Assessing Fiscal Sustainability in Turkey through Cointegration Analysis with Multiple Structural Breaks

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Abstract

Nowadays, from the viewpoint of the authorities in the realm of monetary and fiscal policy, it is of importance to reach the determined macroeconomic targets; but at the same time, the long-term maintenance of the economic stability environment, which is positively affected by the achievement of these targets, is also important in terms of sustainable macroeconomic balances. In this context, it is possible to say that the concept of fiscal sustainability is both a prerequisite and a consequence of consistent monetary and fiscal policies. Therefore, the phenomenon of fiscal sustainability is of particular importance in terms of continuity of public activities, in countries using the borrowing method in public financing due to the persistence of budget deficits for many years, like Turkey. Due to fiscal policies turning into unsustainable models, it will be inevitable that increasing borrowing costs will adversely affect economic growth and development, in parallel with possible increases in interest rates and risk premiums. The study is focused on the bivariate approach, which is prominent in the literature, to examine fiscal sustainability. According to this perspective, fiscal sustainability is determined by the status of the cointegration between budget revenues and budget expenditures (primary). Accordingly, for the monthly data of the period from January 2001 to November 2019, the stationarity statuses were examined via Kapetanios' (2005) unit root test with multiple structural breaks, and the existence of the cointegration relationship between the series was examined through Maki's (2012) test method with multiple structural breaks. According to the analysis results, it was determined that there was no cointegration relationship between the general budget revenues and the general budget primary expenditures series. In this context, no fiscal sustainability was observed in Turkey in terms of the period studied.

Keywords: Fiscal sustainability, Unit root test with multiple breaks, Cointegration test with multiple breaks, Budget Constraint Approach

JEL Classification: E6, E62

1. Introduction

Today, enabling long-term sustainability has become one of the most significant issues of fiscal policies. Accordingly, it is required to rethink the role of governments in the context of its activities aimed at reducing the active participation of the public in the economy and creating and maintaining a stable environment for the activities of the private sector. In this context, since they are a natural cause of instability, unsustainable policies need to be changed in compliance with economic and political expectations. Looking at the economic events around the world in 1970 and afterward, it is observed that continuous policy changes eliminated the sense of trust regarding the concept of sustainability and numerous stability programs have collapsed due to the negative effect of this insecurity environment on the balance of payments (Budina & Wijnbergen, 2008: 119). Similarly, it is seen that although there were no significant

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financial instabilities, the public's efforts to explicitly or implicitly rescue some companies (operating in the financial sector and having difficulties) from bankruptcy also led stability programs to failure due to the financial pressure it created on off-budget financial obligations (Burnside, 2004: 52).

Based on the approaches of Keynesian policies towards growth and stability, difficulties faced in managing and financing budget deficits caused by the increases in public borrowing as one of the methods applied in funding public investments, especially in terms of developing countries, caused several financial problems. Therefore, the increases in debt stocks due to the increase in public deficits have brought the concept of fiscal sustainability to the center of fiscal policies (Cunado et al., 2004: 511).

Regarding Turkey, an increase is observed in public expenditures, due to several reasons such as duty losses setting the ground for the economic crises faced in the 2000s; salary and wage increases incompatible with overemployment policy and productivity in the public sector; overload in public investment project stock; high cost and inefficiency; rapid increase of deficits due to the distortion of actuarial balances of the Social Security Institutions; unproductive agricultural support policies; and inefficient PEE (public economic enterprises) system. In addition to the above, the total tax collection was inadequate because of the narrow tax base despite the high tax rates, and public revenues fell short of financing public expenditures due to the unfair distribution of the tax burden. As a consequence of these, with the weighted effect of high-interest expenses paid for domestic borrowings applied to meet the mentioned financing deficit, especially the relationship between domestic borrowing real interest rate and GNP growth rate, as well as the ratio of public net debt stock to GNP showed negative progress; therefore, domestic debt dynamics became unsustainable. In these circumstances, following the economic crises experienced in Turkey at the beginning of the 2000s, it was aimed to make the stability permanent through the restructuring of the Turkish economy with "Türkiye'nin Güçlü Ekonomiye Geçiş Programı" (Strengthening the Turkish Economy – Turkey's Transition Program) (TCMB, The Central Bank of the Republic of Turkey, 2001: 1-4).

