is to answer these questions. In this context, related literature proposes that there is a relationship between foreign debt and current deficit. In general, if a country has not imported priceless goods, the increase in foreign debt is equal to its foreign current deficit. Foreign deficits are mainly caused from trade deficits. The dependence of the industry on imported goods increase external trade deficits and increase the need for foreign currency in a country. The use of foreign debts for investment leads to lower import volumes and would contribute to the establishment of the balance of external trade deficit. On the other hand if public expenditures are higher than public revenues, the country will need external resources to finance public expenditures. Especially if strategies to boost demand are applied during economic recessions, budget deficits occur. If internal borrowing is used in this situation, internal interests will increase. Increased internal interest rates will increase the cost of internal borrowing and lead to the escape of foreign companies. Because of these reasons, countries choose external debts with lower interests.

The aim of this study is to reveal the reasons of external borrowing in Turkey. For this purpose, the relationship of critical macroeconomic indicators with foreign borrowing between 1991 and 2010 are considered. Vector Autoregressive Model (VAR) and Relative Sensitivity Analysis (RSA) are used. The results of this analysis are expected to contribute to the understanding of foreign borrowing mechanisms in Turkey. The parameters in the analysis are obtained in MATLAB and Datafit environments using least squares approach. Moreover, RSA of external debt to the statistically significant indicators are performed and interpreted. Beside this, Granger causality, variance decomposition and the impulse-response functions are obtained and discussed using VAR method. Dynamic sensitivity analysis of external debt to the macroeconomic indicators when we take the current amounts of the indicators into consideration, with respect to time period are also plotted. The impacts of the statistically significant indicators are discussed.

2. VIEWS OF ECONOMIC APPROACHES ABOUT BORROWING

Different economic approaches have various considerations on the reasons and effects of the borrowing on the economy.

2.1. Classical View

According to the classical economists, the state should not borrow. Because the state affects the market when it borrows from the market. State should not be an actor in the economic life. The main duties of the state are providing services in

education, health and defence areas. Balance in the budget is supported. State can borrow in extradordinary circumstances. State borrowing is a burden to future generations (Buchanan, 1999:3). If borrowed resources are not used in proper areas, debt repayments loosen the economic power of the state. Classical economists ignored the fact that foreign debts may have increased the welfare of the country if the borrowed money is used in capital-saving investments. Furthermore, there is no distinction between the public and private borrowing according to the classical theory.

2.2. Neo-classical View

Neo-classical economists have similar views like classical economicst to the classical economists but they have also used mathematical analysis to explain their views. According to this view, people have rational expectations. In case of borrowings, they think that the state will increase tax rates, hence given their life spans, they try to balance their spendings. Therefore, borrowing will lead to lower spending and saving rates and decrease economic growth rates which will lead to lower capital stocks for the future generations (Verbon, 1993).

According to neo-classical Barro-Ricardo equation, the fiscal deficits can be paid using foreign borrowing and taxation and this does not have any negative effects on the economy (Dornbusch and Fischer, 1998). In other words, Ricardian equivalence argues that a state can finance its spending with tax or foreign debt since the effect on the demand level in the economy is the same.

2.3. Keynesian View

Keynesian balance model says that state intervention is needed for full deployment. According to the Keynesian model, borrowing maintains the economic growth (Çöğürcü and Çoban, 2011). Hence, opposed to classical and neo-classical views, the relationship between borrowing and economic growth is positive. In addition, budget deficits can be financed with borrowings. Following a balanced budget strategy is not a viable solution for fighting unemployment. In this situation, open budget strategy can prevent economic recession. According to the Keynes, borrowing can provide higher standards of living for future generations. For a better living standard, the burden of interest can be carried (Şeker, 2006: 78).

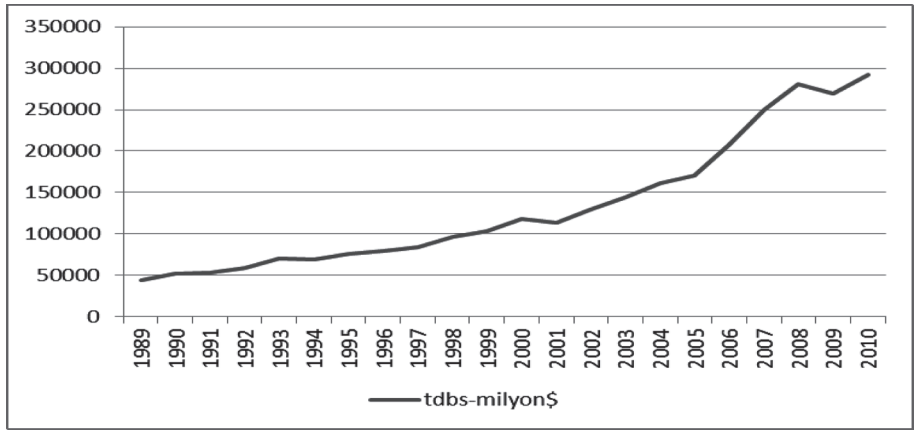
2.4. Monetarist View

According to monetarists, increase in foreign debt damages the effectiveness of financial markets and will create inflationist effects. According to this view, since the roaming of the money is constant, if the gross domestic product (GDP) cannot be increased, the prices will go up as the money supply increases (Stiglitz, 1999: 390). Hence, there is a relation between foreign debt and inflation. High debts caused by public deficits will increase inflation and this situation will further increase the debt load because of the increase of interest. (Stiglitz, 2006). According to the monetarist view, the state has to follow strategies for maintaining the repayment balance and must apply realist currency policies.

3. EXTERNAL BORROWING IN TURKEY

In Turkey, especially by the Decree no. 32 on the Protection of the Value of Turkish Currency in 1989, the limitations on the mobility of capital were lifted and foreign borrowing became much easier. Starting from this period, the discussions on the importance of foreign debt and its relationships with some critical macroeconomic indicators have continued.

Figure 1: Total Foreign Debt Stock in Turkey (1989-2010)



As shown in Figure 1, for the period 1989-2010, foreign debt has risen steadily in Turkey. From the middle of 1990s, as the gloabalisation accelerated, foreign credit possibilities increased and countries used this resource for their structural economic problems (Öztürk and Özyakışır, 2005:1). In this period, the cause of foreign borrowing was its low cost because of the low currency strategy. In addition, unsuccessful attempts of tax incresases and unregistered economy were the reasons (Sarı, 2004:55). In 1994, decreasing money supply was the strategy applied for the reduction of public deficit and inflation with the stability program. As a result of this program, public deficit and foreign debt stock have decreased (Sarı, 2004:56). In addition, Turkish Treasury had difficulty paying the external debt and did not apply for foreign borrowing (Karagöz, 2007:99-110). An economic crisis followed in 2000s as a result of domestic and foreign developments therefore there was a need for foreign borrowing again. From 2002 on, although there was still a budget deficit, budget balance is maintained. However foreign borrowing continued to increase. In this context, it is argued that private sector debts contributed to foreign debt. Hence foreign debt of Turkey increased.

