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Reserve Options Mechanism and FX Volatility

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Reserve Options Mechanism and FX Volatility[‡]

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Abstract

Reserve Options Mechanism (ROM), which is the option to hold FX or gold reserves in increasing tranches in place of Turkish Lira reserve requirements of Turkish banks, was designed and launched by the Central Bank of the Republic of Turkey (CBRT). ROM is a tool unique to the CBRT and it is aimed to support the FX reserve management of the banking system and to limit the adverse effects of excess capital flow volatility on the macroeconomic and financial stability of Turkey. In this paper, we study the effectiveness of ROM on the volatility of Turkish Lira, and to the best of our knowledge, it is the first analytical paper on investigating the effects of the ROM. The results suggest that ROM is an effective policy tool in decreasing the volatility of Turkish lira in the sample period.

Keywords: Reserve Options Mechanism, Volatility of Turkish Lira, Central Bank of the Republic of Turkey's Policy Mix, GARCH.

JEL classification: C12, C58, E58, G10

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1 Introduction

The global crisis in 2008-2009 proved that maintaining low and stable inflation does not guarantee macroeconomic stability if financial stability is overlooked[1]. Therefore, finding a solution on incorporating financial stability in the implementation of monetary policy without diluting the price-stability objective has been discussed by both academicians and policy makers since then[2]. The idea that is gaining ground is that central banks should contribute to financial stability as well as maintain price stability and while doing so, prudential tools should be utilized with a macro perspective rather than micro. Accordingly, using only short-term interest rates as the main policy tool may not be enough to maintain price stability and contribute to financial stability at the same time. Interest rates that provide price stability and financial stability can be different and this necessitates central banks to use multiple policy tools.

Central Bank of the Republic of Turkey (CBRT) adopted a new monetary policy framework called the policy mix since November 2010 in order to offer a country-specific solution to this concern. Within this framework, CBRT recently designed Reserve Options Mechanism (ROM) that is the option to hold FX or gold reserves in increasing tranches in place of Turkish Lira reserve requirements of Turkish banks. In terms of its effects, ROM may be considered as analogous to sterilized FX interventions since their

[1] Borio (2011).
[2] Brunnermeier et al. (2009), Bean (2009).

purpose is mainly to smooth the impact of capital flow volatility on exchange rates and balance sheets of the Turkish banks[3].

In this paper, the effect of ROM on the volatility of Turkish Lira is examined with the Generalized Autoregressive Conditional Heteroskedastic (GARCH) family of statistical techniques. To the best of our knowledge, it is the first empirical study in analyzing the effects of this mechanism. Controlling for other factors, we find that ROM decreases the volatility of exchange rates in Turkey during the period analyzed.

The remainder of the paper is organized as follows. Next section details the new policy mix that the CBRT implemented. Section 3 presents a brief review of the literature. Section 4 gives details about the data set and the methodology used. Section 5 shows the empirical results of this study. Section 6 concludes the paper.

2 The New Policy Mix and Reserve Options Mechanism

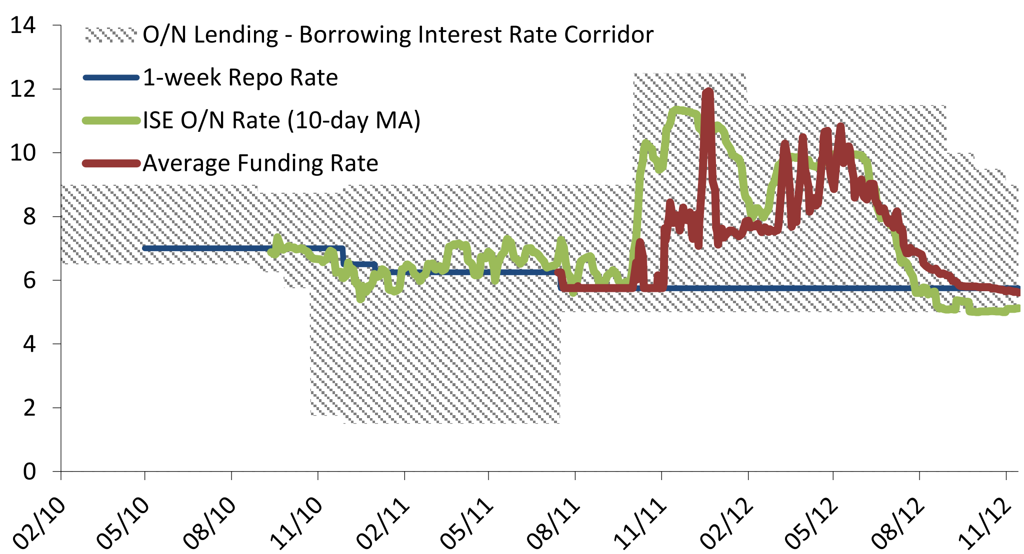
In the new policy mix, while maintaining price stability is the priority goal, contributing to the financial stability becomes a supportive objective in the monetary policy framework.[4] In this framework, required reserves and other macro prudential tools as well as weekly repo rates, interest rate corridor and funding strategy are jointly used as complementary tools for credit, interest rate and liquidity policy, respectively[5]. Figure 1 shows the interest rate corridor, 1-week repo rate, Istanbul Stock Exchange (ISE) Overnight (O/N) interest rate and the CBRT's average funding rate.

