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ANALYSIS OF FISCAL SUSTAINABILITY IN TÜRKIYE: BOOTSTRAP FOURIER ARDL APPROACH

TÜRKİYE'DE MALİ SÜRDÜRÜLEBİLİRLİĞİN ANALİZİ: BOOTSTRAP FOURIER ARDL YAKLAŞIMI

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ABSTRACT

Fiscal sustainability is one of the most important indicators of whether the public budget is within fiscal discipline. The sustainability of the public budget within the discipline affects many macroeconomic variables, such as inflation, economic growth, and income distribution. In this study, fiscal sustainability, one of the important determinants of macroeconomic factors, has been analysed by the Bootstrap Fourier ARDL cointegration method for the period 2006:01-2021:12 in Türkiye. A long-run cointegration relationship has been found between the variables. After determining the cointegration relationship, the long-run coefficient, short-run coefficient, and error correction model coefficient have been estimated. At a 5% significance level, the long-run coefficient was 0.36, the short-run coefficient was 0.21 and the error correction model coefficient was -0.54. As a result of the empirical findings, fiscal sustainability in Türkiye has been found to be weak in the relevant period.

ÖZ

Mali sürdürülebilirlik konusu kamu bütçesinin mali disiplin içerisinde olup olmadığını gösteren en önemli göstergelerden birisidir. Kamu bütçesinin disiplin içerisinde sürdürülebilir olması enflasyon, ekonomik büyüme ve gelir dağılımı gibi birçok

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makroekonomik değişkeni etkilemektedir. Bu çalışmada, makroekonomik faktörlerin önemli belirleyicilerinden birisi olan mali sürdürülebilirlik konusu Türkiye'de 2006:01-2021:12 döneminde Bootstrap Fourier ARDL eşbütünleşme yöntemiyle incelenmiştir. Değişkenler arasında uzun dönemli eşbütünleşme ilişkisi tespit edilmiştir. Eşbütünleşme ilişkisinin tespit edilmesi sonrasında uzun dönem katsayısı, kısa dönem katsayı ve hata düzeltme modeli katsayısı hesaplanmıştır. %5 anlamlılık düzeyinde uzun dönem katsayısının 0.36, kısa dönem katsayının 0.21 ve hata düzeltme modeli katsayısının -0.54 olduğu tespit edilmiştir. Elde edilen ampirik bulgular neticesinde, Türkiye'de ilgili dönemde mali sürdürülebilirliğin zayıf sürdürülebilirlik olduğu tespit edilmiştir.

Keywords: Fiscal Sustainability, Public Finance, Bootstrap Fourier ARDL, Time Series Analysis

JEL Codes: E60, E62, H10, H20, H30

Anahtar Kelimeler: Mali Sürdürülebilirlik, Kamu Maliyesi, Bootstrap Fourier ARDL, Zaman Serisi Analizi

JEL Kodları: E60, E62, H10, H20, H30

INTRODUCTION

After 1980, the dominant neo-liberal policies in the field of economy narrowed the efficiency and effectiveness of the state, accelerated privatisation, which is the process of transferring public resources to the private sector, and tried to minimise the role of the state in the economy. After 1980, another important development occurred in capital movements. Due to increased competition, capital flows tended to move towards legally reliable countries that had high tax advantages and were politically reliable. This situation led to tax competition among countries, and countries increased tax-related advantages (tax rates, tax exemptions-exemption-discount) to attract capital flows. Tax competition has had the effect of reducing the public revenues of countries. Although the dominant economic view tried to minimise the state in the economy, the increasing needs of societies, technological developments, and new duties imposed on the state in economic growth and development reshaped the role of the state in economic life. The increasing duties of the state led to an increase in public expenditures. Declining public revenues on the one hand and increasing public expenditures on the other have increased the importance of public budget policies. The most important point regarding the sustainability of public budget policies has been the harmony between public revenues and public expenditures. The fact that ordinary public revenues and ordinary public expenditures are close to or equal to each other in terms of amount has been considered within the framework of

fiscal discipline, and the concept of fiscal sustainability has become a frequently discussed issue to ensure resource allocation and efficient and effective use of resources. The concept of fiscal sustainability does not imply that all resources are used effectively and efficiently, but in cases where fiscal sustainability is not achieved, the public sector may reduce efficiency and effectiveness by taxing productive resources to generate additional revenue. For this reason, within the framework of the concept of fiscal sustainability, which is also the subject of this study, it is of great importance to ensure that public revenues are at a level and have continuity to meet public expenditures, and from another perspective, public expenditures can be made in line with public revenues to ensure fiscal sustainability.

Fiscal sustainability is one of the most frequently discussed issues in the economic literature. It is one of the most fundamental factors determining the success of economic policies. Since the public sector is an important economic actor as well as an important policymaker in the economy, the importance of fiscal sustainability increases. Fiscal sustainability refers to the compatibility between public revenues and public expenditures. Ensuring fiscal sustainability also makes the policies of decision-makers sustainable. Failure to ensure fiscal sustainability and the mismatch between revenues and expenditures will adversely affect the budget balance. In this case, it will increase the burden of interest payments on the budget in the short and long term. The increased interest burden will reduce the effectiveness of decision makers in formulating policies and/or maintaining existing policies.

