

THE BVAR MODEL OF THE IMPACT OF FOREIGN EXCHANGE POLICY ON FINANCIAL MARKETS

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Abstract: The scientific article examines the impact of exchange rate changes on interest rates in the financial market on the example of the economy of Uzbekistan. According to the results of the analysis, interest rates in the money market, interest rates of short-term deposits in national currency at commercial banks and interest rates of short-term loans in national currency allocated by commercial banks had a positive impulse reaction to the change in the exchange rate. However, interest rates of short-term deposits in foreign currency and interest rates of short-term loans in foreign currency allocated by commercial banks had a negative impulse reaction to the devaluation of the exchange rate.

Key words: foreign exchange policy, money market, credit interest rate, deposit rate, exchange rate, devaluation.

INTRODUCTION

It is important to determine the currency exchange rate regime for each country. Because, by establishing the exchange rate regime, Central Banks give a signal to commodity and financial markets, domestic and foreign economy about how the country's currency policy is conducted, and accordingly, various processes are observed in the economy. Today, the exchange rate regime has taken various forms. In particular, the main ones are:

- fixed exchange rate regime;
- exchange rate regime linked to another currency;
- floating exchange rate regime;
- managed floating exchange rate regime.

These exchange rate regimes arose as a result of different economic conditions. By the middle of the 19th century, the economic relations between countries had increased to such an extent that this situation raised issues such as determining the form of the currency system. It was from that period that international currency systems began to emerge. During the emergence of international currency systems and the stages of its development, various exchange rate regimes emerged.

The correction of the exchange rate by central banks and thereby influencing various processes in the economy is called currency policy. It is through currency policy that countries influence domestic and international economic situations.

Currency policy is considered as a term often used in developing countries. This is because, in contrast to developed countries, the international movement of national currency of developing countries is not ensured. That is, international debts are not received and paid in national currencies of these countries. Therefore, when reading economic literature, it is difficult to find literature that deals with a separate currency policy. Currency policy is a part of monetary policy and is often referred to as monetary and currency policy.

When the exchange rate is in a free-floating exchange rate regime, the value of national currency against foreign currency is formed based on supply and demand in the currency exchange. But this does not mean that Central Banks do not intervene in the formation of the exchange rate at all. When various fluctuations in the economy, various "shocks" in the international economy lead to sharp fluctuations in the national currency exchange rate, central banks can correct the exchange rate in order to mitigate this effect, and this can often be seen in practice.

LITERATURE REVIEW

It is one of the important issues for the states to conduct currency policy correctly and ensure economic stability through it. In this way, economists in many countries have conducted a lot of research aimed at determining the effectiveness of monetary and currency policy, its impact on economic growth, and determining the optimal exchange rate regime. In particular, these research works increased in importance again after the 1950s, and the number of research works on currency policy increased.

Roberto Chang analyzed the intervention by the Central Bank and its effect on the exchange rate. According to him, sterilized currency intervention can be effective by changing the currency composition of assets owned by economic entities. The economist suggests an alternative channel, namely that sterilized intervention can have real effects because it changes the central bank's net credit position vis-à-vis financial intermediaries, thereby affecting external debt limits. The findings of this analysis are developed in the context of an open economy model with local banks subject to periodic mandatory collateral constraints. An intervention will have a real effect if it occurs in conjunction with constraints. At such times, sterilized sales of official reserves ease constraints by reducing central bank debt to domestic banks and free up resources to increase the supply of credit to local economic agents.¹ Economist's analysis provided some noteworthy results for the interaction between central bank intervention policy, official reserve accumulation and monetary policy.

A. Cardoso, A. Duarte analyzed the impact of China's currency policy on foreign trade with the European Union in their research works. After describing the importance of the exchange rate in an open economy and some methodologies used to calculate its equilibrium value, they investigated whether the competitiveness of the Chinese economy is due to an artificial undervaluation of the exchange rate or whether the competitiveness of the economy is related to other factors. For this purpose, they used Vector Error Correction model (VECM) to estimate the long-run export equation. Empirical results show that in the past few years, Chinese exports have taken an "unfair" competitive advantage as a result of currency manipulation. That is, the Chinese government has influenced the competitiveness of the economy and the stimulation of exports by artificially devaluing the national currency.²

