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Effectiveness of Unconventional Monetary Policy Tools on Financial Stability: A NARDL Approach for Turkey*

Geleneksel Olmayan Para Politikası Araçlarının Finansal İstikrar Üzerindeki Etkinliği: Türkiye İçin Bir NARDL Yaklaşımı

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Abstract

The primary purpose of central banks is to achieve and maintain price stability. Until the global financial crisis in 2008, it was accepted that financial stability was achieved in an economy where price stability was achieved. However, after the crisis, it was seen that financial stability could not be achieved in economies where price stability was achieved, and alternative policies began to be sought. In this context, many developed and developing countries have started using unconventional monetary policy tools to ensure financial stability along with price stability. As a result of the expansionary policies implemented by the central banks of developed countries, there has been an intense capital inflow to Turkey, which has led to credit expansion and overvaluation of the domestic currency. Therefore, as of 2011, the Central Bank of the Republic of Turkey (CBRT) started to use non-traditional monetary policy instruments to support financial stability. In this study, a financial stability index has been calculated for the Turkish economy and the effects of interest rate corridor and required reserve implementations on this index were examined with the Non-Linear Auto Regressive Distributed Lag (NARDL) model. According to the results of the analysis, it has been understood that the effects of unconventional monetary policy tools in ensuring financial stability are limited and monetary policy implementations alone are insufficient.

Keywords: Unconventional monetary policy tools, financial stability, CBRT, NARDL

JEL Codes: E43; E44; E52; E58

Öz

Merkez bankalarının birincil amacı fiyat istikrarını sağlamak ve sürdürmektir. 2008 yılında yaşanan küresel finans krizine kadar fiyat istikrarının sağlandığı bir ekonomide finansal istikrarın da sağlandığı kabul ediliyordu. Fakat kriz sonrasında fiyat istikrarının sağlandığı ekonomilerde finansal istikrarın sağlanamadığı görülmüş ve alternatif politika arayışları başlamıştır. Bu bağlamda, birçok gelişmiş ve gelişmekte olan ülke, fiyat istikrarı ile birlikte finansal istikrarı sağlamak için geleneksel olmayan para politikası araçlarını kullanmaya başlamıştır. Gelişmiş ülke merkez bankalarının uyguladığı genişletici politikalar sonucunda Türkiye'ye yoğun bir sermaye girişi olmuş ve bu durum kredi genişlemesine ve yerli paranın aşırı değerlenmesine neden olmuştur. Bu nedenle 2011 yılı itibarıyla Türkiye Cumhuriyet Merkez Bankası (TCMB), finansal istikrarı desteklemek amacıyla geleneksel olmayan para

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politikası araçlarını kullanmaya başlamıştır. Bu çalışmada, Türkiye ekonomisi için bir finansal istikrar endeksi hesaplanmış ve TCMB tarafından kullanılan faiz koridoru ve zorunlu karşılık uygulamalarının bu endeks üzerindeki etkileri, Doğrusal Olmayan Oto Regresif Dağıtılmış Gecikme (NARDL) modeli ile incelenmiştir. Analiz sonuçlarına göre, geleneksel olmayan para politikası araçlarının finansal istikrarın sağlanmasındaki etkilerinin sınırlı olduğu ve para politikası uygulamalarının tek başına yetersiz olduğu anlaşılmıştır.

Anahtar Kelimeler: Gelenksel olmayan para politikası araçları, finansal istikrar, TCMB, NARDL.

JEL Kodları: E43; E44; E52; E58

1. INTRODUCTION

The global financial crisis marked the transition from what many called the "Great Moderation" to the "Great Recession". The stress experienced by the financial sector that began in the summer of 2007 put an end to several years of strong growth for the world economy, accompanied by moderate inflation rates in most advanced market economies (Potter and Smeth, 2019: 6). At the time of the global financial crisis, interest rates in developed countries such as the USA, Japan, United Kingdom and Canada were at or near zero. Since traditional monetary policy practices mainly worked by determining interest rate levels, this meant that traditional policies had already reached their limits in these countries (Morgan, 2009: 163). The set of policy interventions introduced during this period has been termed unconventional monetary policy to distinguish it from the typical (traditional) pre-global financial crisis policy measures (Potter and Smeth, 2019: 8). Quantitative easing, credit easing, interest commitment, interest rate corridor and required reserve implementations were frequently used by central banks as an unconventional monetary policy tool in the post-crisis period. These policy tools were mostly used to combat deflationary pressures and recession (Atılgan, 2016: 250). These monetary expansion policies implemented by the central banks of developed countries also had significant effects on the Turkish economy. In this period of intense short-term capital inflows, rapid credit growth was experienced, and the local currency gained excessive value. This situation threatened price stability by causing macro-financial risks and external imbalances, and also increased the risks to financial stability (Bascı and Kara, 2011: 2). Given these developments, the CBRT designed a new monetary policy framework by taking financial stability as a complementary target in order to reduce macrofinancial risks arising from global imbalances (Binici et al., 2013: 2). With the new policy approach, the implementation of inflation targeting continued, but additional policy instruments were developed to consider financial stability. For this purpose, it tried to reach price stability and financial stability targets by using liquidity management tools, reserve requirement ratios and interest rate corridor application together (Kara, 2012: 2-6).