Türkiye is one of the developing countries and has experienced financial crises in the historical process due to various reasons. Especially after 2005, when the negotiations with the European Union (EU) started, it showed a significant performance in terms of harmonisation with the Maastricht criteria and outperformed many member countries with regards to both budget balance and borrowing criteria as part of fiscal criteria. The "Global Economic Crisis" in 2008, the "Debt Crisis" that emerged in some countries in Europe in 2012, and the "Pandemic" process that started with the spread of the Covid-19 virus in 2019 negatively affected Türkiye's public finances. Since fiscal sustainability refers to the long-run equilibrium situation, this study analysed fiscal sustainability in Türkiye for the period 2006:01-2021:12 using the Bootstrap Fourier ARDL method, one of the time series analysis methods. The fact that the Bootstrap

Fourier ARDL method has not been used before in studies analysing fiscal sustainability in Türkiye has been one of the main motivations for this study. In the first part of the study, the concept of fiscal sustainability was analysed theoretically. In the second part of the study, the studies in the literature on fiscal sustainability were included. In the third section of the study, methodology, data, and econometric analysis results were included. In the last section, a conclusion and discussion were given.

1. FISCAL SUSTAINABILITY

The concept of fiscal sustainability refers to long-term fiscal stabilisation. Fiscal sustainability depends on the solvency of debts and the conditions for a return to fiscal balance to prevent short-term fiscal imbalances from affecting fiscal sustainability. That is, short-term fiscal shocks are likely to occur within fiscal sustainability. Therefore, in the analysis of fiscal sustainability, stationarity and cointegration analyses were performed by considering the long-run (Bystrov & Mackiewicz, 2020, p. 438).

Studies on fiscal sustainability started with Hamilton & Flavin (1986) and were developed by Trehan & Walsh (1988), Hakkio & Rush (1991), and Quintos (1995) and pioneered many applied studies in the literature. Hamilton & Flavin (1986) analysed fiscal sustainability for the first time with the intertemporal borrowing constraint (IBC) method. According to the IBC, the sustainability of budgetary policies, i.e., the expected present value of the future debt stock, requires convergence to "0". The two most important indicators of fiscal sustainability are the primary balance and the public debt stock level (Bui, Fiscal Sustainability in Developing Asia – New Evidence from the Panel Correlated Common Effect Model, 2020, p. 66). Hamilton & Flavin (1986) analysed fiscal sustainability with the stationarity analysis method based on the budget constraint (present value constraint of the budget) approach. In the budget constraint approach, the stationarity of the series of real deficit variables, including the budget deficit, debt stock, discounted value of debt stock, and real interest payments, are tested. (Wilcox, 1989) and (Kremers, 1989) extended the study of (Hamilton & Flavin, 1986). (Hakkio & Rush, 1991) investigated the sustainability of budget deficits by applying cointegration tests. In this context, the existence of a long-run relationship between public revenues and public expenditures, including interest payments is analysed with the help of cointegration tests. The dynamic budget constraint developed by (Hakkio & Rush, 1991: 430) is given by the following equation:

$$G_t + (1 + i_t)B_{t-1} = R_t + B_t \qquad (1)$$

In the formula, : public expenditures (purchases of goods and services, transfer expenditures) at time t,: : public revenues, : public debts and : interest rates. Under budget constraints, the equation was solved as follows (Hakkio & Rush, 1991, p. 431):

$$B_0 = \sum_{t=1}^{\infty} r_t\,(R_t - G_t) + \lim_{n \to \infty} r_n\, B_n \qquad (2)$$

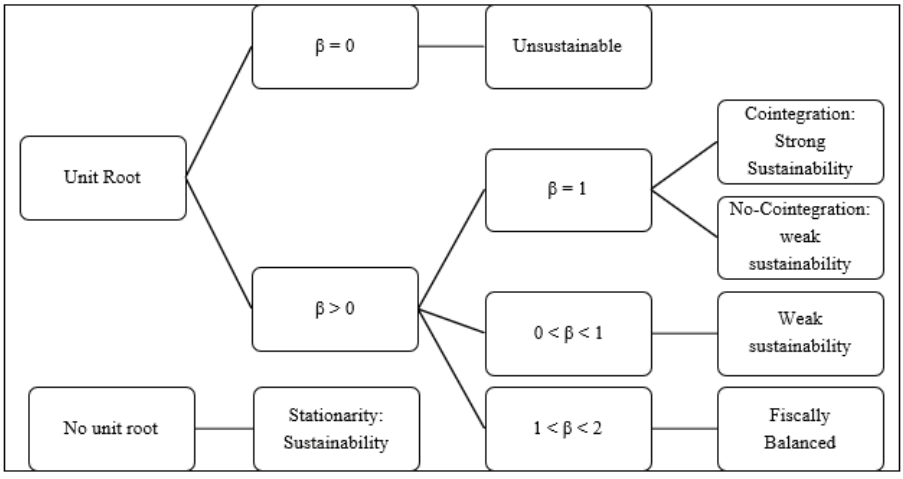
In the equation, and . In order to ensure the sustainability of the intertemporal budget constraint, the limit term in Equation 2 should be "0". This constraint assumes that the public sector borrows new debt to finance budget deficits and requires that the public debt stock be equal to the value of primary budget revenues in the current period. (Hakkio & Rush, 1991, p. 432), assuming an interest rate, transformed Equation 1 into a testable form as follows:

$$R_t = \alpha + \beta G_t + \varepsilon_t \qquad (3)$$

In Equation 3, R_t: public revenues, G_t: public expenditures, including interest payments on past public debt, ε_t: stationary error term. (Hakkio & Rush, 1991, p. 433) stated that fiscal sustainability depends on β=1 condition that and are cointegrated. When $\beta < 1$, i.e., when it is not cointegrated, budget deficits cannot be sustained. (Quintos, 1995, s. 410) defines $0 < \beta < 1$ as weak sustainability.

