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The Effectiveness of Monetary Policy Instruments Applied for Financial Stability in Turkey[1]

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Abstract

As a result of the financial problems that emerged with the 2008 global crisis, central banks have developed non-traditional monetary policies within macroprudential policies due to protect the financial structure. In this context, the Central Bank of the Republic of Turkey (CBRT) has established a new monetary policy framework covering financial stability as of 2010. The aim of this study is to analyze the effectiveness of monetary policy tools applied for financial stability in Turkey. In the study, the effectiveness of monetary policy instruments applied for financial stability in the period 2010-2016 was analyzed within the VAR model. According to the results of the study, a meaningful causality relationship was found between the instruments of monetary policy applied to financial stability and the variables of financial stability. The findings of the analysis show that monetary policy instruments used by the CBRT within the new monetary policy have contributed to financial stability when used together.
Keywords: Financial Stability, Monetary Policy Tools, Interest Corridor, Central Bank Republic of Turkey (CBRT), VAR Analysis

Türkiye'de Finansal İstikrara Yönelik Uygulanan Para Politikası Araçlarının Etkinliği

Öz

2008 küresel krizi ile birlikte ortaya çıkan finansal sorunlar sonucunda merkez bankaları, finansal yapıyı koruyabilmek için makro ihtiyati politikalar kapsamında geleneksel olmayan para politikaları geliştirmiştir. Bu bağlamda Türkiye Cumhuriyet Merkez Bankası (TCMB), 2010 yılı itibari ile finansal istikrarı kapsayan yeni bir para politikası çerçevesi oluşturmuştur. Bu çalışmanın amacı, Türkiye'de finansal istikrara yönelik uygulanan para politikası araçlarının finansal istikrar bağlamında etkinliğini analiz etmektir. Çalışmada, 2010-2016 döneminde finansal istikrara yönelik uygulanan para politikası araçlarının etkinliği VAR modeli kapsamında analiz edilmiştir. Çalışmanın sonuçlarına göre, finansal istikrara yönelik uygulanan para politikası araçları ile finansal istikrar değişkenleri arasında anlamlı nedensellik ilişkisi saptanmıştır. Analiz bulguları, TCMB'nin yeni para politikası çerçevesinde kullandığı para politikası araçlarının bir arada kullanıldığında finansal istikrara katkıda bulunduğunu göstermektedir.
Anahtar Kelimeler: Finansal İstikrar, Para Politikası Araçları, Faiz Koridoru, Türkiye Cumhuriyet Merkez Bankası, VAR Analizi

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Introduction

With the gradual development of technology and the concentration of capital movements across the world, financial markets have become interdependent. Due to this dependence of the financial markets, a problem in the financial markets of developed countries like the USA can cause financial crisis by disrupting the functioning of the whole financial system with the effect of contagion. The spread of financial crises to developed and other developing countries has passed through financial markets. In this context, the financial crisis that emerged in the United States in 2008 has become global as it affects developing countries as well as developed countries. Therefore, problems and solutions in the financial markets have been seriously discussed recently in the literature. As a matter of fact, with the global crisis, financial stability became important in the literature. As the concept of financial stability is multidimensional, no consensus has been reached on a single definition (Crockett, 1997a: 9). This situation makes it difficult to eliminate imbalances in the financial system and to determine the policies that can be applied to combat financial instability. Although many countries have achieved price stability, they have been affected by the global crisis and it has led to questioning the view that price stability is the only condition for achieving financial stability. For this reason, the role of central banks in maintaining and sustaining financial stability began to be discussed with the global crisis, and the traditional view that financial stability would be achieved if price stability was achieved was abandoned (Özatay, 2012a: 20; TCMB, 2014: 2). At the same time, the necessity is emphasized that monetary policy should target financial stability in addition to price stabilization purpose after global crisis.

Monetary expansion policies implemented by central banks in developed countries in order to mitigate the effects of the global crisis has started a strong short-term speculative capital flow towards developing country markets by increasing its global risk appetite. This leads to valuation of domestic currency in developing countries, resulting in deterioration of current account balance and rapid credit expansion by lowering credit interest rates (Kara ve Ekinci, 2018:48; Çevik, 2016: 712; Yılmaz, 2009:5). However, the worldwide spread of the global financial crisis in 2008 has shown that the short-term interest rate used in the traditional monetary policy strategy is insufficient (Carney, 2009; Svensson, 2010). As a result, macroeconomic risks have increased in developing countries and concerns about financial stability have come to the agenda. In this context, many countries have taken measures against macroeconomic risks to get out of the crisis and have introduced new regulations by increasing supervision on financial markets. These regulations as a whole are called macro-prudential policies. Macro-prudential policies focus mainly on macro-financial stability and systemic risk in financial markets (Galati and Moessner, 2011:6). Central banks have also convinced that traditional monetary policies are not sufficient to exit the crisis and have taken non-traditional measures under

macro-prudential policies and created a framework of non-traditional monetary policy regarding price stability, financial stability and macroeconomic stability (Balmumcu, 2013: 33). In the light of these developments, Central Bank of Republic of Turkey (CBRT), in 2010, created a new monetary policy framework in order not to have adverse effect of credit growth due to fluctuations in short-term capital flows and the extreme volatility of the exchange rate after the global crisis on economic stability on the one hand preserving the financial stability (TCMB, 2012b: 2). In this context, instead of a single short-term interest rate, new policy instruments such as a wide interest rate corridor, active liquidity management, reserve requirements and reserve option mechanisms have begun to be implemented (TCMB, 2011a:3). The aim of the study is to analyze the effectiveness of the monetary policy instruments that the CBRT implements for financial stability under the new policy framework that it constituted in 2010. For this reason, it will be empirically examined how effective the monetary policy instruments implemented by the CBRT from the year of 2010 are in terms of price stability and financial stability targets. In the first part of the study, the functioning and policy instruments of the new monetary policy framework of the CBRT were examined. In the second part, empirical studies on the effectiveness of monetary policy and macro prudential policies are given. In the third part, the model and method to be used in the study are explained. In the fourth part, the analysis findings are given. In the last part of the study, the findings of the analysis are evaluated and the results and policy recommendations are included.

