Reserve Options Mechanism and Exchange Rate Volatility: An Implementation for Turkey

Lokman KANTAR*

Abstract

Due to the flexible monetary policies implemented during the crisis, low-interest rates obtained funds has moved towards countries with emerging economies and that caused speculative attacks (the volatility in exchange rates, capital market etc. to make short-term trades.) on countries such as Turkey. Therefore, Turkey has developed a set of measures to ensure price stability along with financial stability. One of these measures is the Reserve Option Mechanism, which enables TL required reserves to be held in foreign currency. Foreign currencies entering the country through the Reserve Options Mechanism will not enter the economy directly, and some of this money will be kept by the CBRT as required reserves by banks. Thanks to this mechanism, it is aimed to reduce the volatility in exchange rates. In this study, the effect of Reserve Options Mechanism on exchange rate volatility has been examined. In this framework, the effect of the GARCH approach used in modelling volatility in the 2011-2016 period and the Reserve Option Mechanism on exchange rate volatility was researched. As a result of the study, it is concluded that the Reserve Option Mechanism (ROM) variable decreases the volatility.

Keywords: *Reserve Options Mechanism, Reserve Options Coefficient, Volatility, GARCH, Global Crisis*

JEL CODES: *C58-E58-G38*

1. Introduction

The Reserve Options Mechanism (ROM) is an application that allows a portion of Turkish Lira required reserves to be held in foreign currency and gold (Koray et al., 2012). Although the main objective of The Central Bank of Turkey (CBRT) is price stability, after the 2008 global crisis they brought forward financial stability as well as price stability. To achieve the financial stability target, the CBRT introduced a new instrument called the Reserve Options Mechanism (ROM), which allows holding required reserves in foreign currency and gold alongside traditional instruments such as required reserves and interest rate corridor. With the ROM, it was aimed to strengthen foreign exchange reserves, to provide banks with more flexibility in their liquidity management, and to reduce the volatility that may arise in exchange rates due to short-term capital movements (Basci, Aktaran Ergin and Aydin: 2017). Thanks to the ROM, banks gain flexibility in establishing Turkish lira required reserves, and can optionally accumulate

Original Research Article
Received: 01.11.2019
Accepted: 12.04.2021

* Asst. Prof., PhD, Istanbul Gelisim University, School of Applied Sciences, Department of Banking and Insurance, Istanbul, TURKEY, E-mail: lkantar@gelisim.edu.tr https://orcid.org/0000-0002-5982-6021

foreign exchange reserves with the central bank (Eroglu and Kara, 2017). In this application, the coefficient indicating the amount of foreign currency or gold is called reserve option coefficient (ROC). The extent to which it will benefit from ROM can be adjusted by increasing or decreasing the ROC. While ROM is used more when ROC is increased, ROM is used less when ROC is decreased. CBRT can change this coefficient depending on the foreign currency inflow into the country.

ROM has an automatic balancing feature, which is different from direct foreign currency purchase and sale interventions, ie banks can decide for themselves how much they will benefit from ROM based on the relative costs of TL and FX resources. Another advantage of ROM is that the foreign exchange reserves that banks hold in the CBRT will grow in proportion to the passive growth rate of the banking sector. This in turn means that banks' reserves have the potential to be bigger than the rate at which the CBRT increases its total reserves (Alper, Kara and Yorukoglu 2012).

It has been a recent discussion in the literature whether the ROM and interest corridor are substitutes for each other. While the interest rate corridor and the ROM are both used to hedge capital flows volatility, the interest rate corridor affects exchange rate volatility through direct portfolio behavior; changing the use of the capital entering the country. For this reason, ROM has reduced the need for the interest rate corridor in order to reduce the volatility of the domestic capital flows on the domestic market. However, the use of ROM does not completely remove the need for the interest rate corridor. ROM can be sterilized with the help of the foreign exchange interest corridor which cannot be withdrawn from the market, which indicates that the ROM and the interest rate corridor can be used as complementary qualities (Kantar 2017).