Overall, the fiscal sustainability analysis can be summarised in Figure 1.

Figure 1: Test Conditions for Fiscal Sustainability

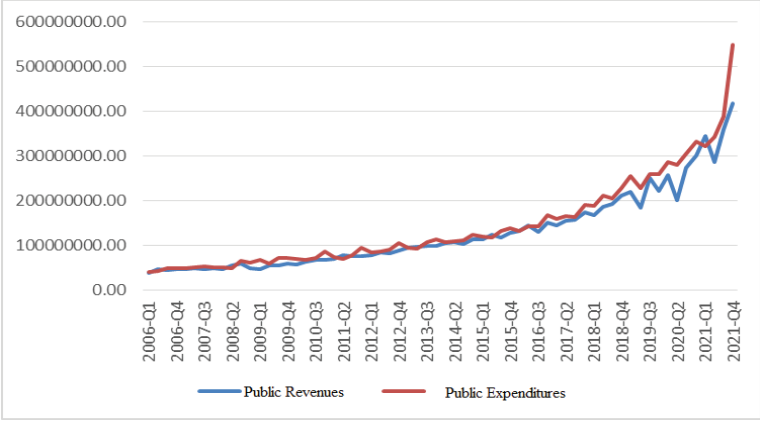


Source: Ji, Ahn & Chapman (2016: 3072).

2. PUBLIC REVENUES AND PUBLIC EXPENDITURES İN TÜRKİYE (2006-2021)

Public revenues and public expenditures in Türkiye are presented in Figure 2. Public revenues and public expenditures in Türkiye are constantly increasing in terms of amount. This increase is a seeming increase in general, and the main reason for this increase is that Türkiye is in an inflationary economic structure. However, during periods of economic crisis and the Covid-19 pandemic, public expenditures, and public revenues exhibit movements different from the average increase/decrease trend. Figure 2 shows that public revenues decreased and public expenditures increased during the 2008 global crisis. In 2020, when the Covid-19 pandemic was experienced, it can be seen that there was a decrease in public revenues and an increase in public expenditures.

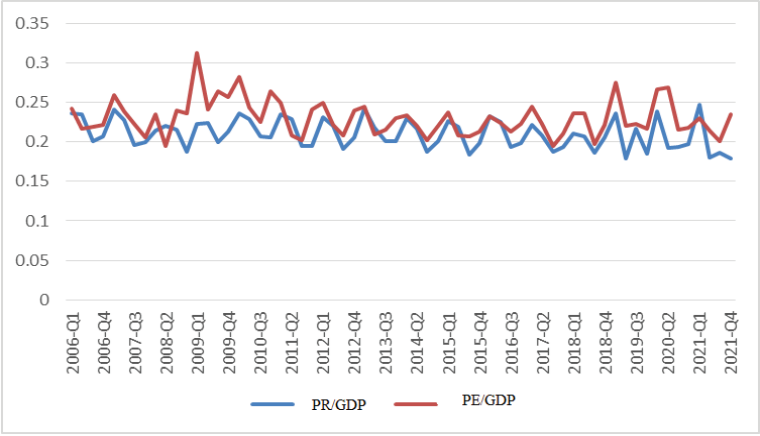
Figure 2: Public Revenues and Public Expenditures in Türkiye (Thousand TL)



Source: (EVDS, 2022)

Analysing the share of public revenues and public expenditures in gross national product will provide clearer information on the trend of public revenues and public expenditures. For this purpose, the share of public revenues and public expenditures in gross domestic product is presented in Figure 3.

Figure 3: Share of Public Revenues and Public Expenditures in GDP (%)

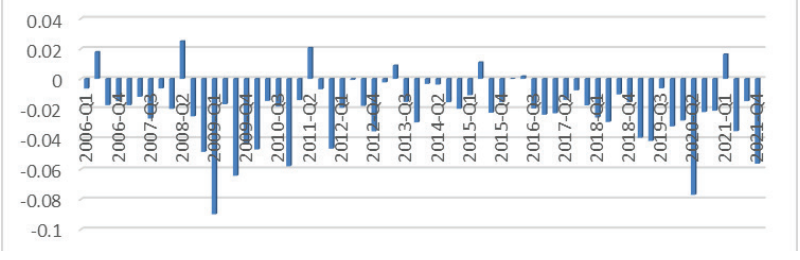


Source: EVDS (2022).

When the share of public revenues in gross domestic product was analysed, it was observed that the highest rate was 23%, the lowest rate was 20%, and the average rate in the related period was 20%. When the share of public expenditures in gross domestic product was analysed, it was seen that the highest rate was 31%, the lowest rate was 19%, and the average rate in the related period was 23%.

As can be seen from Figure 2 and Figure 3, public revenues were insufficient to finance public expenditures for many years in the 2006-2021 period in Türkiye, resulting in budget deficits. The share of budget deficits in gross domestic product is presented in Figure 4.

Figure 4: Budget Deficits/Gross Domestic Product (%)



Source: EVDS (2022).