The New Monetary Policy Framework of The CBRT for Year 2010

The financial crisis experienced in 2008 deeply affected all world economies and devastated its economic policies. As a result of this situation, the central banks of many countries have made important policy changes after the crisis. The most fundamental change at this point is to abandon the view that financial stability will be achieved if price stability is ensured (Serel and Özkurt, 2014: 57). The moderate environment with the continuation of price stability has created a balloon in asset prices, which has been priced over the real value of assets, and which has caused financial system malfunctions. At this point, the financial crisis has revealed a long-standing contradiction between price stability and financial stability, which seem to be non-separated from each other (Özatay, 2012b:5). Non-traditional monetary policies have taken this into account and central banks have been held responsible for the stability of the financial system. This necessitated central banks to use a wide variety of complex monetary policy tools to ensure price stability and financial stability at the same time (Gertler and Karadi, 2011:18). For this reason, the Central Bank of each country had to develop and use different policy tools according to its internal dynamics.

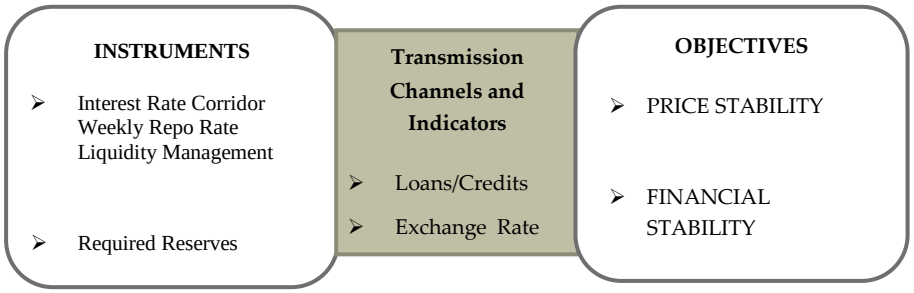
After the 2008 global financial crisis, the interest rate cuts and expansionary monetary policies implemented by developed countries have increased the

global risk appetite and led to volatility in short-term capital flows in Turkey. The balance sheets of firms affected by the overvaluation of domestic currencies in emerging economies such as Turkey as a result of movements in capital flows can lead the banks to excessive credit growth. Short-term capital inflows also led to appreciation of the Turkish lira. This situation has increased imports by creating demand imbalances and the current account balance has rapidly deteriorated. The deterioration of the current account balance, credit expansion and increasing portfolio investments led to financial fragility by bringing together macroeconomic risks. This has brought about worries about macroeconomic stability and financial stability (Başçı and Kara, 2011: 2, Özatay, 2011: 29). Therefore, in the context of the new policy, the CBRT attaches particular importance to variables such as credit and exchange rate. Rapid credit growth is the leading indicator of financial crises in economic writing (TCMB, 2012b: 3). For this reason, limiting exchange rate volatility and domestic credit growth is significant for macroeconomic stability.

In light of these evaluations, the CBRT has started to work for a new monetary policy framework by 2010. In these studies, the CBRT started to focus on financial risks more seriously in terms of macroeconomic stability as a reflection of the imbalances such as the deterioration of current account balances and rapid credit expansion, which are a result of growth periods. The CBRT set forth the operational framework of the new monetary policy in the monetary policy exit strategy published in the 2010. In the new approach, the repo auction rate of one-week maturity rather than overnight borrowing rate is set as the policy interest rate. The liquidity support provided more than market need during the crisis period was gradually reduced and the required reserve ratios were increased (TCMB, 2010a: 3). Foreign exchange liquidity has been brought to pre-crisis levels in a controlled manner. The CBRT activated the alternative monetary policy tools to limit the risks to financial stability, thus initially it put an end to the application of interest payments to Turkish lira required reserves and altered the operational structure of liquidity management (TCMB, 2011b). In this context, the new policy framework of the CBRT is based on the development of an additional set of policy instruments, which aims financial stability besides price stability in the inflation targeting regime. Thus, in order to reach the goal of price stability and financial stability, policy instruments have been diversified and multiple monetary policy tools have started to be used (Demirhan, 2013: 587). According to this, since the end of 2010, the CBRT has decided to use other liquidity policies as active monetary policy instruments besides the interest rate corridor and the required reserves in addition to the policy rate (Başçı and Kara, 2011:4). Figure 1 shows the TCMB's monetary policy instruments, transmission channels and indicators and the objectives of the new monetary policy framework. Policy instruments consist of interest rate corridor, weekly repo rate and liquidity management, and required reserves. Loans and exchange rates are used as transmission channels and indicators. For policy purposes, in addition to

price stability, financial stability is also included (Kara, 2012: 6). With the new policy framework in which financial stability is supported, a policy framework has been established in which the exchange rate volatility is considerably monitored in terms of credit expansion and current account balance (TCMB, 2012a).

Figure 1. Policy Instruments and Objectives of The CBRT



Source: Kara (2012: 6)

While the interest rate, which is a single instrument as a policy tool, was used for price stability as the sole purpose in the traditional monetary policy strategy, in the new approach the interest rate corridor was activated in addition to the policy interest rate and more than one interest rate was used in order to reduce macro financial risks. Effective liquidity management and required reserve application have also been used. The reserve option mechanism (ROM), a new application in the context of required reserves, has been actively used (TCMB, 2011a: 3). In this scope, the framework of the old and new monetary policy of the CBRT is shown in Table 1.

Table 1. Old and New Monetary Policy Framework of the CBRT

	OLD FRAMEWORK	NEW FRAMEWORK
INSTRUMENTS	Policy Rate	Policy Rate Liquidity Management Interest Rate Corridor Required Reserves Reserve Option Mechanism
OBJECTIVES	Price Stability	Price Stability Financial Stability

Source: TCMB (2012b:2)

Unlike the standard inflation targeting framework, which has been implemented since 2006, the new monetary policy framework has been developed in the context of instruments and objectives. While the price

stability as the main objective in the new framework is maintained, the risks related to financial stability in the monetary policy which is applied in harmony with this aim are taken into consideration (TCMB, 2012b:2). Within the framework of the new monetary policy, the CBRT put special emphasis on financial stability. Two intermediate targets have been set by the CBRT to achieve financial stability. The first is credit growth. Because credit growth can create balloons at asset prices, which is seen as a threat to financial stability. For this reason, the CBRT aims to prevent the rapid growth of credit and to prevent the formation of bubbles in asset prices and to make the financial system operate healthier. The second is to reduce the volatility of exchange rates to a minimum level by reducing short-term capital movements. This situation is important in terms of current account balance (Özatay, 2011:29). In the new policy framework, the CBRT specified credit growth and exchange rates as intermediate variables to achieve financial stability target and used these two intermediate variables as indicators. The reason for the CBRT to use these two variables as intermediate indicators is that the countries with the highest expansion in domestic credit volume in 2006-2007 are the countries most affected during the crisis. Countries with high volatility in exchange rates are also affected by the crisis with the increase of current account deficit (Çınar et al., 2010:3-6). In addition, the CBRT highlighted loans and foreign exchange rate so that the new monetary policy can be better understood. The immediate explaination of both variables, easy observation and direct contact with the final instruments are important for a better understanding of the framework of the new policy applied (Kara, 2012:7). Thus, a more descriptive and observable policy framework on the path to policy objectives is presented.

