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The Dynamic Link between Bond Spreads and Fiscal Indicators: An Empirical Investigation of Turkey

Oğuzhan Yelkesen*

Faculty of Economics and Administrative Sciences, Bandirma Onyedi Eylul University, Türkiye

Abstract

In this study, the dynamic relationship between government bond spreads and fiscal indicators is analyzed through different macroeconomic, fiscal, and financial variables with evidence from Turkey. A quarterly time series data set, from 2006:Q1 to 2019:Q3, is used to estimate the vector autoregression (VAR) model. The VAR model is used to determine a possible causal relationship between variables and to identify transmission of a shock in the model. The results show that there is a one-way causality from government bond spreads to fiscal indicators. Additionally, impulse-response functions reveal that the reaction of gross external debt to a shock in bond spreads is statistically more significant vis-à-vis the reaction of the primary budget balance. That is to say, gross external debt is found to be a more appropriate fiscal indicator in providing resiliency to global shocks compared to the primary budget balance for Turkey. The implication for this result in our analyses is that since bond spreads explain changes in fiscal indicators, not vice versa, the Turkish government should reduce external debt to lessen the effect of bond spreads and apply robust policies that would enhance fiscal solvency to create fiscal space to be used as a bulwark against short run shocks.

* **Corresponding Author**, Address: Bandirma Onyedi Eylul University, Public Finance Department, Bandırma/Turkey, e-mail: oyelkesen@gmail.com

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1. Introduction

The developments in the financial markets during the 1980s have expanded the use of debt instruments like bonds and bills in meeting the financing needs of governments, especially those of emerging markets (hereafter, EMs). Government bonds are debt securities issued by countries to borrow from investors and institutions in order to finance their expenditures. Since these instruments are backed by governments, they are regarded as safer instruments compared to other instruments such as those issued by corporations. On the other hand, although bonds are considered safer instruments, they naturally carry and reflect the risk factors that issuer country has. These factors may vary from political risk factors to macroeconomic and fiscal risks, which are seen as the key determinants of solvency for a country. Therefore, although bonds provided governments with higher liquidity and lower transaction costs and helped them create an efficient financial market, the use of new sources that are obtained by issuing bonds seems to depend in part on the fiscal management of the countries and the action of the monetary policy. A fiscally sustainable country or one pursuing a consistent monetary policy or implementing both would be expected to use funds to achieve higher economic performance, consolidating its economic structure against global and regional shocks. However, on the other hand, a risky country that implements an erratic monetary policy and a lax fiscal policy would borrow with higher interest rates that would create an undue burden on budget, which would increase the need for further borrowing and lead to soaring interest rates due to a riskier profile. This would be expected to deteriorate fiscal sustainability by creating an undue burden on budget and stimulate further borrowing with higher interest rates. There exists, therefore, a close relationship between implemented fiscal and monetary policies and the riskiness of a country.

In the aid literature, a standard measure in determining the riskiness of a country, i.e., sovereign default risk, is the emerging market bond index (EMBI).[1] During the last decade, the interaction of bond spreads with different fiscal, monetary and macroeconomic variables at the center of much attention. For instance, Blanchard (2004) substantiated that EMs may be fragile to an upward shift in bond spreads, leading to domestic currency depreciation and deterioration in inflation. In a similar vein, Žigman and Cota (2011) investigated the relationship between fiscal policy and bond spreads and concluded that the direction of public spending and investment, taxation system and the organization of debt instruments are closely related to bond spreads changes. Others like Favero and Giavazzi (2005) concluded that domestic interest rates and exchange rates are significantly affected by EMBI spreads. However, evidence suggests that fiscal policy and its tools are among the most important factors for explaining swings in bond spreads (Alesina & Perotti, 1996). In this study, therefore, I aim at assessing to what extent and how fiscal indicators like the primary budget balance-to-GDP ratio and gross external debt-to-GDP ratio are associated with bond spreads, i.e., EMBI spreads, in Turkey over the period 2006:Q1 and 2019:Q3. The primary purpose of this study is to contribute to the understanding of the dynamic interaction of fiscal indicators with bond spreads in Turkey, which has long been a neglected concept within this particular context. Furthermore, the present study puts a special emphasis on the relationship between bond spreads and fiscal indicators by additionally considering the effect of both control and dummy variables.

The increasing use of government bonds has been a double-edged sword for economies. Although the increasing volume of alternative debt instruments enabled EMs to benefit from external capital markets with lower costs, bond spreads reached a higher level to which they deteriorate fiscal sustainability and ruin the financial market structure. For instance, large swings in bond spreads are expected to increase both the cost of new borrowing and the default risk of a country, which, in turn, are expected to deteriorate the fiscal discipline and macroeconomic stability (Codogno et al., 2003; Žigman & Cota, 2011). On the other hand, deteriorated fiscal indicators would drive bond spreads up by putting fiscal solvency at risk,

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[1] EMBI is calculated as the yield differential of two bonds with similar maturity and currency. One of those bonds is generally issued by an emerging market economy and the other one is issued by an industrialized economy whose money is typically a hard currency. The difference between the yields is called “bond spreads”.

which causes a higher probability of default (Edwards, 1984), and adds to fiscal tension (CiŻkowicz et al., 2022). In view of the two-way relationship between variables, there would be a self-feeding loop of fiscal stress, higher debt requirement, and higher risk premiums, that would eventually raise some question marks over the channel through which bond spreads and fiscal indicators affect each other.

This naturally raises the question of how and to what extent bond spreads and fiscal indicators may affect each other (Nickel et al., 2011). Although few researchers have attempted to analyze the volume of bond issuances and their determinants in Turkey (Culha et al., 2006; Chowdhury et al., 2013), the concept of government bond spreads and its dynamic interaction with fiscal indicators remain unclear. Additionally, both theoretical and empirical studies in the extant literature do not seem to provide a comprehensive understanding of the dynamic relationship between bond spreads and fiscal indicators. That is to say, the available academic research has not taken other macroeconomic factors into consideration within a dynamic structure. That is, they have unilaterally examined the determinants of bond spreads by only focusing either on a period of a financial crisis (Aßmann & Boysen-Hogrefe, 2012) or on a specific area such as the Euro area (see, for instance, Blanco, 2001; Dewachter et al., 2015) or on the effect of global factors on government bond spreads (see, for example, Blanco, 2001; Uribe & Yue, 2006; Adler & Sosa, 2013; Goyari & Kamaiah, 2016; Presbitero et al., 2016; Izadi & Hassan, 2018). Thus, a key problem with much of the literature is that they have not been able to convincingly analyze the problem from a dynamic and two-way perspective.

In this study, therefore, I examine the dynamic relationship between government bond spreads and fiscal indicators, e.g. the ratios of gross external debt and primary budget balance over GDP, in Turkey over the period 2006:Q1 and 2019:Q3. The rationale behind this analysis is to construct a holistic basis for the dynamic structure of the variables of interest. The primary purpose in choosing these variables can be explained by the correlation of the level of gross external debt with higher bond spreads (Ciocchini et al., 2003; Turner & Spinelli, 2013), and fiscal performance (Geithner, 2002), as well as the role of the level of the primary budget balance in determining the probability of default (see Gödl & Kleinert, 2016). However, Edwards (1984) discusses the role of other macroeconomic and financial risk factors in explaining the cost of borrowing. I therefore examine the dynamic relationship between the variables of interest along with other control variables and classify them based on the effect in which they have such as push and pull factors to better understand the case in which I investigate.