In the 2006-2021 period, budget deficits were generally recorded, and the budget deficit principle set out in the Maastricht[2] criteria of the European Union was generally met. In 2009, budget deficits increased due to the economic crisis, and in 2020, budget deficits increased due to the Covid-19 pandemic.

3. LITERATURE REVIEW

There are many empirical studies on fiscal sustainability in the literature using different econometric analysis methods. While some studies conducted analyses by using co-integration tests for time series and panel data analysis based on the method proposed by (Hakkio & Rush, 1991) and (Quintos, 1995), others conducted unit root test analyses by considering the method proposed by (Hamilton & Flavin, 1986).

After investigating the studies, taking into account the (Hakkio & Rush, 1991) and (Quintos, 1995) methods, (Göktaş, 2008) analysed the 1987:1-2007:3 period and found that budget deficits were weakly sustainable, while (Göktan, 2008) found that debt was not fiscally sustainable in the 1999:Q1-2006:Q4 period. Two different analyses were performed by (Aslan, 2009) monthly for the period 2006:01-2009:06 and annually for the period 1980-2005 and the monthly analysis revealed that the budget deficit was sustainable, while the annual analysis revealed a weak form of sustainability. (Adedeji & Thornton, 2010) analysed five Asian countries (India, Pakistan, Philippines, Sri Lanka, and Thailand) for the period 1974-2001 and found that all countries have weak sustainability. (Gabriel & Sangduan, 2010) analysed the period 1975-2005 for the countries of the Bahamas, Finland, France, South Africa, Thailand, and the United States of America (USA) and found that fiscal sustainability has strong form in all countries. (Arısoy & Ünlükaplan, 2010) found that there is no fiscal sustainability as a result of their analyses by taking into account the structural breaks in the 1950-2009 period. (Göçer, 2013) analysed 25 OECD countries, including Türkiye, in the 2000-2011 period and found that fiscal sustainability was weak in the long run. (Şen, Sağbaş, & Keskin, 2010) found out that there was no fiscal sustainability in their analysis with cointegration analyses for the period 1975-2007. In their analyses for the period 1987:01-2010:12 in Türkiye, the weak form of fiscal sustainability was found by (Peker & Göçer, 2012). In addition, in

2- The European Union Maastricht criteria stipulated that the ratio of budget deficits to gross domestic product was required 3 per cent per annum.

the analyses for three sub-periods, it was found that fiscal sustainability was weakly sustainable in the periods 1987:01-1994:03 and 1994:04-2001:01, and strongly sustainable in the period 2001:02-2010:12. (Akanbi, 2015) found that fiscal sustainability in Nigeria in the period 1970-2011 depends on oil revenues and that there is no fiscal sustainability in the absence of oil revenues. In the analysis conducted for the period 1980-2012 in 14 OECD countries, including Türkiye; (İlgün, 2016) found that Türkiye, Switzerland, Canada, Ireland, and Norway had weak fiscal sustainability. (Emirkadı, 2017) found that there was weak sustainability in Türkiye in the period 2004:01-2015:12. (Ji, Ahn, & Chapman, 2016) analysed 610 counties and 671 municipalities in the USA for the period 1970-2006 and found that there are different levels of fiscal sustainability for counties and municipalities. (Akkoç & Kargın Akkoç, 2017) analysed the period 2006:1-2017:3 in Türkiye using the quantile regression method and found that fiscal sustainability was in weak form. (Akkuş & Durmaz, 2019) analysed Türkiye's fiscal sustainability in the period 1930-2016 using the hidden cointegration method and FMOLS, DOLS and CCR methods for long-run coefficient estimation and found that fiscal sustainability was in weak form. (Al, 2019) analysed the 1980-2018 period in Türkiye and found that fiscal sustainability was in weak form. (Göçer & Aslan, 2020), using monthly data for the period 2006:01-2019:11, found that fiscal sustainability in Türkiye was in strong form. (Magazzino, Brady, & Forte, 2019) found that there was no fiscal sustainability in their analysis for G-7 countries in the 1980-2015 period. (Bui, 2020) analysed 22 Asian developing countries for the period 1999-2017 and found that there was no fiscal sustainability in these countries. (Akram & Rath, 2021) analysed the 1997:Q1-2013:Q3 period for India and found that there was fiscal sustainability except for the Asian crisis and the 2008 Global crisis periods.

After investigating the studies taking into account the method of (Hamilton & Flavin, 1986), (Hiroshi, 2008) analysed G-7 countries with non-linear unit root tests and found that countries other than Japan have fiscal sustainability. (Ceylan, 2010) found that there was no fiscal sustainability in the analysis conducted with linear unit root tests in the 1975-2008 period, while there was fiscal sustainability in the analysis conducted with non-linear unit root tests taking into account structural breaks. (Şen, Sağbaş, & Keskin, 2010) analysed the 1975-2007 period with traditional unit root tests and found that there was no fiscal sustainability. (Ersin, 2011) analysed the period 1985:01-2008:10 using non-linear time series methods and found that fiscal sustainability was

constrained. (Byrne, Fiess, & MacDonald, 2011) examined the fiscal sustainability of 15 industrialised countries for the period 1978-2005 and 27 developing countries, including Türkiye, for the period 1990-2005 and found that the long-term fiscal sustainability of both industrialised and developing countries varied depending on the level of global liquidity as a result of econometric analyses. (Hepsağ, 2011) analysed the fiscal sustainability in Türkiye for the period 1990:1-2008:4 using unit root tests with structural breaks and found that there was no fiscal sustainability. (Çınar & Özçalık, 2014) analysed the fiscal sustainability of eight developing countries, including Türkiye, between 1980-2010. In the study, it was found that fiscal sustainability was absent in eight countries. (Karatay Gögül, 2016) found that Türkiye had fiscal sustainability in the 2002:Q1-2015Q3 period. (Altun, 2017) analysed the period 1950-2015 with linear and non-linear tests and found that Türkiye has fiscal sustainability.