According to J. Oseni, the previous studies reached a consensus that monetary policy in developing countries generates more economic activity than fiscal policy. The scientist's research aims at overcoming the existing shortcomings of previous studies by answering the question of which of the macroeconomic instruments is more effective in achieving price stability. The results of the study showed that due to the existence of an exogenous factor, even the strict monetary policy of the Central Bank may not be able to stop excess liquidity from the economy. In the same way, the exogenous factor has destabilized the sustained economic growth resulting from loose monetary policy. The study also found that exchange rates are a more effective tool for achieving price stability than monetary policy rates. Nigeria's economy is heavily dependent on imports, with the majority of imports being consumer goods and services and fewer capital goods. The changes in currency has a greater impact on the economy than changes in interest rates. In such countries, regulator banks have concluded that price stability can be achieved if banks give priority to the formation and implementation of foreign exchange policies that are sound in principle and effective in practice.³

M. Rapetti assessed the impact of the real exchange rate on economic growth and, based on the results obtained, determined that there is a positive correlation between the level of the real

¹Chang, R. (2018). *Foreign exchange intervention redux* (No. w24463). National Bureau of Economic Research.

²Cardoso, A., & Duarte, A. P. (2017). The impact of the Chinese exchange policy on foreign trade with the European Union. *Brazilian Journal of Political Economy*, 37, 870-893.

³Oseni, J. E. (2013). Achieving price stability in Nigeria: Monetary policy rate approach vs. foreign exchange policy approach. *Foreign Exchange Policy Approach* (July 4, 2013).

exchange rate (RER) and economic growth. The analysis suggests that this correlation can be seen as the cause of economic growth in the real exchange rate. That is, a lower and more competitive real exchange rate of the domestic currency relative to foreign currencies supports economic growth. In his view, little effort has been made to analyze currency policy instruments necessary to implement a successful competitive real exchange rate strategy. An exchange rate policy aimed at permanently adjusting the real exchange rate may face difficulties. Because, in his opinion, the nominal and real exchange rates are correlated in the short term, but such correlation gradually disappears in the long term. Instead, targeting an artificially devalued real exchange rate can have a long-term impact on economic performance if the competitiveness of the real exchange rate is stable enough to encourage the expansion of trade activity. The ability to provide such an environment may extend beyond the scope of monetary policy. His research focuses on identifying complementary policies that contribute to the success of currency policy that temporarily improves competitiveness. A formal model formulated by Ross and Scott (1998) was developed to analyze these issues. The main conclusion of the model is that exchange rate depreciation leads to an acceleration of economic growth if it is implemented simultaneously with domestic demand management policies that prevent inflation and wage management policies that coordinate the growth of trade productivity with wage increases.⁴

G. Adler and others developed a model of a small open economy based on the conditions for the central bank to operate in the flexible inflation targeting regime, that is, to focus on currency policy production and inflation stabilization. Based on this theoretical framework, they analyzed the extent to which currency intervention contributes to the achievement of the central bank's goals in a situation with varying levels of confidence in central bank decisions. They obtained two main results. First, in a scenario where economic actors have a high degree of confidence in central bank decisions, currency intervention can improve macroeconomic outcomes by successfully stabilizing domestic output and inflation in response to foreign disturbances. Second, if the confidence of economic actors in the decisions of the central bank is low, the policy of currency intervention has led to a decrease in production, causing a high frequency of prices. That is, in the second scenario, the currency intervention policy prevents the central bank from increasing the effectiveness of the inflation targeting regime. The results of their analysis show that if the confidence of economic actors in the decisions of the central bank is high, the probability of supporting the inflation targeting regime of the currency intervention policy is also high.⁵

RESEARCH METHODOLOGY

The official statistical data of the Central Bank of the Republic of Uzbekistan and the Statistics Committee were used to analyze the impact of currency policy on the financial market. We use the BVAR (Bayesian Vector Autoregression models) model for econometric analysis, i.e. determining the impact of currency policy on the financial market. The reason we use this model is that the impact of currency policy on interest rates in the financial market takes place after a certain period.

When assessing the impact of currency policy on the financial market, the interest rate in the money market (MMR_t), the real interest rates of short-term deposits in national currency in commercial banks ($RSTDRNC_t$), the real interest rates of short-term deposits in foreign currency in commercial banks ($RSTDRFC_t$), the real interest rates of short-term loans allocated by commercial banks in national currency ($RSTLRNC_t$) and the real interest rates of short-term loans allocated by

⁴Rapetti, M. (2013). Macroeconomic policy coordination in a competitive real exchange rate strategy for development. *Journal of Globalization and Development*, 3(2), 1-31.