The interplay between the Turkish bond market and international markets, however, dates back to the 1980s (Akkaya, 2018). In parallel with this, external debt and its financing was a chief problem in 1982, during which the Turkish economy suffered from budget deficits and short run foreign debt repayments (Aricanli & Rodrik, 1990). Since then, the volume of bonds issued by the Turkish government has continuously increased and played a crucial role in providing foreign capital for public financing. Moreover, Turkey's bond spreads have also increased from 223 basis points (bps) in 2006 to 477 bps in 2019[2], showing increasing perceived risk and higher debt service payments that would negatively affect fiscal balance. During the same period, Turkey's outstanding general government debt (denominated in billions of US dollars) has constantly increased and reached approximately US$80 billion in 2019. In this sense, the investigation of the dynamic relationship between fiscal indicators and bond spreads would be of great importance in determining to what extent they affect each other and offering a solution to the acute fiscal and/or economic problems stemming from higher borrowing costs in Turkey. As an emerging market economy, Turkey has been carrying the structural social, economic and institutional characteristics of developing countries. The findings of this study will contribute to the literature by offering an alternative and a dynamic perspective of the short run relationship between bond spreads and fiscal indicators for other developing countries. The findings will also suggest new perspective for further studies and policymakers in terms of evaluating the short run characteristics of the current economic stance and simulating long run policy making.

The contribution of this article is threefold: Firstly, a two-way and dynamic approach regarding the relationship between government bond spreads and fiscal indicators is developed, which has long been omitted in the extant literature for Turkey. Second, a set of control variables, which are classified as credit, default, and liquidity risk factors (Tomz & Wright, 2013) are used, and divided into pull and push factors to better capture the relative effect of each risk factor in analyzing the dynamic structure of our model. Finally, this article takes discussions a step further by contributing to the current knowledge of the extant literature from a different perspective. In line with this, the research questions that I seek to answer are as follows:

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[2] These are JP Morgan EMBI+ spreads and obtained based on Global Economic Monitor (GEM) of the World Bank.

i) Is there a significant Granger-causal relationship between government bond spreads and fiscal indicators in Turkey? If so, is it unidirectional or bidirectional?

ii) How are government bond spreads and fiscal indicators related?

To answer these questions, this article employs a Vector-Autoregressive Model (VAR) and Granger-causality test to determine the direction of any possible causality, and Impulse Response Functions (IRFs) to measure the response of the variables in case of a shock to the system of functions. In addition, I control for both domestic and external factors that may have a side-effect on the empirical test of the hypotheses above.

The findings show that there is unidirectional causality from government bond spreads to fiscal indicators in Turkey, implying that movements in the ratio of both primary budget balance and the gross external debt over GDP can be explained by changes in bond spreads. Considering the IRFs results, the responses of fiscal variables to a shock in bond spreads are consistent with the causality results, showing that when a positive shock is given to bond spreads, gross external debt (measured as a percentage of GDP) increases for four periods, whereas primary budget balance over GDP ratio decreases for about four periods. The empirical evidence highlights the role of bond spreads in determining how fiscal indicators can be used for policy decisions in Turkey. Gross external debt seems to be more sensitive to the shocks in spreads compared to the primary budget balance. This might well be explained by the direct effect of spreads on the level of borrowing costs and by their indirect effect on the primary budget balance as higher debt payments reflect on the budget with a lag.

Although the results show that there is unidirectional causality from bond spreads to fiscal indicators in Turkey, it does not necessarily mean that fiscal indicators as domestic factors have no importance as they strictly determine the mechanism through which bond spreads and their effects are transmitted (Özatay et al., 2009). Fiscal indicators could be used as a bulwark against external shocks in the short run, as it is empirically proved by Bellas et al. (2010). Put it differently, to soften the impact of higher bond spreads caused by global, regional, or national factors and circumvent their crippling effect on the overall economy, lower external debt stock and stability in primary budget balance may help Turkey overcome short run economic imbalances through effective debt management and the implementation of sound macroeconomic policies.

The rest of the paper is organized as follows. Section 2 reviews the nexus between bond spreads and fiscal indicators from both empirical and theoretical points of view. Section 3 defines the model and demonstrates the data that are utilized in testing the hypotheses. Section 4 presents the findings, and finally, Section 5 concludes.

2. Literature Review

The role of bond spreads has drawn increasing attention in the extant literature. As stated by Eichengreen et al. (2019), governments borrow not only for fiscal purposes like deficit financing but also for the development of the financial system by providing a basis for easy interaction between investors at a lower cost. Because the price of borrowing would help governments carry out sustainable fiscal policy and achieve those purposes within the foreseeable process of policymaking. This, therefore, extends the scope of bond spreads and puts it in a different place where it becomes more important for EMs. In the aid literature, however, the nexus between government bond spreads and fiscal indicators has been taken into consideration from both theoretical and empirical point of views.

2.1. Theoretical Literature

In the theoretical literature, studies generally use descriptive analyses and theoretical models in explaining the theoretical background of the nexus between bond spreads[3] and fiscal indicators. Prior to delving into the dynamic relationship between bond spreads and fiscal indicators, the reason why these two fiscal indicators were determined and the interaction among them will be discussed. An increasing ratio of government external debt raises a question mark over fiscal sustainability. As Afonso and Reis (2016) stated, sovereign yields will tend to increase as it is linked to concerns regarding fiscal unsustainability. A higher ratio of external debt over GDP would surge perceived risk as the probability of not being able to honor debt repayments increases. It would, in turn, increase interest rates of new borrowing for riskier countries, complicating attempts to reach resources in the international debt market and damage the reputation for further payments. Governments, however, are expected to curb and eliminate surging sovereign spreads by using other fiscal instruments like having higher primary budget

[3] In the present study, bond spreads refer to the government bond spreads and may be used interchangeably with sovereign yields.

balance-to-GDP ratio to be able to meet debt repayments at the due date and to lower the probability of default risk. Moreover, the primary budget balance-to-GDP ratio is considered as another significant proxy for fiscal sustainability and credit risk as it shows the revenue balance of a government, that is, solvency (Chouragui et al., 1990). Therefore, the ratio of primary budget balance over GDP enables investors and lenders to assess and evaluate budgetary performance before deciding to lend.

Against this backdrop, these two fiscal indicators are essential for fiscal credibility, which is a highly important factor in determining the level of risk premia for a country. These two fiscal indicators have also been seen as the main indicators of fiscal fragility (Alessandrini et al., 2014). As Montes and Acar (2020) argued well, a low level of credibility negatively affects people's belief in the ability of a government to sustain its fiscal commitment and therefore increases uncertainties about future fiscal policy formulations. In this context, the interaction between these two fiscal indicators can be clarified. Higher fiscal performance would depend on the mutual interaction of the debt and budget indicators. A higher ratio of primary budget balance over GDP shows that a government can meet its debt repayments, so reduces risks and paves the way for lower priced debt contracts for future borrowings. On the other hand, a lower ratio of primary budget balance over GDP raises concerns regarding the ability of a government to be able to repay its debt and therefore increases sovereign yields, deteriorating future borrowing and damaging credibility of a government. In a similar way but differently, a higher debt level would force economic management to necessarily have more primary surpluses in order to meet its obligations, which otherwise would have disrupted the fiscal sustainability.

The interplay between these two fiscal indicators, therefore, determine the extent to which how bond spreads would change. Although there are many studies investigating the role fiscal indicators on bond spreads (for example, see, Ferrucci, 2003; Rowland & Torres, 2004; Attinasi et al., 2009), the mechanism through which bond spreads and fiscal indicators affect each other seems to be dynamic and mutual. Other macroeconomic factors like lower growth rate, higher inflation rate or a higher ratio of current account balance over GDP may also regarded as other risk factors for higher bond spreads. This may, in turn, severely affect fiscal indicators and cause a self-feeding loop and deem the main fiscal indicators ineffective through higher borrowing costs. This shows us that the relationship between bond spreads and fiscal indicators should be analyzed in a dynamic framework and other risk factors should also be taken into consideration.