4. METHOD, DATA AND ANALYSIS

In this section of the study, the methodology used in the econometric analysis, the series of variables, and the results of the econometric analysis are presented.

4.1. Method

In the econometric methodology of the study, the Augmented Dickey-Fuller (ADF) unit root test developed by (Dickey & Fuller, 1979), the Fourier ADF unit root test extended with Fourier functions by (Enders & Junsoo, 2012) and the Fourier ADF unit root test first developed by (Pesaran, Shin, The Fourier Autoregressive Distributed Lagged (FARDL) model developed by (Yılancı, Bozok, & Gorus, 2020) by incorporating Fourier functions into the Autoregressive Distributed Lagged (ARDL) model developed by (Yilanci, Bozok, & Smith, 2001) were utilised. In general, the ARDL test was preferred because it allowed variables to be stationary at different levels, to be used with small samples and to test the long-run cointegration relationship (Yılancı, Cutcu, & Cayir, 2022).

In this study, equation no. 4 was taken into account to analyse the long-run relationship between public revenues "pr" and public expenditures "pe" variables for the analysis of fiscal sustainability:

$$pr_t = \beta_0 + \beta_1 pe_t + \mu_t \qquad (4)$$

In equation 4, "pr" is the dependent variable and "pe" is the independent variable. The relationship in this model can be expressed as in equation 5 using the ARDL test approach developed by (Pesaran, Shin, & Smith, 2001):

$$pr_t = \beta_0 + \beta_1 pr_{t-1} + \beta_2 pe_{t-1} + \sum_{i=1}^{p-1} \delta_i' \Delta pr_{t-i} + \sum_{i=1}^{p-1} \varphi_i' \Delta pe_{t-i} + \varepsilon_t \quad (5)$$

If Equation 5 is rewritten by including the error correction model, it can be shown as Equation 6:

$$pr_t = \beta_0 + \beta_1 pr_{t-1} + \beta_2 EC_{t-1} + \beta_3 pe_{t-1} + \sum_{i=1}^{p-1} \delta_i' \Delta pr_{t-i} + \sum_{i=1}^{p-1} \lambda_i' \Delta EC_{t-i} + \sum_{i=1}^{p-1} \varphi_i' \Delta pe_{t-i} + \varepsilon_t \quad (6)$$

denotes an independent and identically distributed error term with finite variance and zero mean. Δ and p denote the first difference operator and lag length. The optimal lag length is determined by considering the Akaike Information Criteria (AIC). The existence of a long-run relationship in the ARDL model depends on the rejection of the main and hypotheses. F-test (F_A) and t-test (t) are used to test the main hypotheses (Pesaran, Shin, & Smith, 2001; Yılancı, Bozok, & Gorus, 2020).

(McNown, Sam, & Goh, 2018) suggest the use of an additional F-test (F_B) to complement the existing tests of (Pesaran, Shin, & Smith, 2001). The hypothesis of this test is as follows:

$$H_{0C} = \beta_2 = \beta_3 = 0 \quad (7)$$

In Equation 6 and Equation 7 above, the lagged values of dependent and independent variables, the lagged value of the dependent variable and the lagged value of the independent variable are tested, respectively. According to the results of F_A, F_B, and t-tests, four different situations emerge (Yılancı, Bozok, & Gorus, 2020, p. 5):

i. If the results of F_A, F_B and t-tests are significant, cointegration relationship exists.

ii. If the results of F_A, F_B and t-tests are insignificant, there is no cointegration relationship.

iii. If F_A and F_B are significant and the t-test result is insignificant, the first degenerate state is in question.

iv. If F_A and t-test are significant and F_B is insignificant, the second degenerate state is in question.

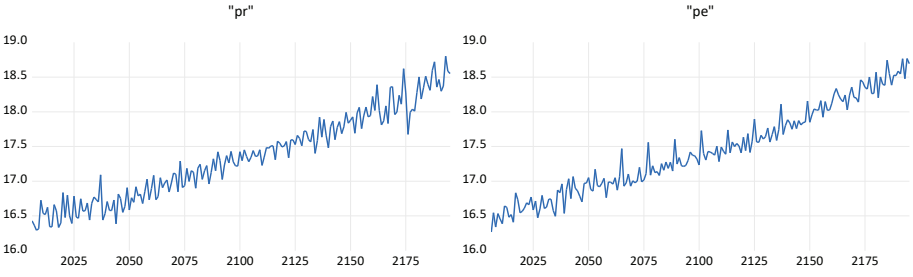
Degenerate states imply that there is no long-run cointegration relationship between the variables, the Fourier ARDL (FARDL) form, extended by (Yılancı, Bozok, & Gorus, 2020, p. 6) by including the Fourier function, is shown as follows:

$$pr_t = \beta_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 cos\left(\frac{2\pi kt}{T}\right) + \beta_1 pr_{t-1} + \beta_2 EC_{t-1} + \beta_3 pe_{t-1} + \sum_{i=1}^{p-1} \delta_i' \Delta pr_{t-i} + \sum_{i=1}^{p-1} \lambda_i' \Delta EC_{t-i} + \sum_{i=1}^{p-1} \varphi_i' \Delta pe_{t-i} + \varepsilon_t \quad (8)$$

The model in Equation 8 is estimated by selecting the value of "k" that minimises the sum of least squares [k=(0.1,0.2,.....,5)]. Critical values for F_A, F_B and t-tests are obtained through bootstrap simulation (Yılancı, Bozok, & Gorus, 2020, pp. 6).