In the context of the importance of ensuring and maintaining fiscal sustainability; this study aims to determine whether fiscal sustainability was achieved in Turkey concerning the monthly data of the period [2001.01-2019.11] within the framework of the budget constraint approach for general budget primary expenditures and general budget revenues through cointegration analysis with structural breaks.

2. The Concept of Fiscal Sustainability and Approaches

Regarding the concept of fiscal sustainability, it is observed that various perspectives are introduced in the literature:

Marks (2004) noted that ensuring financial capability without the need for any regulations to be made in the income and expenditure policies of governments or the ability to maintain current financial performance in order to comply with budget limits are the main factors of fiscal sustainability. Valderrama (2005: 29-30), on the other hand, explained fiscal sustainability as the ability of governments to pay their debts, as well as maintaining the policy-procedure structure indefinitely. However, it is clear that due to the structural and economic differences between countries, it is not easy to access and maintain an ecosystem that enables the design and implementation of long-term policies and procedures in terms of the effectiveness of regulatory systems.

Abdul and Ostry (2005) associated the concept of fiscal sustainability with public debts; highlighted the importance of putting some constraints on the way primary surpluses are projected when assessing public debt sustainability, and the importance of assessing the

country's historical track record when making predictions for the future. In this context, they stated that primary surplus projections based on historical data would provide a useful benchmark to assess the realism of fiscal forecasts underlying debt sustainability calculations. Therefore, they emphasized that governments' primary surplus projections also covering information on future growth and interest rates, could be used to generate the magnitude of adjustments required to take measures against overborrowing and to return the debt to a sustainable level - together with all relevant institutions, policies, and reliable reform programs where necessary.

Celasun et al., (2007) discussed fiscal sustainability in the context of fiscal behaviors, shocks facing the economy, and especially the role of public debt in shaping the fiscal risk profile due to fiscal policy. The intertemporal budget constraint and the relationship between the primary balance and the public debts were stated to be at the center of the literature in the context of the sustainability of debts. In terms of public debt, a sustainable position is often viewed as one where the government (or public sector) has solvency. Therefore, concerning solvency, the present value of government disbursements (including debt amortization, interest payments, and non-interest expenditures) should not exceed the present value of public revenues or, equivalently, the present value of future net revenues of the non-interest expenses (the primary balances) should at least surpass the current public debt.

According to the EU (2015), fiscal sustainability is employed to assess how long the current fiscal policy can support the state budget without any problems. In this context, the fiscal gap concept was referred to as an indicator of the long-term sustainability of public finances. The fiscal gap arises from the intertemporal budget constraint linking flows of budget expenditures and revenues collected over the decades and it is defined as the sum of current government debt and the present value of the future primary deficit flow. In the context of the fiscal gap, the causes of budget imbalances are based on two main elements: increase in public spending, and decrease in public revenues as a result of the negative impact caused by the shrinkage in tax revenues due to the economic recession.

Dabrowski (2015) points to the restriction of budget deficits to 3 percent of GDP in the Fiscal Responsibility Compact of the European Monetary Union's (EMU) Maastricht Treaty and states that this limitation is of great importance for monetary union and fiscal and macroeconomic governance. Kotlikoff (2019: 4-5) on the other hand, emphasizes that the use of the budget deficit to assess fiscal sustainability has a further meaning beyond being a general presumption now that it is incorporated in the Financial Responsibility Compact of the European Monetary Union's Maastricht Treaty.