4. LITERATURE REVIEW

In the literature, the majority of studies about foreign debt appears to be related to the foreign debt stock and economic growth. Beside, studies which have examined the relationship between external debt and other main macroeconomic indicators are limited compared to the number studies analysing the relationship of foreign debt and economic growth. In the literature, it is generally concluded that the relation between the economic growth and foreign borrowing is negative. In other words, as the economic growth increases, foreign borrowing decreases. In the studies regarding the relationship between public deficit, openness and foreign borrowing, mostly a positive relationship has been found. The relationship between the domestic interest rates, international interest rates and foreign borrowing are found to be positive in other works. The relations between the internal interest rates, international interest rates, the relation of foreign borrowing are found to be positive in other works. For instance, the economic growth rate and external debt of Pakistan for the period 1987-2001 is studied by Kemal (2001). He concluded that there is a negative relationship between the foreign debt and the growth rate. Burnside and Dollar (2000) investigated the effect of foreign debt on the economic growth rate for 56 countries in the period of 1970-1993. They found out that foreign debt and economic growth rate has a negative relationship even though this relationship is weak. Ogunmuyiwa (2010) used time series for Nigeria for 1970-2007 to estimate a regression. Their results also imply that there is a causal relationship between the external debt stock and the economic growth rate. Malik et al (2010) also studied the connection between the economic growth rate and the external debt in Pakistan for the period of 1972-2005 and concluded that there is a negative relationship. Similarly, Safdari et al (2011) used vector autoregressive method (VAR) in order to investigate the relation relationship between economic growth rate and foreign debt stock for Iran in the period of 1974-2007. Their results are consistent with the other studies and show that there is negative relationship. Wijeweera et al (2005) studied the long-run and short-run relationship between GNP and foreign debt in Sri Lanka for the period of 1952-

2002. They concluded that the there is a weak and inverse relation between the GNP and the external debt service payments. On the other hand, Schlarek et al (2004) investigated the connection between external debt and economic growth for developing and developed countries using empirical evidence taken from the World Bank. They found that for developing countries that external debt stock and GDP have an inverse relationship and this is created by public foreign debt rather than private foreign debt amount. They did not find a significant relationship between economic growth and external debt using panel data for 93 countries for the period of 1969-1998. Their results suggest that there is a nonlinear relationship between these quantities. The connection between GDP and foreign debt is studied by Asteriou (2008) using data for five South Asian countries. Their results, based on panel data, show that there is a weak relationship between these indicators. The study of Lin and Sosin (2001) considered 77 countries and sub-samples of various regions. Their results show that for African countries, there is a negative relationship between economic growth rate and external debt while for industrialised countries, the relationship is positive. Butts (2009) investigated the causal relationship between economic growth rate and external debt using the data of 27 Latin American and Carribean countries for the period of 1970-2003. The results show that there is an inverse bi-directional relationship between these quantities. For heavily debted countries, Cunningham (1993) concluded that there is a strong negative relation relationship between the mentioned indicators. This relationship is also studied for Turkey by Karagol (2002) for the period of 1956-1996 using vector error correction model. They concluded that there is a negative short-run relation between the economic growth rate and the external debt. Their results also show that there is a uni-directional relation relationship between economic growth rate and external debt. The results also show that there is a uni-directional relationship between external debt and GNP. Bilginoglu and Aysu (2008) investigated the mentioned relation for Turkey in the period of 1968-2005 using regression analysis. They concluded that there is a weak negative connection. Ceylan and Durkaya (2011) analyse the relationship between economic growth and TDS in Turkey for the period of 1987-2007 using time series approach. The Engel-Granger linear co-integration method is also used in their study to verify the relationship. Ulusoy and Küçükkale (1996) also studied the Turkish economy for the period of 1965-1994 and investigated the connection between TDS and economic growth rate. Their results show that there is an inverse relationship between TDS and economic growth.

Some of the studies analyzing public deficit, openness, internal and external interest rates and foreign borrowing are as follows. Ishfaq and Chaudhary (1999) studied their relationship for Pakistan for the period of 1980-1998 and concluded that prolonged prevalence of high fiscal deficits in Pakistan caused the accumulation of the external debt hence there is a positive relationship between the fiscal deficit and the external debt stock. In another study, Awan et al (2011) concluded that there is no significant connection between the fiscal deficit and the external debt. On the other hand, U.S. external debt is analysed in a government report presented by Cline (2007). They found out that the fiscal deficit has a menaingful positive effect on the external debt. Zafar et al (2008) investigated this relationship for Pakistan in the period of 1972-2007 using Error Correction Method (ECM). They found out that there is a long run positive association between the openness and the external debt stock. Similarly, Eichengreen and Portes (1986) concluded that there is a connection between the openness and the external debt stock in 1930s. On the other hand, Ferraro and Rosser (1994) studied the indicators responsible for the accumulation of foreign debt in third world countries. Their results show that the increase in interest rates is a cause of the increase in the foreign debt stock. Stambuli (1998) also investigated the reasons of the increase in the total foreign debt stock and also concluded that the rise in the interest rates affects the external debt stock. In the study of Tiruneh (2004) using panel data of developing countries, it has been concluded that debt servicing, capital flight and income instability are the major causes of the TDS. Hasan (1999) also investigated the indicators affecting the TDS in Pakistan and concluded that current account deficit and the patterns of financing are the main factors affecting the TDS. Similarly, Bilquees (2003) studied the macroeconomic parameters that have impacts on the TDS and found out that the changes in the exchange rate, fiscal deficits and the interest rate are important indicators having impact on the TDS. The amount of foreign aid is argued to be a major variable having impact on the TDS in Pakistan according to Mohey-ud-din (2005).

Javed and Sahinöz (2005) investigated the cross relations among the macroeconomic indicators namely growth rate, investment amount and export limits and concluded that tthere is no significant relationship between TDS and growth rate, a significant positive relationship between TDS and export limits and a significant negative relationship between TDS and investment. On the other hand Edo (2002) investigated the factors affecting the TDS and found out that public expenditure, payment balance and global interest rate have significant effects on the TDS. After reviewing the existing literature related to the issue of foreign indebtedness it can be concluded that there are many factors responsible for the accumulation of foreign debt of developing countries.

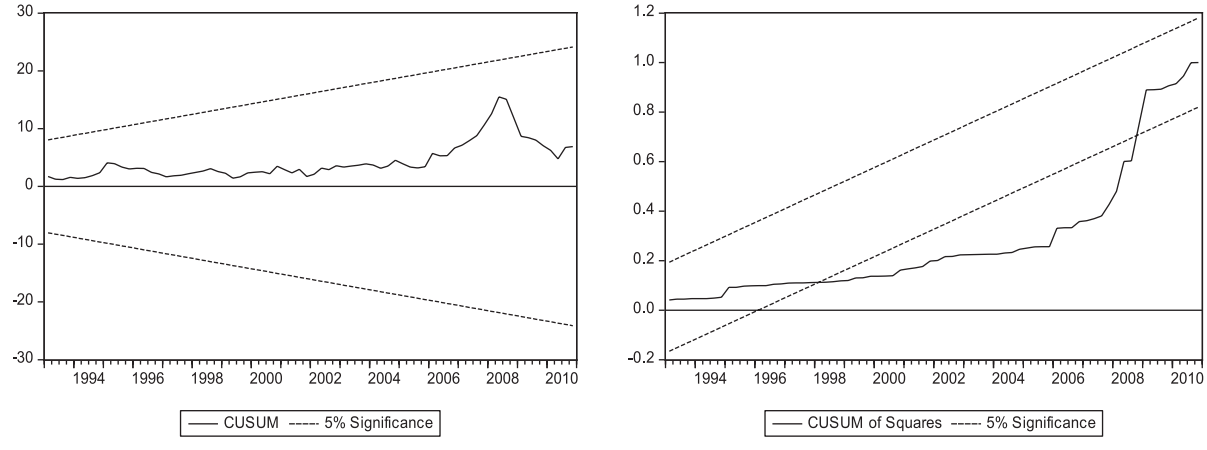
5. VARIABLES AND THE APPLIED METHODS

In this study, the relations among the total foreign debt stock (TDS), growth rate, current account deficit, public borrowing, real exchange rate, domestic and international inter-banking borrowing interest rate and economic crisis periods are chosen as factors for Turkey in the period of 1991-2010. These data are provided by the Central Bank of Turkey, Turkish Statistics Institute, International Monetary Fund, Turkish State Planning Department. As empirical methods, Relative Sensitivity and Vector autoregression modelling have been used.