[3] Alper et al. (2012).
[4] For details of the CBRT's policy mix, see Başçı and Kara, (2011).
[5] Başçı (2012).

As part of the liquidity policy, a pillar of the new policy mix, O/N interest rates are adjusted according to the course of economic and financial developments without changing the weekly repo rates, i.e. the policy rate (Başçı, 2011). Moreover, CBRT has occasionally delivered additional monetary tightening (AMT) in order to prevent undesired exchange rate movements from deteriorating the inflation outlook via pass-through and expectations. On the days of AMT, funding supplied via quantity auction method at the policy rate is reduced (or given none at all). Instead, market is funded via market price based auctions, and hence, O/N rates settle close to the upper bound of the interest rate corridor.

Figure 1

Interest Rates and Monetary Policy

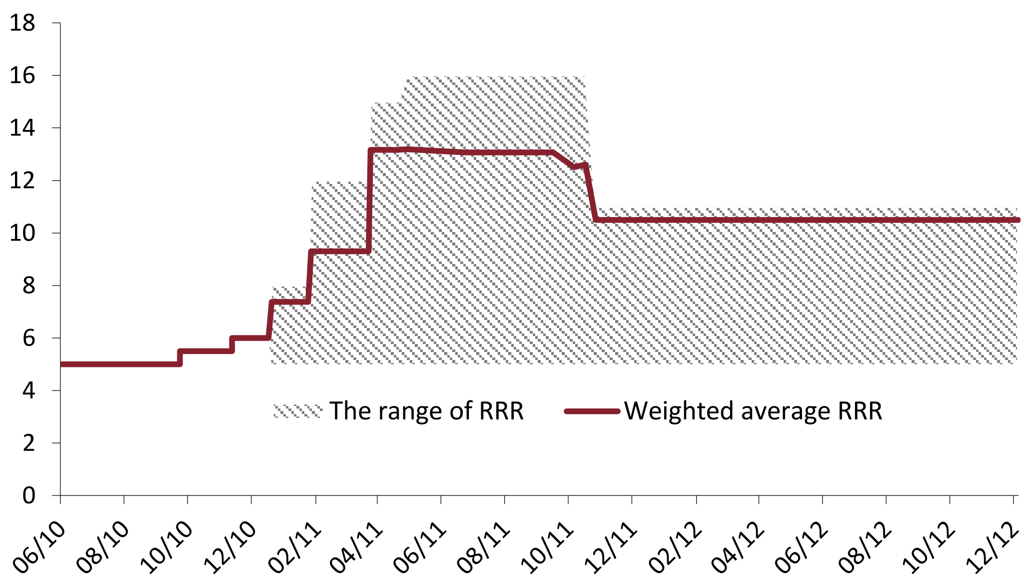


In the period of October 2010 and August 2011, strong global risk appetite drove short-term capital inflows to emerging markets. During this period, CBRT aimed to lengthen the maturity of capital inflows and to prevent excessive appreciation of the

Turkish lira. Reserve requirement ratios were also raised to control domestic demand and to prevent excessive credit growth in order to rebalance domestic and foreign demand. In the period of August 2011 and June 2012, concerns on the sovereign debt of some European countries had resulted in an escalation in global risk aversion, and CBRT proactively utilized the same policy tools in the opposite direction in response to capital outflows. During this period, Turkish lira reserve requirements were reduced to decrease the liquidity requirements of the banking sector. Figure 2 shows the range and the weighted average of reserve requirement ratios (RRR).