In the analysis part of the study, the cointegration relationship between the dependent variable total budget revenues (pr) and the independent variable total budget expenditures (pe) is analysed using monthly data for the period 2006:01-2021:12 in Türkiye by taking into account the methodology used by (Hakkio & Rush, 1991) and (Quintos, 1995). The data sets of the variables were obtained from the Electronic Data Distribution System of the Central Bank of the Republic of Türkiye. In the analysis, the logarithm of the series belonging to the variables was taken and then seasonal adjustment was made with the Tramo-Seats method to remove seasonal effects since the series are monthly data. The series of the variables are presented in Figure 2.

Figure 2: Series of Variables



In the analysis part of the study, firstly, it was tested whether the series were stationary with the Augmented Dickey-Fuller (ADF) test, one of the traditional unit root tests. Table 1 presents the results of the ADF unit root test.

Table 1: ADF Unit Root Test Results

Variable		ADF	
		Fixed-Trend	**Fixed**
"pr"		-0.272392	2.623888
"Δpr"		-8.644344	-8.088648
"pe"		1.561129	3.406404
"Δpe"		-10.25240	-9.523263
Critical Values	**1%**	-4,009849	-3.466786
	5%	-3.434984	-2.877453
	10%	-3.141481	-2.575332

According to the results of the ADF unit root test, it is seen from the results in Table 1 that the series are non-stationary at the level and stationary when the first differences are taken. In addition to the conventional unit root test, the Fourier ADF (FADF) test developed by (Enders & Lee, the Flexible Fourier Form and Dickey-Fuller Type Unit Root Tests, 2012) were also utilised. Table 2 presents the results of the FADF unit root test.

Table 2: FADF Unit Root Test Results

Variable	F-Statistics	MinKKT	Frequency Value (k)	FADF t-statistic
"pr"	73.10093	4.535640	1	-0.597917
"Δpr"	0.807486	7.302027	3	-6.133742*
"pe"	56.42168	3.291078	1	-2.013983
"Δpe"	1.914313	5.217690	5	-7.578807*

Note: The critical values of the Fourier ADF unit root test for the model with constant and trend are -4.87, -4.31 and -4.02 for frequency value (k)=1 for 1%, 5% and 10% values, respectively. The critical values of the Fourier ADF unit root test for the model with constant and trend are -4.38, -3.77 and -3.43 for frequency value (k)=3 at 1%, 5% and 10%, respectively. Fourier ADF unit root test critical values are -4.18, -3.56 and -3.24 for the model with constant and trend for frequency value (k)=5 at 1%, 5% and 10%, respectively. The critical values for the F test used to test the significance of the trigonometric terms are 11.70, 8.88 and 7.62 for the model with constant and trend at 1%, 5% and 10% levels, respectively.

According to the results in Table 2, it is seen that the "pr" and "pe" variables are units rooted at the level. It is seen in Table 2 that the FADF t-statistics at the level of the variables are smaller than the critical values stated by (Enders & Lee, The Flexible Fourier Form and Dickey-Fuller Type Unit Root Tests, 2012). This indicates that the series are unit rooted. If the significance of the trigonometric coefficients is examined for the significance of the Fourier terms, since the estimated F-statistic is greater than the critical values specified by (Enders & Lee, The Flexible Fourier Form and Dickey-Fuller Type Unit Root Tests, 2012) for the trigonometric coefficients, it is statistically determined at the 1% significance level that the trigonometric coefficients are significant and therefore the Fourier terms are significant.

According to both the conventional ADF unit root test and the FADF unit root test based on the Fourier approach, the "pr" and "pe" series are I (1). After determining that the series are I (1), the Fourier ARDL test was applied to determine the long-run relationship between the variables.

Table 3: Fourier ARDL Test Results

			Bootstrap Critical Values				Bootstrap Critical Values				Bootstrap Critical Values		
Frequency	**AIC**	**F_A**	**0.9**	**0.95**	**0.99**	**t-ist**	**0.9**	**0.95**	**0.99**	**F_B**	**0.9**	**0.95**	**0.99**
3	-0.85	11.41	7.49	8.66	11.10	-4.61	-3.70	-3.99	-4.50	4.73	-1.05	-0.65	0.39

"F_A", "t-ist" and "F_B" statistics are estimated in Fourier ARDL cointegration results. The F_A test statistic is used to test the significance of the dependent and independent variables in the model, the "t-ist" test statistic is used to test the significance of the lagged value of the dependent variable and the F_B test statistic is used to test the significance of the lagged value of the independent variable. In order for there to be cointegration, all three test statistics should be greater than the Bootstrap critical values in absolute value. When the test results in Table 3 were analysed, it was found that the frequency value was 3. " F_A ", "t-ist" and " F_B" test statistics are greater than the bootstrap critical values at a 5% significance level. This shows that there is a cointegration relationship between the variables.