5.1. Variables

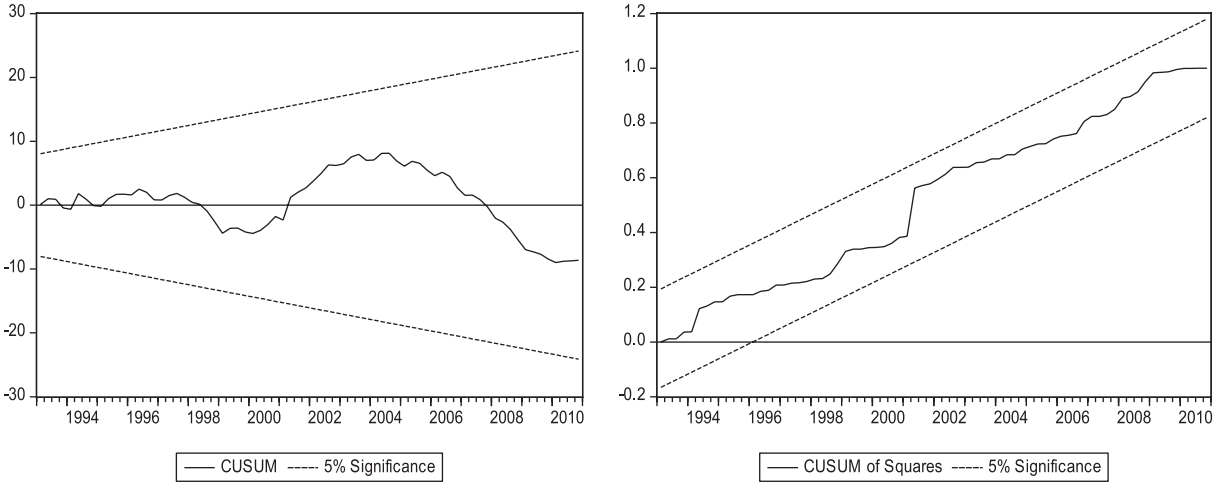
Variables are normalized using the general price level of the year 1987 except the exchange rate which is normalized according to year 1994. The effects of economic crises are also included in the model using an external dummy variable. The values of the dummy variable are determined using CUSUM and CUSUMQ square tests.

Figure 2: CUSUM and CUSUM square tests results



According to Figure 2, the coefficients of the model are stable as the result of CUSUM test while unstable according to CUSUMQ test. A dummy variable is set up for structural variation according to CUSUMQ test.

Figure 3: CUSUM and CUSUM square tests results when the dummy variable used in the model



Dummy varianble is unity for 1998:3-2008:3 period, and zero for other periods. Figure 3 shows that after the dummy variable, the results of CUSUM and CUSUMQ tests appear to be stable.

Table 1. Variables in the study

DTDBSSA	Total Foreign debt stock/GDP. First difference stationary and seasonally adjusted series.
CADSA	Current balance/GDP. Stationary and seasonally adjusted series.
DKKBGSA	The ratio of non-interest public borrowing requirement to the GDP. First difference stationary and seasonally adjusted series.
DLIBORSA	London interbank offered rate. First difference stationary and seasonally adjusted series.
DTOTSA	Terms of trade. First difference stationary and seasonally adjusted series.
FAIZSA	Domestic interest rate. Stationary and seasonally adjusted series.
GDPSA	Domestic growth rate. Stationary and seasonally adjusted series.
OPENSA	The ratio of the sum of import and export volumes to the GDP. Stationary and seasonally adjusted series.
Dummy	Dummy variable, defined as one and zero.

In this study, variables are selected according to the economic theory and the studies in the literature. Total foreign debt stock/GDP: This ratio is used for measuring the credibility of the country as well as a figure of merit for risk and debt analyses. According to economic expectations; the relationship between the economic growth, current account deficit, public sector borrowing requirement used as budget deficit, openness and the foreign debt stock is negative while this relationship is positive between foreign interest rate and foreign debt stock.

5.2 Ampirical Methods

Firstly, Vector Autoregressive Regression (VAR) method is used in this study. VAR is introduced by Sims in 1980 for the economics for the first time (Sims, 1980). There are no a priori constraints in this method. Each variable used in the model is defined as a function of the delayed values of the other variables (Davidson and McKinnon, 1993; 685). In this study, foreign borrowing function is expressed as;

DTDBSSA= f (CADSA, KKBGSA, DLIBORSA, DTOTSA, FAIZSA, GDPSA, OPENSA)

(1)

VAR analysis has three tools, namely Granger causality test, impulse response analysis and variance decomposition. The results of the impulse response analysis and variance decomposition have to be supported by Granger causality test. Causality relationship is taken into consideration for the model setup.

The causality relationship is analyzed and the influence of each variable on the other variables are investigated by Granger Causality test. Causality relationship can also be assesed using Wald Test (Enders, 1995, 373).

$$F = \frac{(HKTS - HKT)}{HKT/(n-k)} \qquad (2)$$

In Equation (2), HKTS is the sum of square errors of the constrained model, HKT is the sum of the errors of the unconstrained model, n is the number of observations, k is the number of parameters in the model. Calculated F value is compared to the F values in the table to test the hypotheses.

In variance decomposition, the change in variance of each variable is investigated dependent on the delay of other variables. On the other hand, impulse-response analysis shows the response of all the variables when a unit impact is given to a specified variable (Warne, 2004). Cholesky decomposition of the error terms is used to obtain the coefficients of the impulse-response function. The error terms are orthogonalized and variance-covariance matrix is diagonalized for the Cholesky decomposition. Hence, the order of the variables in the model is important. This order is determined using the causality relationship. If the variables are ordered in an improper way, impulse-response functions change and wrong estimations occur (Hamilton, 1994; 323).

Monte Carlo method is utilized for the calculation of confidence levels of impulse-response functions. A random sample is selected among the asymptotic distribution of VAR coefficients. This selection is repeated 100 times and then the sample distribution of impact-response coefficients is found. Standard deviations are obtained using this distribution. The obtained deviations show the standard errors of impact-response functions (Killian and Chang, 2000).

Time series need to be stationary before performing the VAR analysis (Gujarati, 1995; 750). Various tests are used to check if the time series is stationary or not. Among these tests, PP (Phillips-Perron) and KPSS (Kwiatkowski, Phillips, Schmidt, Shin) unit root tests are performed in this study. PP unit root test applied a non-parametric improvement to remove the autocorrelation. Some studies in the literature support KPSS test since PP test is sensitive to the lag length. The zero hypotheses of PP tests and KPSS tests are the inverse of each other. In PP test, the existence of unit tests implies the zero hypothesis while in KPSS test, being stationary is taken as zero hypothesis (Kwiatkowski et al, 1992: 159-178).

Secondly, Relative Sensitivity Analysis (RSA) is used for the assessment of the influence of macroeconomic variables on the foreign debt stock. In comparative statique analysis, changes in endogenous variables are investigated in connection with the change in exogenous variables. In other words, changes in an economic outcome is investigated and then the influences on the other economic parameters are determined. The analysis on the changes of economic inputs and outputs can be viewed as a branch of statistics called sensitivity analysis. Elasticity is a subset of sensitivity analysis, it is given as a sensitivity measure for an economic variable, for example we can measure the elasticity of the demanded quantity to one of its determinants such as income.

Several local and global sensitivity analyses applied to microeconomic and macroeconomic problems exist in the literature. In Borgonovo and Peccati (2004), absolute sensitivity analysis is applied to the equations regarding the investment decisions and then the elasticity of survival risk validation is investigated. Similarly, a global sensitivity analysis is performed on investment decisions in energy sector (Borgonovo and Peccati, 2006).