2.2. Empirical Literature

As briefly discussed in the introduction, the natural link between fiscal indicators and bond spreads hinges on the credit and default risk factors (Lo Conte, 2009). For instance, a constant increase in the government debt over GDP ratio raises doubts regarding whether the government will be able to service its debt, resulting in a higher perceived risk and higher bond spreads (Gramlich, 1990). Similarly, as pointed out by Chouragui et al. (1990), the primary budget balance-to-GDP ratio would be one of the key determinants of credit risk, which is a crucial factor in the assessment of the default probability. These arguments, however, have been supported by Gruber and Kamin (2012) whose analysis showed empirically that an increase in the ratio of government deficit over GDP causes government bond yields to be 15 basis points higher for the G-7 countries. Likewise, Engen and Hubbard (2004) found that an increase in the budget deficit-to-GDP ratio causes sovereign yields to rise about 19-29 basis points. In the literature, therefore, both variables are used as a proxy for fiscal sustainability and performance (for example, see, Žigman & Cota, 2011; Gruber & Kamin, 2012) and reconciled with risk premium as they show countries' solvency (Codogno et al., 2003).

Although the credibility and solvency of a country can be assessed in part by the fiscal fundamentals (the ratios of external debt and primary budget balance over GDP), the interplay between bond spreads and fiscal indicators is not entirely clear-cut. The extent to which fiscal indicators affect bond spreads would depend on many other factors like the level of openness of the economy, the share of Ricardian-type consumers in total consumption (Faini, 2006), and the countries' level of development (Nickel et al., 2011), and many others. That is to say, the major problem in explaining the dynamic relationship between government bond spreads and fiscal indicators might well be neglecting macroeconomic, country-specific, and external factors as they inevitably affect the dynamic structure between the variables of interest (Dailami et al., 2008).

In view of the above discussions, it seems that the inclusion of variables that would have a crucial impact on the dynamic relationship should be taken into consideration. Consistent with this, several empirical studies in the literature have attempted to determine the main *explanans* of the bond spreads by considering the role of macroeconomic and international factors. For instance, Bellas et al. (2010) analyzed the long- and short run determinants of the bond spread by employing a fixed-effects model for 14 EMs over the period 1997:Q1-2009:Q2 and found that, in the long run, macroeconomic fundamentals explain a big part of the bond spread changes. In a similar vein, Chowdhury et al. (2013) investigated the effects of macroeconomic indicators on government bond spreads for 25 emerging market economies by using panel data regression and fixed effect estimation over the period 2000-2009. The authors showed that there is a positive relationship between inflation, foreign direct investment, current account balance-to-GDP ratio, and bond spreads.

Another strand of the extant literature points out the role of global economic factors on bond spreads as they matter for liquidity and market access (Presbitero et al., 2016). EMs are, by their nature, fragile and vulnerable to liquidity shocks, putting them in a position where they can hardly find sources to finance their deficits and service debt repayments. The empirical evidence for global factors, however, differs in the extant literature. Several studies have used US Treasury bond yields as a proxy for global liquidity (see, for example, Blanco, 2001; Codogno et al., 2003; Uribe & Yue, 2006; Haugh et al., 2009; Goyari & Kamaiah, 2016), whereas others have used the volatility indices like VIX and VDAX (see, for example, Scheicher, 2003; Adler & Sosa, 2013; Izadi & Hassan, 2018). The general consensus regarding the role of international factors on bond spreads is that not only the fiscal fundamentals affect the risk premium of governments, but also swings in financial markets and fluctuations in global economic conditions affect the level of risk through tightening international capital, making governments unable to find required funds to service their debt repayments.

As another international factor, the role of financial crises has also been highlighted in the literature. Financial crises trigger sovereign debt crises by constraining the ability of EMs to borrow. The explanation is that when the economies are heavily exposed to a financial shock, uncertainty will rise and the capital will go to safer countries, which would, in turn, increase the borrowing cost of EMs. In line with this, some find that financial crises have a significant impact on government bond spreads by changing investors' risk appetite, forcing governments to run expansionary fiscal policy, leading to lower growth rates, and neutralizing the effect of monetary policy during and after the crises (Guler & Talasli, 2012; Bobetko et al., 2013; Tagkalakis, 2013). This phenomenon, however, has been specifically examined in the work of Kılınç et al. (2012) as the author analyzed the role of both the 2001 and 2008 crises on bond spreads and found that spreads dramatically surged in the 2001 crisis compared to the 2008 global financial crisis due to weak economic fundamentals.

In view of the above, this paper aims to expand the scope of those discussed above and consider other factors that would affect the dynamic relationship between government bond spreads and fiscal indicators. Those control variables have been determined from the related literature and divided into two separate parts, push and pull factors. The model presented below, however, seems to be appropriate to analyze such a dynamic relationship by additionally including the impact of those factors in the model and distinguishes the current study from the ones discussed above by enabling us to analyze the dynamics of whole variables within a model, rather than using a one-sided model that only attempts to find the determinants of bond spreads.

3. Data and Econometric Methodology

In this study, I analyze the dynamic relationship between government bond spreads and fiscal indicators for Turkey over the 2006:Q1-2019:Q3 period. The observed period is deliberately constrained due to the changes in budget classification as of 2006 and the changes in the composition of public debt as of 2019. I consider the ratios of primary budget balance and gross external debt over GDP as fiscal fundamentals, while using the emerging market bond index (EMBI+) spread as a proxy for bond spreads, which are referred to as the variables of interest. In addition to them, control variables are used and divided into two parts. First, CPI-based inflation, real GDP growth rate, and current account balance-to-GDP ratio are used as pull factors, which are partly controllable by governments and dependent on countries' economic policies, while the 3-month US Treasury bill rate and the VIX index are taken as push factors, which are completely determined by external factors. Since the VAR model treats all variables in the model as endogenous, I exogenously deploy a dummy variable for the financial crisis according to the business cycle reference dates of the National Bureau of Economic Research (NBER). The dummy takes the value of 1 for the 2008 global financial crisis periods between 2007:Q4 and 2009:Q2, and 0 for the non-crisis periods.

3.1 Variables Definition

No need to start from scratch, but the variables of interest consist of the ratios of primary budget balance and gross external debt over GDP as fiscal indicators, and EMBI+ as government bond spreads. The primary budget balance shows the ability of a government in providing sustainability in public finance management since the balance shows the ability of a government to meet its obligations with its conventional sources. Thus, a higher ratio of primary budget balance over GDP is expected to decrease bond spreads through higher credibility. As for gross external debt, it is the sum of short and long run outstanding debt stock of the public sector, the private sector and the Central Bank of Republic of Turkey (CBRT). A higher ratio of gross external debt over GDP raises questions about whether the government can meet its short and long run liabilities and increases bond spreads through increasing the probability of default risk. When it comes to EMBI+, it is the interest payment of Turkey's 10-year US dollar-denominated bond yield over the default-free instrument of the 10-year US Treasury yield. As a measurement unit of the cost of borrowing faced by EMs, the emerging market bond index (EMBI) is frequently used in international financial markets (Özatay et al., 2009). Although EMBI and EMBI+ are highly correlated (0.98), EMBI+ is the extended form of the EMBI index, which covers only Brady Bonds, and differs slightly from the EMBI by additionally containing Eurobonds, sovereign external loans, and local instruments (Morgan, 1995). On the other side, EMBI+ is more reachable compared to EMBI and EMBI Global (EMBIG). Hence, EMBI+ is preferable to be used as a proxy for government bond spread.

On the other hand, some control variables have been incorporated into the model to make sure that I do not ignore the pull and push factors that would have a significant impact on the dynamic structure of the analysis. The reason I treat these variables as pull and push factors is that their origin and possible effect in the model vary depending upon their characteristics. As example of pull factors, which are mostly shaped by the domestic macroeconomic management and controlled by government policies, I first use CPI-based headline inflation to include the effect of increasing uncertainty and surging prices that affect the overall economy via deteriorating the market mechanism. Higher inflation would also affect consumption and saving behaviors of individuals that have a great impact on overall economic activity through credit channels and lead to uncertainty for both monetary and fiscal policies, causing bond spreads to be higher.