Khadan and Ruprah (2016) stated that, in fiscal sustainability, the remainder after the interest payments were deducted from the budget deficit, which represented the primary balance required to stabilize the debt ratio, indicated the direction and magnitude of the fiscal arrangements needed. According to Khadan (2019: 3-4), the concept of fiscal sustainability refers to the ability of governments to fulfill the intertemporal budget constraint (IBC). The intertemporal budget constraint is based on the idea that governments guarantee to post sufficient budget surplus in the future to cover the accumulated debt and interest payments associated with fiscal deficits in the current period. In general terms, the present value of current and future cash outflows cannot exceed the present value of the already existing funds and future cash inflows. If the IBC halts in the present value, that is, the current debt levels, it is considered that fiscal policy is sustainable, and future fiscal surpluses in the economy will be compensated by the present value.

According to Allen and Gu (2018), the concept of fiscal sustainability is not only limited to the financial power that governments have at the point of repaying the funds they provide through

borrowing. Besides, the effectiveness of long-term policies set by governments is also connected to the concept of fiscal sustainability. In this sense, a body of policies harmonized and made consistent with all the practices regarding budget constraints has importance in terms of fiscal sustainability. Pradhan (2019: 102) considered fiscal sustainability as the key element of macroeconomic policy research within the context of identifying the sources of risk and vulnerability in a country's fiscal and macrostructure and suggesting appropriate policies to avoid sudden macroeconomic crises. Emphasizing that continuous assessment of fiscal sustainability was essential, it was stated that it was necessary to approach fiscal sustainability multidimensionally by evaluating both theoretical and empirical frameworks together.

3. Econometric Analysis

3.1. Description of the Data

In the study, for the examination of the fiscal sustainability in Turkey, a cointegration analysis of general budget primary expenditures and general budget revenues was performed for monthly data covering the period between January 2001 and November 2019. The data were obtained from the Electronic Data Delivery System of the Central Bank of the Republic of Turkey (TCMB-EVDS), www.tcmb.gov.tr database. The analyses were conducted employing Gaussian codes and EViews version 10.0. The variables in the model are given in Table 1.

Table 1: Description of the Variables Employed in the Analysis

Variable	Indication	Description
General Budget Revenues	GBR	Independent variable
General Budget Primary Expenditures	GBPE	Dependent variable

Below are the graphs showing the course of the variables over time.
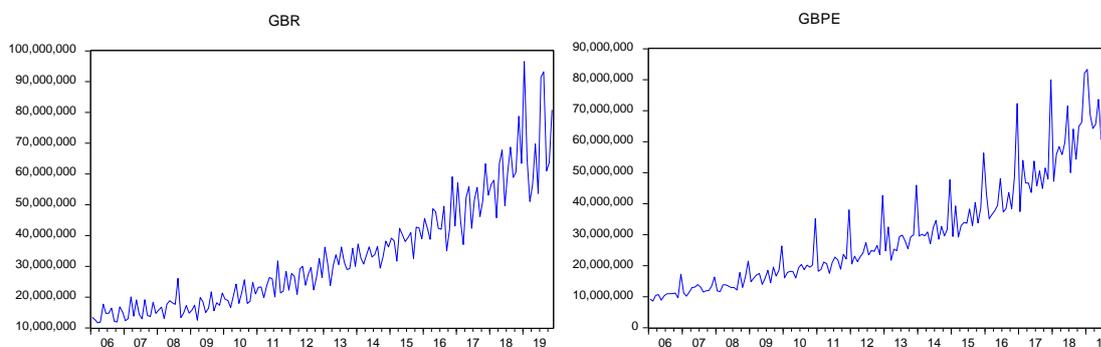
Descriptive statistical information about the variables is presented in Table 2.

Table 2: Descriptive Statistical Information about the Variables Studied

Statistics	GBR	GBPE
Average	33.191.966	31.553.011
Median	29.390.529	26.357.644
Maximum	96.523.290	83.333.700
Minimum	11.641.375	8.597.277
Standard deviation	18.063.855	18.722.174

3.2. Data Analysis and Method

In the study, for the analysis of the fiscal sustainability in Turkey, the stationarities of the series were examined via Kapetanios' (2005) unit root test with multiple structural breaks, and the existence of the cointegration relationship between the series was examined through Maki's (2012) test method with multiple structural breaks.