Figure 2

TL Reserve Requirements



In the meantime, CBRT has adopted a new policy mechanism called Reserve Options Mechanism that aims to support the FX reserve management of the banking system, to increase FX reserves of CBRT and to limit the adverse effects of excess capital flow volatility on the macroeconomic and financial stability of Turkey. ROM gives

Turkish banks the option to hold FX or gold reserves in place of a certain fraction of TL reserve requirements. The mechanism is designed to operate as an automatic stabilizer to changes in capital flows through giving the flexibility to Turkish banks adjusting their FX reserves endogenously in accordance with their liquidity needs.[6]

Figure 3

Reserve Options Mechanism (FX)

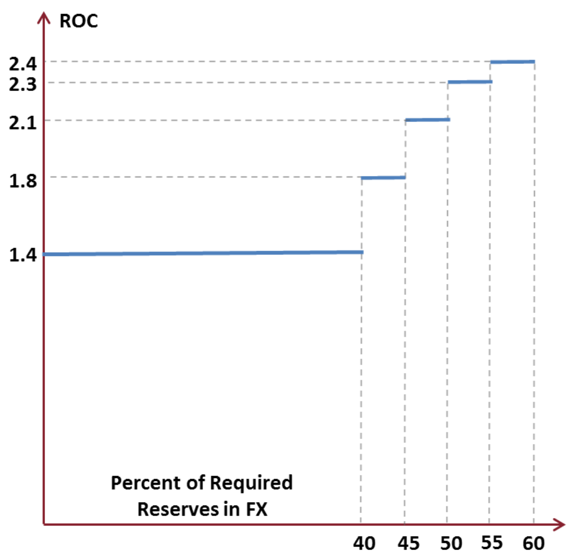
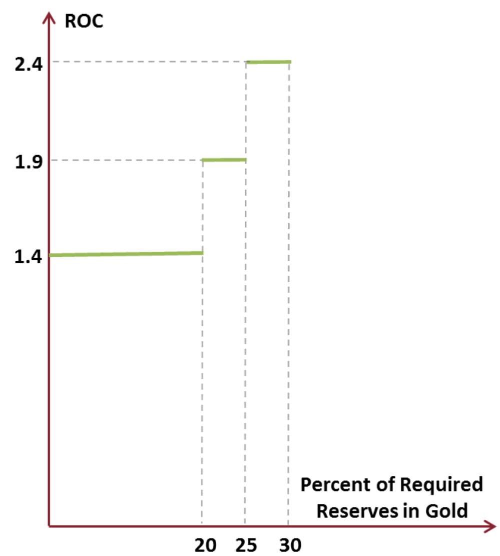


Figure 4

Reserve Options Mechanism (Gold)



The mechanism was put in place in dynamic steps in order to familiarize the market with the new policy tool as well as to meet the needs of the liquidity conditions. At first, the upper limit for one-to-one FX reserves that might be held to maintain Turkish lira reserve requirements was set at 10% in September 2011 and then it was increased gradually to 40%. In May 2012, reserve option coefficient (ROC) was introduced and the upper limit of the facility was raised to 45% — the total amount of FX in place of TL reserve requirements is calculated by multiplying the first tranche

[6] For the design of the mechanism, see Alper et al. (2012).

corresponding to 40% of TL reserve requirements by a ROC of "1", as previously, and the second tranche corresponding to 5% of TL reserve requirements multiplied by a ROC of "1.4". After having been revised a number of times, the upper limit of the above-mentioned facility has been raised to 60% in August 2012 and the current ROC's are as follows: the first 40%: **1.4**, 40% - 45%: **1.8**, 45% - 50%: **2.1**, 50% - 55%: **2.3** and 55% - 60%: **2.4** (Figure 3). Similarly, the upper limit for one-to-one gold reserves that could be held in place of TL reserve requirements was set at 10% in September 2011 and then it was increased gradually to 30%. As of now, the ROC's for gold are as follows: the first 20%: **1.4**, 20% - 25%: **1.9** and 25% - 30%: **2.4** (Figure 4).