In statistics, basically three types of sensitivities can be calculated in order to provide insight to the analysts, namely absolute sensitivity, semi-normalized sensitivity and the normalized (relative) sensitivity. Let the outcome of a model be y, which is a function of input variables such x1, x2,...., xn as shown in Equation (3).

$$y = f(x_1, x_2, ..., x_n) \qquad (3)$$

Absolute sensitivity is defined as the absolute change in the output y with respect to the change in one of the input variables, x_n (Grasman and Straten, 1994).

$$S_{abs} = \frac{\Delta y}{\Delta x_n} \quad (4)$$

Semi-normalized sensitivity includes the change in the output variable with the ratio of the changes of output and input variables as given in Equation (5).

$$S_{semi-norm} = y\frac{\Delta y}{\Delta x_n} \quad (5)$$

Absolute values and the rate of changes of both output and input variables exist in the definition of the relative sensitivity as formulated in Equation (6).

$$S_{relative} = \frac{x}{y}\frac{\Delta y}{\Delta x_n} \quad (6)$$

Relative sensitivity is utilized in various fields in theoretical and applied science such as medical science (Banks et al, 2009). The reason of this method is to analyze the effects of various indicators for a certain period. Hence, periods where relative sensitivities have higher values can be investigated Moreover, these results can give insights for authorities working on economic strategies.

6. RESULTS AND DISCUSSION

The variables are made stationary and the seasonal effects are removed before time series analysis. Exponential Correction Method (Holt-Winters-No Seasonal) is used for the removal of seasonal effects. The subscript "SM" is used for the variables whose seasonal effects are removed. On the other hand, PP and KPSS tests are used for testing if the series are stationary or not. The results of stationary (unit root) tests are given in Table 2.

Table 2. The results of stationary (unit root) tests

Variables	PP, Level		KPSS, Level	
	Intercept	Intercept&trend	Intercept	Intercept&trend
GDPSA	0.00* (-3.52)	0.00* (-4.08)	-0.46*** (0.34)	0.12*** (0.07)
FAİZSA	0.03** (-2.89)	0.00* (-4.78)	0.99* (0.74)	0.14*** (0.11)
CADSM	0.00* (-3,51)	0.00* (-4,08)	0,86* (0,74)	0,084* (0,22)
OPENSA	0.00* (-3.52)	0.00* (-4.78)	0.74* (0.73)	0.21** (0.15)
	PP, first difference		KPSS, first difference	
	Intercept	Intercept&trend	Intercept	Intercept&trend
DTDBSA	0.00* (-3.52)	0.00* (-4.08)	0.36*** (0.35)	0.12*** (0.06)
DKUR	0.00* (-3.17)	0.00* (-4.08)	0.35*** (0.15)	0.12*** (0.60)
DKKBG	0.00* (-3.52)	0.00* (-4.80)	0.35*** (0.09)	0.12*** (0.07)
DLİBOR	0.00* (-3.52)	0.00* (-4.80)	0.35*** (0.07)	0.12*** (0.06)
DTOT	0.00* (-3.52)	0.00* (-4.80)	0.35*** (0.06)	0.12*** (0.06)
DUMMY	0.00* (-3.52)	0.00* (-4.08)	0.57** (0.46)	0.21** (0.14)

**Statistically significant according to 1% significance level. **Statistically significant according to 5% significance level. ***Statistically significant according to 10% significance level.*

During the VAR analysis, AIC and SC delay criteria are utilized for the determination of the lag length while LM test and White test are used for autocorrelation and changing variance, respectively. According to these tests, the lag length with the calculated probability values higher than 0.05 is four (Appendix A Figure 7, Table 7, Table 8 and Table 9).

6.1 VAR Granger Casuality

The causality relation among the variables are shown in Table 3 with one lag.

Table 3. VAR Granger Causality/Block Exogeneity Wald Tests

Dependent variable: DTDBSSA			
Excluded	Chi-sq	df	Prob.
CADSA	12.46007	4	0.0142
DKKBGSA	11.81821	4	0.0188
DLIBORSA	4.819394	4	0.3063
DTOTSA	3.635160	4	0.4576
FAİZSA	6.863841	4	0.1433
GDPSA	9.796336	4	0.0440
OPENSA	8.297961	4	0.0813

According to the Granger causality analysis results given in Table 3, trade deficit has one way relationship with public sector borrowing requirement while this relationship is in both ways with economic growth rate and openness. No Granger causal relationship exists between foreign debt and current account deficit, LIBOR, terms of trade, openness (Table 7).

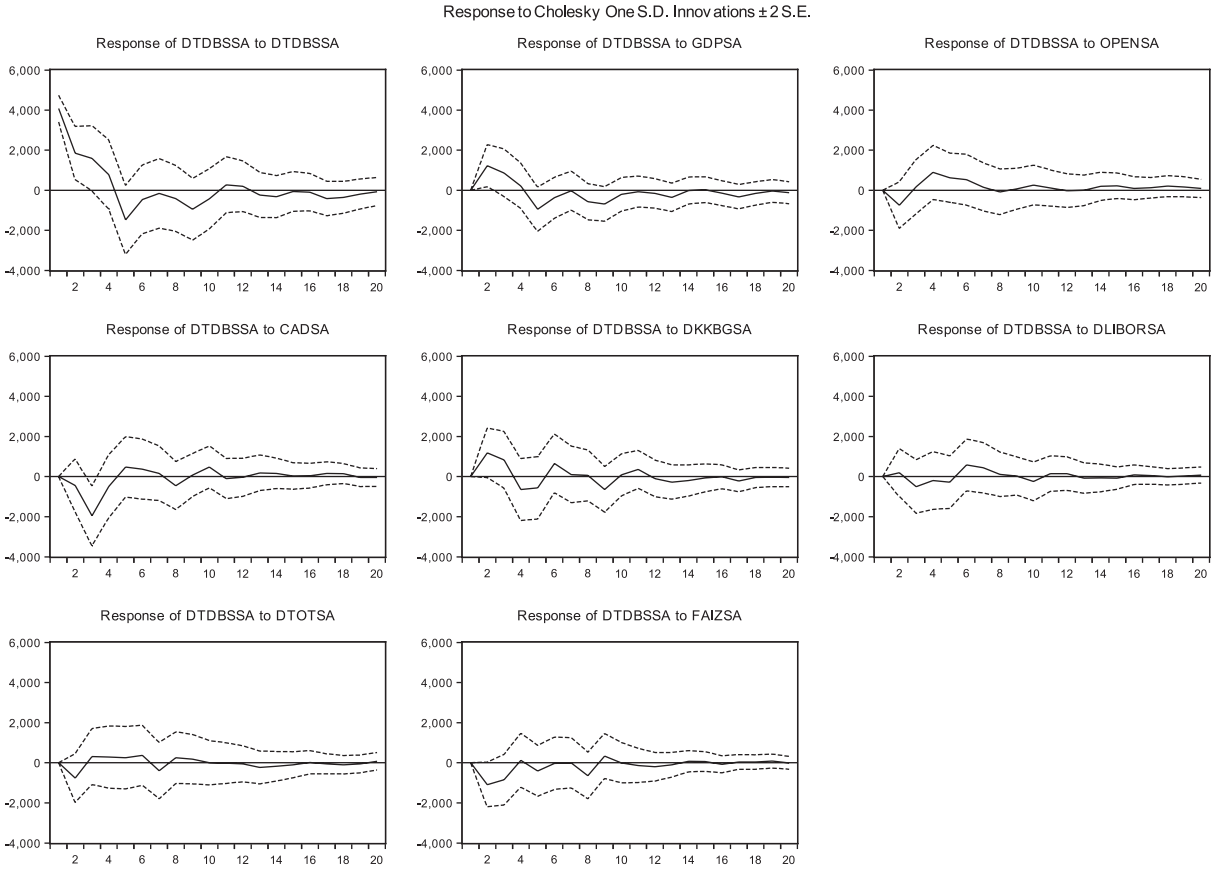
6.2 Variance Decomposition Analysis

The ratio of non-interest public borrowing requirement to GDP, real exchange rate and economic growth are the variables that have impact on the external debt in accordance with Granger causality analysis as can be seen from Table 8. According to this table foreign borrowing is affected mostly from by its own past values. In other words, foreign borrowing increases because of the past borrowings. This can be interpreted as follows: foreign borrowing is not used in effective investments. Second parameter affecting foreign borrowing is economic growth, this is supported by Granger causality tests. Next, openness and trade deficit are influential. The effects of these variables are small in the second period but then they have a greater effect.