⁵Adler, G., Lama, R., & Medina, J. P. (2019). Foreign exchange intervention and inflation targeting: The role of credibility. *Journal of Economic Dynamics and Control*, 106, 103716.

commercial banks in foreign currency ($RSTLRFC_t$) were as the main interest rates in the financial market, devaluation level of national currency (DEV_t) were selected as endogenous factors affecting them. Statistics of the selected indicators for the period 2017M10-2023M08 were given in monthly terms, in terms of real value and growth.

ANALYSIS AND DISCUSSION OF RESULTS

Currency policy has become one of the most important economic policies in developing countries. It is widely used in eliminating shocks in the foreign economy or mitigating the impact on the domestic economy through currency policy. However, in recent years, developing countries have been moving towards inflation targeting, which reduces the role of currency policy in the economy. Despite this, central banks in developing countries often show the goal of stabilizing the exchange rate by carrying out currency intervention.

At the initial stage of the econometric analysis, we performed a number of statistical calculations. These are descriptive statistics of the selected data, that is, it mainly analyzes such indicators as the average data, maximum and minimum data, deviation from the average (standard deviation). We also analyzed the normal distribution of selected indicators in our research work.

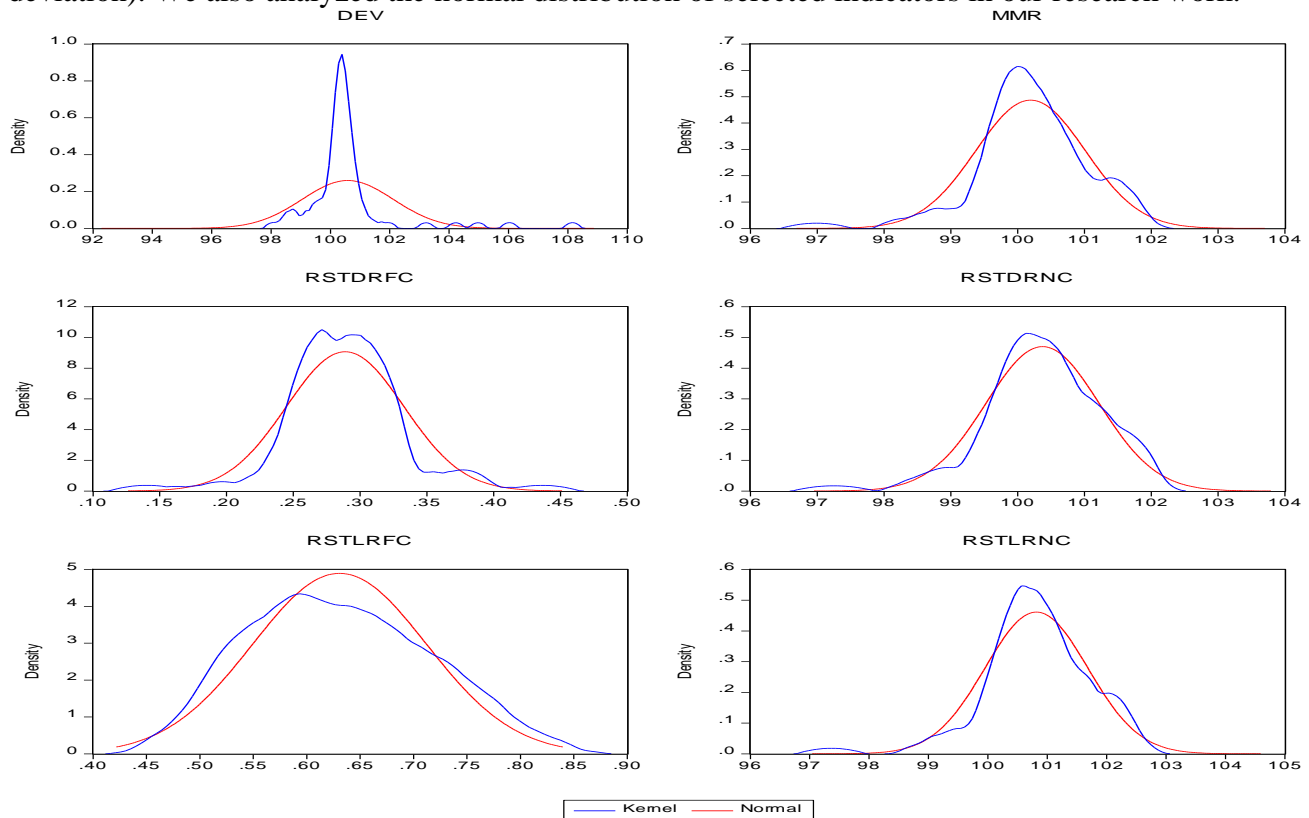


Figure. Normal distribution of selected indicators⁶

The Jacques Beer coefficient was used to test the normal distribution of the data. The analysis showed that all indicators, such as the interest rate in the money market, the real interest rates of short-term deposits in national currency in commercial banks, the real interest rates of short-term deposits in foreign currency in commercial banks, the real interest rates of short-term loans allocated by commercial banks in national currency and the real interest rates of short-term loans allocated by commercial banks in foreign currency chosen to assess the impact of currency policy on the financial