Figure 5
FX Reserves (Million USD)

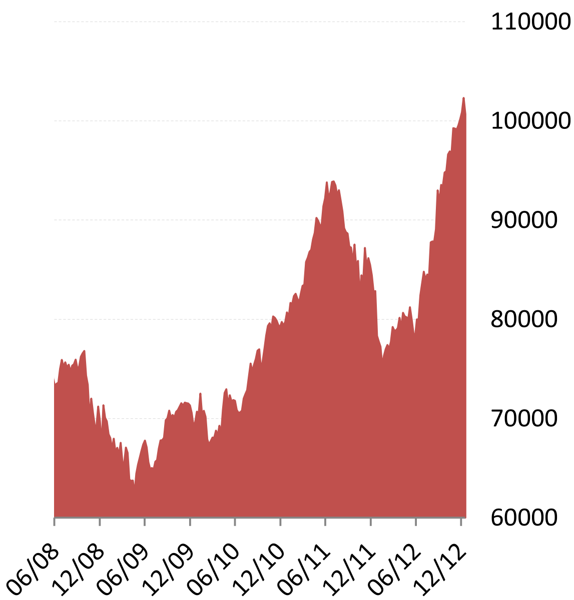
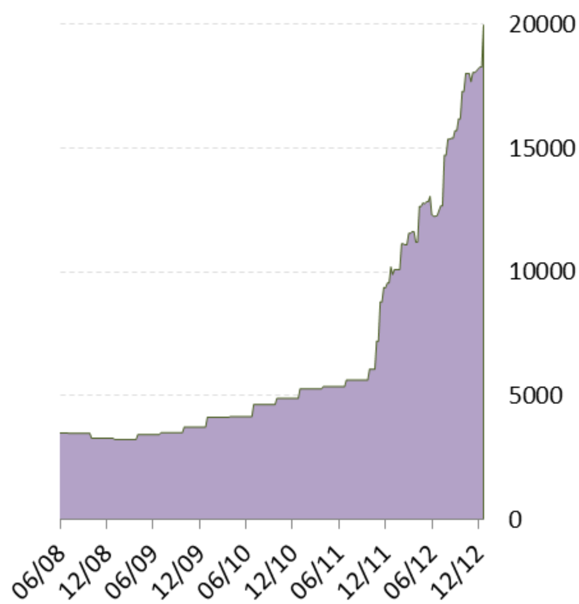


Figure 6
Gold Reserves (Million USD)



This new facility not only provides Turkish lira liquidity to banks in a more permanent way and lowers their cost, but also supports the CBRT's foreign exchange and gold reserves (Figure 5 and Figure 6).

3 Literature Review

Since ROM is a unique tool designed and operated by CBRT only, literature on the mechanism is relatively thin and specifically ROM's effectiveness on managing exchange rate volatility in the face of capital flows has not been worked on. However, first we will briefly highlight studies that focus on the uses of reserve requirements as part of the monetary policy and then look at works in which the focus is the factors that affect exchange rate volatility — central bank interventions and currency futures trading.

The purpose of reserve requirements within the central banking circles has evolved over time as did the literature on the use and effectiveness of them. In the early days, they have been viewed as a necessary and useful source of liquidity for the banking system as well as a means of monetary control process for the central banks. However, in the 90s, major central banks have reduced or eliminated reserve requirements, partly due to changing perspectives on monetary policy frameworks and partly due to innovations and deregulations letting banks circumvent deposits that require reserves.