Literature Review on the Effectiveness of Non-Traditional Monetary Policies and Macro-Prudential Policies

In the literature Bernanke and Blinder (1992) and Bagliano and Favero (1998) are the most basic studies on the effectiveness of monetary policy. In the aftermath of the 2008 global crisis, within the scope of macro-prudential policies, non-traditional monetary policy tools have begun to be applied in many countries to mitigate the effects of the global crisis on central banks and to ensure financial stability without compromising price stability. In this regard, studies on the effectiveness of non-traditional monetary policies and macro-prudential policies in the literature have started recently. These studies are summarized in Table 2. When the relevant literature is examined, the general findings show that non-traditional monetary policy plays a supporting role in financial stability and monetary policy instruments applied by central banks for financial stability is effective in limiting credit growth threatening financial stability.

Table 2. Selected Studies About the Effectiveness of Monetary Policy and Macro Prudential Policies

Study	Methodology	Country/Period	Findings
Bernanke and Blinder (1992)	*VAR, Granger Causality*	USA 1959-1989	After the restrictive monetary policy shock, it was stated that short-term securities stock decreased faster than the loans. It was emphasized that the effects of strict monetary policy had an effect on the loans over time.
Bagliano and Favero (1998)	*VAR*	USA 1966-1996	It is noted that policy rates reacted prominently to simultaneous fluctuations of long-term interest rates, and that the impact of the restrictive monetary policy on output did not stem from the long-term interest rates.
Glocker and Towbin (2011)	BVAR	Brazil 1999-2010	An increase in the required reserves and interest rates causes a contraction in domestic loan growth. It has been determined that the required reserve ratios contribute to financial stability.
Peersman (2011)	*SVAR* 1999- 2009	Euro Region 1999-2009	It has been found that as a means of monetary policy, multiple instruments can be effectively used together to influence macroeconomic variables
Yavuzarslan (2011)	*VAR*	Turkey 2002-2010	There is no direct relationship between the bank's balance sheets variables and the required reserves. However, there was a meaningful and positive interaction in the monthly period between the required reserve ratios in TL and the types of loan interest rates.
Oktar and Dalyancı (2011)	*VAR, Granger Causality*	Turkey 2003-2010	The application of monetary policy to affect the current account balance is of great importance in terms of sustainable financial stability and economic growth.

Tovar et al. (2012)	*Panel VAR*	Latin American Countries 2003-2011	It has been identified that required reserves have a short-run effect on loan growth. Monetary policy and other macro-prudential instruments are complementary in terms of financial stability.
Binici et al. (2013)	*VAR/* *Panel Data*	Turkey *2005-2010/2010-2012*	It shows that both the loan and deposit interest rates gave a significant, strong and similar response to the overnight borrowing rate, which is the policy rate in the period before May 2010. It is pointed out that, in case of using the upper bound of the interest rate instead of the policy rate, the loan rates react strongly and significantly to the upper bound of the corridor.
TCMB (2013b)	*Dynamic OLS*	Turkey 2010-2013	According to the results of the study, the interest rate corridor, policy interest rate and the required reserves are influential on credit growth. It is emphasized that non-traditional policy instruments are influential on credit composition and that these instruments are of importance in terms of financial stability.
Federico et al. (2013)	*VAR*	Argentina, Brazil, Colombia Uruguay 1995-2010/1992-2011	According to the results of the study, it has been determined that, when the required reserves are correctly defined, it replaces the monetary policy rather than complementary element.
Cicioğlu et al. (2013)	*Structural VAR-Toda Yamamato Causality Analysis*	Turkey 2003-2013	There is no causality relationship between open market operations and current account deficit and it has been found that there is a causality relationship from current account deficit to the rediscount transactions. Moreover, it is reported that an increase in the policy interest rate has reduced the current account deficit.
Gambacorta et al. (2014)	*Panel VAR*	8 Developed Countries 2008-2011	Macroeconomic effects of non-traditional monetary policies applied in different countries have been shown to be similar.

Claessens et al. (2014)	*GMM*	48 Countries 2000-2010	Analysis results show that macro prudential policies limit credit growth and asset growth.
Meinusch and Tillmann (2015)	*Qual VAR*	USA 2007-2013	As a result of the analysis, quantitative expansion policy has been found to have a moderate effect on economic activity, inflation, interest rates and stock market prices
Dell' Ariccia vd. (2015)	*Panel Regression*	170 Countries 1970-2010	Macro prudential policy instruments are indicated to be important in limiting the balloons that form in the credit market. Thus, the policies implemented in the framework of macro financial stability have been considered as effective.
Aikman et al.. (2016)	*VAR*	USA 1975-2015	According to the results of the study, macro precautionary instruments used to limit excessive credit growth are effective for the economy. It is also stated that monetary policy can also be effectively used to limit credit growth.
Cerutti et al.. (2017)	*GMM*	119 Countries 2000-2013	It has been found that the policies implemented are often applied according to credit growth rates, and help to limit credit growth.
Eroğlu and Kara (2017)	*VAR*	Turkey 2010:1-2016:6	The capital movements and total credits for financial stability indicators were found to be weak against the model's monetary policy tools.

Model and Method

The financial stability that gained importance in all world economies after the global crisis of 2008 has been determined by the CBRT as the ultimate target within the new policy framework. In this study, attempts were made to examine the effectiveness of the non-traditional monetary policy instruments in the context of financial stability and price stability that the CBRT imposed for financial stability after the 2008 global crisis. The basis of our work has been constituted by the instruments and objectives of the new policy mix that the CBRT, shown in Figure 1, formed as a result of targeting

financial stability without compromising price stability after the global crisis.