⁶Compiled by the author based on selected statistical data.

market, as well as devaluation levels of national currency, have a normal distribution. Because it was found that the Jacques-Bera coefficient calculated for all selected indicators is reliable and their probability is less than 0.05.

71 observations were made using selected indicators. Below we analyze descriptive statistics of nine selected indicators.

Table**Descriptive statistics of indicators.**

	DEV	MMR	RSTDRFC	RSTDRNC	RSTLRFC	RSTLRNC
Mean	0.582743	0.195041	0.288830	0.373179	0.630801	0.818059
Median	0.363553	0.155070	0.284937	0.337303	0.627256	0.796939
Maximum	8.160190	1.758410	0.436123	1.871790	0.814712	2.442197
Minimum	-1.933385	-3.008385	0.140377	-2.751828	0.483333	-2.633847
Std. Dev.	1.536407	0.819247	0.043999	0.848652	0.081517	0.864694
Jarque-Bera	368.3755	23.29101	19.03263	11.98016	2.491669	25.10183
Probability	0.000000	0.000009	0.000074	0.002503	0.287701	0.000004
Observations	71	71	71	71	71	71

According to the results of the observation, the average interest rate in the money market, calculated using exogenous variables, was 0.19%, and the monthly change of this indicator was a maximum of 1.76% and a minimum of -3.01% for the observed period. The standard dispersion of this indicator was 0.82%.

Also, the average real interest rate on short-term deposits in national currency allocated by commercial banks was 0.37%, and this indicator accounted for a maximum of 1.87% and a minimum of -2.75% during the observed period. The standard dispersion of this indicator was 0.85%. If we pay attention to changes in real interest rates of short-term deposits in foreign currency in commercial banks, then the average level of this indicator was equal to 0.29%, and this indicator made up a maximum of 0.44% and a minimum of 0.14% during the considered period. The degree of deviation from the average of this indicator made up 0.85.

At the same time, the average real interest rates of short-term loans allocated by commercial banks in national currency was 0.82%, and this indicator made up a maximum of 2.44% and a minimum of -2.63% during the observed period. The standard dispersion of this indicator was 0.86%. If we pay attention to the changes in real interest rates of short-term loans allocated by commercial banks in foreign currency, then the average level of this indicator was equal to 0.63%, and this indicator reached a maximum of 0.81% and a minimum of 0.48% during the considered period. The standard deviation of this indicator was equal to 0.81.

We took exchange rate fluctuations as endogenous factors affecting interest rate changes in the financial market, and the national currency devaluation index averaged 0.58%, and this indicator was a maximum of 8.16% and a minimum of -1.93% during the observed period. The standard dispersion of this indicator was equal to 1.54%.

Below is an analysis of the inter-correlation of selected exogenous and endogenous indicators.

Table

Correlation matrix between selected indicators

	DEV	MMR	RSTDRFC	RSTDRNC	RSTLRFC	RSTLRNC
DEV	1					
MMR	-0.2684	1				
RSTDRFC	0.0910	-0.2170	1			
RSTDRNC	-0.2553	0.9873	-0.2087	1		
RSTLRFC	0.1321	0.0548	0.3570	0.0502	1	
RSTLRNC	-0.2291	0.9883	-0.2124	0.9856	0.0783	1

When assessing the impact of exchange rate changes on interest rates in the financial market, it is appropriate to initially analyze the correlation relationship. According to the results of the analysis, the correlation of the exchange rate change with the interest rate in the money market is equal to -0.27, and it was found that there is an inverse relationship between them. Also, the correlation of the exchange rate change with the real interest rates of short-term deposits allocated by commercial banks in national currency is equal to -0.25, and the correlation with the real interest rates of short-term deposits allocated by commercial banks in foreign currency is equal to 0.09.

The correlation of exchange rate changes with real interest rates of short-term loans allocated by commercial banks in national currency is equal to -0.23. In the analysis, the correlation of the exchange rate change with the real interest rates of short-term loans allocated by commercial banks in foreign currency was studied, according to which the correlation between the two indicators was equal to 0.13.

