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RESERVE OPTIONS MECHANISM: A NEW MACROPRUDENTIAL TOOL TO LIMIT THE ADVERSE EFFECTS OF CAPITAL FLOW VOLATILITY ON EXCHANGE RATES

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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 volatility in capital flows on the macroeconomic and financial stability of the economy. 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 empirical 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 during the sample period.
JEL C12, C58, E58, G10
Keywords Reserve Options Mechanism, Volatility of Turkish lira, Central Bank of the Republic of Turkey's Policy Mix

ÖZ Bankalara Türk lirası cinsinden zorunlu karşılıklarının bir bölümünü döviz ve altın cinsinden tutma imkânı tanıyan Rezerv Opsiyonu Mekanizması (ROM), Türkiye Cumhuriyet Merkez Bankası tarafından tasarlanmış ve uygulamaya konulmuştur. TCMB'ye özgü bir para politikası aracı olan ROM, bankacılık sisteminin döviz rezerv yönetimini desteklemek ve sermaye hareketlerindeki aşırı oynaklığın makroekonomik ve finansal istikrar üzerindeki olumsuz etkilerini azaltmak amacıyla kullanılmaktadır. Bu çalışmada, ROM'un döviz kuru oynaklığı üzerindeki etkisi araştırılmaktadır. Bildiğimiz kadarıyla, ROM'un etkileri ampirik olarak ilk defa bu çalışmada analiz edilmektedir. Sonuç olarak, ROM'un incelenen dönemde kur oynaklığını düşürücü yönde belirgin bir etkisinin olduğu tespit edilmiştir.
REZERV OPSİYON MEKANİZMASI: SERMAYE HAREKETLERİNDEKİ OYNAKLIĞIN DÖVİZ KURLARI ÜZERİNDEKİ OLUMSUZ ETKİLERİNİ SINIRLAYAN YENİ BİR MAKRO-İHTİYATİ ARAÇ
JEL C12, C58, E58, G10
Anahtar Kelimeler Rezerv Opsiyon Mekanizması, Döviz kuru oynaklığı, Türkiye Cumhuriyet Merkez Bankası Politika Bileşimi

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1. Introduction

The global financial crisis took over the world since the collapse of Lehman Brothers in 2008 through profoundly complex financial linkages within and between advanced and emerging economies. Notwithstanding the rate cuts that brought policy rates close to the zero bound, advanced economies have opted to implement radical measures to lift up the economy from its ravaged state. While advanced economies are facing with slow demand and lower credit growth, emerging economies have their own problems to deal with as side effects of the former's difficulties. Global monetary expansion created abundant liquidity within the global financial system that looked for a higher yield in an environment with interest rates close to zero and emerging market assets were the answer to this search. This resulted in the volatility of short-term capital flows to emerging economies.

In this volatile financial environment, emerging economies have started searching new measures to maintain price and financial stability. Therefore, finding a solution on incorporating financial stability in the implementation of monetary policy without diluting the price-stability objective has been a main concern for central banks.[1] Accordingly, it has started to be discussed that 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.

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

Figure 1. Capital Flow and Turkish Lira Volatility
(Bonds and Equities, Implied Volatility[2])

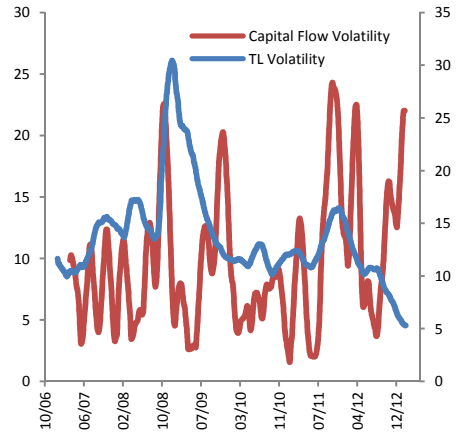
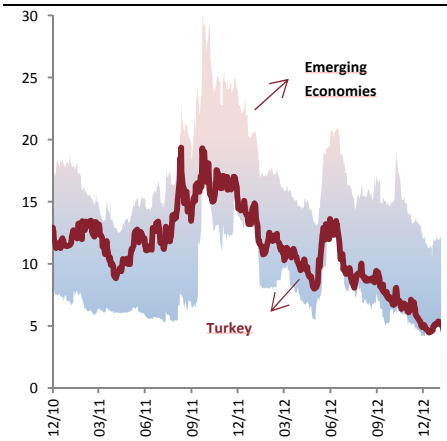