As another pull factor, real GDP growth rate is used as it enlarges the capacity of governments to meet financial obligations. A higher real GDP growth rate decreases the bond spreads by lowering the default probability and by increasing the solvency of a government. I also use current account balance, which is the sum of net primary and secondary income and the net export of goods and services, to show the dependency of a country on foreign capital. An increasing ratio of the current account balance over GDP would increase the resiliency of the government to risky external developments and competitiveness in honoring its debts, implying that lower bond spreads. As for push factors, however, the 3-month US Treasury bill rate, which is the short run end of the risk-free US Treasury instruments, is used to measure the degree of global liquidity and short run capital flow in the international market. I then replaced the 3-month US Treasury bill rate with the 10-year US Treasury Bond rate to check the robustness of the model. Lastly, the fear index, which is alternatively called as the VIX index, is considered as another push factor. The VIX shows global risk appetite, which directly affects the volatility and perceived risk of the markets. Thus, an increase in the VIX index is expected to increase bond spreads.

Summary statistics of the variables and where the data are gathered from and how they are proxied are presented in Table 1 and Table 2 below, respectively.

Table 1: Summary statistics

	SMPBS	GDP	CAB	GED	INF	EMBI	LVIXI	BILLRT	TENYR
Mean	0.563377	4.775397	-4.713.521	43.14481	9.529091	296.9654	2.869353	12.69636	-0.901818
Median	0.577781	5.626230	-4.956.987	39.80414	8.800000	285.1181	2.801541	-0.100000	-0.900000
Maximum	1.753082	11.49193	1.187142	60.90000	22.40000	594.4966	4.070735	400.0000	36.20000
Minimum	-1.454.473	-1.252.644	-9.377.732	36.06168	4.300000	172.3074	2.333114	-8.010.000	-2.440.000
Std. Dev.	0.623052	4.709854	2.411211	6.942304	3.507593	94.04704	0.349538	71.80978	12.57146
Skewness	-0.553618	-1.263.684	0.594679	0.995491	1.905286	1.303348	1.129537	3.327910	0.790527
Kurtosis	3.688908	5.165534	3.484208	2.845551	7.006677	4.319017	4.590520	17.38297	4.063081
Jarque-Bera	3.897129	25.38508	3.779024	9.138863	70.06524	19.55863	17.49267	575.5977	8.318458
Probability	0.142478	0.000003	0.151146	0.010364	0.000000	0.000057	0.000159	0.000000	0.015620
Sum	30.98573	262.6469	-2.592.437	2372.965	524.1000	16333.10	157.8144	698.3000	-4.960.000
Sum Sq. Dev.	20.96248	1197.867	313.9526	2602.562	664.3735	477621.7	6.597564	278458.8	8534.250
Observations	55	55	55	55	55	55	55	55	55

Table 2: Variables and Sources

Variable Name	Definition/Unit	Source
TENYR	10-year US Treasury Bond Rate / Percentage Change (%)	St. Louis FED (FRED) https://fred.stlouisfed.org
LVIXI	Volatility Index (VIX) / Log of the Index	St. Louis FED (FRED) https://fred.stlouisfed.org
GDP	Real GDP growth / Percentage change from the previous year (%)	OECD https://data.oecd.org/
INF	CPI-based (Headline) Inflation / Percentage change over previous years (%)	OECD https://data.oecd.org/
EMBI	JPMorgan EMBI+ Spreads / Basis Points	World Bank (GEM) https://databank.worldbank.org/
CAB	Current account balance / Percentage of GDP (%)	OECD https://data.oecd.org/
GED	Gross external debt / Percentage of GDP (%)	Ministry of Treasury and Finance https://www.hmb.gov.tr/
SMPBS	Primary budget balance / Percentage of GDP (%)	Ministry of Treasury and Finance https://www.hmb.gov.tr/
BILLRT	3-month US Treasury Bill Rate / Percentage Change (%)	St. Louis FED (FRED) https://fred.stlouisfed.org
Dummy	Dummy variable for the financial crisis of 2007-2008/ 1 for the crisis period, 0 otherwise	National Bureau of Economic Research (NBER) https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions

3.2 Methodology

In analyzing the dynamic relationship between government bond spreads and fiscal indicators and incorporating control variables into the model, the vector autoregressive (VAR) model is used. The rationale behind choosing the VAR model is that the model gives us an opportunity to analyze the variables by considering their both current and the past values, providing a dynamic basis for a time-series analysis containing autocorrelated variables. Therefore, it is suitable for modeling macroeconomic data (Sims, 1980) and making a policy analysis. Since there are two main fiscal indicators in our analysis, I run the VAR model twice for each fiscal indicator separately to better assess their individual interaction with bond spreads. The basic VAR model, therefore, can be written as follows:

$$VAR(p): y_t = \alpha + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \cdots + \beta_p y_{t-p} + \varepsilon_t \tag{1}$$

where *VAR(p)* shows that VAR with p lags, that is, p-th order of the VAR model, y_t consists of the variables in the model, α is the constant term, β is the coefficients, ε_t is the error term. Since the ordering is important in the VAR model to better grasp causality between the variables, I order the variables by considering their relative exogeneity. In other words, the variables are ordered in a way that they will be aligned from more exogenous to less endogenous with the help of economic theory. For instance, changes in economic activity, proxied by real GDP growth rate, affect other variables significantly, whereas real GDP growth rate does not quickly react to the shocks given to other variables due to its slowness, i.e., dependence on many other factors. In line with this logic, I order the variables as follows: Real GDP growth rate *(GDP)*- current account balance-to-GDP ratio *(DCAB)*- gross external debt-to-GDP ratio *(DGED*)/ primary budget balance-to-GDP ratio *(SMPBS)*- CPI-based (headline) inflation rate *(DINF)*- J.P. Morgan EMBI+ spreads *(DEMBI)*- the VIX index *(DLVIXI)*- 3-month US Treasury bill rate *(BILLRT)*. BILLRT is then substituted with 10-year US bond rate *(TENYR)* and reconducted the IRFs to check the robustness of the model and deploy a dummy variable in order to take the effect of the 2007-2008 financial crisis into consideration.

As a preliminary, I first apply a unit root test to check the stationarity of the variables via the Augmented Dickey-Fuller (ADF) method, because the accuracy of predictions about the reaction of the variables to the shocks is heavily dependent on the stationarity condition of variables. Otherwise, the non-stationary data could lead to spurious regression. The null hypothesis is that the variable has a unit root, whereas the alternative hypothesis is that the variable has no unit root. Accordingly, the null is not rejected if $\varphi = 1$ and said the variables to be non-stationary, while in the case of $\varphi < 1$, the null is rejected, and the variable is said to be stationary by referencing to Eq. (2) below

$$y_t = \varphi y_{t-1} + \varepsilon_t \tag{2}$$

As seen in Table 3, we take differences of current account balance-to-GDP ratio (CAB), gross external debt-to-GDP ratio (GED), inflation rate (INF), J.P. Morgan emerging market bond index (EMBI), real GDP growth (GDP) and the log of volatility index (LVIXI) to make them stationary at 5% significance level, while using others at the level as they are already stationary 1% and 5% significance level, making sure that all variables used in the final model are stationary. This, however, enabled us to make a short run analysis since taking the first differences of the variables causes some information loss in the long run (Wooldridge, 2013, p.632).

Table 3: Augmented Dickey-Fuller Unit Root Test Results

	With Constant		With Constant & Trend	
Variable	Level	Difference	Level	Difference
SMPBS	4,554***	-7,871***	5,506***	-7,776***
	(0.00)	(0.00)	(0.00)	(0.00)
GDP	-2,012	-3,885***	-2,175	-3,832**
	(0.28)	(0.00)	(0.49)	(0.02)
CAB	-2,389	-6,003***	-2,606	-5,959***
	(0.14)	(0.00)	(0.27)	(0.00)
GED	1,908	-5,615***	-0,623	-6,474***
	(0.99)	(0.00)	(0.97)	(0.00)
INF	1,02	-6,793***	0,416	-7,671***
	(0.99)	(0.00)	(0.99)	(0.00)
EMBI	-2,752*	-6,113***	-3,064	-4,171***
	(0.07)	(0.00)	(0.12)	(0.00)
LVIXI	-2,846*	-8,362***	-3,309*	-8,297***
	(0.05)	(0.00)	(0.07)	(0.00)
BILLRT	6,128***	-10,813***	6,262***	-10,708***
	(0.00)	(0.00)	(0.00)	(0.00)
TENYR	5,598***	-7,132***	5,533***	-7,088***
	(0.00)	(0.00)	(0.00)	(0.00)

Notes: *; **; *** denotes respectively 10%, 5%, and 1% significance level. Probabilities are in parentheses.