Taking into account that the impact of exchange rate changes on the financial market occurs after a certain "lag", we conducted our econometric analysis using the BVAR (Bayesian vector autoregression models) model. When conducting an analysis based on this model, we carried out the Augmented Dickey-Fuller Test based on the initially selected indicators.

Table

The result of Augmented Dickey-Fuller Test

	Indicators	t-Statistic	Probability	Conclusion
1	DEV	-7.112130	0.0000	I(0)
2	MMR	-4.478297	0.0005	I(0)
3	RSTDRFC	-3.894717	0.0034	I(0)
4	RSTDRNC	-4.295792	0.0010	I(0)
5	RSTLRFC	-1.977979	0.2957	I(1)
6	RSTLRNC	-4.345695	0.0008	I(0)

With the help of this Augmented Dickey-Fuller test model, we test the indicators for unit root and it is appropriate to infer whether these indicators are stationary or non-stationary.

As can be seen from the data in the above table, out of the selected indicators, only the real interest rates of short-term loans of commercial banks in foreign currency are in a non-stationary state. All other selected indicators are stationary. We can also see this from the image data below.

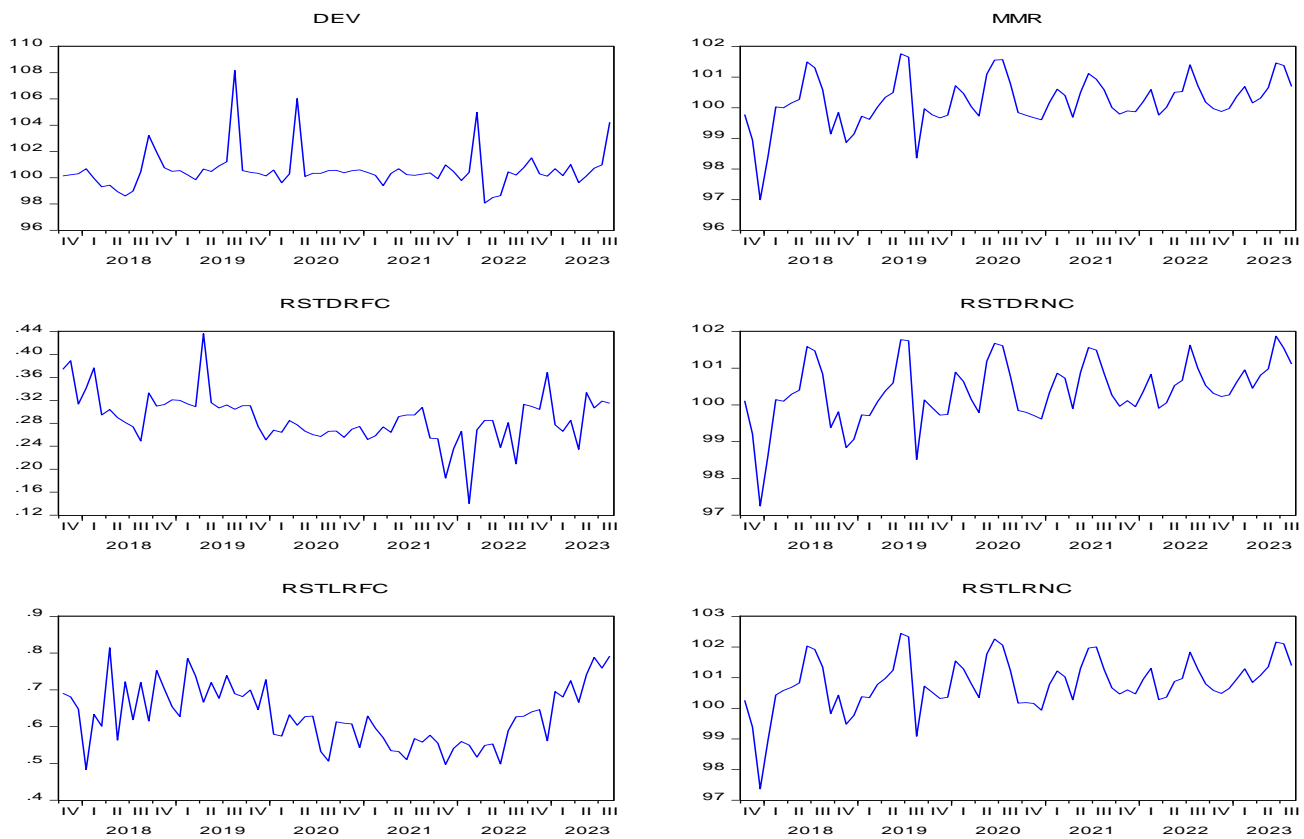


Figure. Dynamics of change of selected indicators⁷

From this we can conclude that the BVAR model can be used because the non-stationary indicators have a logical relationship with the rest of the indicators. From the next stage of our analysis, we need to choose the optimal "lag" for the BVAR model. For this, we use the Lag Length Criteria method.