Figure 2. FX Implied Volatility
(1-Month, Countries with Current Account Deficit[3])



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.[4] 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 (TL) reserve requirements of Turkish banks. Although there is excessive volatility in the capital flows, volatility of Turkish lira has declined to historically low levels (Figure 1). Moreover, TL has become one of the least volatile currencies among emerging economies.[5]

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.

[2] Capital flow volatility is the 3-month moving standard deviation of one-year cumulative bond and equity flows. Turkish lira volatility is the 3-month moving average of USD/TL volatility derived from 1-month options.
[3] Emerging countries with a recent history of current account deficit are Poland, Brazil, Chile, South Africa, Indonesia, Columbia, Mexico, Czech Rep., Romania, and Turkey.
[4] For details of the CBRT's policy mix, see Başçı and Kara (2011); Kara (2012); Akçelik, Başçı, Ermişoğlu, and Oduncu (2013).
[5] Değerli and Fendoğlu (2013) show that TL has shown lower level of volatility, skewness, and kurtosis relative to other emerging economies' currencies after November 2011 and this can be attributed to interest rate corridor and ROM.

The remainder of the paper is organized as follows. Next section discusses the measures taken against capital flow volatility by emerging economies after the global financial crisis. Section 3 explains the Reserve Options Mechanism. Section 4 presents a brief review of the literature. Section 5 gives details about the data set and the methodology used. Section 6 shows the empirical results of this study and Section 7 concludes the paper.

2. Measures Against Capital Flow Volatility

While advanced economies try to figure out their path amidst the financial havoc, emerging markets are facing a different challenge in the post-crisis episode. The excessive capital flow volatility poses difficulties for emerging market authorities. In order to deal with the adverse consequences of capital flow volatility, emerging markets implemented varying policy measures to sustain price and financial stability after the global financial crisis. These measures can be considered in two categories: capital controls and macroprudential measures.

On the capital controls front, The Central Bank of Chile extended the total maximum foreign investment limit of Pension Funds from 60% to 80%. In Colombia, existing tax exemptions on the payment of interests for credits granted by foreign entities are eliminated. Moreover, tariff tax was reduced in order to stimulate imports. Through this, it was aimed to increase demand for foreign exchange and to prevent the appreciation pressure on Colombian peso. In Korea, a tax of 14% on the profits earned from national treasury bonds for foreign investors has been started to implement.[6] Brazil used *Tax on Financial Transactions (IOF)* to curb excessive speculative capital inflows; at first, IOF for nonresidents' portfolio investment in fixed income instruments was increased from 0% to 2%, and later it was raised to 6%. IOF on guarantees for external investment in the futures market was also raised to 6% from 0.38%.[7] Abarca et al. (2012) find evidence that these measures have limited effect for most countries. Furthermore, they argue that in some cases these measures might have an opposite consequence from the one projected. On the other hand, Pereira da Silva and Harris (2012) claim that these measures have been effective in the Brazilian case.

On the macroprudential front, in Indonesia, the reserve requirement ratio for the foreign currency holdings was raised from 1% to 5%, and later it was raised to 8%. Moreover, a new regulation on net open position of foreign currency liquidity was introduced for Indonesian banks. In Turkey, reserve requirement ratios were increased to prevent excessive credit growth and to control domestic demand. Moreover, reserve requirements were

[6] Abarca et al. (2012).
[7] Pereira da Silva and Harris (2012).

differentiated according to the maturity in order to lengthen the average maturity of deposits. Also, CBRT terminated the interest payment on reserve requirements. Furthermore, CBRT has started to implement a new unique tool called Reserve Options Mechanism that will be discussed in detail in the next section.

3. Reserve Options Mechanism

CBRT has designed and launched a new macroprudential tool 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 volatility in capital flows on the macroeconomic and financial stability of the economy.