In order to estimate the VAR model and to see the results of both IRFs and Granger-causality tests, the appropriate lag-length must first be chosen for the model. As the VAR model will be run twice for each fiscal indicators, I separately estimated the appropriate lag-length for two different models. According to Akaike Schwarz (AIC) lag length criterion, four lags have been determined for each model.[4] I also checked diagnostics to determine whether residuals are serially correlated and normally distributed but did not find any evidence to the contrary. However, heteroskedasticity problem could not be diagnosed due to a singular matrix.

Next, a possible causal relationship between variables is tested via Granger-causality tests. The Granger causality tests allows us to analyze a possible causal relationship between the variables in question. If one considers two variables, x_t *and* y_t for Granger causality in a VAR model, it will be depicted as follows:

$$y_t = \sigma_1 + \sum_{j=1}^{n} ¥_j y_{t-j} + \sum_{i=1}^{n} ¢_i x_{t-i} + \varepsilon_{y_t} \tag{3}$$

$$x_t = \sigma_2 + \sum_{j=1}^{n} \emptyset_i y_{t-j} + \sum_{i=1}^{n} \vartheta_i x_{t-i} + \varepsilon_{x_t} \tag{4}$$

where ε_{y_t} *and* ε_{y_t} are not correlated with each other. I test the hypothesis that x_t does not granger cause y_t if $¢_i = 0$, and does granger cause y_t if $¢_i \neq 0$. Similarly, it can be said that y_t does not granger cause x_t if $\emptyset_i = 0$, and granger cause if $\emptyset_i \neq 0$.

4. Empirical Results

As stated in the data and methodology section above, I run the VAR model for each fiscal indicator separately to find their individual relevance to the bond spreads, which is important for posing policy advice. Before estimating the interrelationship between the variables, I checked whether the VAR models are dynamically stable according to Roots of Characteristics Polynomial and found that the models are stable since all their eigenvalues are positioned within the circle.

I iterated granger causality tests by replacing fiscal indicators with each other to provide a basis for our hypotheses and to examine the possible causal relationship between the variables separately. In this way, Table 4 shows that there is one way causality from bonds spreads (DEMBI) to gross external debt (DGED), suggesting that DEMBI does not Granger cause DGED

[4] Although one lag offered by different information criteria, I choose four lags suggested by Akaike's Information Criterion (AIC) for the VAR model with gross external debt (GED). Otherwise, variables would not be normally distributed. I also choose four lags for the VAR with primary budget balance (SMPBS) to provide consistency between the two models.

due to the significance (p<5%). It specifically implies that increases or decreases in the ratio of the gross external debt over GDP may simply be explained by the past values of the government bond spreads. Thus, the collective expression of the risk factors apparently explains a great part of the changes in the ratio of gross external debt over GDP in the short run. Since I first took the difference of some variables before conducting our analysis, the total observation, i.e., the number of quarters, decreased from 55 to 50.

Table 4: Granger Causality Test with Gross External Debt

Null Hypothesis:	Obs	F-Statistic	Prob.
DEMBI does not Granger Cause DGED	50	3.74201	0.0110**
DGED does not Granger Cause DEMBI		1.29550	0.2877

Notes: *; **; *** denotes respectively 10%, 5%, and 1% significance level.

On the other hand, Table 5 below reports that there is a one-way causality from bond spreads (EMBI+) to the primary budget balance as a percentage of GDP (SMPBS), implying that variances in primary budget balance-to-GDP ratio are most likely driven by bond spreads in addition to the effects of certain country-specific factors.

Table 5: Granger Causality Test with Primary Budget Balance

Null Hypothesis:	Obs	F-Statistic	Prob.
DEMBI does not Granger Cause SMPBS	50	2.98456	0.0298**
SMPBS does not Granger Cause DEMBI		0.93256	0.4546

Notes: *; **; *** denotes respectively 10%, 5%, and 1% significance level.

At first blush, it seems that both gross external debt and the primary budget balance in Turkey are driven by bond spreads. However, it is puzzling that bond spreads are the collective expression of various risk factors, so it is rather difficult to know exactly which factor affect the most the fiscal indicators in Turkey. Nevertheless, it should be noted that if fiscal indicators do not granger cause bonds spreads in the short run, it does not necessarily mean that fiscal indicators have no impact on risk premium at all. They would inevitably affect the riskiness of the country over the course of time via credit risk and the probability of default.

To better understand the dynamic relationship between government bond spreads and fiscal indicators, one must look at the effect of a positive shock on other endogenous variables in the model. Figure 1 below shows that when a positive shock is given to the bond spread (DEMBI), the response of the gross external debt-to-GDP ratio (DGED) lasts positively (almost 0.5%) for about four periods, but it only unfolds statistically significant response at the third lag. This is in line with the theory that higher bond spreads would increase interest rates and result in more expensive contracts for new debt issues, which would, in turn, adversely affect the financing of current and future economic activities. Consequently, Turkish government would be in pursuit of new revenue sources to honor higher debt repayments either via higher taxes or new borrowing, which would eventually impede growth and increase the credit risk. This would again lead bond spreads to be higher due to higher perceived risk and create a spiral-up effect. This is, however, in line with the Granger-causality test results, which show the existence of a causality from DEMBI to DGED.

The IRF results also show that when a positive shock is given to the gross external debt-to-GDP ratio (DGED), the bond spread (DEMBI) responds positively (almost 20 basis points) for about four periods but is insignificant for all lags. The positive response, however, is in line with the findings of some previous studies (see, for example, Bellas et al., 2010; Nickel et al., 2011; Heinemann et al., 2014; Dewachter et al., 2015; Garita & Le’on, 2015). This finding also supports the theory that higher government debt would increase bond spreads through a higher probability of default. Since the variables are composite and dynamically related to each other, IRF results may give an idea about to what extent the variables may react to any changes in the VAR model.

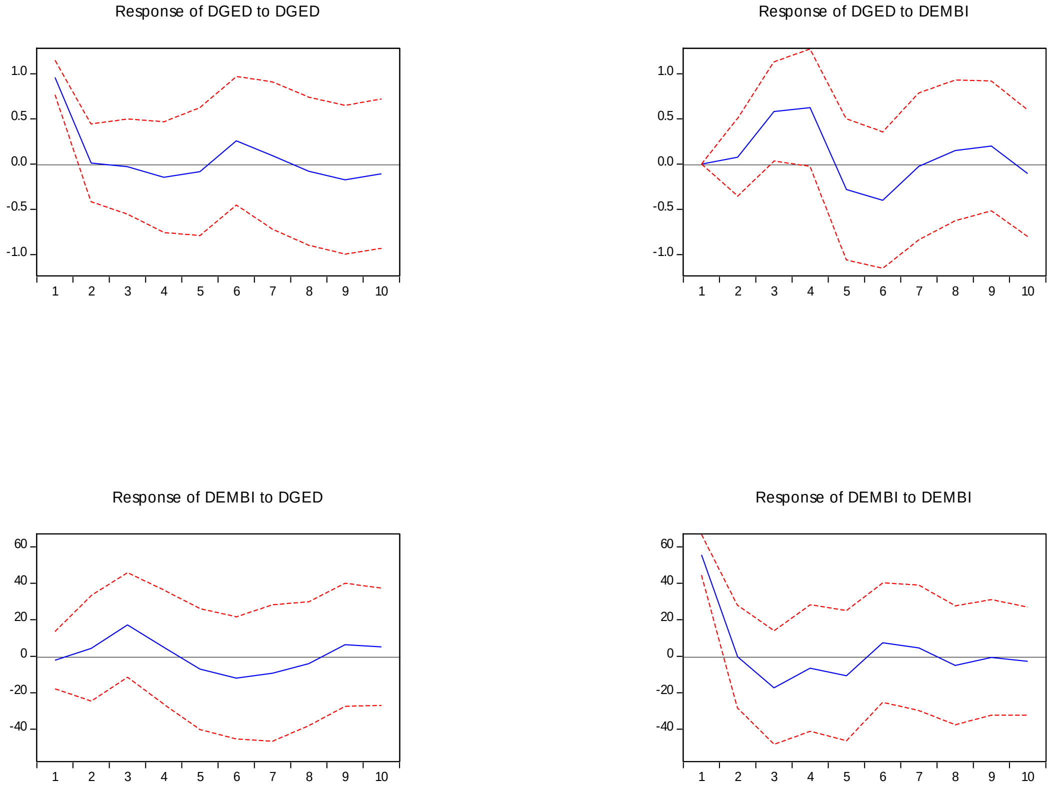

Figure 1: Impulse Response Analysis of the Model with Gross External Debt-to-GDP Ratio