The detection of the cointegration relationship between "pr" and "pe" variables indicates that there is fiscal sustainability. In order to determine whether fiscal sustainability is weak or strong, the long-run coefficient should be analysed. Accordingly, the long-run coefficients are presented in Table 4.

Table 4: Fourier ARDL Model Long-Run Coefficient Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
"pe"	0.36	0.10	3.55	0.0005
"c"	10.41	1.81	5.72	0.0000

According to the results in Table 4, the long-run coefficient is estimated as 0.36. A coefficient of $0<\beta<1$ indicates that fiscal sustainability is weak in the relevant period.

Table 5: Fourier ARDL Short Run and Error Correction Model Coefficient Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
"pe"	0.21	0.07	2.86	0.0047
ECM	-0.54	0.09	-5.69	0.0000

Table 5 presents the Fourier ARDL short-run coefficient and error correction model (ECM) coefficient. A short-run coefficient smaller than 1 indicates that fiscal sustainability is not strong in the short run. The fact that the coefficient of the error correction model is negative and statistically significant indicates that the error correction model works. It shows that the deviations that occur in the short run between the variables that move together in the long run are rebalanced in the long run. The error correction model shows that the long-run analysis is reliable.

5. ANALYSIS OF EMPIRICAL RESULTS

In the study analysing fiscal sustainability in Türkiye for the period 2006:01-2021:12 based on the methodology developed by (Hakkio & Rush, 1991) and (Quintos, 1995), the stationarity of the variables was tested with the ADF unit root test and Fourier ADF unit root test, which are the traditional unit root tests, and according to the results of both tests, the variables were found to be stationary at the first order. After determining that the variables are stationary at the first degree, the cointegration relationship between the variables was examined with the Fourier ARDL method, and according to the test result, a long-run cointegration relationship was found between the variables. In the next stage, the long-run coefficient, short-run coefficient, and error correction term coefficient were estimated. The long-run coefficient and the short-run coefficient are statistically significant at a 5% significance level

and the coefficient value is between 0 and 1 ($0<\beta<1$). Since this situation is defined as weak sustainability according to (Quintos, 1995), it can be said that fiscal sustainability in Türkiye in the relevant period is "weak sustainability". The findings are similar to those in the fiscal sustainability literature (Göktaş, 2008), (Göktan, 2008), (Aslan, 2009), (Göçer, 2013), (İlgün, 2016), (Emirkadı, 2017), (Akkoç & Kargın Akkoç, 2017) and (Al, 2019). As stated in the literature section, the related studies have also found that fiscal sustainability in Türkiye is weak.

RESULT

According to the empirical findings, fiscal sustainability was found to be weak in Türkiye during the period 2006:01-2021:12. This result can be explained by the fact that the public budget in Türkiye has been continuously running a budget deficit over the years and this situation has been tried to be managed by borrowing policies. The increase in the deficit in the public budget, especially during the pandemic and economic crisis periods, has caused sharp breaks in the fiscal discipline of Türkiye, which has weak fiscal sustainability. Public budget deficits may also lead to structural problems, such as twin deficits and/or triple deficits with the deterioration in economic conditions over time. Continuous borrowing by the public sector due to budget deficits may create pressure on both the transfer of savings to the public sector and interest rates. Therefore, public expenditure policies that lead to budget deficits should be reviewed by public decision-makers.

In order to strengthen its fiscal sustainability, Türkiye should first expand its fiscal space by controlling public expenditures. Inefficient public expenditures should be reviewed, and austerity measures should be implemented in a strict and controlled manner. The fiscal purpose of taxation should be realised by increasing public revenues. In addition, public revenues should be stabilised by preventing tax losses and evasions by combating the informal economy. Since Türkiye runs a budget deficit, it should ensure fiscal discipline, and monetary policies should contribute to fiscal discipline. The change in fiscal sustainability from weak to strong in the long run will have positive effects on specific macroeconomic variables, and this positive change will help political decision-makers gain political power. By ensuring fiscal sustainability, it may be easier for policymakers to take measures in

extraordinary situations, such as economic crisis and Covid-19. The financial effects of the decisions taken can be eliminated more easily in future periods. In cases of weak fiscal sustainability, policymakers may have difficulty making decisions.

As a result, all countries try to meet public expenditures with public revenues, but for various reasons, they cannot meet public expenditures with public revenues. While the increase in the burden of public duties due to the development of societies increases public expenditures, the public revenues of countries decrease due to reasons such as tax competition and tax exemption-reduction-exemptions. This situation causes budget deficits at the initial stage, and extraordinary developments also widen budget deficits. In this context, as a policy recommendation of the study, countries should be efficient, economical, and effective in using public resources, avoid wasteful expenditures, observe macroeconomic balances while using a portion of the budget other than mandatory expenditures, and ensure fiscal discipline, which will play an important role in achieving stronger fiscal sustainability and ensuring economic stability.

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TÜRKİYE'DE MALİ SÜRDÜRÜLEBİLİRLİĞİN ANALİZİ: BOOTSTRAP FOURIER ARDL YAKLAŞIMI

Adil AKINCI

GENİŞLETİLMİŞ ÖZET

Mali sürdürülebilirlik, kamu gelirleri ile kamu giderleri arasındaki uyumluluğu ifade etmektedir. Mali sürdürülebilirliğin sağlanması aynı zamanda karar alıcıların politikalarını da sürdürülebilir hale getirmektedir. Mali sürdürülebilirliğin sağlanamaması, gelir ile gider arasındaki uyumsuzluk, bütçe dengesini olumsuz etkileyecektir. Bu durumda ise kısa ve uzun vadede bütçedeki faiz ödemesi yükünü arttıracaktır. Artan faiz yükü nedeniyle politika üretmede ve/veya mevcut politikaları sürdürmede karar alıcıların etkinliği azalacaktır.