It is understood that the policy texts of the CBRT refer to the concept of financial stability by credit growth and exchange rate. Kara (2012) stated that the loans and exchange rate variables can be seen as an indicator for financial stability. It has been emphasized that macroeconomic imbalances caused by capital movements often show themselves in variables such as loans and exchange rates. For this reason, the CBRT sees controlled domestic credit growth in the direction of financial stability and to prevent overvaluation in the exchange as an interim target, and attaches a special importance to these variables. Indeed, it is stated in the literature that credit growth and overvaluation of domestic currency increase the likelihood of a financial crisis (Jordà et al., 2010; Mendoza and Terrones, 2008; Reinhart, 2012; Schularick and Taylor, 2009).

With the "Monetary Policy Exit Strategy" published by the CBRT in April 2010, the one-week repo interest rate was set as the policy interest rate and a new policy framework for financial stability was created to mitigate the effects of the global crisis. In this context, the time series covering May 2010-December 2016 were employed in our study by taking from the CBRT data distribution system in monthly frequency. The variables used in the study, the symbols of the variables and their contents are given in Table 3.

Table 3. Data Set and Contents

Variables	Symbols	Contents of Variables
Credit Growth	KREDI	Banking Sector-Domestic Credit Volume
Real Effective Exchange Rate	REDKE	Real Effective Exchange Rate Based on TUFE (2003 = 100)
Inflation	TUFE	Consumer price index
Upper Bound of Interest Corridor	BOV	CBRT Lending Interest Rate
Policy Rate	REPO	1 Week Repo Interest Rate
Lower Bound of Interest Corridor	BOA	CBRT Borrowing Interest Rate
Required Reserve Ratios	ZKO	Average Required Reserve Ratios (FX and TL)

For the required reserve ratios in the data set, the average of TL and foreign currency required reserves was taken into account and analyzed. The logarithms of the variables KREDI, REDKE and TUFE were taken so that all variables used in the study are brought to the same level. Later, KREDI, REDKE and TUFE variables were included in the analysis by seasonally adjusted Census X-13 method. The letter "L" assigned to the variables means logarithmic transformation.

The effectiveness of the new monetary policy framework developed by the CBRT in 2010 in the context of price stability and financial stability was analyzed by time series techniques. Extended Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were used to determine the stationary ratings of the variables. In the study, in determining short-term relationships between variables and in monetary policy applications, the impulse-response analysis obtained from vector autoregressive (VAR) method and the analysis of variance decomposition which are frequently used were applied. In addition, Granger causality analysis was applied in order to determine causality relations between variables.

The VAR model was first proposed by Sims (1980). The VAR model is a dynamic system in which each variable in the system has its own lagged value and it shows the relationship between past values of other variables (Yavuzarslan, 2011:126). Since macroeconomic variables interact with one another, it is a problem to distinguish between internal and external variables. However, in VAR models, contrary to other simultaneous equations systems, this problem does not ocur, because the internal-external variable is not discriminated (Gujarati, 2001:749-750; Kasapoğlu, 2007:39; Sevüktekin and Çınar, 2014:496). In VAR models, all variables are considered internally. For this reason, VAR models are frequently used in measuring the response of macroeconomic variables to monetary policy (Bagliano and Favero, 1998:1072).

The standard form of a bivariate VAR model can be expressed by the following equations:

$$y_t = a_1 + \sum_{i=1}^{p} b_{1i}\, y_{t-i} + \sum_{i=1}^{p} b_{2i}\, x_{t-i} + v_{1t} \qquad (1)$$
$$+v_{1t}$$

$$x_t = c_1 + \sum_{i=1}^{p} d_{1i}\, y_{t-i} + \sum_{i=1}^{p} d_{2i}\, x_{t-i} + v_{2t} \qquad (2)$$
$$+v_{2t}$$

In the above equation, p is the lag length, and v is the random error term which has no heteroskedasticity, no multicollinearity and normally distributed. The assumption that errors in the VAR model are unrelated to their lagged values does not impose any restrictions on the model. Because, autocorrelation problem can be overcome by increasing lag length of variables (Özgen and Güloğlu, 2004:96).

Analysis Findings

In the analysis, first the stationarity features of the variables were determined. The ADF and PP unit root test results, which are frequently

used in the literature for the series, are shown in the Table 4. According to the table, the consumer price index (LTUFE) and the reserve requirement ratio (ZKO) variables were determined to be stationary according to both tests. Variables other than LTUFE and ZKO are not stationary in level values. It has been found that when the first difference of the variables is taken, it becomes stationary. For this reason, the non-stationary variables at level were become stationary by taking the first differences and included in the analysis.

Table 4. Unit Root Test Results

Variables	ADF Test Statistics		PP Test Statistics		Results
	Level Values	First Difference Values	Level Values	First Difference Values	
LKREDI	-1.95(0)	-6.68***(0)	-1.97(4)	-6.79***(4)	**I(1)**
LREDKE	-2.93(1)	-6.26***(0)	-2.48(2)	-6.21***(4)	**I(1)**
LTUFE	-4.23***(1)	--	-3.85**(2)	--	**I(0)**
BOV	-1.84(0)	-7.98***(0)	-2.12(3)	-7.98***(1)	**I(1)**
REPO	-2.60(0)	-8.37***(0)	-2.76(2)	-8.40***(6)	**I(1)**
BOA	-2.91(0)	-8.12***(0)	-3.05(2)	-8.12***(0)	**I(1)**
ZKO	-5.91***(8)	--	-7.42***(8)	--	**I(0)**

Note: *** and ** represent significance at 1% and 5% respectively. The values in parentheses in the ADF statistic give the optimum lag numbers determined according to the Schwarz Information Criteria; The PP statistic gives Newey-West Bandwidth.

In the VAR model, the appropriate lag length must first be determined. Lag length in VAR analysis is very important because it significantly affects the analysis results. In the study, the determination of the lag length under the VAR model is shown in Table 5.