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.[8] To make things concrete, suppose, there is a surge in capital inflows due to search for higher yields in emerging economies. With ROM in effect, banking system replaces TL with FX in its required reserve accounts, mopping up the excess FX liquidity in the market and relieving the appreciation pressure on the domestic currency, TL. If, on the other hand, decreased risk appetite causes rapid capital outflows, the banking system would fulfill their FX needs by withdrawing money from the ROM facility and replacing it with the now abundant TL, preventing a depreciation pressure on the currency.

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 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).

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

Figure 3. Reserve Options Mechanism (FX)

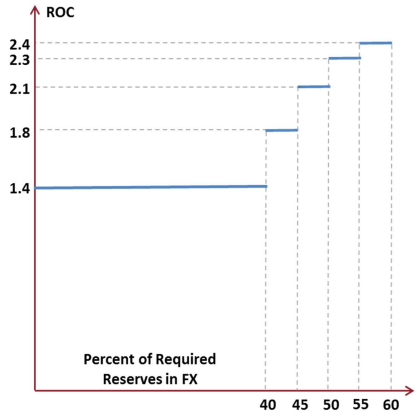
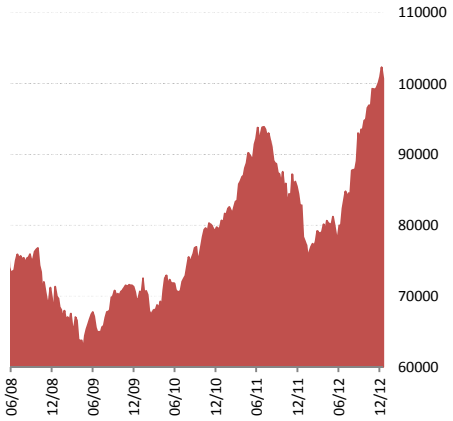


Figure 4. FX Reserves (Million USD)



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 reserves (Figure 4). In terms of its purpose and effects, ROM may be considered as analogous to sterilized FX interventions.[9] However, ROM is a market friendly tool that smooths the impact of capital flow volatility on exchange rates and balance sheets of the Turkish banks without affecting domestic currency liquidity.

4. Literature Review

Countries have implemented capital flow measures (CFMs) in order to prevent the negative effects of the volatility of short-term capital flows. These measures can be in various forms, such as those imposed on inflows or outflows, on different maturities or on different types of flows. During the Asian crisis, Malaysia imposed CFMs and Kaplan and Rodrik (2001) claim that they had beneficial impacts. On the other hand, Dornbusch (2001) argues that they were imposed after the country already stabilized. De Gregorio, Edwards, and Valdes (2000) claim that the capital flow measures imposed by Chile were effective in increasing the quality of the financing of debt from short-term towards longer term. In contrast, Forbes (2005) argues that short-term credit was penalized; hence, small and medium-sized firms,

[9] Alper et al. (2012).

which typically find it harder to issue long-term bonds, faced much higher costs of capital.

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. Thus, 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 so has 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) establish 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 Taşkın (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. Federico, Vegh, and Vuletin (2012) distinguish reserve requirement adjustments as endogenous and exogenous via a narrative

approach, and find that reserve requirement policy acts as a substitute for monetary policy rather than a complement.

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 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. Disyatat 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.

5. Data and Methodology

The study uses the daily return on the currency basket that is calculated as 0.5*(EUR/TL) + 0.5*(USD/TL). The data set covers the period between October 15, 2010 and September 28, 2012, with 511 total observations. Initial data point was chosen based on the removal of remuneration on required reserves.[10] 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

[10] 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.

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.

At first, how the exchange rate volatility has changed after the introduction of ROM is examined using GARCH (1, 1)[11] as described below in Model 1. In Model 1, the return on the currency basket is used as the dependent variable, while a dummy variable for the introduction of ROM is used as an independent variable.[12] 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.[13]

Model 1:

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

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

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

Model variables are defined as below:

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

$$D_{ROM} = \begin{cases} 0, the\ days\ before\ the\ introduction\ of\ ROM\ (15.10.2010 - 29.09.2011) \\ 1, the\ days\ after\ the\ introduction\ of\ ROM\ (30.09.2011 - 28.09.2012) \end{cases}$$

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[14] in which the return on the currency basket is used as the dependent variable similar to Model 1 and the amount

[11] 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)

[12] 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.