3.2.1. Kapetanios (2005) Unit Root Test With Multiple Structural Breaks

A time series can be stationary around various deterministic trends in different periods throughout the analysis period. These changes might emerge from the structural differentiations (breaks) that occur in intercept and/or trend. These breaks may be caused by war, peace, natural disasters, terrorist incidents, policy changes, and economic crises. Perron (1989) states that unit root analyses performed without considering these structural breaks might yield erroneous results and diminish the reliability of the test; and, however, in the presence of structural breaks, standard Augmented Dickey-Fuller (ADF) tests tend to fail in rejecting the unit root hypothesis, that is, tend to identify stationary series as non-stationary. Disregarding probable structural breaks in unit root testing causes erroneous results. In the Kapetanios (2005) method, multiple structural breaks are allowed and structural break dates are determined endogenously. The model used in this test is as follows:

$$y_t = a_0 + a_1 t + \beta y_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{m} \varphi_i DU_{i,t} + \sum_{i=1}^{m} N_i DT_{i,t} + \epsilon_t \qquad (3.1.)$$

$$DU_{i,t} = \begin{cases} 1 & t > T_{b,i} \\ 0 & t \leq T_{b,i} \end{cases} \quad ve \quad DT_{i,t} = \begin{cases} t - T_{b,i} & t > T_{b,i} \\ 0 & t \leq T_{b,i} \end{cases} \qquad (3.2)$$

Here, *DU* is the dummy variable that indicates the structural break occurring in the intercept, and *DT* is the dummy variable that shows the structural break in the trend. The null hypothesis of the test is: *"The series is not stationary under structural breaks".* In this test, each period is considered as a potential structural break date; the date indicated by the dummy variable in the model, where the error sum of squares has a minimum value, is regarded as the first break date. As soon as the first break date is added to the model, the next structural break date is investigated. This stage proceeds until m break date and the structural break numbers and dates of the model that gives the minimum *T-* statistic, are reported (Capistrán and Ramos-Francia, 2009: 351).

Table 3: Kapetanios (2005) Unit Root Test Results

Variables	*τ-statistics*	*Critical Values*			*Structural Break Dates*
		1%	*5%*	*10%*	
GBR	-2.362	-5.741	-4.955	-3.752	2009.01, 2010.09, 2014.03, 2016.01, 2018.03
GBPE	-2.886	-5.683	-4.770	-3.618	2009.05, 2010.10, 2014.07, 2015.05, 2018.06
ΔGBR	-9.812*	-6.712	-5.723	-4.392	-
ΔGBPE	-9.374*	-6.505	-5.399	-4.228	-

*Indicates the stationarity of the series at the 0.05 significance level.

The test statistics were acquired by the codes written for the Gauss program. The critical values were obtained with 1.000 iterations utilizing bootstrap. As the test method, the model, which determines the number of structural breaks according to the data set and allows structural breaks in intercept and trend, was selected. To detect the actual structural break points in the series,

only the structural break dates identified in the level values of the series were reported. When the results in Table 3 are examined, it is seen that the series are not stationary at the level, but they become stationary when the first difference is taken, that is, they are stationary. Looking at the structural break dates identified by the test method, it is possible to see the effects of currency fluctuations in 2014, 2016, and 2018, the dates when the impacts of the 2010 financial crisis continued.