Türkiye gelişmekte olan ülkelerden birisi olup çeşitli nedenlere bağlı olarak tarihsel süreç içerisinde mali krizler yaşamıştır. Özellikle Avrupa Birliği (AB) müzakerelerinin başladığı 2005 sonrasında Maastricht kriterlerine uyum noktasında ciddi bir performans göstererek mali kriterler açısından hali hazırda birliğe üye birçok ülkeden gerek bütçe dengesi gerekse borçlanma kriteri açısından daha iyi performans göstermiştir. 2008 yılındaki "Küresel Ekonomik Kriz", 2012 yılında Avrupa'daki bazı ülkelerde ortaya çıkan "Borç Krizi", 2019 yılında Covid-19 virüsünün yayılmasıyla başlayan "Pandemi" süreci Türkiye'nin kamu maliyesini olumsuz etkilemiştir. Mali sürdürülebilirlik uzun dönemli denge durumunu ifade ettiği için, bu çalışmada Türkiye'de mali sürdürülebilirlik 2006:01-2021:12 döneminde zaman serisi analizi yöntemlerinden Bootstrap Fourier ARDL yöntemiyle incelenmiştir. Covid-19 pandemisinin mali sürdürülebilirliği etkilemesi ve Türkiye'de mali sürdürülebilirlik analizi konusunu inceleyen çalışmalarda daha önce Bootstrap Fourier ARDL yönteminin kullanılmamış olması, bu çalışmanın ortaya çıkmasında temel motivasyon kaynaklarından birisi olmuştur.

Geleneksel birim kök testi olan ADF birim kök testi ve Fourier ADF birim kök testi ile değişkenlerin durağanlığı sınanmış olup, her iki test sonucuna göre de değişkenlerin birinci derecede durağan oldukları tespit edilmiştir. Değişkenlerin birinci derecede durağan oldukları tespit edildikten sonra Fourier ARDL yöntemiyle değişkenler arasındaki eşbütünleşme ilişki incelenmiş olup, test sonucuna göre değişkenler arasında uzun dönemli bir eşbütünleşme ilişkisi tespit edilmiştir. Sonraki aşamada ise uzun dönem katsayısı, kısa dönem katsayısı ve hata düzeltme terimi katsayısı hesaplanmıştır. Uzun dönem katsayısının ve

kısa dönem katsayısının istatistiki olarak %5 anlamlılık düzeyinde anlamlı olduğu ve katsayısı değerinin 0 ile 1 ($0<\beta<1$) arasında olduğu tespit edilmiştir. Bu durum (Quintos, 1995)'a göre zayıf sürdürülebilirlik olarak tanımlandığı için, ilgili dönemde Türkiye'de mali sürdürülebilirliğin "zayıf sürdürülebilirlik" olduğu söylenebilir. Bu sonuç, Türkiye'de kamu bütçesinin yıllar itibariyle sürekli bütçe açığı vermesi ve bu durumun sürekli borçlanma politikaları ile yönetilmeye çalışılması ile açıklanabilmektedir. Özellikle pandemi ve ekonomik kriz dönemlerinde kamu bütçesindeki açığın artması mali sürdürülebilirliği zayıf olan Türkiye'nin mali disiplininde sert kırılmalara neden olduğu görülmektedir. Kamu bütçe açıkları zaman içerisinde ekonomik şartlarda meydana gelen bozulmalarla birlikte ikiz açığa ve/veya üçüz açık gibi yapısal problemlere de sebebiyet verebilmektedir. Bütçe açıkları nedeniyle kamunun sürekli borçlanması ise hem tasarrufların kamuya aktarılması hem de faizler üzerinde baskı yaratabilmektedir. Bu nedenle bütçe açıklarına sebebiyet veren kamu harcaması politikaları kamuda karar alıcı olanlar tarafından gözden geçirilmelidir.

Sonuç olarak, tüm ülkeler kamu gelirleri ile kamu harcamalarını karşılamaya çalışmaktadır, ancak çeşitli nedenlerle kamu gelirleri ile kamu harcamalarını karşılayamamaktadır. Toplumların gelişmesine bağlı olarak kamunun görev yükünün artması kamu harcamalarını arttırırken; vergi rekabeti, vergi muafiyet-indirim-istisnaları gibi nedenlerle de ülkelerin kamu gelirleri azalmaktadır. Bu durum henüz başlangıç aşamasında bütçelerin açık vermesine neden olmakla birlikte, yaşanan olağanüstü gelişmeler de bütçe açıklarını büyütmektedir. Bu kapsamda, çalışmanın politika öneri olarak da ülkelerin kamu kaynaklarını kullanmada verimli, iktisadi ve etkin olması, israfa neden olacak harcamalardan kaçınması, bütçenin zorunlu harcamalar dışında kalan kısmını kullanırken makroekonomik dengeleri gözetmesi ve mali disiplini sağlaması mali sürdürülebilirliğin daha güçlü forma kavuşması ve ekonomik istikrarın sağlanması hususunda önemli rol oynayacaktır.