As previously mentioned, the impulse response functions for the primary budget balance-to-GDP ratio (SMPBS) were also performed. To better assess the individual relevance of the fiscal indicators to bond spreads, I separately investigated IRFs for each fiscal variable. As Figure 2 shows, when shock by one standard deviation is given to the bond spread (DEMBI), SMPBS is negative (reaching about -0.2%) for about four periods and statistically insignificant as the confidence lines cover zero for all lags. Higher spreads would be expected to deteriorate the budget balance by creating an extra spending for interest payments, leading up to an undue burden on budget. Ultimately, higher risk premia and increasing cost of economic transactions may dampen overall economic activity and narrow the taxable base, increasing dependency on more expensive foreign sources to finance. But this relationship is not statistically significantly related to the theoretical explanation.

On the other hand, Figure 2 also indicates that the response of DEMBI to a positive shock given to (SMPBS) is negative (reaching about -10 basis points) and insignificant for about two periods. A higher ratio of SMPBS translates into greater discipline that decreases the probability of default in honoring debt service. That is, bonds spreads would decrease with a better performance of the budget management. This is, however, in line with some previous studies reported in the literature (Engen & Hubbard 2004; Baldacci et al., 2008; Gruber & Kamin, 2012). Although the impact of a shock in the primary budget balance is positive, as expected, it is statistically insignificant, which is supported by Ferrucci (2003), Dailami et al. (2008), Bellas et al. (2010), Nickel et al. (2011), and Heinemann et al. (2014). The magnitude of a shock and its significance would differ depending upon the time period in question, the applied method, and the level of development of an individual country or country groups. Even the short and long run analyses would differ from each other in terms of the expected effect of global and macroeconomic fundamentals.

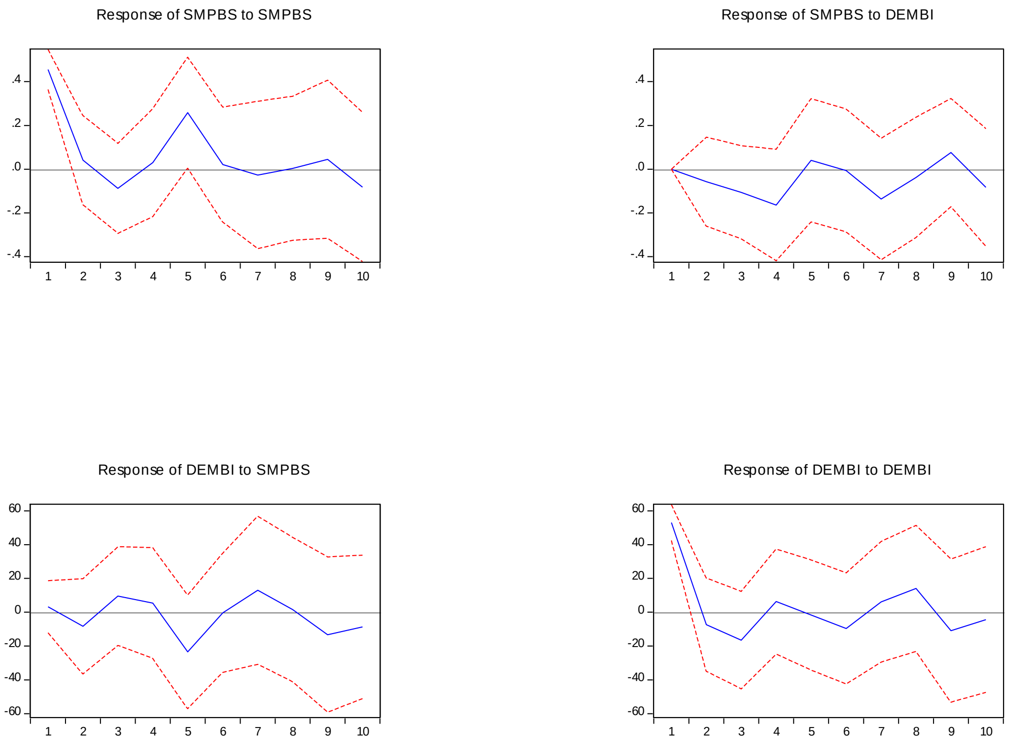

Figure 2: Impulse Response Analysis of the Model with Primary Budget Balance-to-GDP Ratio

The short run evidence presented above indicate that both the ratios of gross external debt and the primary budget balance over GDP are explained by the changes in the risk premium of the country. That is to say, since there is one-way causality from bond spreads to fiscal indicators and a shock given to bond spreads are more consistent and statistically significant in the case of gross external debt, not vice versa, for instance, it seems that Turkey's bond spreads are rather effective in explaining changes in fiscal indicators. However, it is also possible to say that in the short run, Turkey's risk premium is mainly determined by external factors, rather than country-related risk factors, which shows the vulnerability or fragility of the country to external shocks, as shown above. These results draw our attention to the importance of considering the role of fiscal indicators in the medium and long-term towards external shocks. Although extensive research has been carried out on the determinants and importance of bond spreads, no single study exists which adequately points out the use of fiscal indicators in a dynamic context in relieving devastating effects of short run external-related shocks, that is, a big and abrupt increase in bond spreads.

Since the dynamic relationship between bond spreads and fiscal indicators is analyzed, I have only reported IRF results belonging to these variables of interest. The general results of the IRF that include all macroeconomic variables are presented in Appendix 1. As a robustness check, however, 3-month US Treasury bill rate (BILLRT) is replaced with 10-year US Treasury bond rate (TENYR). The empirical findings show that impulse response results have not changed. That is to say, the robustness of the model has been confirmed by substituting one exogenous variable with another in the recursive order (Appendix 2).

5.Conclusion

In this paper, I investigate the dynamic relationship between government bond spreads and fiscal indicators in Turkey during the period 2006:Q1-2019:Q3. To this end, the Vector Autoregressive (VAR) analysis is applied to analyze the dynamic structure between variables of interest by additionally deploying some control variables to make a robust analysis that captures other dynamics that have a possible effect on the model. I also use Granger-causality test to determine both a possible causal relationship and the direction of the causality between variables. Lastly, impulse response functions are used to understand how and in what way each variable in the model responds to a shock. Since the VAR model and impulse response functions are generally used to analyze the short run dynamics of the variables, the long-run analysis is left out of scope of the present study.

The results of this paper show that the ratio of gross external debt over GDP responds positively to a positive shock given to the government bond spreads for four periods, statistically significant only at the third period. This finding is consistent with the result of the Granger-causality tests that suggest a unidirectional causality from the spreads to the gross external debt. This could be explained by the mechanism where higher perceived risk (i.e., shock in EMBI) leads to higher transaction costs, making economic transactions more expensive. This, in turn, may dampen the overall economy by increasing the cost of capital, which is one of the key determinants of the economic activity and investment in the country. On the other hand, the response of bond spreads to a shock given to gross external debt is insignificant but positive for about three periods.