6.3 Impulse-Response Analysis

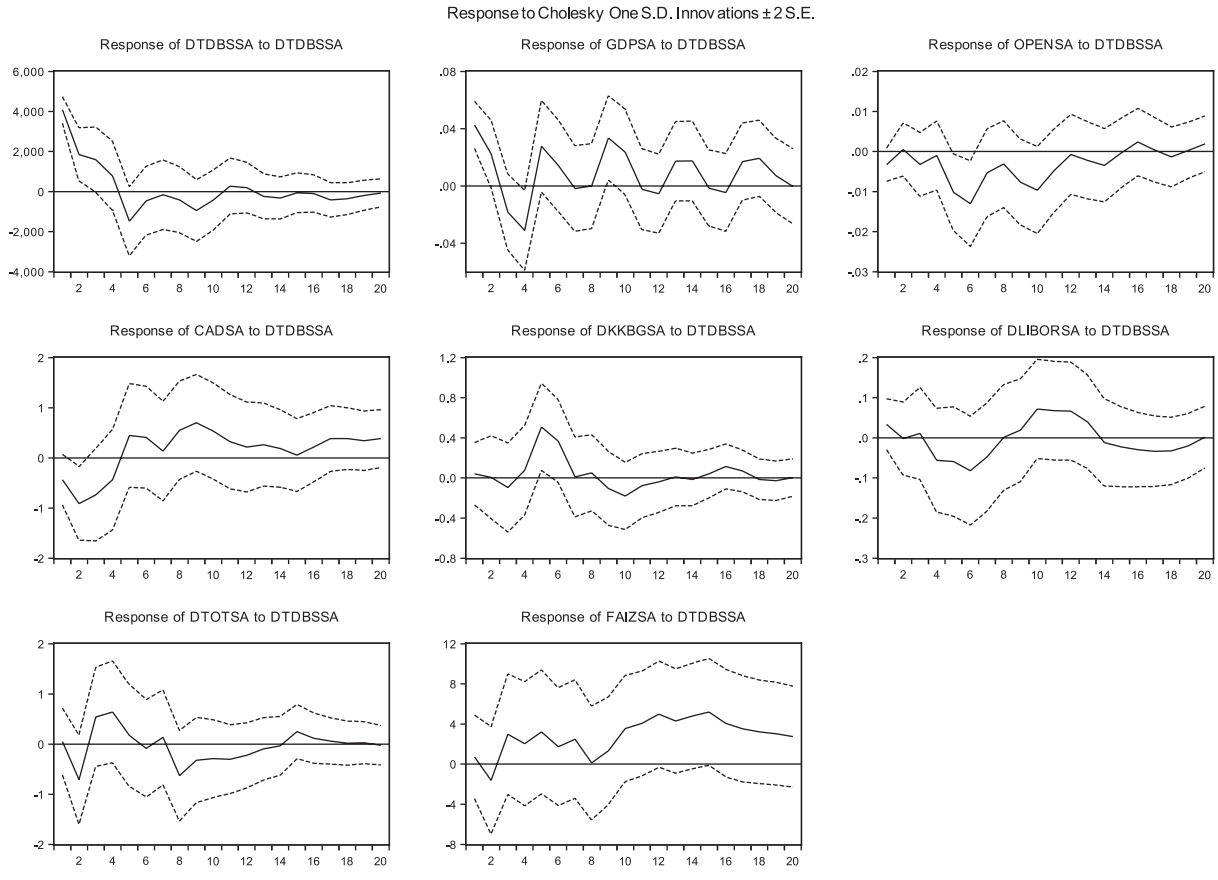
In Figure 4 the response of the total foreign debt to the other variables in the model are shown.

Figure 4. The response of the total foreign debt to the other variables



The variation of the total foreign debt stock can be seen form Figure 4, the reaction of foreign borrowing to itself is positive for the first four periods, negative until the tenth period and then a fluctuating decreasing trend exists. The reaction of foreign borrowing to economic growth is positive for the first four periods and then negative. This reaction goes to zero after the tenth period. The reaction to the openness is negative for the first three periods and positive otherwise. This reaction goes to zero after the eighth period. The response of the foreign borrowing to current account deficit is negative for the first four periods and then fluctuates and goes to zero after the tenth period. Similarly, the variation of the foreign borrowing with the public sector borrowing requirement is positive for the first three periods and then varies. This response goes to zero after the fourteenth period. The response of foreign interest rate is weak for the first period and then fluctuates. This reaction goes to zero after the tenth period. The effect of the terms of trade on total foreign debt stock is negative first two periods and then positive until the sixth period and then this reaction goes to zero. The effect of domestic interest rate on total foreign debt stock is negative for the first eight periods and then fluctuates. It goes to zero after the tenth period.

Figure 5. The responses of the variables to the foreign debt

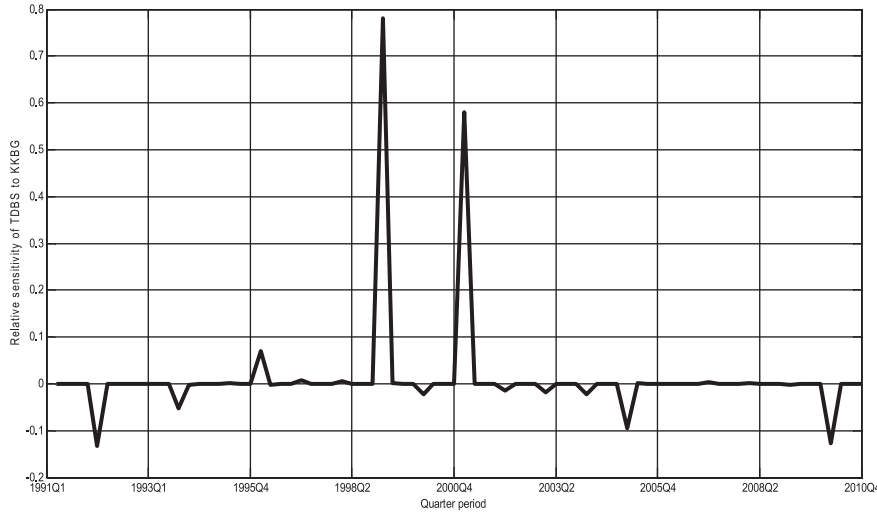


The effect of total foreign debt stock on economic growth, openness and non-interest public borrowing requirement is extremely low as it is verified by the Granger causality test. It has a fluctuating structure. The impact of the total foreign debt stock on the current account is negative for four periods and positive until the twentieth periods. The effect of the total foreign debt stock on the foreign interest rate is positive at the first period and then has a negative effect until the eight period. Until the twentieth periods, it has a fluctuating structure. The first three stages of the response of the terms of trade to the external debt is negative, then it is positive until the sixth period and negative until the eighteenth period. After the eighteenth period, the reaction is close to zero. The effect of total foreign debt stock on the domestic interest rate is positive in the first period and then is negative in the second period. Until the twentieth period, its effect is positive and higher than other variables.