One of the purposes of the study is to calculate a comprehensive financial stability index to show the course of financial stability in the Turkish economy. Another purpose of the study is to empirically test the effectiveness of the monetary policies implemented by the CBRT to ensure financial stability in the post-crisis period. When the studies on the Turkish economy (Binici et al., 2013; Haznedaroğlu, 2014; Bulut, 2015; Alper et al., 2018; Kaya, 2017; İlhan, 2018 etc.) are examined, it is seen that financial stability is represented by a single indicator, generally credit growth or the amount of non-performing loans, in studies examining the effects of monetary policy practices on financial stability. From this point of view, it is thought that this study is more inclusive than other studies in the literature, since it includes a long-term and comprehensive financial stability index calculation and tests the effects of different monetary policy practices on financial stability with the help of a nonlinear model.

For this purpose, in section 2, details of the methodology employed in constructing the financial stability index and its constituent sub-indexes are represented. Section 3 presents an

overview of the literature. Section 4 presents thr model, data and methodology. Section 5 covers the estimation results, and in section 6, policy implications and the conclusion are presented.

2. AGGREGATE FINANCIAL STABILITY INDEX

According to the Central Bank of the Republic of Turkey (CBRT), the definition of price stability, which is shown as the main target of central banks; "*It is the condition of maintaining a low and stable inflation rate that will not be effective in the decision-making processes of economic agents for the main long-term objectives of monetary policy such as growth and employment*." Although there is no consensus on the definition of the concept of financial stability, which is considered a basic objective together with price stability after the crisis, it can be defined as the situation in which economic functions such as efficient distribution of resources, payment system and risk distribution can be performed regularly even in periods of fluctuation, shock or structural change (Darıcı, 2012: 2).

While calculating the financial stability index for the Turkish economy, the Aggregated Financial Stability Index developed by Morris (2010) was used. This index provides a more comprehensive measurement opportunity by using the Financial Development Index, Financial Vulnerability Index and Financial Strength Index as sub-indexes which are frequently used in the literature (Özcan, 2006; Dhal et al., 2011; Başkaya et al., 2016; Aydi and Aguir, 2017; Kuek et al., 2019; Arip et al., 2019 etc.) to measure financial stability or instability. As in the rest of the world, the banking system constitutes a large part of the financial system in Turkey. For this reason, indexes created to measure financial stability or instability generally focus on banking data. In addition to banking data, the Aggregated Financial Stability Index includes macroeconomic data for the relevant country and various indicators from around the world. Considering that financial globalization has reached enormous dimensions in the world economy, especially with the recent developments, it can be argued that the financial system in a country is affected not only by the indicators of its own country, but also by the indicators of other countries with which it interacts. For this reason, the Aggregated Financial Stability Index was used in the study, since it is thought to give more realistic results regarding the financial situation of the Turkish economy. Table 1 shows the index created by Morris and the effects of the variables on the index.

Table 1: Aggregate Financial Stability Index

Sub-Index	Indicators	Impact	Source
Financial Development Index	Total Credit/GDP[1]	+	**CBRT**
	Market Capitalization/GDP	+	**BIST/CBRT**
	Interest Spread	-	**CBRT**
	Herfindahl-Hirschmann Index (HHI)	+	**BAT**
Financial Vulnerability Index	Inflation Rate	-	**CBRT**
	General Budget Deficit/Surplus (%GDP)	+	**MTF-CBRT**
	General Account Deficit/Surplus (%GDP)	+	**CBRT**
	REER (Change)	-	**CBRT**
	Non Govermental Credit/Total Credit	+	**CBRT**
	Loans/Deposits	-	**BRSA**
	Deposits/M2	+	**BRSA/CBRT**
	(Reserves/Deposits)/(Note&Coins/M2)	+	**BRSA/CBRT**
Financial Soundness Index	Capital/Assets	+	**BRSA**
	Non-Performing Loans/Total Loans	-	**BRSA**
	Z-Score	+	**BRSA**
	Liquidity Ratio	+	**BRSA**
World Economic Climate Index	World Economic Growth	+	**OECD**
	World Inflation Rate	-	**OECD**
	Economic Climate Index	+	**CESifo**

Abbreviations: BAT: The Banks Association of Turkey, MTF: Ministry of Treasury and Finance, BRSA: Banking Regulation and Supervision Agency
Source: Morris, 2010: 7

The Aggregated Financial Stability Index shown in Table 1 has been calculated for the Turkish economy to cover the period 2004M1-2019M12. Since the value ranges of the variables in the index are different, the data must be standardized before the index is created. After compiling the data in the index, the data of all variables were normalized between 0-1 by means of Equation (1) shown below and the index was calculated with these values.

$$Xnormalize = \frac{\mathrm{X}-\mathrm{Xmin}}{\mathrm{Xmax}-\mathrm{Xmin}} \quad (1)$$

After the variables in the index were normalized, each sub-index was calculated over arithmetic averages with the equal weighting method. Then, the Financial Stability Index was calculated by combining the sub-indices. The formulas used in the calculation are as shown below:

[1] In the literature, the Total Credit/GDP variable is taken as an indicator of financial depth and is not seen as a negative situation for financial stability up to a certain extent. Kara et al. (2013) calculated optimal Credit/GDP and credit growth rates that would not threaten financial stability for the Turkish economy. According to the results of the study; The Loan/GDP ratio, which will not threaten the financial stability for the Turkish economy, has been determined as 55% and loan growth as 15%. At the time of the study, the current loan growth in Turkey was calculated as 7.5% annually and it was stated that this rate should be reduced gradually in order not to threaten financial stability in the coming years. Since the loan growth was below 15% during the period covered in this study, the effect of the Total Credit/GDP variable on the index was taken as positive while calculating the index.