As for the relationship between the primary budget balance and sovereign bond spreads, a positive shock given to sovereign bond spreads seems to deteriorate the balance for about four periods. However, interpretation of this relationship is limited due to the statistically insignificant results. Moreover, the extant literature is not unanimous on whether the changes in the budget balance have a statistically significant impact on risk premiums of countries. Therefore, it seems that statistically different results prove that an analysis utilizing the primary budget balance needs to be interpreted with caution since the differences in the country group, the period investigated, country development level, and country-specific factors might deliver different results.

Overall, the results of the Granger-causality test and impulse response functions show that the ratio of gross external debt over GDP appears to be more sensitive and significant to the changes in bond spreads compared to the ratio of primary budget balance over GDP. That is to say, the composite risk factors and their interaction with the level of external debt seems to be more significant in the short run for Turkey. This may give us a hint as to which fiscal indicator should be used to avoid the ill effects of higher risk premiums leading up to higher borrowing costs. In an environment where higher spreads cause higher external debt, this would lead to an undue burden on the budget, which would make the budget much less flexible and lessen the impact of both fiscal and monetary policies applied. Taken together, these findings suggest a role for fiscal indicators in mitigating the crippling effect of global liquidity changes on the domestic economy in the case of a sudden stop in capital flow or an increase in capital costs due to higher perceived risk and borrowing costs. The resilience of fiscal policy could further help reduce the perceived risk by lowering the probability of default. This eventually turns our attention to strengthening the structure of fiscal fundamentals for our case because countries showing better performance in fiscal policy seem to have lower bond spreads and a better financial structure.

All in all, this analysis has some policy implications for policymakers who are eager to decrease the negative effects of bond spreads in the short run. I propose to use fiscal indicators as a bulwark against the deteriorating effect of a higher debt service in the short run. For this, I further suggest setting up a careful management of expectations that would have a significant impact on lessening the short run effects of external factors. This can be achieved through strategic prioritization of government spending and allocation of economic resources in a way that would increase the resiliency of the economy. On the other hand, the government may also resort to fiscal consolidation to decrease both the ratio of debt and fiscal deficit over GDP, which would make fiscal policy more resilient against sudden external shocks. To succeed them, policies should be supported by an appropriate environment for investment and capital flow, which are highly important for creating fiscal space for the government through insuring short run financing. Considering the composite structure of bond spreads, even if fiscal indicators have no effect on it in the short run, enhancements in the fiscal fundamentals would, at least, reduce the crippling effect of short run shocks.

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Appendix 1. Overall Impulse-Response Results