Weiner (1992) looks at the changing role of reserve requirements for central banks and concludes that rather than being used in a traditional manner, i.e. controlling money stock, reserve requirements are utilized in facilitating control over short term rates. Reinhart and Reinhart (1999) establishes required reserves as a tool for mitigating the impact of foreign exchange interventions on domestic money supplies during times when developing countries deal with the volatility of capital flows. Montoro (2011) constructs a New Keynesian model with a banking sector and an interbank market that are constrained by capital and liquidity restrictions. In this model, he finds that introducing reserve requirements can complement monetary policy in stabilizing the business cycle when the economy is subject to demand shocks, but not under supply shocks. Glocker and Towbin (2012) also analyze the use of reserve requirements in preserving price stability and sustaining financial stability. Their results imply that reserve requirements are in favor of price stability objective only if financial frictions are non-trivial and are more effective if there is a financial stability objective and debt is denominated in foreign currency. Mimir, Sunel and Taskin (2012) construct a monetary DSGE model with a banking sector, in which banks are subject to time-varying reserve requirements adjusted countercyclical to expected credit growth. The authors find that countercyclical reserve policy reduces the volatilities of key real macroeconomic and financial variables compared to fixed reserve policy over the business cycle in response to Total Factor Productivity and money growth shocks.

On exchange rate volatility, empirical literature presents mixed results on the effectiveness of central bank interventions. Makin and Shaw (1997) claim that official intervention during 1983–1993 did not smooth exchange rate volatility of Australian dollar. Dominguez (1998) argues that intervention operations generally increase the volatility of exchange rates for dollar-mark and dollar-yen exchange rate volatility over the 1977-1994 period. Domaç and Mendoza (2004) analyze this issue for Mexico and Turkey and they conclude that foreign exchange sales decreased the volatility, whereas Guimarães and Karacadağ (2004), on the contrary, consider that these interventions had a limited effect on volatility. Disyatata and Galat (2007) do not find evidence that interventions by the Czech National Bank had an influence on short-term exchange rate volatility of Czech koruna.

Similarly, there are empirical studies about the impact of the introduction of currency futures trading into the underlying currency spot markets with mixed results. Clifton (1985) observes an increase of volatility in the currency spot market after the introduction of futures by using data from Chicago's International Monetary Market. Chatrath *et al.* (1996) study the impact of the introduction of futures trading on the volatility in the spot rates of the British pound, Canadian dollar, Japanese yen, Swiss franc and the Deutsche mark. They find that the introduction of currency futures trading has a significant positive impact on the volatility in the exchange rate changes. Jochum and Kodres (1998) find that the introduction of futures on currencies decreases the spot market volatility for the Mexican peso and has statistically insignificant effects on the spot market volatility of the Brazilian real and Hungarian forint. Oduncu (2011) examines the impact of the introduction of futures trading on Turkish lira and shows that the introduction of futures had led to diminished exchange rate volatility of Turkish lira.