Volatility refers to the price of a financial asset and the fluctuation of the overall market during a certain period of time. Statistically, it is a measure of the distribution and spread of the development of a financial asset around a certain average. According to definitions in the literature, volatility, as a measure of risk, indicates the systematic and unavoidable risk of an asset as a measure of the change of the price of the asset relative to the market index, refers to the variance or standard deviation of the asset (Ertugrul 2012).

Since 1973, the concept of volatility has begun to be effective from the years when advanced industrial countries' currencies transitioned from an adjustable fixed exchange rate system to a free floating exchange rate exchange rate system. Volatility has indicated its impact on different areas between countries. These are in the form of volatility related to inflation in emerging markets experiencing exchange rate, interest, stocks and inflation problems (Kantar 2017).

There are two proposals in the literature for the prevention of exchange rate volatility. These are:

I. Restructuring of the international exchange system by returning to the gold standard or fixed exchange rate system as the exchange rate system,
II. The fluctuations in the foreign exchange rates are interfered with

the monetary policies implemented by the central banks and the intensive capital inflows and outflows are controlled. (Ertugrul 2012)

This high level of volatility in stocks and exchange rates has laid the foundation for many empirical studies and economic modeling in economic summer. The most important studies on the determination of volatility are the studies of Engle (1982) and Bolerslev (1986) (Sarikovanlik, Koy, Akkaya, Yildirim ve Kantar, 2019). After the global financial crisis began in 2008, primarily due to the lowering of interest rates in especially the United States and Europe, low-cost funds obtained from the United States and European countries tended to move towards developing countries with higher interest rates such as Turkey. Since foreign currencies entering the country in a short-term and uncontrolled manner will cause volatility in the exchange rates of countries, the central banks of developing countries have taken various measures to ensure that these currencies enter the market under a certain control. Some of these measures are methods such as required reserves and interest corridor. Central Bank of the Republic of Turkey (CBRT) has put ROM into practice to prevent volatility in exchange rates and avoid allowing the separation of foreign currency and gold reserve to ensure financial stability. Although short-term empirical studies have been carried out with the effect of the ROM on the exchange rate volatility, the lack of any empirical work on whether the ROM is effective in the long term has been the motivation for this study.

2. Literature Review

Work on exchange rate volatility has become even more important since the Bretton-Woods system collapsed in 1973, leaving the money of the industrialized countries to fluctuate. In 1987, Bollerslev estimated the daily exchange rates and the volatility of stock prices using the GARCH (1,1) -t model in the 1980-1985 period.

Hseih (1989), used daily data from 1974-1983 to examine the volatility between the US dollar, Canada, Switzerland, Germany, England and Japan with the help of ARCH and GARCH models and found that the EGARCH (1,1) model of the GARCH models gave better results.

Engel and Hamilton (1990), examined the volatility between the US dollar and the German, French and British currencies in the period 1973-1988 with the Markov transformation model, which was better predicted than the random walk model.

Heynen and Kat (1994), estimated the volatility between the US dollar and the 5 currencies in the 1980-1992 period with GARCH (1,1), EGARCH (1,1), and Stochastic volatility models and found the best ending GARCH (1,1) model.

Engel (1994), succeeded in studying volatility with Markov transformation model and random walk model with 18 different exchange rates in the period of 1973-1986 and using the Markov transformation model to predict the direction of exchange rate changes.

West and Cho (1995), discussed the volatility of five weekly bidirectional nominal exchange rates against the US dollar in the period 1973-1989 with the univariate constant variance model

(ARIMA), GARCH (1,1) and IGARCH (1,1) they have reached the conclusion that it is not possible to find the best prediction model.

Fong (1998), explored the volatility between the Mark / Paund exchange rate and the SWARCH model in 1987-1994, and the ERM crisis in 1992 was well captured as the model considers the structural break.

Beine, Laurent and Lecourt (2003), attempted to estimate the volatility between the Dollar / German Mark and the Dollar / Japanese Yen currencies using the SWARCH model taking into account GARCH and structural breakdown in two different periods, 1985-1995 and 1991-1995. According to the results of the study, the SWARCH model considering the structural break was found to be more successful than the GARCH model.