Table 5. Determination of Lag Length

Lag Length	LR	FPE	AIC	SC	HQ
0	NA	1.53e-11	-5.040645	-4.821012	-4.953118
1	664.8957	2.12e-15	-13.92734	**-12.17028***	**-13.22712***
2	84.68696	1.95e-15	-14.04500	-10.75050	-12.73208
3	83.75814	1.59e-15	-14.34485	-9.512920	-12.41924
4	**80.38190***	**1.18e-15***	**-14.82924***	-8.459884	-12.29094
5	38.40679	2.24e-15	-14.52480	-6.618008	-11.37381
6	49.36580	2.90e-15	-14.82786	-5.383637	-11.06417

NOTE: * Indicates the optimal lag length according to the relevant criteria. LR: Likelihood Ratio, **FPE**: Final Prediction Error, **AIC**: Akaike Information Criterion, **SC**: Schwarz Information Criterion, **HQ**:Hannan-Quinn information criterion

The lag length in the VAR analysis should not be too long or too short. If the lag length is taken too short, autocorrelation problem arises. If the lag length is taken too long, information about the interaction of the variables may be lost and the variables take on higher values than they are in reality, and excessive parameterization occurs (Kasapoğlu, 2007: 56 ; Bozdağlıoğlu and Özpınar, 2011: 47).

As a result of the tests made to determine the lag length, 1 lag according to SC and HQ,, and 4 lag according to LR, FPE and AIC seem to be appropriate. When determining the number of lags, the number of lag which consisting no autocorrelation problem should be selected, so the lag length in our study is set to 4.

In the study, the causality test developed by Granger (1969: 553-560) under the VAR analysis was conducted to establish the basis of the VAR analysis and to determine whether the variables in the system interacted with each other and to support the results of the impulse-response function and variance decomposition analyses. Accordingly, if the addition of the information of the variable x contributes to the prediction of the variable y, the variable x is the cause of the variable y (Özgen and Güloğlu, 2004:97). In this context, there may be a one-way causality from x to y, and a bi-directional causality between two variables.

Table 6. Granger Causality Analysis Results

H_0 Hypothesis	Probability values	F Statistics	Direction of Causality
LREDKE is not the Granger cause of DLKREDI.	0.0621	2.36197	⇔
DLKREDI is not the Granger cause of LREDKE.	0.0023	4.64422	
LTUFE is not the Granger cause of DLKREDI.	0.0064	3.92219	⇒
DLKREDI is not the Granger cause of LTUFE.	0.8829	0.29092	
DBOV is not the Granger cause of DLKREDI.	0.0064	3.93176	⇒
DLKREDI is not the Granger cause of DBOV.	0.2894	1.27321	–
DBOA is not the Granger cause of DLKREDI.	0.0072	3.84518	⇒
DLKREDI is not the Granger cause of DBOA .	0.8751	0.30276	–
DREPO is not the Granger cause of DLKREDI.	0.0806	2.18184	⇒
DLKREDI is not the Granger cause of DREPO.	0.5382	0.78622	

ZKO is not the Granger cause of DLKREDI.	0.1103	1.96392	–
DLKREDI is not the Granger cause of ZKO.	0.7859	0.43082	
LTUFE is not the Granger cause of DLREDKE.	0.1326	1.83472	⇒
DLREDKE is not the Granger cause of LTUFE.	0.0882	2.11956	
DBOV is not the Granger cause of DLREDKE.	0.2044	1.52739	⇒
DLREDKE is not the Granger cause of DBOV.	0.0222	3.06774	
DBOA is not the Granger cause of DLREDKE.	0.0151	3.33367	⇒
DLREDKE is notthe Granger cause of DBOA.	0.1900	1.57998	
DREPO is not the Granger cause of DLREDKE.	0.5567	0.75753	⇒
DLREDKE is not the Granger cause of DREPO	0.0473	2.54958	
ZKO is not Granger cause of DLREDKE.	0.0538	2.46060	⇒
DLREDKE is not the Granger cause of ZKO.	0.8988	0.26602	
DBOV is not the Granger cause of LTUFE.	0.3981	1.03072	–
LTUFE is not the Granger cause of DBOV.	0.9230	0.22591	
DBOA is not the Granger cause of LTUFE.	0.0138	3.39534	⇒
LTUFE is not the Granger cause of DBOA.	0.1439	1.77748	
DREPO is not the Granger cause of LTUFE.	0.8135	0.39224	–
LTUFE is not the Granger cause of DREPO.	0.6252	0.65528	
ZKO is not the Granger cause of LTUFE.	0.0013	5.04607	⇔
LTUFE is not the Granger cause of ZKO.	0.0684	2.29369	

Note: The lag length is taken as 4 in the information criterion.

According to the results of Granger causality analysis, it is seen that there is a bi-directional causality between DLREDKE and DLKREDI. In addition, a bi-directional causality relationship was found between ZKO and LTUFE and between DBOA and ZKO. Again according to the results of causality analysis, the variables which have one-way causality relation and the direction of the causality are as follows:

• The cause of DLKREDI is LTUFE, DBOV, DBOA at 1 percent significance level, and DREPO at 10 percent significance level.

• DLREDKE is the cause of LTUFE at 10 percent significance level.

• DLREDKE is the cause of DBOV at 5 percent significance level.

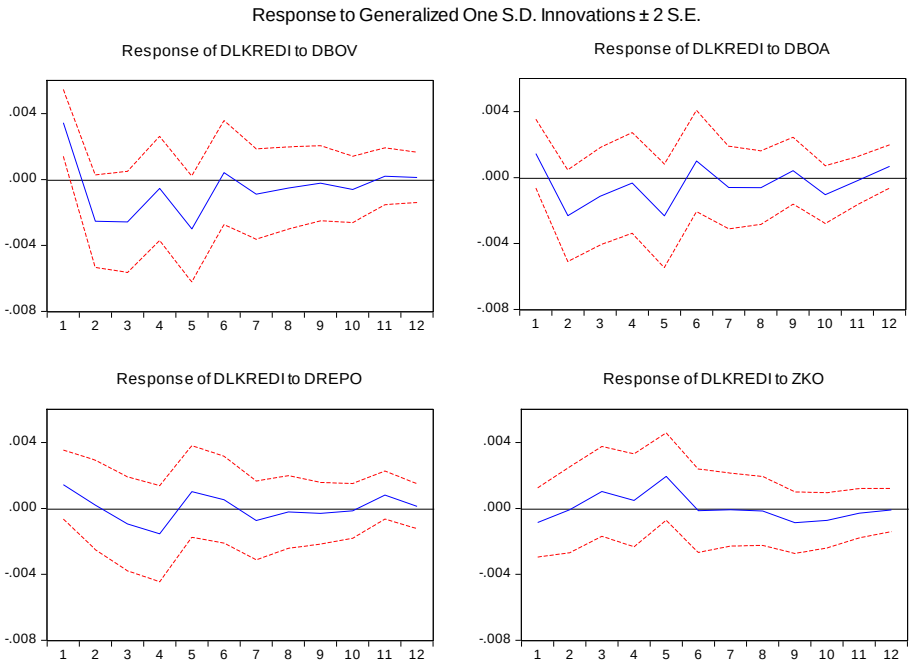
• DLREDKE is the cause of DREPO at the 5 percent significance level.