$$FDI = \frac{\sum_{j=1}^{4}(I_{gj})}{4} \quad (2)$$

$$FVI = \frac{\sum_{j=1}^{8}(I_{kj})}{8} \quad (3)$$

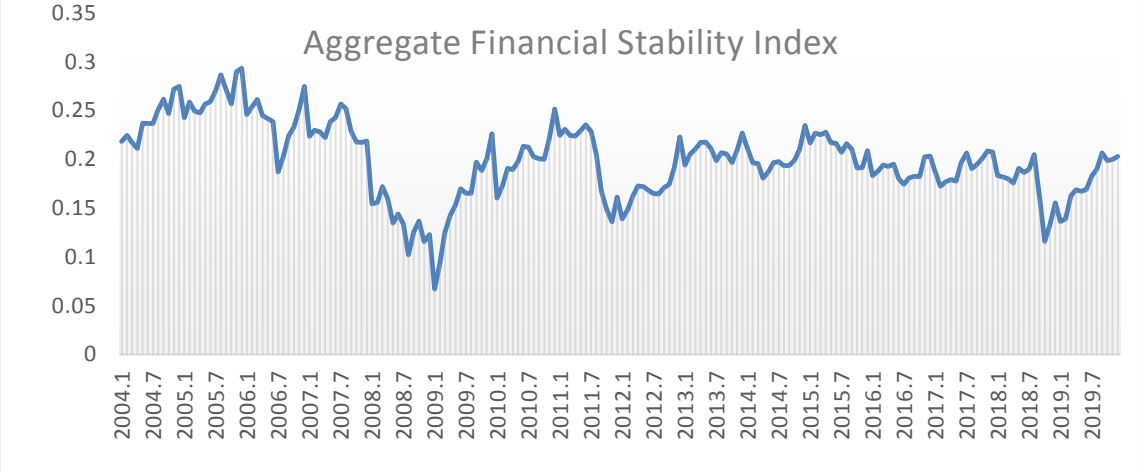
$$FSI = \frac{\sum_{j=1}^{4}(I_{sj})}{4} \quad (4)$$

$$WECI = \frac{\sum_{j=1}^{3}(I_{dj})}{3} \quad (5)$$

$$AFSI = \left(\frac{4FDI+8FVI+4FSI+3WECI}{19}\right) \quad (6)$$

Calculated index values can take negative values because there are variables that negatively affect in the index. As the index value approaches 1, the strength of the relevant index increases. Graph 1 shows the Aggregate Financial Stability Index of Turkey for the period of 2004M1-2019M12.

Figure 1: Aggregate Financial Stability Index (2004M1-2019M12)



When the calculated financial stability index is analyzed, the negative effects of the 2008 crisis can be clearly seen in Turkey as well as in the rest of the world. The index value, around 0.3 before the crisis, dropped below 0.1 after the crisis. The index, which entered the recovery process after the crisis, experienced a break again with the 2011 European debt crisis, which was described as the continuation of the 2008 global financial crisis. The index, which recovered again in the second quarter of 2012, started to decline again in 2018 with the exchange rate crisis in Turkey. The effects of the crises experienced both on a global and local scale can be clearly seen. Therefore, the index is considered to be an explanatory indicator of the relevant period.

3. LITERATURE REVIEW

Since there is no generally accepted definition and indicator of financial stability, it is seen that different variables are used to represent financial stability in studies. In some of the studies, financial stability is measured with the help of an index, while in others it is measured with a single variable. In this section, studies on financial stability are examined under two headings: studies using indexes and studies using a single variable. The literature on unconventional monetary policy tools will be examined under a separate heading. In Table 2, studies measuring financial stability with an index are shown.

Table 2: Studies Measuring Financial Stability with an Index

Author/s	Year	Period	Country Group	Variables Used	Method[2]
Albulescu	2008	1997-2007	Romania	AFSI	Chanut-Laroque Method
Albulescu	2010	1997-2009	Romania	AFSI, Growth Rate, Interbank Interest Rate, ROBOR, BET, Foreign Currency Loans/GDP	OLS, VAR Simulation
Morris	2010	1997-2010	Jamaica	AFSI, M2, Treasury Bill Yield	Monte Carlo Simulation
Morales and Estrada	2010	1995-2008	Colombia	FSI	ARIMA-VECM
Cheang and Choy	2010	1996-2010	Macao	AFSI	PC Method
Dhal et al.	2011	1996-2012	India	BSI, GDP, Inflation Rate, Interest Rate	VAR, Granger Causality
Jakubík and Slačík	2013	1999-2011	Emerging Market Economies (Europe)	FII, Macroprudential Indicators	GMM
Arzamasov and Penikas	2014	2003-2013	Israel	IFSI	PC Method
Arzamasov and Penikas	2014	2002-2013	48 Countries	Financial Soundness Indicators (IMF), ER	Linear Regression
Sere-Ejembi et al.	2014	2007-2012	Nigeria	BSSI	PC Method
Nayn and Siddiqui	2014	2004-2011	Bangladesh	AFSI	PC Method
Popovska	2014	2005-2012	Macedonia	FSI, Z-Skor, S-Skor	CAMELS
Asian Development Bank	2015	2008-2012	Vietnamese	FSI	CAMELS
Keliuotytė and Staniulėnienė	2015	2004-2013	Lithuania-Estonia-Chech Republic-Slovakia	AFSI, FVI	Panel Regression
Manolescu and Manolescu	2017	2004-2016	Romania	FSI, GDP	VAR
Nasreen and Anwar	2017	1980-2012	South Asia Countries	AFSI, EINT, FINT, EG, GEXP	ARDL
Koong et al.	2017	1997-2011	Malaysia	FSI, Credit Expansion	GMM
Fidanoski et al.	2018	2006-2016	Macedonia	FSI, Inflation Rate, Growth Rate	ARDL
Thach et al.	2019	2000-2015	Vietnamese	FSI, Fiscal Policy, Macroprudential Policies	SEM
Nasreen and Anwar	2019	1980-2014	South Asia Countries	AFSI, Interest Rate, Inflation Rate, Growth Rate, Exchange Rate	ARDL