[13] It is a possibility that policymakers may react to the volatility of the TL itself through changing the ROM trenches or the ROCs, implying an endogeneity in the variance equation. However, the data period coincides with the construction phase of the ROM mechanism, i.e. changes in trenches or coefficients are for construction purposes and not for an endogenous response.

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

of FX reserves held in place of Turkish lira reserve requirements is used as an independent variable. The change in VIX[15], 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[16,17]. 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 Quarterly GDP of Turkey.

Model 2:

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

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

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

Model variables are defined as below:

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

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

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

$$ROM_t = \frac{\text{The amount of FX reserves held in place of TL reserve requirements}}{\text{Quarterly GDP}}$$

6. Empirical Results

First, unit root tests were applied to all variables to check for stationarity. Table 1 (in the Appendix) shows the of the Augmented Dickey-Fuller (ADF) test results. 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 (in the Appendix) shows the results of the ADF test statistics for these new variables and it is found that they are stationary. 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.

[15] 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).

[16] 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.

[17] For robustness check, European VIX is used rather than VIX and the similar results are obtained.

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 (in the Appendix) 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.

In Model 1, the impact of the introduction of ROM on the exchange rate volatility is studied. Estimation results are shown in Table 5.[18] 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. Estimation Results for the Model 1

Variance Equation		
	Coefficient	Probability
C	0.010	0.009
ε_{t-1}^2	0.022	0.216
h_{t-1}	0.958	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 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.

[18] Since the focus of this study is the volatility of Turkish lira, the results of the mean equation are omitted and not shown in Table 5 and Table 6.

Table 6. Estimation Results for the Model 2

Variance Equation		
	Coefficient	Probability
c	0.165	0.024
ε_{t-1}^2	0.084	0.126
h_{t-1}	0.450	0.047
$RVIX_t$	0.003	0.099
FXS_t	1.765	0.880
D_{AMT}	-0.059	0.022
ROM_t	-1.166	0.033

7. 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	-2.224	0.198
VIX_t	-2.251	0.189
FXS_t	-9.530	0.000
ROM_t	1.127	0.998

Table 2

Variable	ADF t-Statistic	Probability
R_t	-21.201	0.000
$RVIX_t$	-16.435	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	0.002	0.965	0.077	0.781
2	0.985	0.611	1.838	0.399
3	2.223	0.527	1.842	0.606
4	2.329	0.676	1.867	0.760
5	2.329	0.802	2.172	0.825
6	2.347	0.885	3.951	0.683
7	3.329	0.853	10.040	0.186
8	8.145	0.419	13.937	0.083
9	8.145	0.520	15.058	0.089
10	8.735	0.557	15.498	0.115
11	11.718	0.385	15.687	0.153
12	13.647	0.324	15.695	0.206
13	13.653	0.399	15.893	0.255
14	13.659	0.475	16.371	0.291
15	13.829	0.539	16.698	0.337
16	14.156	0.587	16.728	0.403
17	14.368	0.641	16.754	0.471
18	14.425	0.701	16.768	0.539
19	14.476	0.755	17.694	0.543
20	14.482	0.805	17.872	0.596
21	14.521	0.846	18.157	0.639
22	16.300	0.801	18.610	0.669

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	2.405	0.121	0.015	0.904
2	2.660	0.264	0.434	0.805
3	4.902	0.179	0.439	0.932
4	5.201	0.267	0.442	0.979
5	5.783	0.328	2.981	0.703
6	6.385	0.381	3.612	0.729
7	7.587	0.370	3.790	0.804
8	9.758	0.282	4.045	0.853
9	10.329	0.325	4.762	0.855
10	12.216	0.271	5.794	0.832
11	14.528	0.205	6.275	0.854
12	17.552	0.130	6.537	0.887
13	17.728	0.168	6.978	0.903
14	17.786	0.217	8.480	0.863
15	18.028	0.261	8.928	0.881
16	18.721	0.283	9.968	0.868
17	18.845	0.338	11.731	0.816
18	19.177	0.381	11.731	0.861
19	20.096	0.389	11.749	0.896
20	21.400	0.374	12.984	0.878
21	21.401	0.435	14.227	0.860
22	21.870	0.468	14.635	0.877