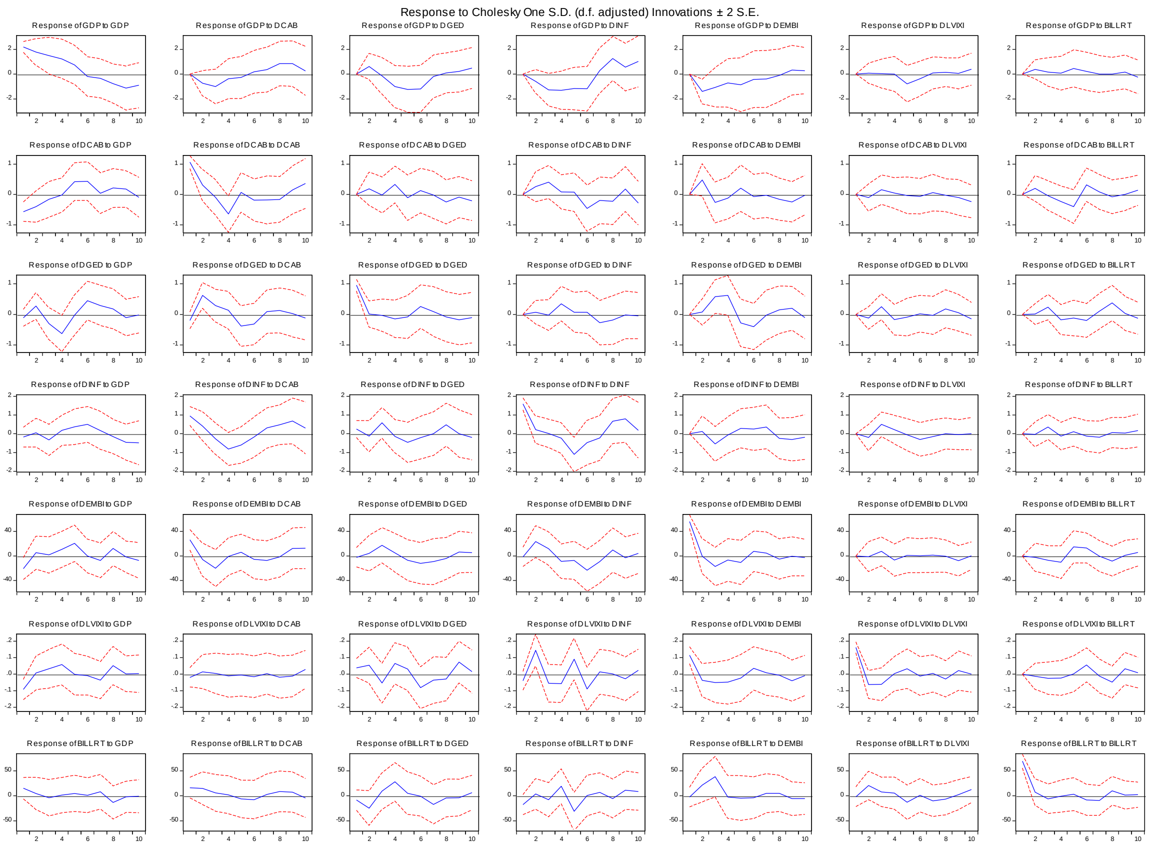

Figure 1.1 Overall Results with Gross External Debt-to-GDP Ratio

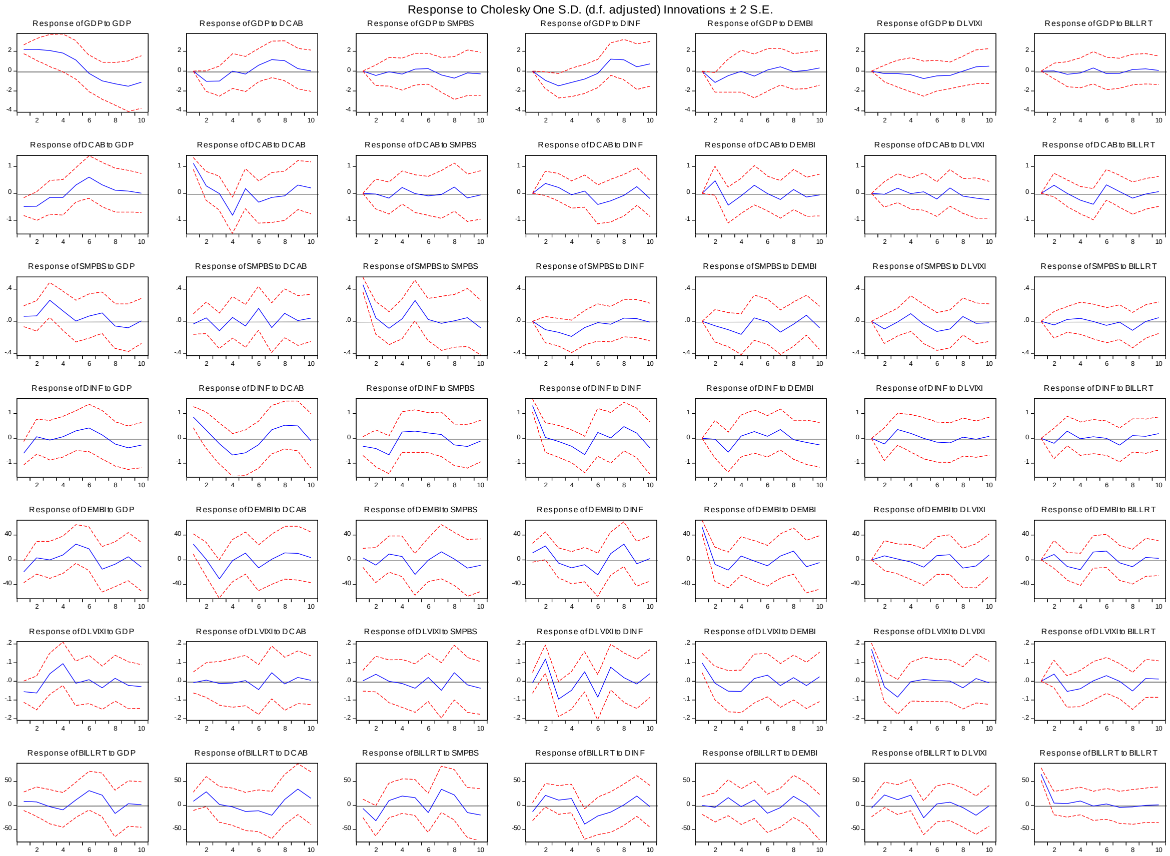

Figure 1.2 Overall Results with Primary Budget Balance-to-GDP Ratio

Appendix 2. The Robustness Check Results

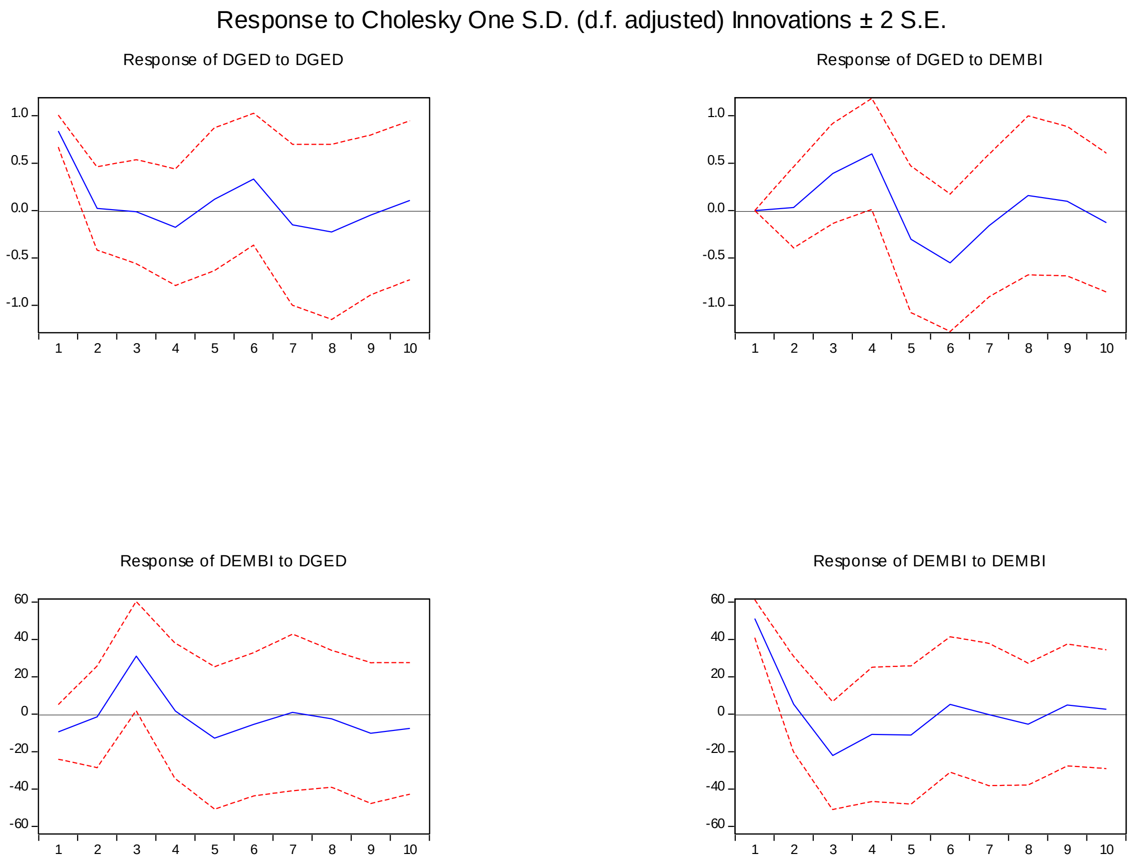

Figure 2.1 Robustness Check of the Model with Gross External Debt-to-GDP Ratio

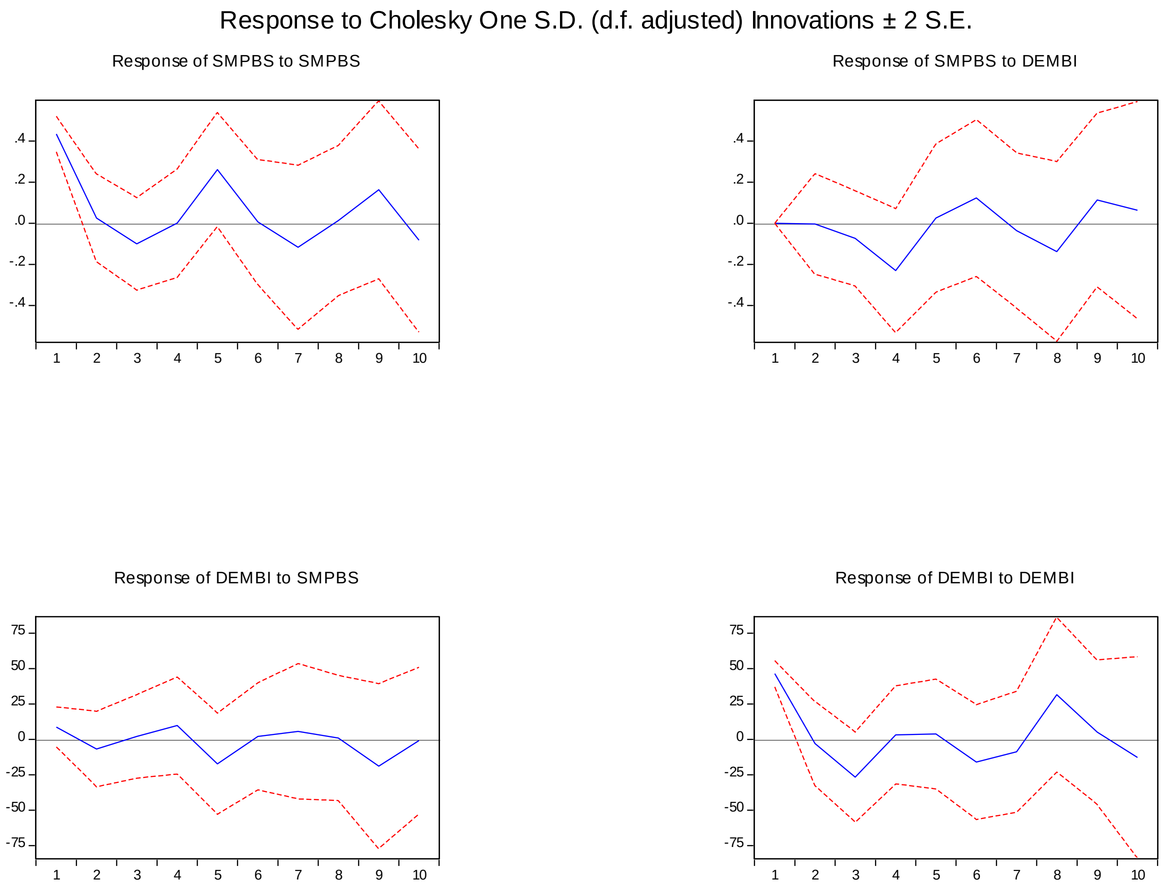

Figure 2.2 Robustness Check of the Model with Primary Budget Balance-to-GDP Ratio