Fidrmuc and Horvath (2008), examined foreign exchange volatility of countries such as the Czech Republic, Hungary, Poland, Slovakia and Romania from the new EU member states in the period 1999-2006 by using the TARCH model which takes into account GARCH and asymmetry. Because of the asymmetry observed in the currencies of these countries, the TARCH model, which takes asymmetry into consideration, proved to be better.

Caglayan and Dayioglu (2009), examined the volatility of OECD countries in exchange rates during the 1993-2006 period with ARCH, GARCH, EGARCH and TGARCH models. They found that for most countries asymmetric ARCH models (TGARCH) were better than symmetric models in the study.

Ermisoglu, Oduncu and Akcelik (2013), formed a currency basket composed of 0,5 * Euro / TL and 0,5 * Dollar / TL between the dates of 2010-2012 and examined the effect of ROM on exchange rate volatility by using the GARCH (1,1) model and that ROM has reduced exchange rate volatility.

Demirhan (2013), in his study examining the financial stability instruments of the CBRT, stated that the required reserve application was used to adjust the credit volume and reduce the volatility in short-term interest rates, while the interest rate corridor and the ROM application were used to reduce the negative effects of foreign capital inflows on the economy.

Aysan et al. (2014), examined the effectiveness of the asymmetric interest rate corridor and the ROM used by the CBRT to ensure financial stability. According to the findings of the study, they stated that the asymmetric interest corridor is used to eliminate the negative effects of short-term capital movements, and the ROM is used to prevent volatility in exchange rates.

Ersoy and Isil (2016), examined the monetary policy instruments implemented after the global crisis and stated that, according to the study findings, required reserves and ROM implementation limited credit expansion.

Icellioglu (2017), examined the monetary policy tools implemented by the CBRT to achieve the price and financial stability targets in 2010 and after. According to the findings of the study, it was concluded that the wide interest rate corridor gave flexibility to the applied interest policies, strengthened the balance sheets of banks with the required reserve application and reduced the volatility caused by capital movements in exchange rates with the ROM application.

Oner (2018), examined the monetary policies implemented by the CBRT after the 2008 global crisis. According to the findings of the study, he emphasized that after the global crisis, price stability has become important as well as financial stability and that non-traditional monetary policy tools such as required reserves, interest rate corridor, ROM and communication policy are used to ensure financial stability.

Kurum and Oktar (2019), tested the effectiveness of the ROM application implemented by the CBRT to ensure financial stability. According to the findings of the study using Engle-Granger Cointegration and Toda-Yamamoto Causality analyzes using monthly data from 2011-9: 2018-12, they concluded that the ROM application has significant effects on the exchange rate.

When the studies on the ROM implementation are examined, the studies on the effect of the ROM application on financial stability are related to whether it reduces the exchange rate volatility. In this study, both the effect of ROM application on financial stability will be examined and it is aimed to contribute to the literature by testing the effect of ROM on negative shocks in exchange rates.

3. Data and Methodology

In the literature, ARCH models are used because of the fact that the errors observed in the time series in the models related to the exchange rate are not normally distributed and they are not linear. In this study, the GARCH, TGARCH and EGARCH models which take into account the asymmetry and conditional variance of ARCH models that are developed later, will be used as a comparative measure and to determine whether ROM is more effective against negative shocks in order to contribute to the model economy literature, will be added.

An exchange basket of 0.5 (Euro / TL) and 0.5 (Dollar / TL) was formed by taking the daily exchange rate from the electronic data distribution system (EVDS) of the central bank as the exchange rate in this study which examines the effect of ROM on exchange rate volatility. The dataset includes dates between 16/09 / 2011-16 / 09/2016; since the data in the dataset has been publicly disclosed on different dates, the date of 16/09/2016 was taken as the last date of data interval in terms of harmonization of dates. Again, another reason why these dates are taken as a basis is the CBRT abolished the interest rate on required reserves within this date range. In case of payment of interest on required reserves, the effectiveness of the ROM implementation decreases. The aim of the study is that the period in which no interest payments for required reserves are paid since the ROM implementation has an effect on financial stability is the period of the study.