Abbreviations: FSI: Financial Soundness Index – Financial Stability Index AFSI: Aggregate Financial Stability Index BSI: Banking Soundness Index, FII: Financial Instability Index, ROBOR: Romanian Interbank Offer Rate, BET: Bucharest Stock Exchange Rate, IFSI: Integral Financial Stability Index, ER: Resilience of the Economy, BSSI:

[2] If there is only one variable about an index Method columns show the calculation methods of the Financial Stability Index, if there is more than one variable Method columns show the methods that are used to analyze the impact of macro variables on financial stability.

Banking System Stability Index, BAFSI: Balkan Aggregate Financial Stability Index, FVI: Financial Vulnerability Index, EINT: Economic Integration, FINT: Financial Integration, EG: Economic Growth, GEXP: Government Consumption Expenditure, SEM: Structural Equaiton Modeling.

In the study of Morris (2010), it was concluded that the increase in interest rates negatively affected financial stability. Dhal et al. (2011) concluded that low interest rates support financial stability without threatening price stability. In their study, Keliuotytė and Staniulėnienė (2015) highlighted the need for financing, public health expenditures and public debt stock as fiscal fragility variables that exert negative pressure on financial stability. Nasreen and Anwar (2017) stated that trade openness and foreign capital flows are an important source of growth for developing countries, but they can destabilize financial stability if necessary domestic measures are not taken. Koong (2017) stated that the expansion in commercial loans negatively affected financial stability. Fidanoski (2018), found a negative relationship between real growth rate and financial stability and economic stability, and a positive relationship with price stability.

When the studies using the index are examined; it is seen that the indices created in a large part of the studies are created by "principal component analysis" and generally banking data is used intensively. In some of the studies, only the index is calculated and evaluated on tables and graphics, while in others, the calculated index is taken as a dependent variable, and an empirical analysis is made. While the "VAR" model came to the fore in the empirical analyzes made before 2016, it is seen that the "ARDL" model is used extensively in the studies conducted after this year. The most used independent variables in these studies are inflation rate, growth rate and exchange rate. Studies measuring financial stability with a single variable are shown in Table 3.

Table 3: Studies Measuring Financial Stability with a Single Variable

Author	Year	Period	Country Group	Variables Used	Method
Babihuga	2007	1998-2005	96 Countries	FSI, Inflation Rate, Interest Rate, Growth Rate, GDP per Capita, Unemployment Rate	OLS, GMM
Berger et al.	2009	1999-2005	23 Developed Countries	Z-Skor, Capital/Total Assests, Non-Performing Loans/Total Loans, Market Structure, Banking Controls, Business Cycle	GMM
Kuttner and Shim	2013	1980-2011	57 Countries	Real Estate Prices, Real Estate Loans, Macroprudential Measures	Panel Regression
Creel et al.	2015	1998-2011	European Union	Economic Performance Indicators, Financial Depth Indicators, Financial Stability Indicators	GMM
Lee et al.	2015	2000-2013	10 Asia Countries	Credit Expansion, Real Estate Prices, Macroprudential Policies	Qual VAR
Zdzienicka et al.	2015	1969-2008	USA	Real Banking Loans, Real Estate Price Index, Macroprudential Policies	DL, OLS, VAR
Noman et al.	2017	1990-2014	Southeast Asian Countries	Z-Skor, Non-Performin Loan Ratio, Capital Asset Raito, HHI, Lerner Index, Panzar-Rosse H Statistic	GMM
Kim and Mehrotra	2018	2000-2012	Australia, Indonesia, Korea ve Thailand	Credit Expansion, Inflation Rate, Macroprudential Policy Index	Panel VAR
Akıncı and Rumsey	2018	2000-2013	57 Countries	Total Loans, Real Estate Loans, Real Estate Prices, Macroprudential Measures	Dynamic Panel
Klingelhöfer and Sun	2019	2000-2015	China	Credit Expansion, Macroprudential Measures	SVAR
Phan et al.	2021	1996-2016	23 Countries	Z-Skor, Economic Policy Uncertainty, Inflation Rate, GDP per Capita, Growth Rate, Market Structure Indicators	Panel Regression

Babihuga (2007) stated that high inflation, high interest rate and high exchange rate negatively affect financial soundness indicators. Lee et al. (2015) concluded that macroprudential policies can be effective in ensuring financial stability in Asian countries. Zdzienicka et al. (2015), was concluded that monetary policy shocks have significant and permanent effects on financial conditions and can reduce long-term financial instability, while the effect of macroprudential policies on financial conditions is faster but shorter. In their study, Kim and Mehrotra (2018) stated that the macroprudential policies implemented were effective in limiting credit growth and contributed to financial stability. Klingelhöfer and Sun (2019) stated that macroprudential policies can be used as a complement to monetary policy

without triggering an economic slowdown and balancing the accumulation of financial vulnerabilities. Phan et al. (2021), it is concluded that economic policy uncertainty has a negative effect on financial stability and that a one-unit standard deviation in economic policy uncertainty has a negative effect of 5 per cent on financial stability on average.