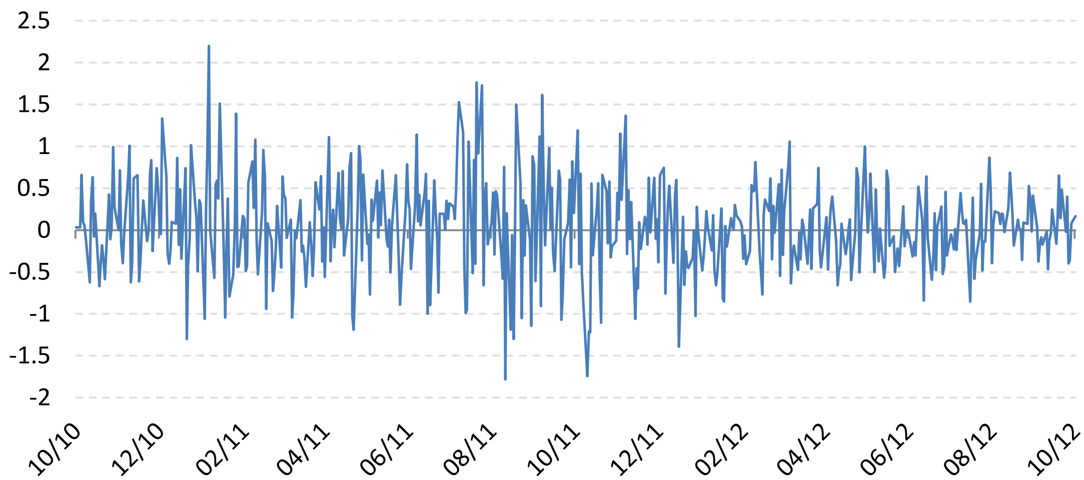
4 Data and Methodology

The study uses the daily change in the currency basket that is calculated as 0.5*(Euro/TL) + 0.5*(USD/TL). The data set covers the period between October 15, 2010 and October 15, 2012, with 522 total observations. Initial data point was chosen based on the removal of remuneration on required reserves.[7] Zero or very low interest rates on required reserves, in general, is considered to be a prerequisite for using required reserves as an effective policy tool. The GARCH framework is used in order to examine the impact of ROM on the volatility of Turkish lira. The GARCH model has been developed by Bollerslev (1986) from the Autoregressive Conditional Heteroskedastic (ARCH) model previously introduced by Engle (1982). In ARCH, the changing variance is included into estimation in order to obtain more efficient results. It is assumed that the error term of the return equation has a normal distribution with zero mean and a time varying conditional variance, so the forecasted variance of return equation varies systemically over time. One of the most appealing features of the GARCH framework, which explains why this model is so widely used in the literature, is that it captures one of the well-known empirical regularities of the returns, the volatility clustering. Figure 7 shows volatility clustering in daily returns of the currency basket.

[7] CBRT announced the termination of interest payment on reserve requirements on September 23, 2010 (CBRT, 2010). This change became effective as of the calculation period dated October 1, 2010 and the maintenance period began on October 15, 2010.

Figure 7

Daily Returns of the Currency Basket



At first, how the exchange rate volatility has changed after the introduction of ROM is examined using GARCH (1, 1)[8] as described below in Model 1. In Model 1, the change in the currency basket is used as the dependent variable, while a dummy variable for the introduction of ROM is used as an independent variable[9]. If the coefficient of the dummy variable is negative and significant, it implies that exchange rate volatility is lower during the period when ROM is in effect.

Model 1:

$$R_t = \beta_0 + \beta_1 R_{t-1} + \beta_2 R_{t-4} + \beta_3 R_{t-5} + \varepsilon_t \qquad (1.a)$$

$$\varepsilon_t \sim N\ (0, h_t) \qquad (1.b)$$

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \alpha_3 D_{ROM} + u_t \qquad (1.c)$$

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[8] GARCH(1,1) is selected over other GARCH specifications as it is the most frequently used model in describing volatility in the literature as well as in market analyses. (Berüment and Günay, 2003; Hansen and Lunde, 2005; Oduncu, 2011)

[9] Initially, first five lags of the dependent variable R_t is included as regressors in the mean equation but only the first, the fourth and the fifth lags are found to be significant. Thus, only these lags are included in the model. However, we obtain similar results if all the first five lags are included in the model.

Model variables are defined as below:

$R_t = \ln\left({}^{p_t}/_{p_{t-1}}\right) * 100,\ p_{t=}$ value of the currency basket

$$D_{ROM} = \begin{cases} 0, the\ days\ before\ the\ introduction\ of\ ROM\ (15.10.2010 - 29.09.2011) \\ 1, the\ days\ after\ the\ introduction\ of\ ROM\ (30.09.2011 - 15.10.2012) \end{cases}$$

Then, we fine tune our analysis of ROM on the volatility of exchange rates by enriching our model with the course of the change in ROM over time as well as other control variables that we believe to be important in TL volatility. Hence, we construct Model 2[10] in which the change in the currency basket is used as the dependent variable similar to Model 1 and the amount of FX reserves held in place of Turkish lira reserve requirements is used as an independent variable. The change in VIX[11], which well captures the fluctuations in capital flows, a dummy for Additional Monetary Tightening and the daily amount of FX sold by CBRT through auctions and interventions are used as control variables in the model[12]. To normalize the series of the amount of FX reserves held in place of Turkish lira reserve requirements and the daily amount of FX sold by CBRT through auctions and interventions, they are divided by Gross FX Reserves of the CBRT[13].

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[10] Like Model 1, initially first five lags of the dependent variable R_t is included as regressors in the mean equation but only the first and fourth lag is found to be significant. Thus, only these lags are included in the model. However, we obtain similar results if all the first five lags are included in the model.