(Rt), foreign exchange amounts (DMSt) that the central bank sold through direct interventions, additional monetary tightening by the central bank as a control variable (days when monetary tightening was done1 , other days 0 DEPS), the change in the VIX[1] index (ΔVIX), which well reflects the fluctuations in global capital flows, was also included in the model as a further explanatory variable, reflecting the amount of foreign currency held for Turkish Lira required reserves under the ROM in order to measure the effect of ROM.[2]

Model:

$$R_t = \beta_0 + \beta_1 R_{t-1} + \beta_2 R_{t-3}{}^{3} + \beta_3 \Delta VIX_t + \beta_4 DMS_t + \beta_5 D_{EPS} + \beta_6\, ROM_t + \varepsilon_t \quad (1)$$

$$\varepsilon_t \sim N(0, h_t) \quad (2)$$

$$h_t = a_0 + a_1 \varepsilon_{t-1}^2 + a_2\, h_{t-1} + a_3 \Delta VIX_t + a_4 DMS_t + a_5\, D_{EPS} + a_6\, ROM_t + u_t \quad (3)$$

$$h_t = a_0 + a_1 \varepsilon_{t-1}^2 + a_2\, h_{t-1} + a_3 \Delta VIX_t + a_4 DMS_t + a_5\, D_{EPS} + a_6\, ROM_t + a_7\, D_{ROMt}{}^{4} + u_t \quad (4)$$

The explanations of the variables used in the model are as follows:

$R_t = \ln(P_t/P_{t-1})*100$ P_t: Value of exchange basket

$\Delta VIX_t = \ln(VIX_t/VIX_{t-1})*100$ VIX_t: VIX Value:

$$DMS_t = \frac{\text{Exchange rate amount sold by CBRT through intervention or tendering}}{\text{Gross exchange rate reserve of CBRT}}$$

D_{EPS}= 0, other days

1, days when the additional monetary consolidation is implemented

$$ROM_t = \frac{\text{Exchange rate amount retained for Turkish Lira reserve requirements within the scope of ROM}}{\text{Gross exchange rate reserve of CBRT}}$$

[1] VIX is an index measuring the implied volatility for the S & P 500 index. This index is expressed as a percentage and is considered as a sign of global risk desire. This decline in the index is expressed as an increase in risk desire, while the increase is expressed as a decrease in risk desireç

[2] DMSt and ROMt variables in the model are normalized by dividing to gross reserves. Again, the series are made stable by taking the natural logarithm of the variables Rt and ΔVIXt.

[3] The first five delays of Rt variables are included to the model, however only first and third delays are considered as meaningful.

[4] In order to test the effect of ROM on negative shocks to the DROMt variable variance equation 1 if Rt <0; otherwise it is added as a control variable of 0; will be compared with the variance equation before addition.