6.4 Relative Sensitivity Analysis Results

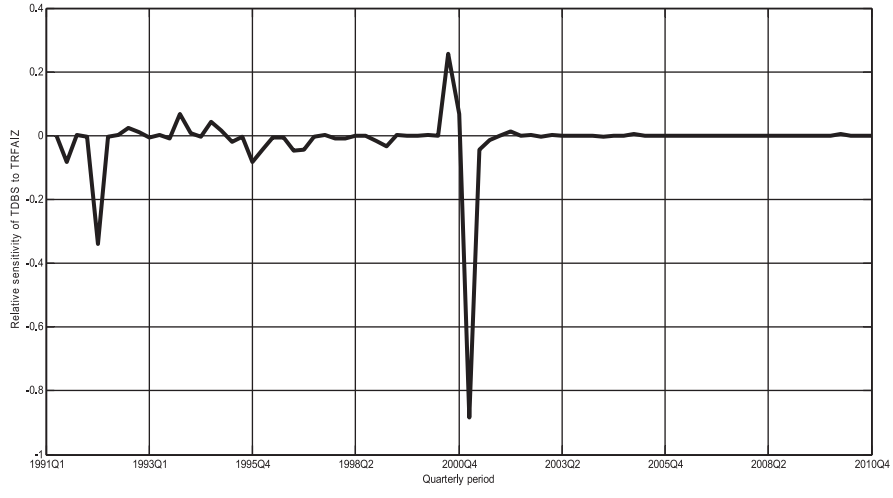
The definitions of the absolute sensitivity and the relative sensitivity are already summarized in Section 5.2. The results of this analysis are presented in the following Figures 6a-6g. The zero values of the sensitivities mean that the considered parameter has no sensitivity on the foreign borrowing. This analyses will contribute to the literature by answering questions like "which parameter has an effect on the foreign borrowing in which year?". The sensitivity coefficients will show the effects of various economic strategies on the foreign debt stock. Detailed economic policies can be made using these sensitivity data.

Figure 6a. The relative sensitivity of the total foreign debt stock to the non-interest public borrowing requirement



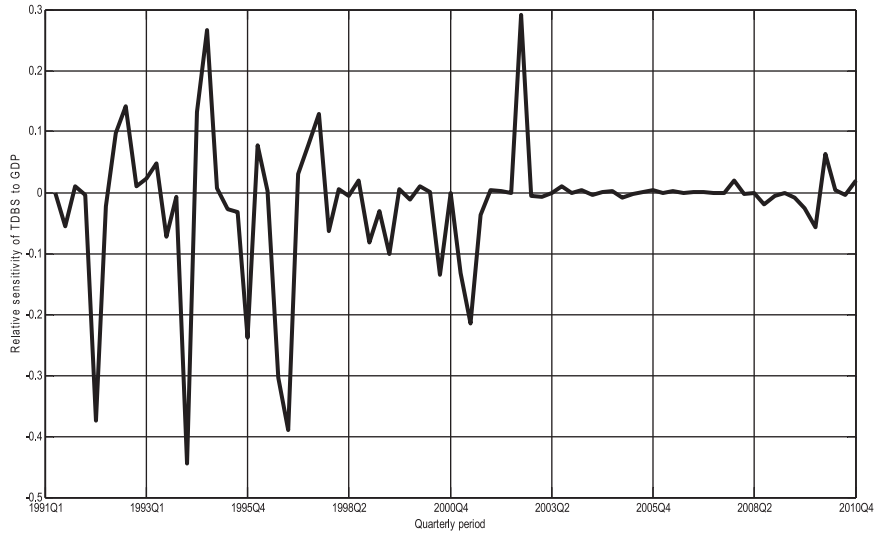
According to Figure 5a, the relative sensitivity of the foreign debt stock to the non-interest public borrowing is higher during 1999, 2000-2001 economic recession and crisis times. The sensitivity could be decreased from 2002 by following the balanced budget strategy. However there is a slight increase in 2009-2010, like 1991-1992 and 2004 periods.

Figure 6b. The relative sensitivity of the total foreign debt stock to the domestic interest rate



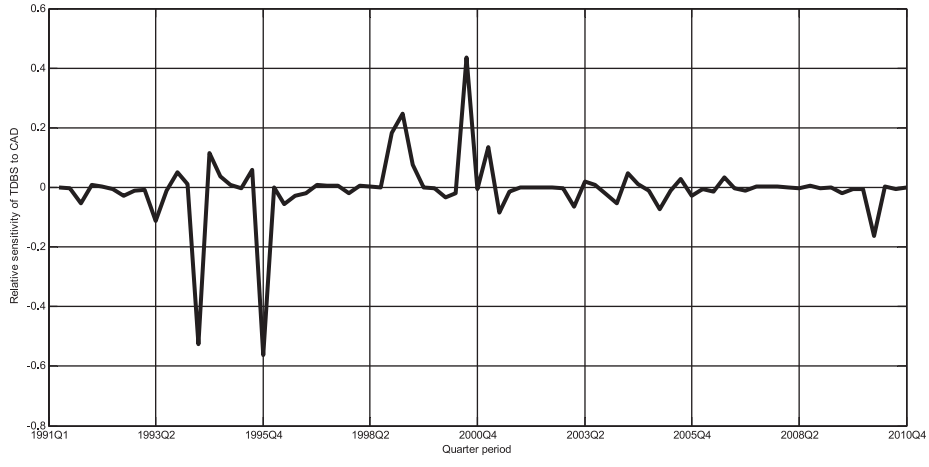
Sensitivity coefficient between domestic and foreign debt interest rate for 1991-1992 is higher compared to the 2000s. However, between 1999- 2001, we see the highest sensitivity between the two variables. Since 2002, the decreased sensitivity coefficients can be observed. The decline in the inflation rate has enabled the decline in the domestic interest. In this period, although internal interest rates were low, domestic borrowing did not decrease. In this period, private sector external debt increased more rapidly than the government debt.

Figure 6c. The relative sensitivity of the total foreign debt stock to the economic growth rate



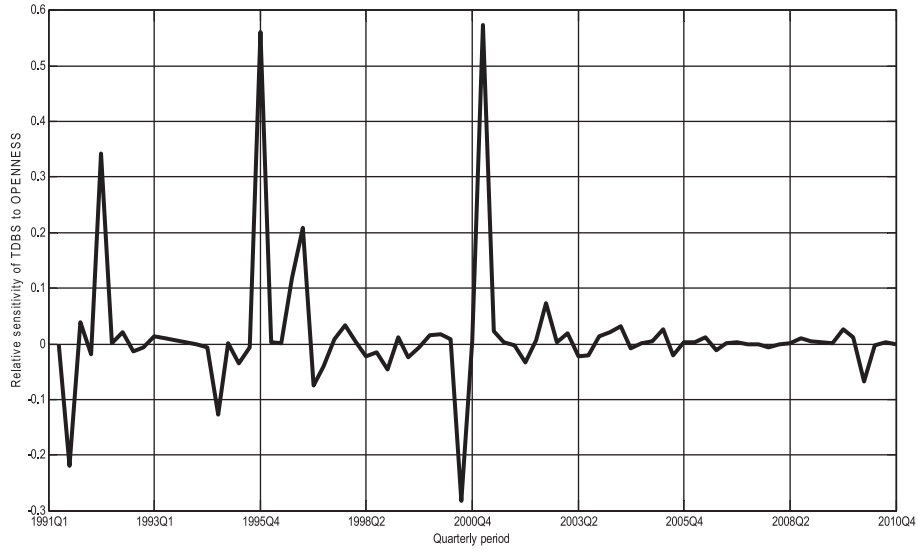
The sensitivity of external debt to economic growth rate is high until 2002. In particular, this coefficient is -4.45 in 1994. But since the end of 2002, the relationship between these two variables is weakened. For these this period, we can say that external debt is used in non-productive areas. This sensitivity coefficient has increased again between 2008-2009.