When the studies measuring financial stability with a single variable are examined; It is seen that "credit volume" and "non-performing loans" are taken in most studies representing financial stability. Other variables used to represent financial stability stand out as the financial development and financial soundness indices calculated and published as annual data by the IMF, and the "Z-Score" value calculated for the banking system. While the "GMM" method is preferred more in the empirical analysis, macroprudential policies, inflation rate and growth rate are used as an independent variable. Studies on unconventional monetary policy tools are shown in Table 4.

Table 4: Studies on Unconventional Monetary Policy Tools

Author	Year	Period	Country Group	Variables Used	Method
Tovar et al.	2012	2003-2011	Latin America Countries	Credit Volume, Reserve Requirement Ratios, Macroprudential Policies	Panel VAR
Glocker and Towbin	2012	1997-2010	Brazil	Interest Rates, Reserve Requirement Ratios	BVAR
Binici et al.	2013	2005:Q1-2010:Q10 2010:Q11-2012:Q12	Turkey	Interest Rate Corridor, Reserve Requirement Ratios, Commercial Loans, Deposits	VAR- Panel GMM
Cordella et al.	2014	1970-2011	52 Countries	Credit Expansion, Interest Rate, Reserve Requirement Ratios, Exchange Rate	Panel VAR
Bulut	2015	2011-2015	Turkey	Credit Expansion, Interest Rate Corridor	Johansen and Maki Cointegraiton
Alper et al.	2018	2010-2015	Turkey	Commercial Loans, Consumer Loans, Reserve Requirement Ratios, Liquidity Ratio	Dynamic Panel
Fendoğlu	2017	2000-2013	18 Countries	Credit Volume, Macroprudential Policy Index, Reserve Requirement Ratios	Dynamic Panel

Tovar et al. (2012) stated that reserve requirement ratios have a temporary effect on financial stability and play a complementary role in monetary policy. Glocker and Towbin (2012) stated that the reserve requirement application can be used as a complement to the interest rate policy in ensuring financial stability. Binici et al. (2013) stated that the asymmetric interest rate corridor policy applied together with an active liquidity management strategy can affect loan and deposit rates through different channels, and therefore, the interest rate corridor policy can be used as a macroprudential policy tool to adjust the credit margin. Cordella et al. (2014) stated that an increase in reserve requirement ratios reduces credit expansion by increasing the spread of interest rates and can be used effectively together with the interest rate. In his study, Bulut (2015) stated that the CBRT could slow down credit growth with the uncertainty in the corridor and the interest rate corridor could be used as a macroprudential tool to affect loans and aggregate demand in Turkey.

When the studies on unconventional monetary policy tools are examined; It is seen that more studies have been done at the national level. In both national and international studies, analyzes on the effects of the "reserve requirements" come to the fore. In the studies on the

interest rate corridor, there is an intensity in the studies carried out in Turkey. While the "VAR" models are generally preferred in the analyzes, the effects of unconventional monetary policy tools on credit volume are examined.

4. MODEL DATA AND METHODOLOGY

In the study, based on the monetary policy texts published by the CBRT[3], the linear equation shown in Equation (7) was created in order to examine the effect of unconventional monetary policy tools implemented as of the end of 2010 on financial stability.

$$AFSI_t=\beta_0+\beta_1 WACF_t+\beta_2 TLRR_t+\beta_3 FCRR_t+u_t \quad (7)$$

Here, $AFSI_t$ is the financial stability index value at time t; $WACF_t$ is the weighted average cost of funding at time t; $TLRR_t$ is the Turkish Lira required reserve ratio applied by the CBRT at time t; $FCRR_t$ shows the required reserve ratio applied to foreign currency deposits by the CBRT at time t.

Monthly data covering the period 2011M1-2019M12 were used in the study. The financial stability index variable used in the analysis; Since it includes seasonally changing values such as inflation rate, current account deficit, budget deficit and loans, it was included in the analysis by being seasonally adjusted before being included in the analysis. Information about the variables used in the study is shown in Table 5.

Table 5: Variables Used in Analysis

Variables	Definiton	Data Source
AFSI	Aggregate Financial Stability Index	Author Calculation
WACF	Weighted Average Cost of Funding	CBRT
TLRR	Turkish Lira Required Reserve	CBRT
FCRR	Foreign Currency Required Reserve	CBRT

The index developed by Morris (2010) representing the financial stability used as the dependent variable in the study was calculated monthly for Turkey. Information on the calculation of the index has been explained in detail in the previous section. Interest rate corridor and required reserve implementations were taken as unconventional monetary policy tools in the study. Weighted Average Cost of Funding, which is used as an indicator by the CBRT, is taken as an indepented variable for the represantation to interest rate corridor. The weighted average cost of funding is calculated by weighting the lending interest rate, which is the upper band of the interest rate corridor, and the policy interest rate. For the required reserve application, which is another non-traditional monetary policy instrument, the weighted averages of the required reserve ratios (up to 1.3 and 6 months, up to 1 year, more than 1 year, up to 3 years, more than 3 years) applied by the CBRT to TL and foreign deposits are included in the study. Required reserve ratios are announced twice in some months and three times in some months during the year. While the reserve requirement ratios were included in the study, a single ratio was obtained for each month by taking the geometric averages of the ratios announced within a month.