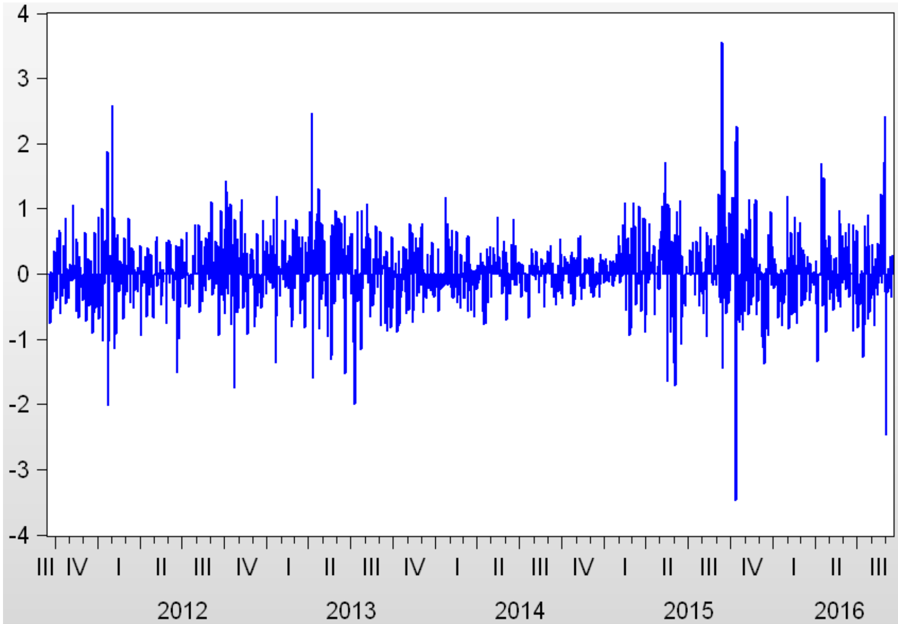

Figure 1: Daily return of the exchange rate basket

As seen in Figure 1, the use of ROM is highly preferred from the beginning of 2011 to the middle of 2014, and with the increase in the cost of foreign exchange, it is observed that the banks have begun to act a little abstention about ROM use (Ermisoglu et al., 2013).

3.1. Stability Analyzes

In order to create models in the time series, the variables in the model must be stationary, ie they should not have unit roots. If the variables included in the model are not stable, the results obtained will be biased and the results will be misinterpreted (Brooks 2008).

Table 1: Stability of the variables used in the model

Variables	*ADF t-statistics*	*P- value*
R_t	-31.56483	0,0000
ΔVIX_t	-44,99015	0,0001
DMS_t	-17,50721	0,0000
ROM_t	-3,366976	0,0123
ΔROM_t	-42,73098	0,0000

As indicated in Table 1, when the unit root tests of the variables in the model are applied, all the variables except for the ROMt variable are significant at the 1% significance level and do not contain the unit root. All variables are stable at the 1% significance level when the ROMt variable is first subtracted and the ΔROMt variable is reordered.[5]

[5] Since DEPS is a control variable, it is not necessary to display it on the table.

3.2. Estimation and Results of Models

In order to test the effect of ROM on exchange rate volatility, the lowest AIC, SIC values to be applied with GARCH (1,1), GJR or TGARCH (1,1) and EGARCH (1,1) it will be considered as a good model. Since the effect of ROM on volatility is measured in the model, the results are interpreted through the variance equation.

Table 2: GARCH (1,1) Variance Equation

Variables	*Coefficients*	*P Value*
c	0,147084	0,0000
ε^2_{t-1}	0,127005	0,0000
h_{t-1}	0,509321	0,0000
ΔVIX_t	-,003997	0,0000
DMS_t	-6,548730	0,0000
D_{EPS}	-0,042819	0,0000
ROM_t	-0,173839	0,0018

As indicated in Table 2, the GARCH (1,1) model was considered to be an effect of reducing the volatility of the variable ROMt in the variance equation. But here the volatility does not give an idea of whether positive shocks or negative shocks are there. For this reason, by re-testing the model by adding a control variable to the GARCH (1,1) model that can give an idea of the response of ROM to negative shocks to the variance equation;

Table 3: GARCH (1,1) Model Modified Variance Equation

Variables	*Coefficients*	*P Value*
c	0,164116	0,0000
ε^2_{t-1}	0,123536	0,0000
h_{t-1}	0,539482	0,0000
ΔVIX_t	-0,003868	0,0001
DMS_t	-4,099848	0,1402
D_{EPS}	-0,027864	0,0144
$\underline{ROM_t}$	-0,110093	0,1466
D_{ROMt}	-0,269960	0,0000

When we look at Table 3, we clearly observe that ROM is more effective in negative shocks when we add the D_{ROMt} control variable to the variance equation. For this reason, it seems to be a more useful model than the previous variance equation.