Figure 6d. The relative sensitivity of the total foreign debt stock to the current account deficit



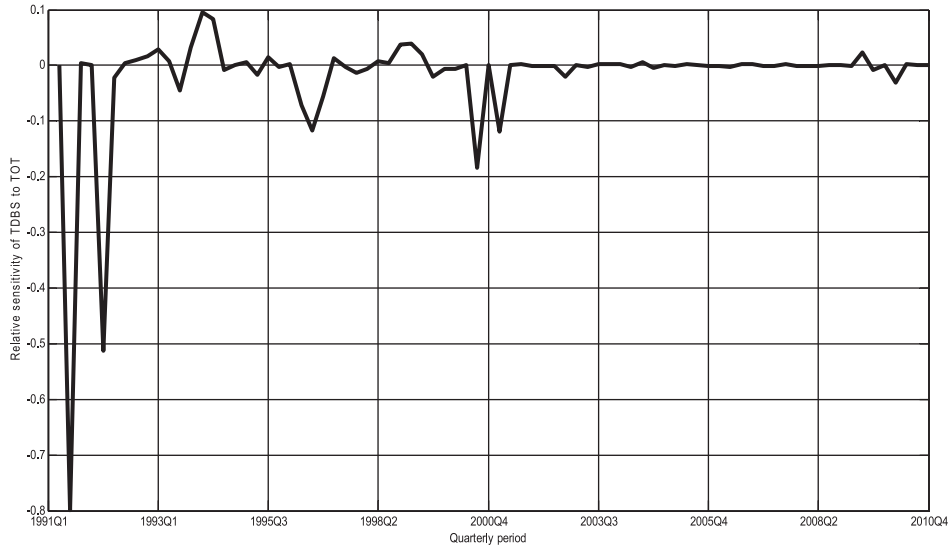
For the 1993-1995 and 1998-2001 periods, the sensitivity coefficient between these two variables have high values. Until 2010, although the coefficient of sensitivity is low; it is said that the relationship between the current account deficit contributed to external borrowing. In the period after 2002 the current account deficit has continued.

Figure 6e. The relative sensitivity of the total foreign debt stock to openness



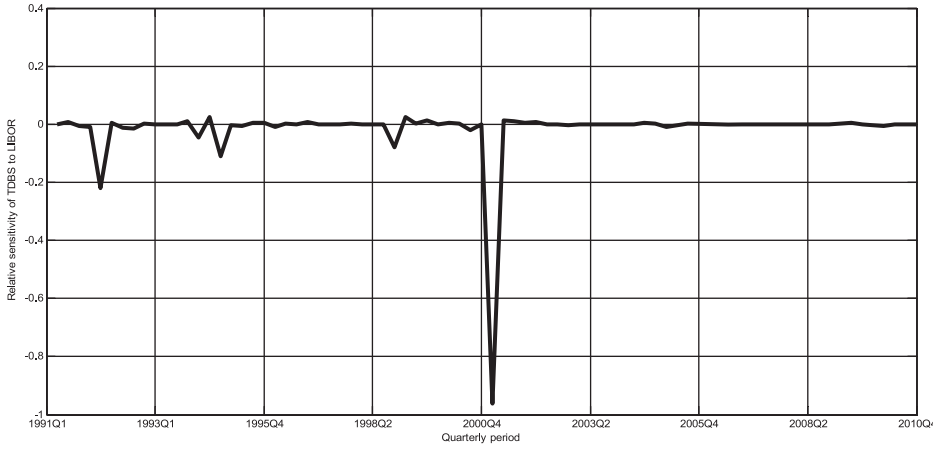
Sensitivity to the openness of the external debt is higher until 2002. In particular, 1991-1992, 1994-1996, 1999-2002 periods, sensitivity coefficient has the highest value. For example, in early 2000 sensitivity coefficient has been approximately 0.6 and -0.3 in 2001. Since 2002, this value decreased gradually, showed an increase again in 2010. The revival of global trade has affected positively Turkey's trade volume.

Figure 6f. The relative sensitivity of the foreign debt to terms of trade



Sensitivity coefficient between external debt and terms of trade in 1991 reached the highest value. It is high until 1994. During these years, the terms of trade turned against Turkey. This situation has occurred at the same period as the increase in the foreign debt. In 2000-2001, there is continued sensitivity between these variables. Between 2003-2007, the sensitivity approached zero. So improvements in the terms of trade is not considered to be influential on foreign debt. 2008-2009 period, the sensitivity increased again to decline in 2010.

Figure 6g. The relative sensitivity of the total foreign debt stock to LIBOR



The sensitivity of the foreign debts to the international interest rate increased for 1991-1992, 1994, 1999 and 2001. I took its highest value -0.9 in 2001. This sensitivity is rather low from 2002 on. It generally is zero. This shows that the effect of the international interest rate on foreign borrowing became weak.

Relative sensitivity of the TDS to the non-interest public borrowing is plotted in Figure 6a. According to this plot, the relative sensitivity has much higher values around the years 1999 and 2001 which are economic crisis years. Similarly, the effects of 2001 economic crisis can easily be seen from the relative sensitivity of the TDS to real exchange rate being 0.99. The plot of the relative sensitivity of the TDS to domestic interest rate shows that through 1990s, there is an alternating relative sensitivity and it takes the peak value during the 1999, 2000 and 2001 crisis. However due to the low domestic interest after 2002, this plot takes constant values. The relative sensitivity of the TDS to the growth rate is much higher compared to the those of the other parameters. The reason of this is that the growth rate of Turkey has an alternating behavior without any stableness. The stable behavior of this relative sensitivity which is in the period of 2003-2008 finishes and the global economic crisis is thought to be a reason. The relative sensitivity of TDS to the current account deficit also shows peaks in the years of 1994, 1995, 1999 and 2001. During the 2001 crisis, the relative sensitivity of the TDS to LIBOR has a high negative value. This can be connected to the high foreign debts in this year. The relative sensitivity of TDS to openness has peak values until the year 2003. Among these years, the highest value is in the year 2001. The relative sensitivity has a decreasing trend until 2008. After 2008, the sensitivity started to have high values. This can be connected to the industrialization dependent on the import and the variations in the GDP in Turkey. Finally, the relative sensitivity of TDS on terms of trade has peak values in the years 1991 and 1992 and then between 1994 and 2000 it also has high values. Then between 2001 and 2008 it has a stable behavior but in 2008 the relative sensitivity again started to respond.

7. CONCLUSIONS

The detailed investigation of the relationships among the foreign debt stock and economic growth rate, current account deficit, non-interest public borrowing requarement, domestic and international inter-banking borrowing interest rate is performed for Turkey in the period of 1991-2010 in this work. Firstly, vector autoregressive method (VAR) is used to obtain a linear model and then Granger causality test, variance decomposition and the impulse-response plots are obtained. According to the Granger causality test results, non-interest public borrowing requirement, real exchange rate, domestic interest rate and the economic growth rate are the main reasons of the accumulation of foreign debt. The mentioned relationships are unidirectional. Moreover, variance decomposition and impulse-response functions verify the results of the Granger test.

In the second part of this study, the concept of relative sensitivity is used in this modelling for the first time in the literature to make a contribution. A linear regression model is built and then the relative sensitivities of the macroeconomic indicators

on the foreign debt stock are obtained. According to the results of this method, the relative sensitivity of the foreign debt to the growth rate is the highest. This result supports Keynesian approach. Beside this, the relative sensitivity of the total foreign debt is higher for openness, current account deficit, domestic interest rate and non-interest public borrowing requirement than the other variables. Lastly, especially in times of economic crisis, the sensitivity of foreign debt to all the variables is higher than other periods.

The main contribution of this study is that foreign borrowing in Turkey is modelled using several parameters and the sensitivity coefficients among these parameters are calculated for each year. The existence and the level of the relationship between the considered parameters can be amalyzed using the sensitivity coefficients. Hence, this analysis enables researchers to make detailed investigations. The obtained results show the effects of the economic strategies on foreign borrowing in Turkey. This method can be applied to other areas in the future. The effects of the economic strategies can be analysed per year.