[11] VIX measures the implied volatility of S&P 500 index options and it is quoted in percentage points. It is widely used as an indicator for the global risk appetite. The decrease in the VIX index signals an increase in the global risk appetite. VIX is included as a control variable in similar studies analyzing exchange rate volatility (Cairns et al. 2007).

[12] The dummy variable for the days of AMT is included in the model since Akçelik et al. (2012) show that additional monetary tightening has a significant role in reducing volatility in the Turkish lira exchange rate. Moreover, the daily amount of FX sold by CBRT is included in the model because it might also affect the exchange rate volatility.

[13] For robustness check, ROM_t and FXS_t variables are constructed by dividing to Quartely GDP rather than the Gross FX Reserves of the CBRT. The similar results are obtained.

Model 2:

$$R_t = \beta_0 + \beta_1 R_{t-1} + \beta_2 R_{t-4} + \beta_3 RVIX_t + \beta_4 FXS_t + \beta_5 D_{AMT} + \beta_6 ROM_t + \varepsilon_t \quad (2.a)$$

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

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \alpha_3 RVIX_t + \alpha_4 FXS_t + \alpha_5 D_{AMT} + \alpha_6 ROM_t + u_t \quad (2.c)$$

Model variables are defined as below:

$RVIX_t = \ln\left({VIX_t}/{VIX_{t-1}} \right) * 100$, VIX_t= *value of the VIX*

$$FXS_t = \frac{\text{The daily amount of FX sold by CBRT through auctions and interventions}}{\text{Gross FX Reserves of the CBRT}}$$

$$D_{AMT} = \begin{cases} 0, other\ days \\ 1, days\ of\ AMT \end{cases}$$

$$ROM_t = \frac{\text{The amount of FX reserves held in place of TL reserve requirements}}{\text{Gross FX Reserves of the CBRT}}$$

5 Empirical Results

First, unit root tests were applied to all variables to check for stationarity. Table 1 shows the of the Augmented Dickey-Fuller (ADF) test results (Table 1 in Appendix). Based on tests, FXS_t series is stationary; however, the null hypothesis of the unit root was not rejected for the currency basket, the VIX and ROM_t. Thus, in order to make data stationary, the variables, R_t and $RVIX_t$ are obtained using abovementioned variables. Table 2 shows the results of the ADF test statistics for these new variables and it is found that they are stationary (Table 2 in Appendix). Although ROM_t shows non-stationary properties during the sample period, it is bounded between 0 and 1; hence, it does not explode. Therefore, using ROM_t would not violate the analysis since its impact on the FX volatility is bounded.

Second, the correlogram of the standardized residuals and square standardized residuals are examined in order to assess whether the selected GARCH model fits well to the data. Table 3 and Table 4 show that the Q statistics of lagged auto correlations are insignificant (p>0.05), so the selected GARCH models capture volatility clustering and persistence existing in the data (Table 3 and Table 4 in Appendix).

In Model 1, the impact of the introduction of ROM on the exchange rate volatility is studied. Estimation results are shown in Table 5[14]. Since the sign of the dummy variable is negative and statistically significant at 1%, it indicates that there is a decrease in the exchange rate volatility after the introduction of ROM.

Table 5

Variance Equation		
	Coefficient	Probability
C	0.009	0.007
ε_{t-1}^2	0.021	0.226
h_{t-1}	0.960	0.000
D_{ROM}	-0.007	0.003

The second model, where we enriched the first model with the course of the change in ROM over time as well as other control variables, assesses the impact of ROM on the FX volatility. Table 6 presents the results of the variance equation of the model. The coefficient of ROM_t is negative and it is statistically significant at 5%. Thus, it shows that the Reserve Options Mechanism is significant in lessening the volatility of the

[14] Since the volatility of Turkish lira is examined in this study, the results of the mean equation are irrelevant and so they are not shown in Table 5 and Table 6.

exchange rate in the sample period. Moreover, additional monetary tightening has also a decreasing effect on the volatility of Turkish lira at 5% significance level. This finding is in line with the results of Akçelik et al. (2012). Also, the change in VIX is statistically significant at 10%. On the other hand, the daily amount of FX sold by CBRT through auctions and interventions do not have any significant effect on TL volatility.