In the study, the relationship between the variables was examined with the NARDL model developed by Shin et al. (2014). There is no definite opinion on the effect of funding costs or reserve requirement ratios on financial stability in the theoretical and applied literature. Financial stability can be supported by increasing or decreasing these ratios

[3]CBRT (2010). *Monetary and Exchange Rate Policiy in 2011,* Ankara: CBRT , CBRT (2011). *Monetary and Exchange Rate Policiy in 2012,* Ankara: CBRT.

depending on the state of the economy. Fort his reason, it was considered to use an asymmetric model in the study and the NARDL model was applied. The basis of the NARDL model is based on the ARDL model, but unlike the ARDL model, it shows the asymmetrical relationship between the variables as well as the symmetrical relationship. When examining this relationship in the NARDL model, the cumulative sums of the positive and negative changes of the independent variables are used. After calculating the cumulative totals, the NARDL model is constructed as shown in Equation (8).

$$\Delta AFSI_t = \alpha_0 + \rho AFSI_{t-1} + \beta_1^+ WACF_{t-1}^+ + \beta_2^- WACF_{t-1}^- + \theta_1^+ TLRR_{t-1}^+ + \theta_2^- TLRR_{t-1}^-$$

$$\phi_1^+ FCRR_{t-1}^+ + \phi_2^- FCCRR_{t-1}^- + \sum_{i=1}^{p-1} \gamma \Delta AFSI_{t-i} + \sum_{i=0}^{q-1} \lambda_1^+ \Delta WACF_{t-1}^+ + \sum_{i=0}^{q-1} \lambda_2^- \Delta WACF_{t-1}^- +$$

$$\sum_{i=0}^{q-1} \lambda_3^+ \Delta TLRR_{t-1}^+ + \sum_{i=0}^{q-1} \lambda_4^- \Delta TLZRR_{t-1}^- + \sum_{i=0}^{q-1} \lambda_5^+ \Delta FCRR_{t-1}^+ + \sum_{i=0}^{q-1} \lambda_6^- \Delta FCRR_{t-1}^- + \varepsilon_t \quad (8)$$

5. ESTIMATION RESULTS

In order to measure the effects of the unconventional monetary policy tools that CBRT put into practice as of the end of 2010, on financial stability, the NARDL model was applied to cover the period 2011:1-2019:12. Although the NARDL model allows for cointegration analysis between series that are stationary at different orders, Pesaran et al. (2001) did not give any value for I(2) so the series should be tested for stationarity before starting the analysis. First of all, the Phillips-Perron unit root test, which is a traditional unit root test, was applied to the variables. Afterwards, the Zivot and Andrewa unit root test was applied, which takes into account the structural breaks in the series. Finally, Sollis unit root test was performed in accordance with the NARDL model applied in the study. Table 6 shows the unit root test results.

Table 6: Unit Root Test Results

Variables	Phillips-Perron Test Statistic		Zivot and Andrews Test Statistic		Sollis Test Statistic
	Level	1 st difference	Level	1 st difference	Out of Trend (Level)
AFSI	-3.016190	-8.050543*	-4.501939	-8.139489*	4.52740
WACF	-2.264568	-8.455340*	-4.984523	-9.669909*	7.07281*
TLRR	-1.068924	-10.34804*	-6.25511*	-11.01996*	0.97454
FCRR	-1.944650	-6.997384*	-3.379558	-7.810720*	5.47898

Note: *,** and *** denote the 1%, 5% and 10% significance levels, respectively.

After examining the stationarity of the series with unit root tests, the NARDL model was established to examine the cointegration relationship between the series. After the NARDL model was established, the long- and short-term asymmetrical relations between the variables were tested with the help of the Wald test and the analysis results were interpreted according to the results. Table 7 shows the results of the NARDL model.

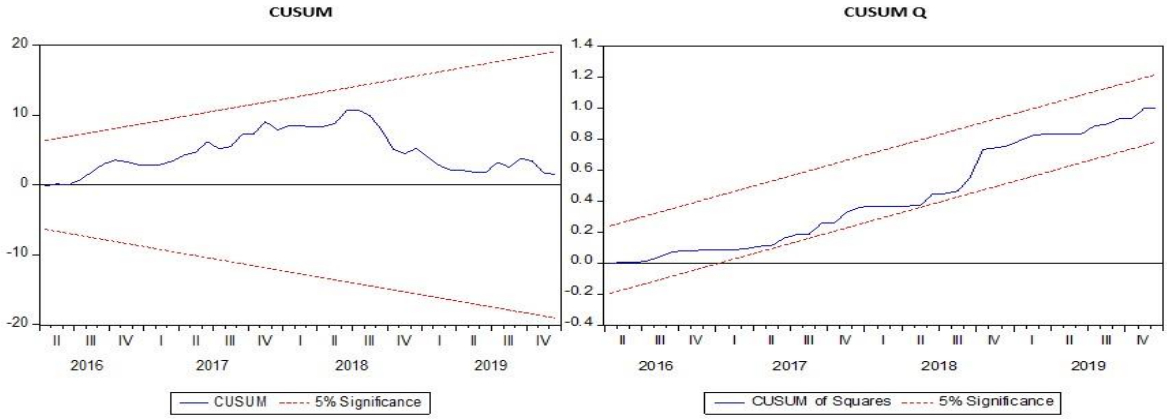
Table 7: NARDL F Bound Test and Diagnostic Results

Test Statistic	Value	k
F-Statistic	9.655380*	6
Estimated Model		**Optimal Lag Structure (AIC)**
AFSI/ $WACF^{+}$, $WACF^{-}$, $TLRR^{+}$, $TLRR^{-}$, $FCRR^{+}$, $FCRR^{-}$		3,6,1,8,7,7,7
Diagnostic Results		
Breusch-Godfrey Serial Correlation LM Test		0.4122*
Heteroskedasticity Test: White		0.9999*
Ramsey Reset		0.1137*
Jarque – Bera		0.7200*

Note: *,** and *** denote the 1%, 5% and 10% significance levels, respectively.