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APPENDIX

APPENDIX A

Figure 7: Inverse Roots of AR Characteristic Polynominal

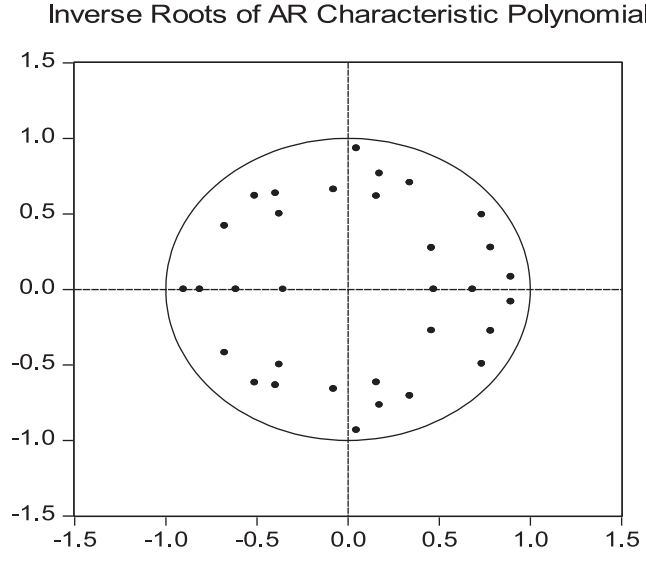

Table 4: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1385.350	NA	6519070.	38.39315	38.89517	38.59321
1	-1228.355	270.9773	517206.2	35.84535	38.35544*	36.84566*
2	-1146.387	123.5136	338764.2	35.35307	39.87124	37.15364
3	-1076.599	89.86380	345459.7	35.19450	41.72074	37.79532
4	-994.2635	87.97522	299903.4*	34.69215*	43.22646*	38.09322
5	-914.0453	68.13045	372086.3	34.24782	44.79021	38.44914
6	-800.1534	71.76756	306359.4	32.88091*	45.43138	37.88249
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

Table 5: VAR Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	74.20660	0.1797
2	52.71559	0.8421
3	66.22830	0.3999
4	56.54632	0.7346
5	65.83050	0.4133
6	82.36282	0.0609
7	83.49424	0.0514
8	78.42062	0.1061
9	51.31221	0.8740
10	51.54458	0.8690
11	85.28720	0.0389
12	72.10419	0.2277

Table 6: VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Chi-sq	Df	Prob.
2370.171	2340	0.3268

Table 7: VAR Granger Causality/Block Exogeneity Wald Tests

Dependent variable: CADSA			
Excluded	Chi-sq	df	Prob.
DTDBSSA	4.568086	4	0.3346
DKKBGSA	9.777196	4	0.0444
DLIBORSA	4.828300	4	0.3054
DTOTSA	10.89218	4	0.0278
FAIZSA	5.331821	4	0.2549
GDPSA	6.979800	4	0.1370
OPENSA	1.483454	4	0.8296
Dependent variable: DKKBGSA			
Excluded	Chi-sq	df	Prob.
DTDBSSA	4.890068	4	0.2988
CADSA	0.331224	4	0.9877
DLIBORSA	4.549048	4	0.3368
DTOTSA	0.335088	4	0.9874
FAIZSA	4.171107	4	0.3833
GDPSA	1.209851	4	0.8765
OPENSA	1.344640	4	0.8538
Dependent variable: DLIBORSA			
Excluded	Chi-sq	df	Prob.
DTDBSSA	9.056699	4	0.0597
CADSA	3.514861	4	0.4756
DKKBGSA	7.248523	4	0.1233
DTOTSA	7.819383	4	0.0984
FAIZSA	26.90676	4	0.0000
GDPSA	9.831011	4	0.0434
OPENSA	8.629482	4	0.0711
Dependent variable: DTOTSA			
Excluded	Chi-sq	df	Prob.
DTDBSSA	1.383375	4	0.8471
CADSA	2.696412	4	0.6098
DKKBGSA	6.348731	4	0.1746
DLIBORSA	5.913173	4	0.2057
FAIZSA	4.075108	4	0.3959
GDPSA	8.384938	4	0.0785
OPENSA	4.170773	4	0.3834

Dependent variable: FAIZSA			
Excluded	Chi-sq	df	Prob.
DTDBSSA	1.160149	4	0.8846
CADSA	2.502865	4	0.6441
DKKBGSA	2.418009	4	0.6594
DLIBORSA	2.689626	4	0.6110
DTOTSA	2.991716	4	0.5592
GDPSA	6.932864	4	0.1395
OPENSA	8.888338	4	0.0640
Dependent variable: GDPSA			
Excluded	Chi-sq	df	Prob.
DTDBSSA	8.438158	4	0.0768
CADSA	16.51310	4	0.0024
DKKBGSA	13.21887	4	0.0103
DLIBORSA	2.704005	4	0.6085
DTOTSA	8.004197	4	0.0914
FAIZSA	18.13263	4	0.0012
OPENSA	5.659639	4	0.2260
Dependent variable: OPENSA			
Excluded	Chi-sq	df	Prob.
DTDBSSA	11.51031	4	0.0214
CADSA	2.771519	4	0.5968
DKKBGSA	5.681626	4	0.2242
DLIBORSA	6.827150	4	0.1453
DTOTSA	4.618663	4	0.3287
FAIZSA	5.519401	4	0.2380
GDPSA	11.63061	4	0.0203

Table 8: Variance Decomposition of DTDBSSA

Period	S.E.	DTDBSSA	GDPSA	OPENSA	CADSA	DKKBGSA	DLIBORSA	DTOTSA	FAIZSA
1	4076.082	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	5048.702	78.65839	5.867192	2.165434	0.766814	5.471369	0.152668	2.272694	4.645442
3	5862.544	65.70075	6.507395	1.695864	11.73030	6.062976	0.838645	1.955418	5.508646
4	6049.516	63.35845	6.226431	3.755494	11.66479	6.826838	0.895618	2.057572	5.214801
5	6395.309	62.03501	7.747646	4.302519	10.97887	6.881523	0.989643	1.996411	5.068379
6	6523.751	60.11171	7.771395	4.776392	10.87069	7.627206	1.734736	2.235323	4.872546
7	6556.301	59.57122	7.695520	4.784098	10.81923	7.575314	2.155758	2.574264	4.824592
8	6647.034	58.33932	8.226849	4.669135	10.99266	7.377502	2.124613	2.648283	5.621643
9	6791.668	57.85137	8.901913	4.483137	10.54083	7.958767	2.036266	2.605820	5.621898
10	6834.980	57.51622	8.880350	4.567700	10.90021	7.874873	2.136838	2.572899	5.550910
11	6854.611	57.34548	8.839665	4.567867	10.85826	8.100314	2.170585	2.559157	5.558674
12	6864.888	57.25642	8.868737	4.555759	10.82839	8.096582	2.207889	2.558155	5.628064
13	6891.425	56.93375	9.063539	4.520869	10.81571	8.195530	2.205039	2.657444	5.608115
14	6909.268	56.85729	9.017224	4.577570	10.81138	8.233741	2.204185	2.708283	5.590331
15	6914.994	56.77058	9.003552	4.672941	10.79500	8.229322	2.214032	2.726413	5.588158
16	6919.139	56.72117	9.039844	4.685993	10.78549	8.219873	2.228700	2.723960	5.594965
17	6946.499	56.63777	9.193716	4.680297	10.75399	8.253847	2.216622	2.708973	5.554783
18	6963.107	56.63391	9.201964	4.743497	10.74623	8.218873	2.206416	2.718062	5.531049
19	6968.749	56.61542	9.190264	4.793211	10.73206	8.207309	2.203891	2.721291	5.536556
20	6971.895	56.57410	9.215227	4.804742	10.72697	8.204082	2.212239	2.730745	5.531903