Table 6

Variance Equation		
	Coefficient	Probability
c	0.016	0.036
ε_{t-1}^2	0.001	0.967
h_{t-1}	0.956	0.000
$RVIX_t$	0.002	0.070
FXS_t	0.792	0.555
D_{AMT}	-0.011	0.043
ROM_t	-0.048	0.032

6 Conclusion

After the global financial crisis, it was well understood by both academicians and policy makers that price stability is not sufficient for maintaining macroeconomic stability by itself and financial stability is integral to the well-functioning of the domestic and global financial markets. Therefore, finding a solution on how to incorporate financial stability in the implementation of monetary policy without diluting the price-stability objective has become a significant concern for central bank authorities. The

Central Bank of the Republic of Turkey adopted a new monetary policy framework called the new policy mix since November 2010 in order to offer a country-specific solution to this concern. In this policy mix, Reserve Options Mechanism is a tool unique to the CBRT and it is aimed to support the FX reserve management of the banking system and to limit the adverse effects of excess capital flow volatility on the macroeconomic and financial stability of Turkey.

In this paper, effect of ROM on the volatility of TL is analyzed. After controlling for other factors, it is found that ROM is significant in lessening the volatility of Turkish lira in the period analyzed. Therefore, in addition to being an effective policy tool in increasing the FX reserves of CBRT and supporting liquidity management of the banking system, ROM contributes to the financial stability of Turkey through limiting the adverse effects of excess capital flow volatility.

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Appendix

Table 1

Variable	ADF t-Statistic	Probability
p_t	-2.210	0.203
VIX_t	-2.262	0.185
FXS_t	-9.530	0.000
ROM_t	1.127	0.998

Table 2

Variable	ADF t-Statistic	Probability
R_t	-21.430	0.000
$RVIX_t$	-16.616	0.000

Table 3: Correlogram of Standardized Residuals and Standardized Residuals Squared for Model 1

Lags	Standardized Residuals		Standardized Residuals Squared	
	Q-Stat	Prob	Q-Stat	Prob
1	0.000	0.991	0.169	0.681
2	0.798	0.671	2.185	0.335
3	1.997	0.573	2.185	0.535
4	2.087	0.720	2.197	0.700
5	2.088	0.837	2.478	0.780
6	2.101	0.910	4.789	0.571
7	2.985	0.886	11.476	0.119
8	7.184	0.517	15.472	0.051
9	7.185	0.618	16.711	0.053
10	7.947	0.634	17.217	0.070
11	10.734	0.466	17.322	0.099
12	12.512	0.405	17.329	0.138
13	12.522	0.485	17.443	0.180
14	12.527	0.564	17.726	0.220
15	12.580	0.635	17.984	0.264
16	13.089	0.666	17.985	0.325
17	13.549	0.699	18.000	0.389
18	13.603	0.755	18.005	0.455
19	13.716	0.800	18.958	0.460
20	13.735	0.844	19.144	0.512
21	13.878	0.875	19.483	0.554
22	15.784	0.826	19.961	0.585

Table 4: Correlogram of Standardized Residuals and Standardized Residuals Squared for Model 2

Lags	Standardized Residuals		Standardized Residuals Squared	
	Q-Stat	Prob	Q-Stat	Prob
1	0.062	0.803	0.125	0.724
2	1.167	0.558	1.843	0.398
3	3.294	0.348	2.627	0.453
4	3.476	0.481	2.691	0.611
5	4.349	0.500	5.608	0.346
6	4.888	0.558	6.622	0.357
7	6.032	0.536	9.009	0.252
8	8.822	0.358	9.010	0.341
9	9.353	0.405	10.309	0.326
10	11.885	0.293	10.408	0.405
11	14.599	0.202	11.260	0.422
12	17.023	0.149	11.397	0.495
13	17.025	0.198	12.005	0.527
14	17.028	0.255	12.678	0.552
15	17.087	0.314	13.445	0.568
16	17.758	0.338	14.213	0.583
17	18.327	0.369	15.557	0.555
18	18.538	0.421	15.632	0.618
19	19.450	0.428	15.654	0.680
20	19.884	0.465	15.863	0.725
21	19.896	0.528	16.652	0.732
22	20.498	0.552	16.666	0.781

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