Table 4: GJR / TGARCH (1,1) Model Variance Equation

Variables	*Coefficients*	*P Value*
c	0,165249	0,0000
ε_{t-1}^2	0,129459	0,0000
$\varepsilon_{t-1}^2 * I_{t-1}$	-0,072647	0,0299
h_{t-1}	0,542539	0,0000
ΔVIX_t	-0,004588	0,0000
DMS_t	-4,031068	0,3967
D_{EPS}	-0,027901	0,0232
$\underline{ROM_t}$	-0,105995	0,1686
D_{ROMt}	-0,257562	0,0000

When we examine Table 4, we see that positive shocks in the model are more likely to affect the exchange rate volatility, because the coefficient of the ε_{t-1}^2It-1 variable is negative, but the asymmetry is not taken care of since the main subject of the thesis is the effect of ROM on volatility.

Table 5: EGARCH (1,1) Model Variance Equation

Variables	*Coefficients*	*P Value*
ω	-0,089681	0,6021
$\left\lvert \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right\rvert$	0,113444	0,0000
$\varepsilon_{t-1}/\sqrt{h_{t-1}}$	0,052502	0,0000
$\log h_{t-1}$	0,977748	0,0000
ΔVIX_t	-0,013406	0,0000
DMS_t	-13,13530	0,0008
D_{EPS}	0,047476	0,0039
$\underline{ROM_t}$	-0,040183	0,2892
D_{ROMt}	-0,139106	0,1300

When examining Table 5, although the model has advantageous aspects compared to other models and ROM correctly determines the effect on volatility, statistically the results are not significant.

Table 6: GARCH Models for Turkey Foreign Exchange Rate Series

			GARCH(1,1)	TGARCH(1,1)	EGARCH(1,1)
Variance Model	α_0	Coefficient	0,164116	0,165300	-0,089367
		p Value	0,0000	0,0000	0,0000
	α_1	Coefficient	0,123536	0,129334	
		p Value	0,00000	0,0000	
	β_1	Coefficient	0,539474	0,543263	0,977849
		p Value	0,0000	0,0000	0,00000
	γ	Coefficient		-0,072855	
		p Value		0,0291	
	δ_1	Coefficient			0,113051
		p Value			0,0000
	δ_2	Coefficient			0,052550
		p Value			0,0000
Criteria	**AIC Criteria**		*1,173915*	*1,177468*	*0,998226*
	SIC Criteria		*1,219197*	*1,225769*	*1,046527*
	Logprobility		*-1056,197*	*-1058,440*	*-894,8816*

When Table 6 is examined, the model with the lowest AIC and SIC criterion and the highest Logability value is chosen as the best model according to the model results. According to this, although the EGARCH (1,1) model is the best model, the GARCH (1,1) model has been chosen as a more suitable model because some variables in the variance equation are meaningless.

In order to be able to decide the compatibility of the generated model, the standardized mistakes and mistakes squares are examined, it is reached that the errors are meaningless at 1% level in all delayed periods and error squares in the first two delay periods, that is, the model is valid.

Table 7: Correlogram of Standardized Errors and Error Squares

Standardized Errors			Stnadardized Error Squares		
Term	**Q Statistics**	**p Value**	**Term**	**Q Statistics**	**p Value**
1	1,2965	0,255	**1**	3,7749	0,052
2	4,5582	0,102	**2**	7,4418	0,024
3	4,8361	0,184			
4	4,8388	0,304			
5	4,9596	0,421			

When we test whether the ARCH effect is present in the result of GARCH (1,1) model;

H_0: Errors have no ARCH impact

H_1: Errors have ARCH impact

As indicated in Table 7; Here, H_0 hypothesis was accepted at the 5% level of significance of the model errors (p value 0.0523), so that the ARCH impact was not found in the errors.