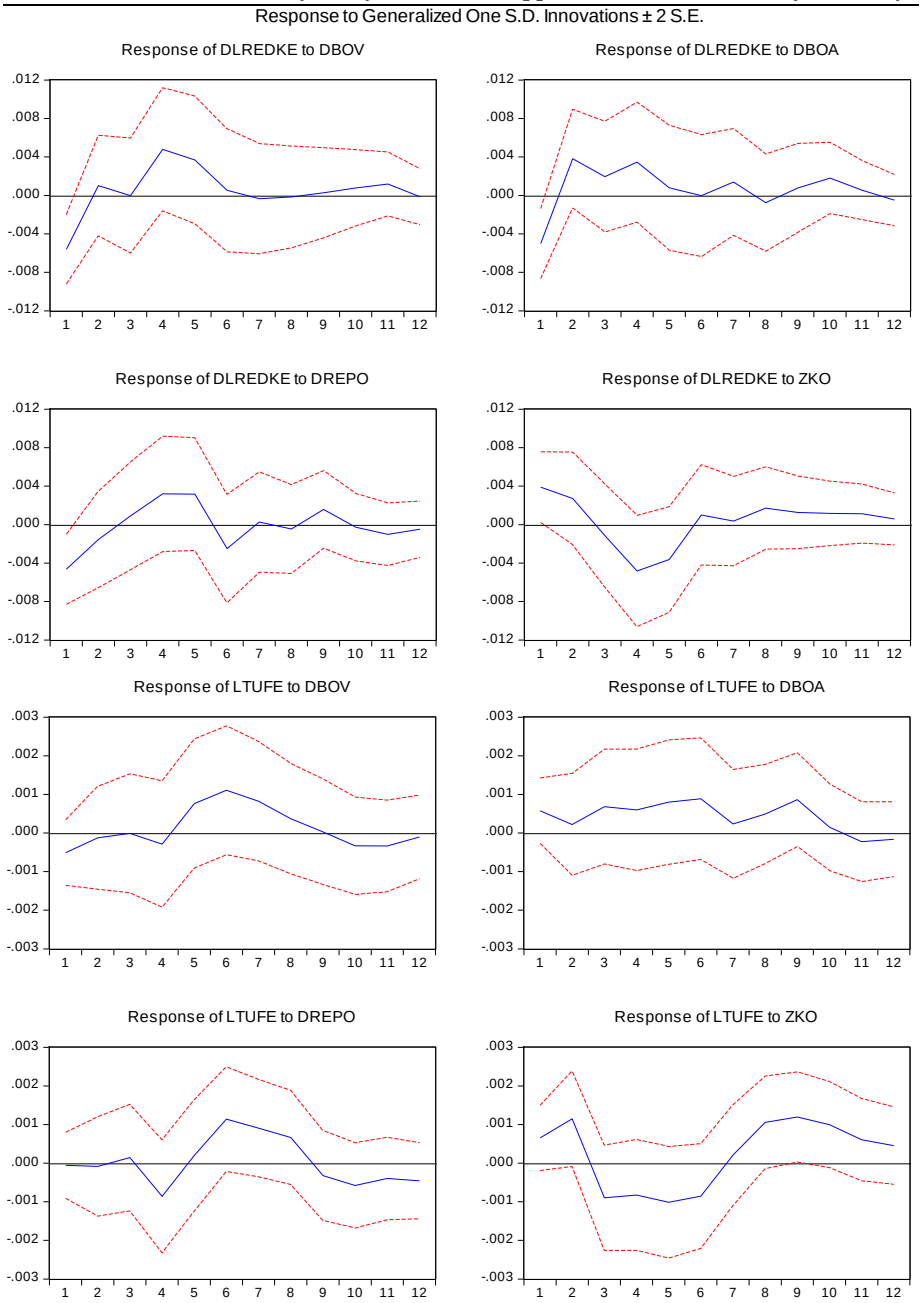
• DBOA and ZKO are the causes of DLREDKE at levels of significance of 5 percent and 10 percent, respectively.

• DBOA is the cause of LTUFE at 5 percent significance level.

In the estimated results of VAR models, it can be difficult to directly interpret the coefficients obtained for better understanding of the relations between the variables in the model. For this reason, impulse-response functions and variance decomposition tools can be used to support the results obtained in the analysis of causality (Lütkepohl and Saikkonen, 1997:128). In impulse-response analysis, the ordering of the variables in the VAR model is very important, and depending on the order of the variables, a given shock can also change the effect on other variables. However, recently, in the impulse-response analysis in the VAR model, the analysis in which the responses to shocks that did not depend on the order of variables have become important (Algan and Gencer, 2011:204). For this reason, a generalized impulse-response analysis proposed by Pesaran and Shin (1998) was used, in which the order of the variables was ignored. In this method, unlike the verticalized impulse-response analysis, the ordering of the variables in the VAR model is not important. In this approach, error estimation variance decomposition is also created ignoring the order. In the study, in the graphs obtained from the impulse-response analysis, the magnitude and direction of the response given by the other variables for a given shock is shown in the vertical axis, and the response given by the other variables to one unit shock is shown for 12 months after being given in the horizontal axis.

Figure 2: The Response to Credit, Exchange Rate And Consumer Price Indexes On Shocks Given To Monetary Policy Instruments





In the graphs obtained from the above impulse-response analysis, the responses of the credits, the exchange rate and the consumer price index which are given in response to the shocks given to the CBRT's new monetary policy instruments were measured. In other words, in the impulse-response analysis, the responses of the variables used for price stability and financial stability to the monetary policy instruments according to the new monetary policy framework of CBRT are examined.