3.2.2. Maki (2012) Cointegration Test with Multiple Structural Breaks

Cointegration tests conducted without considering the existence of structural breaks in the cointegration equation may produce outcomes with deviation. Maki (2012) developed a method in which a structural break is determined endogenously, and that allows up to five structural breaks. The null hypothesis of the model is that there is no cointegration between the series. Maki (2012) discussed the cointegration relationship between series under structural breaks by four different models. In the research algorithm of the test, each period is considered as a potential break point, t-statistics are calculated, and the points, where t-ratios are at a minimum, are accepted as the break points. In this method, all the series to be analyzed must be I(1). Maki (2012) developed four different models for testing whether there was a cointegration relationship between the series in the presence of structural breaks. These models are;

Model 0: The model without the trend, in which a break is allowed in the level,

Model 1: The model without the trend, in which a break is allowed in the level and slope,

Model 2: The model with the trend, in which a break is allowed in the level and slope,

Model 3: The model in which a break is allowed in the level, slope, and, trend.

$$Model\ 0: y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \beta x_t + u_t$$

$$Model\ 1: y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + u_t$$

$$Model\ 2: y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \gamma x + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + u_t$$

$$Model\ 3: y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \gamma t + \sum_{i=1}^{k} \gamma_i t K_{i,t} + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + u_t \quad (3.3.)$$

The null hypothesis of the test is as *"There is no cointegration relationship between the series under structural breaks"*. The critical values required to test this hypothesis were calculated by Monte Carlo simulation and are presented in the table below.

Table 4: Maki (2012) Cointegration Test Results

Models	Test Statistic	1%	5%	10%	Break Dates
Model 0	-3.961	-6.823	-5.961	-4.789	2010.01, 2014.08, 2015.02, 2016.09, 2018.01
Model 1	-4.173	-6.565	-5.843	-4.908	2009.10, 2015.07, 2016.09, 2017.06, 2018.02
Model 2	-3.055	-6.449	-5.755	-4.652	2009.09, 2014.01, 2015.01, 2017.03, 2018.01
Model 3	-3.387	-6.125	-5.128	-4.339	2009.04, 2015.04, 2016.02, 2017.09, 2018.03

When the results in Table 4 were examined, it was ascertained that there was no cointegration relationship between the series. Since the test statistic values did not exceed the critical values, the H1 hypothesis indicating that there was no cointegration relationship was accepted. In short, these series did not move together in the long run.

The picture of non-sustainability appearing as a result of this study supports the results of the limited number of academic studies conducted by Göktan (2008), Şen, Sağbaş, and Keskin (2010), and Hepsağ (2011) to investigate the fiscal sustainability of the public sector in Turkey.

4. Conclusion

This study aims to put forward whether fiscal sustainability was achieved in Turkey concerning the monthly data of the period 2001.01-2019.11 within the framework of the budget constraint approach for general budget primary expenditures and general budget revenues through cointegration analysis with structural breaks. In the study, in order to analyze the fiscal sustainability in Turkey, the stationarities of the series were examined via Kapetanios' (2005) unit root test with multiple structural breaks, and the existence of the cointegration relationship between the series was examined through Maki's (2012) test method with multiple structural breaks. As a result of the analysis, it was determined that there was no cointegration relationship between the series. In other words, these series did not move together in the long run, and it was concluded that fiscal sustainability was not achieved in the period studied.

For effective fiscal sustainability in Turkey, above all, it is required to maintain the planned equilibrium between the budget revenues and budget expenditures. In this context, since the future values of public revenues and public spending have importance for fiscal sustainability, efforts should be made for the difference between public revenues and public expenditures to be realized as close to each other as possible. From this standpoint, fiscal policies require to be designed and implemented properly in compliance with the objective of ensuring the effectiveness of public revenues and public expenditures. In terms of public revenues, it is important to reduce the unrecorded economy and to expand the tax base by ensuring a balance between tax discounting, exclusions, and exemptions and direct and indirect taxes. In terms of public expenditures, it is important to finance rational public expenditures, which are both capable of reducing future public expenses and are likely to turn into public revenues in the future. Thus, with a system based on stronger foundations, financial management can have higher maneuverability to protect fiscal sustainability against any negative circumstances that might be encountered during growth and contraction periods of the economies.

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