When it is examined whether the errors in the model indicate a normal distribution, it is determined that the value of the error is 8,266,613, that is, the thick tail. This result is accepted as being a frequent situation in volatility models and non-linear models. According to the findings and results obtained, the appropriate conditional variance equation for the series;

$$h_t = 0.164116 + 0{,}123536\varepsilon_{t-1}^2 + 0{,}539474\, h_{t-1} - 0{,}003868\Delta VIX_t - 4{,}099838DMS_t$$

$$-0{,}027863\, D_{EPS} - 0110093\, ROM_t - 0{,}269959\, \mathrm{D}_{\mathrm{ROMt}}$$

Conclusion

In this study, the effect of ROM on exchange rate volatility has been tested with GARCH models. The return (Rt) of the 50% USD and 50% Euro currency basket representing the exchange rate is accepted as the dependent variable. Volatility Index (VIX), the amount of foreign currency sold through linear interventions (DMS), Additional monetary tightening (DEPS), with the first (Rt-1) and third lag values (Rt-3) of the exchange rate return, Turkish A regression model was created with ROM variables representing the ratio of the exchange rates held for the lira required reserves to the central bank's exchange rate reserves. In the study, a variance model was created that takes into account the volatility in the exchange rate and the DROM dummy variable was included in the model to measure the effect of negative shocks on exchange rate returns. In all the variance equations, which were made separately according to the GARCH (1,1), TGARCH (1,1) and EGARCH (1,1) models used to measure volatility, the ROM variable was found to be statistically significant and the sign was negative as expected. In other words, it is concluded that the ROM variable reduces the exchange rate volatility. As the effect of negative shocks was examined in the study, the DROM variable was found to be significant according to the GARCH (1,1) and TGARCH (1,1) models, but not statistically significant compared to the EGARCH (1,1) model. Among GARCH (1,1), TGARCH (1,1) and EGARCH (1,1) models according to the decision criteria (the model with the lowest AIC and SIC criterion and the highest Log Likelihood value), it was concluded that GARCH (1,1) model is the most suitable one. According to the GARCH (1,1) model, both the ROM variable and the DROM variable were found to be statistically significant and negative. As can be seen from these results, it is found that the ROM implementation reduces the volatility of exchange rate returns and is more effective against negative shocks.

Developing countries are usually exposed to short-term capital flows because of high interest rates, which in turn affects the exchange rate volatility in the country and thus negatively affects financial stability. For this reason, this study suggests that the use of ROM, an engineering work of the CBRT, in countries with similar conditions is extremely important in terms of ensuring financial stability.

REFERENCES

ALPER, K. KARA, H. & YORUKOĞLU, M. (2013). Reserve Options Mechanism, *Central Bank Review. 13,1-14*

AYSAN, A.F., FENDOGLU, S. & KILINC, M. (2014). Managing Short-Term Capital Flows in New Central Banking: Unconventional Monetary Policy Framework in Turkey, TCMB Working Paper, No:14/03, 1-25.

BEINE M, LAURENT, S& LECOURT C.(2003). Official Central Bank Interventions and Exchange Rate Volatility: Evidence from a Regime-Switching Analysis, *Europen Economic Review, 47, 891-911*

BASCI, E. (2012). Zorunlu Karşılıklar ve Diğer Makro- İhtiyati Tedbirler: Gelişmekte olan Ülkeler Deneyimleri Konferansı, http://www.tcmb.gov.tr/wps/wcm/connect/50e02fca-8df1-4567-8179-ec1cb3bc2b12/Basci-ZorunluKarsilik-konusma.pdf?MOD=AJPERES&attachment=true&CACHE, Erişim Tarihi: 12.05.2016

BOLLERSLEV, T.(1987). A conditionally Heteroskedastic Time Series Model for Speculative Prices and Rates of Return. *Review of Economics and Statistics, 69, 542-547*

BROOKS, C.(2008). *Introductory Econometrics for Finance*. Second Edition

CAGLAYAN, E. & DAYIOGLU, T.(2009). Döviz Kuru Getiri Volatilitesinin Koşullu Değişen Varyans Modelleri ile Öngörüsü. *İstanbul Üniversitesi İktisat Fakültesi Ekonometri ve İstatistik Dergisi, 9,1-16*

DEMİRHAN, B. (2013). Türkiye'de Yeni Yaklaşım Çerçevesinde Para Politikalarının Finansal İstikrarı Sağlama Yönünde Uygulanması. Afyon Kocatepe Üniversitesi İİBF Dergisi. XV(II), 567-589.