When the results of the impulse-response analysis are examined, it is seen that a standard deviation shock on the upper and lower bounds of the interest corridor has a negative effect on the loans and it lost its significance on the real effective exchange rate after a short period of time together with creating a negative effect at the beginning. The consumer price index does not seem to react significantly to a standard deviation shock in the lower and upper bounds of the interest rate corridor. In the face of a standard deviation shock that occurs at the policy rate, the loan volume responds positively but shows downward reaction in the first two periods, and starts to react negatively in the third period and then the effect of the shock disappears. Real effective exchange rate appears to have a negative response to a shock at policy interest rate. The consumer price index, on the other hand, does not seem to react significantly to the shock of the policy interest rate. A standard deviation shock in the required reserve ratios has a negative effect on the loans and responds positively but shows downward reaction in the first two periods, and then creates negative effect in the third period on the real effective exchange rate. While the consumer price index responds positively in the first two months in response to a shock in the required reserve ratios, the direction of this response becomes negative from the third month on.

The variance decomposition decomposes the variance of prediction error of each variable in the system according to each intrinsic variable. It shows what percentage of the changes in one of the variables in the system results from itself, and what percentage from the other variables (Enders, 1995:311). In the study, it has been attempted to analyze the credit expansion, which was accepted as indicator variables within the scope of the financial stability target by the CBRT, and the most influential variables on the exchange rate has been investigated by applying variance decomposition for the each two variables separately. Moreover, variance decomposition has been done for the consumer price index in line with the price stability target. The results of the variance decomposition are shown in Tables 7, 8 and 9.

According to the results of the variance decomposition of the loans, a significant part of the changes in the loans in the 1-month period after itself are explained by the overnight lending rate, which is the exchange rate and upper bound of the interest rate corridor. Recently, about 33 per cent of the change in loans is due to itself, 22 per cent of the overnight lending rate, about 17 per cent of the real effective exchange rate and about 16 per cent of the consumer price index. According to the results of the variance decomposition of real effective exchange rate, about 74 percent of the change in the real effective exchange rate in the first period is due to itself and about 12 percent of the overnight lending rate (DBOV). With the second period, the explanation percentages of other variables the foreign currency is increasing. In the tenth period, changes in the variance of the exchange rate variable account for about 16 percent of the consumer price index, about 15 percent of the loan volume, and about 11 percent of the overnight lending

rate. According to the variance decomposition results of the consumer price index variable, it shows that the changes that occurred in the consumer price index in the first period are largely due to themselves. In the following periods, it is seen that the most important source of changes in the consumer price index after itself is the required reserve ratios (ZKO). In the tenth period, about 19% of the changes in the consumer price index are explained by the required reserve ratios.

Table 7. Results of Variance Decomposition of Credits

Period	S.H	DLKREDI	DLREDKE	LTUFE	DBOV	DBOA	DREPO	ZKO
1	0.00912	58.9648	17.4505	7.23451	14.2766	0.82329	1.22899	0.02119
2	0.00994	51.5146	14.6836	12.0350	18.4828	1.93820	1.32732	0.01822
3	0.01097	42.8810	13.1331	19.8112	20.6751	1.82782	1.40078	0.27073
4	0.01137	40.2489	16.7523	18.4645	19.4719	1.72587	3.00541	0.33092
5	0.01217	35.3547	16.1719	16.2742	23.0535	2.04855	3.98238	3.11458
6	0.01229	34.7050	16.8735	15.9949	22.7031	2.52575	4.05360	3.14387
7	0.01242	34.1328	17.3915	15.9257	22.7439	2.47472	4.22205	3.10912
8	0.01246	34.1878	17.3640	15.8271	22.7657	2.54934	4.20881	3.09702
9	0.01261	33.5815	17.5371	15.7007	22.2647	2.81426	4.15683	3.94471
10	0.01267	33.2831	17.3690	15.6152	22.2753	3.23016	4.12006	4.10702

Table 8. Results of Variance Decomposition of Real Effective Foreign Exchange Rate

Period	S.H	DLKREDI	DLREDKE	LTUFE	DBOV	DBOA	DREPO	ZKO
1	0.01614	0.00000	73.6086	1.81914	12.0348	1.03350	6.00417	5.49967
2	0.01867	16.5897	55.0591	3.06784	9.28993	5.91922	5.31121	4.76290
3	0.02151	17.0848	41.5929	20.0996	6.99667	5.61551	4.18363	4.42674
4	0.02348	15.0750	41.0563	16.8791	10.0217	4.75510	4.73586	7.47672
5	0.02443	15.3695	38.7793	15.5997	11.5364	5.10220	5.60271	8.00997
6	0.02474	15.1402	38.3613	15.6798	11.2963	4.97718	6.55219	7.99280
7	0.02494	15.2309	37.9804	15.7986	11.1364	5.50923	6.46369	7.88061
8	0.02507	15.0950	37.7314	15.7026	11.0292	5.54554	6.43052	8.46556
9	0.02516	14.9974	37.4733	15.6038	10.9552	5.55391	6.76625	8.65004
10	0.02527	14.8865	37.2663	15.5241	10.9572	5.97430	6.73104	8.66036

Table 9. Results of Variance Decomposition of the Consumer Price Index

Period	S.H	DLKREDI	DLREDKE	LTUFE	DBOV	DBOA	DREPO	ZKO
1	0.00369	0.00000	0.00000	88.9709	1.90235	8.49949	0.12920	0.49800
2	0.00495	3.79236	1.05025	83.6474	1.12082	5.25920	0.12936	5.00057
3	0.00542	6.82390	3.16781	72.8103	0.93544	6.82558	0.11248	9.32440
4	0.00593	6.99870	7.36535	60.9499	1.01932	8.25368	2.69901	12.7139
5	0.00618	6.47723	8.88779	56.6320	2.45009	8.08555	2.48838	14.9788
6	0.00642	6.15427	8.33217	52.6253	5.23387	7.71240	4.59608	15.3458
7	0.00657	6.22259	7.97772	50.3041	6.56632	7.58944	6.07540	15.2643
8	0.00671	6.09594	7.67302	48.1882	6.58995	7.51811	6.57235	17.3623
9	0.00688	6.06586	7.33434	45.9382	6.27774	9.45432	6.71854	18.2109
10	0.00698	6.06045	7.13507	44.6319	6.31845	9.53814	7.25394	19.0619

Conclusion and Evaluation

In many developed and developing countries after the 2008 global crisis, within the scope of macro-prudential policies, audits for financial markets have been increased, central banks' role in the financial sector has been expanded, and important changes have been made in monetary policy.