The results of the CUSUM and CUSUMQ tests performed to measure the stability of the long-term coefficients are shown in Graph 2. Since the curves obtained from the CUSUM and CUSUM Q test statistics are between the critical limit of 5% significance, it can be said that the estimated coefficients are stable in the long run.

Figure 2: Plots of CUSUM and CUSUMQ



As a result of the diagnostic tests of the model, it was concluded that the model was significant. However, before interpreting the long- and short-term coefficients of the variables, Wald tests should examine whether there is an asymmetrical relationship between the variables. If it is decided that there is no asymmetrical relationship between the variables as a result of the Wald tests, the results of the NARDL model cannot be interpreted, in this case only the coefficients should be interpreted with the ARDL model. The long- and short-term asymmetrical relationships between the variables are shown in Table 8.

Table 8: Long and Short Term Wald Test Results

	Long Run WLR	Short Run WSR	Result
WACF-AFSI	5.219778** (0.022)	23.53361 *** (0.000)	Long and Short Term Asymmetric
TLRR-AFSI	9.496027*** (0.002)	32.49338 *** (0.000)	Long and Short Term Asymmetric
FCRR-AFSI	0.844641 (0.3612)	8.8943420*** (0.002)	Long Term Symmetric Short Term Asymmetric

Note: ** and *** indicate that the long- and short-term symmetry null hypotheses are rejected at the 5% and 1% significance levels, respectively.

According to the Wald test results shown in Table 8, there is an asymmetrical relationship between WACF and TLRR and AFSI in both the long and short term. There is an asymmetrical relationship in the short term and a symmetrical relationship in the long term between FCRR and AFSI. After determining the existence of an asymmetrical relationship

between the variables, the results of the NARDL model can be interpreted. NARDL model estimation results are shown in Table 9.

Table 9: NARDL Model Estimation Results

WACF-AFSI		TLRR-AFSI		FCRR-AFSI	
$AFSI_{t-1}$	-0.251925*** (0.0626)	$AFSI_{t-1}$	-0.251925*** (0.0626)	$AFSI_{t-1}$	-0.251925*** (0.0626)
$WACF^{+}_{t-1}$	-0.259043*** (0.0457)	$TLRR^{+}_{t-1}$	4.744457*** (1.0024)	$FCRR^{+}_{t-1}$	-0.734846*** (0.1319)
$WACF^{-}_{t-1}$	-0.091469** (0.0366)	$TLRR^{-}_{t-1}$	-0.543967*** (0.0787)	$FCRR^{-}_{t-1}$	-0.590227*** (0.2199)
$\Delta AFSI_{t-1}$	-0.260438*** (0.0867)	$\Delta AFSI_{t-1}$	-0.260438*** (0.0867)	$\Delta AFSI_{t-1}$	-0.260438*** (0.0867)
$\Delta AFSI_{t-2}$	-0.542644*** (0.0917)	$\Delta AFSI_{t-2}$	-0.542644*** (0.0917)	$\Delta AFSI_{t-2}$	-0.542644*** (0.0917)
$\Delta WACF^{+}_{t-3}$	-0.126699** (0.0607)	$\Delta TLRR^{+}_{t-1}$	-6.853466*** (1.9018)	$\Delta FCRR^{+}_{t-1}$	0.601400** (0.2384)
$\Delta WACF^{+}_{t-4}$	-0.225621*** (0.0583)	$\Delta TLRR^{+}_{t-3}$	-7.316774*** (2.0715)	$\Delta FCRR^{+}_{t-6}$	-4.394904** (1.7934)
$\Delta WACF^{+}_{t-5}$	-0.179864*** (0.0620)	$\Delta TLRR^{+}_{t-4}$	-4.394904** (1.7934)	$\Delta FCRR^{-}_{t}$	-2.749690*** (0.5895)
Constant	-3.159912*** (0.5863)	$\Delta TLRR^{+}_{t-5}$	-4.008890** (1.6683)	$\Delta FCRR^{-}_{t-2}$	2.591178*** (0.5993)
$L_{WACF^{+}}$	**-1.028*** **	$\Delta TLRR^{+}_{t-6}$	-0.595235*** (0.1770)	$\Delta FCRR^{-}_{t-6}$	-2.032949*** (0.5028)
$L_{WACF^{-}}$*	**0.363*** **	$\Delta TLRR^{+}_{t-7}$	-0.913492*** (0.1529)	Constant	-0.913492*** (0.1529)
		$\Delta TLRR^{-}_{t-1}$	0.417296*** (0.1468)	$L_{FCRR^{+}}$	**-2.916*** **
		$\Delta TLRR^{-}_{t-2}$	0.684002*** (0.1360)	$L_{FCRR^{-}}$*	**2.342** **
		$\Delta TLRR^{-}_{t-3}$	1.095756*** (0.1626)		
		$\Delta TLRR^{-}_{t-4}$	0.833741*** (0.1612)		
		Constant	-3.159912*** (0.5863)		
		$L_{TLRR^{+}}$	**18.832*** **		
		$L_{TLRR^{-}}$*	**2.159*** **		

*After calculating the coefficients for negative shocks, they are added to the table by multiplying with (-1). The values in parentheses show the standard errors of the coefficients. ** and *** indicate 5% and 1% significance levels, respectively.