ENGLE, C. ve HAMILTON J.D.(1990). Long Swings in the Dollar: Are They in the Data and Do Markets Know It?. *The American Economic Review, 80(4), 689-713*

ENGLE, C.(1994). Can the Markow Switching Model Forecast Exchange Rates? *Journal of International Economics, 36, 151-165*

ERGIN, A. & AYDIN, I. H. (2017). Finansal İstikrarı Sağlamaya Yönelik Bir Araç: Rezerv Opsiyon Mekanizması, *Batman Üniversitesi Yaşam Bilimleri Dergisi*, 7(1/1):63-75

EROGLU, N. & KARA, F. (2017). Makro İhtiyati Para Politikası Araçları ve Türkiye Uygulaması Üzerine Genel Bir Bakış, *İşletme ve Finans Çalışmaları Dergisi* 6(2):60-69.

ERSOY, H. &ISIL G. (2016). Küresel Kriz Sonrası Merkez Bankası Para Politikaları ve Finansal Sistem Üzerine Etkileri, İstanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi, Yıl:15, Özel Sayı:29:349-374.

ERTUGRUL, H. M. (2012). *Türkiye'de Döviz Kuru Volatilitesi ve Enflasyon İlişkisi.* Doktora Tezi.Ankara Hacettepe Ü. Sosyal Bilimler Enstitüsü.

FIDRMUC, J. &HORVATH, R. (2008). Volatility of Exchange Rates in Selected New EU Members: Evidence from Daily Data. *Economic Systems, 32(1), 103-118*

FONG, W.M. (1997). Volatility Persistence And Switching ARCH in Japanese Stock

Returns. *Asia-Pasific Financial Market, 4(1), 37-57*

HEYNEN, R.C. & KAT, H. M. (1994). Volatility Prediction: A Comparison of Stochastic Volatility, GARCH (1,1) and EGARCH (1,1) Models. *Journal of Derivatives, 2(2), 50-65*

HSIAH, D.A. (1989). Modeling Heteroskedasticity in Daily Foreign Exchange Rates. *Journal of Business and Economic Statistics, 7, 307-317*

ICELLIOGLU, C. (2017). Finansal İstikrar ve Türkiye Cumhuriyet Merkez Bankası'nın Para Politikası Stratejisi, Mehmet Akif Ersoy Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 9(20): 20-38

KANTAR, L. (2017). *Rezerv Opsiyon Mekanizması ve Döviz Kuru Volatilitesi: Türkiye Üzerine Bir Uygulama*. Doktora Tezi. İstanbul. İ.Ü. Sosyal Bilimler Enstitüsü

KURUM, E. M. & OKTAR, S. (2019): Rezerv Opsiyon Mekanizmasının Döviz Kuru Üzerindeki Etkisi, *Marmara Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 41(1):223-246

ODUNCU, A. ERMISOGLU E.& AKCELİK, Y. (2013). Merkez Bankasının Yeni Enstrümanı Rezerv Opsiyonu Mekanizması ve Kur Oynaklığı, *Bankacılar Dergisi, 86, 43-52*

ONER, S. (2018). 2008 Küresel Krizi Sonrası Dönem TCMB Para Politikası Uygulamaları, Avrasya Sosyal ve Ekonomi Araştırmaları Dergisi (ASEAD), 5(12):409-416

SARIKOVANLIK, V., KOY, A., AKKAYA, M., YILDIRIM, H. H., KANTAR, L. (2019). Finans Biliminde Ekonometri Uygulamaları, Seçkin Yayıncılık, Ankara.

WEST, K. D. ve CHO, D. (1995) The Predictive Ability of Several Models of Exchange Rate Volatility. *Journal of Econometrics, 69, 367-391.*