One of the important lessons taken from the global crisis is that price stability is not the only condition for financial stability. For this reason, after the crisis, central banks have moved beyond traditional approaches to search for alternative policies. In this context, many countries have developed non-traditional monetary policies according to their economic conditions. With the "Monetary Policy Exit Strategy" published by the CBRT in 2010, a new monetary policy framework has been created to limit macro financial risks. In the new framework, the CBRT has included financial stability in addition to price stability as primary objective set. The CBRT attaches particular importance to credit expansion and exchange rate variables for financial stability and considers these two variables as indicators for financial stability. In the new policy mix, the CBRT uses interest rate corridors, required reserves, reserve option mechanism tools for these purposes together with active liquidity management. For the CBRT, the main rationale for this practice is that rather than using a tool for one purpose, multiple tools are used for multiple purposes. The CBRT can take preventive action against global risks by increasing instrument diversity. In this regard, the effectiveness of the monetary policy instruments in the new policy

framework of the CBRT in terms of price stability and financial stability has been analyzed within the framework of the VAR model for the period of May 2010-December 2016. Since stationarity is an important concept in the VAR model, the stationarity of variables is tested first. Then, lag length for variables in the VAR model has been determined. In the continuation of the study, it has been tested whether the VAR model that has been created provided stability conditions. Granger causality analysis was performed according to the determined lag length.

According to the results of the causality analysis, a causality relation was found from the interest corridor components and from the real effective exchange rate and the consumer price index to the credit volume. In this context, it can be said that the changes in domestic credit volume have been changed depending on the interest rate corridor variables. This situation is an expected result in practice. Because interest rate corridor variables are used to control credit expansion in the new policy mix of the CBRT. A causal relation from the real effective exchange rate to the consumer price index was found. The causality relation from the real effective exchange rate to the consumer price index is a realistic result because of expectations in the economy. Accordingly, an upward movement in the exchange rate cause to an upward movement in inflation through the cost channel in the economy by increasing the prices of the imported goods. Indeed, it is understood that the rise in inflation in Turkey's economy in recent years stems from changes in the exchange rate. In addition, a causality relation was found from the required reserve ratios towards the consumer price index.

According to the results of the impulse-response analysis and variance decomposition in the VAR model, it can be said that the interest corridor components have a significant influence on the credit volume. In particular, it has been found that the volume of the credit is quite sensitive to the overnight lending rate, which is the upper bound of the interest corridor. In this case, it can be asserted that the interest corridor components are an effective means of limiting credit expansion. The CBRT may limit the credit expansion by expanding the interest rate corridor upward during monetary tightening periods. Considering that the CBRT adopted credit expansion as an indicator variable in the direction of its financial stability target, it is understood that the interest rate corridor applied to financial stability is an effective tool and the results overlap with the CBRT implementations. Credits also affect real effective foreign exchange rate besides policy rate and required reserves. The CBRT can restrict capital inflows by narrowing down or upward the interest rate corridor and reducing exchange rate volatility. This situation is very important in terms of financial stability. Therefore, it can be said that monetary policy tools of the CBRT have effect on the two components of financial stability (i.e. credit expansion and exchange rate). Moreover, the results are also consistent with the CBRT practices. Interest corridor components do not appear to have a significant effect on the consumer price index. One notable point here is that the policy rate does not have a significant influence on the consumer price index. This result is

consistent with other studies in the literature and with CBRT applications. Oktar et al. (2013: 14) states that the CBRT has not actively used policy interest rates in inflation developments. It is emphasized that the CBRT responded to inflation developments after 2010 in the form of an increase in the average interest rate and the required reserve ratios. Indeed, the CBRT controlled inflation by increasing required reserve ratios and average funding interest rates in late 2011 and early 2012. In addition, Binici et al. (2013) examined the interest rates of CBRT in the pre-2010 period and the post-2010 period in the study on the interest rate corridor and stated that the policy rate did not have a significant effect on the credit interest and deposit interest in the post-2010 period. When analyzed in this respect, the fact that the policy rate does not have a significant effect on the consumer price index can be explained by the increase in instrument diversity in the monetary policy as a result of the changes in the CBRT's monetary policy in 2010. Parallel to this, it has been found that real effective exchange rate and required reserve ratios have a significant effect on the consumer price index. It is understood that the CBRT has restricted the liquidity in the market by increasing the required reserve ratios rather than the policy rate and has taken the internal demand under control by increasing the difference between the credit interest and the deposit interest. Therefore, it is seen that the CBRT used the required reserve ratios as an effective tool to control inflation after 2010. As a matter of fact, the CBRT tried to control inflation by increasing the required reserve ratios at the end of 2011 and at the beginning of 2012. The result that the required reserve ratios have a significant influence on the consumer price index is consistent with the findings of the causality analysis and the CBRT implementations.

As a result, when we consider the monetary policy objectives and tools that the CBRT put into practice in 2010, we have achieved results consistent with monetary policy implementations. The CBRT's interest rate corridor tool has been effective on the credit expansion and exchange rate volatility, which are interim variables for financial stability. For the price stability target, it has been determined that the exchange of required reserves and the exchange rate are effective.

The increase in instrument diversity within the new policy framework is considered to be a significant advantage for the CBRT as it allows the CBRT to control multiple macroeconomic variables. It can also be said that the reserve option mechanism, a new tool, is effective in increasing the foreign exchange reserves of the CBRT and in limiting the volatility of exchange rates caused by capital movements.

It is considered important for the CBRT to work harmoniously with all regulatory and supervisory institutions in order to ensure financial stability and sustainability. The CBRT's flexible monetary policy against macro financial risks contributed to price and financial stability. However, in order to ensure stability in the long term, it is necessary to reduce foreign

dependency, to protect the current balance by encouraging exports and to solve the structural problems in the financial system and to make the economy have a healthier structure. In such a case, the effect of the monetary policy on the real and financial sector will be even greater.

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ANNEX

Autocorrelation Test Results

Lags	LM-Stat	Prob
1	41.09383	0.7817
2	37.12226	0.8933
3	44.57558	0.6529
4	45.66369	0.6092
5	48.10293	0.5094
6	35.05318	0.9333

Heteroscedasticity White Test Results

Joint test:

Chi-sq	df	Prob.
1658.837	1624	0.2681

7	64.27639	0.0704
8	44.51035	0.6555
9	36.65293	0.9035
10	53.07392	0.3200
11	47.99021	0.5140
12	54.97263	0.2588

Inverse Roots of AR Characteristic Polynomial