In the model, the Stepwise Least Squares (STEPLS) method was used to perform Wald tests and to separate the short- and long-term coefficients. This method removes the nonsignificant lags of the variables in the short run from the model and estimates the model with only significant lags.

When the table results are examined, there is an inverse relationship between WACF and AFSI in the long run. As the WACF value increases, the AFSI value decreases and as the WACF value decreases, the AFSI value increases. However, since there is an asymmetric relationship between WAC and AFSI, the effects of positive and negative shocks are different from each other. According to the results, the effect of positive shocks in WACF is greater than the effect of negative shocks. When the results between TLRR and AFSI are examined, both positive and negative shocks occurring in TLRR have a positive effect on AFSI. However, the effect of positive shocks is much greater than the effect of negative shocks. The fact that the

effect of positive and negative shocks in TLRR is the same and very different in coefficients clearly shows the asymmetrical relationship between the two variables. When the results between FCRR and AFSI are examined, it is seen that the effects of positive and negative shocks occurring in FCRR are close to each other in the long run. As a result of the Wald tests performed above, it was concluded that there was an asymmetrical relationship between FCRR and AFSI in the short-term but symmetrical in the long run. When the coefficients of positive and negative shocks occurring in FCRR are examined, it is seen that there is an inverse relationship between FCRR and AFSI.

The results of the analysis, examining the effects of the unconventional monetary policy instruments used by the CBRT within the framework of the new monetary policy strategy, on the financial stability index calculated by us, yielded results in line with the targets set by the CBRT when adopting this application. In order to support financial stability in this period, a monetary policy consisting of low policy rates, a wide downward interest rate corridor and high reserve requirement ratios was designed (CBRT, 2011). In the study conducted by Başçı and Kara (2011) in which the first effects of the CBRT's new monetary policy strategy were analyzed, it was stated that a low policy interest rate, high required reserves and a wide interest rate corridor would be an appropriate strategy to reduce financial risks and eliminate macroeconomic imbalances. Although the implemented policies are effective in the first period, it is seen that these effects decrease in the long term. In order to prevent the decrease in the exchange rate and the increase in the loan amount in the period of intense capital inflows, the interest rate corridor and required reserves were used as effective policy tools. However, the increases in both the exchange rate and inflation in the following years reduced the effectiveness of monetary policy implementation alone.

The results of this study are generally in line with the CBRT implementation targets and the studies in the literature (Özcan, 2006; Babihuga, 2007; Dhal, 2011; Tiryaki & Yılmaz, 2012; Glocker & Towbin, 2012; Tetik & Ceylan, 2015). However, this study differs from the studies in the literature in several aspects. Firstly, in the studies on the interest rate corridor in the literature, the benchmark interest rates within the interest rate corridor are included in the analysis. In this study, the weighted average funding cost, which emerged with the liquidity management application, which is used as a policy tool that supports the interest rate corridor, and which shows the interest rate that the market needs, is used. In other words, the results of both the interest rate corridor and the liquidity management application were tested together with this variable. Secondly, while Turkish Lira required reserves are generally included in the analysis in studies on the Turkish economy, in this study both Turkish Lira and foreign currency reserve requirements are included in the analysis. The third and most important one is the analysis method used in the study. While linear methods are generally used in studies on financial stability or unconventional monetary policy instruments, a nonlinear model was used in this study, in which the effects of positive and negative changes in the independent variables on the dependent variable can be examined separately.

6. CONCLUSION

In the study, the effect of unconventional monetary policy instruments on financial stability was examined. In order to measure this effect, a financial stability index was calculated. The NARDL method, which is an asymmetric analysis, was used in the study. According to the findings, it was concluded that the effect of unconventional monetary policy instruments on financial stability is limited. When the financial stability index calculated for the Turkish economy and the results of the analysis are evaluated, it is seen that the financial

system in Turkey is in a fragile structure and has been greatly affected by the crises. The policies implemented by the central bank have an impact on financial stability, but this effect remains at a limited level. According to the results of the analysis, a change in reserve requirement ratios has a greater impact than a change in interest rates. The most effective monetary policy instrument of central banks, both before and after the crisis, was the interest rate. However, changes in interest rates in the Turkish economy did not have a significant impact on financial stability. Since price stability has already been achieved with traditional monetary policy practices in developed countries, they have succeeded in providing financial stability with unconventional tools after the crisis. However, price stability could not be fully achieved in Turkey in the pre-crisis period. Although the monetary policies implemented to ensure financial stability along with price stability after the crisis were successful in the first periods, it is seen that both price stability and financial stability are moved away from it in the following years.

It can be said that the unconventional monetary policy practices implemented in this period were insufficient to support financial stability, since the financial stability index remained at low levels throughout the period examined in this study and tended to decline in the post-crisis period. If we need to make an assessment specific to the Turkish economy, it can be said that a new policy should be followed in order to ensure price stability and financial stability as well. It is seen that it is difficult to achieve both price stability and financial stability targets by a single institution, namely the CBRT, and financial stability cannot be achieved by monetary policy practices alone. It is thought that the implementation of monetary policies together with fiscal policies and in a supportive manner will yield more efficient results in terms of ensuring both price and financial stability.

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