Table

The optimal "lag" (Lag Length Criteria) selection method for the BVAR model, which estimates the impact of exchange rate changes on interest rates in the financial market

VAR Lag Order Selection Criteria

Endogenous variables: DEV MMR RSTDRFC RSTDRNC RSTLRFC RSTLRNC

Sample: 2017M10 2023M08

Lag	LogL	LR	FPE	AIC	SC	HQ
0	100.4504	NA	2.50e-09	-2.777952	-2.582113	-2.700355
1	203.2646	184.4609	3.53e-10*	-4.743077*	-3.372204*	-4.199895*
2	239.1522	58.05341*	3.62e-10	-4.739770	-2.193864	-3.731004
3	260.6151	30.93189	5.92e-10	-4.312209	-0.591270	-2.837859

As can be seen from the table, the optimal number of lags for our model is 1 based on the Final prediction error (FPE), Akaike information criterion (AIC) Schwarz information criterion (SC),

⁷Compiled by the author.

and Hannan-Quinn information criterion (HQ)tests. Based on this, we can choose 1 as a number of "lags" in our model.

We can see the impact of exchange rate changes on interest rates in the financial market from the following table of results of the BVAR model based on the selected "lag".

Table

BVAR model of the impact of exchange rate changes on interest rates in the financial market

Bayesian VAR Estimates

Sample (adjusted): 2017M11 2023M08

Included observations: 70 after adjustments

	DEV	MMR	RSTDRFC	RSTDRNC	RSTLRFC	RSTLRNC
DEV(-1)	0.271562 (0.09603) [2.82794]	0.149018 (0.04822) [3.09006]	0.003663 (0.01131) [0.32387]	0.140444 (0.04886) [2.87463]	0.000941 (0.01190) [0.07907]	0.147706 (0.04976) [2.96849]
MMR(-1)	-0.168675 (1.46856) [-0.11486]	1.010857 (0.73750) [1.37065]	-0.047770 (0.17298) [-0.27616]	0.445536 (0.74716) [0.59630]	-0.032028 (0.18199) [-0.17599]	0.461854 (0.76095) [0.60694]
RSTDRFC(-1)	-1.187937 (3.17220) [-0.37448]	0.310416 (1.59306) [0.19485]	0.184646 (0.37365) [0.49417]	0.278603 (1.61393) [0.17262]	0.325355 (0.39311) [0.82764]	0.328791 (1.64372) [0.20003]
RSTDRNC(-1)	-0.717751 (1.38906) [-0.51672]	-0.274691 (0.69758) [-0.39378]	0.051887 (0.16361) [0.31713]	0.396004 (0.70672) [0.56034]	-0.043105 (0.17214) [-0.25041]	-0.289078 (0.71976) [-0.40163]
RSTLRFC(-1)	2.797109 (2.12343) [1.31726]	-1.293658 (1.06638) [-1.21313]	0.141224 (0.25011) [0.56464]	-1.242983 (1.08034) [-1.15055]	0.363064 (0.26314) [1.37972]	-1.098586 (1.10028) [-0.99846]
RSTLRNC(-1)	1.582974 (1.38064) [1.14655]	0.111406 (0.69335) [0.16068]	-0.006724 (0.16262) [-0.04135]	0.016130 (0.70243) [0.02296]	0.077210 (0.17109) [0.45127]	0.677763 (0.71540) [0.94739]
C	1.226976 (4.63137) [0.26493]	1.004455 (2.32585) [0.43187]	0.033551 (0.54552) [0.06150]	0.950021 (2.35631) [0.40318]	-0.035260 (0.57394) [-0.06144]	0.986390 (2.39980) [0.41103]
R-squared	0.103164	0.235337	0.262899	0.267074	0.349374	0.262994
Adj. R-squared	0.017751	0.162512	0.192699	0.197272	0.287409	0.192803
Sum sq. resids	148.0116	35.79113	0.094474	36.89914	0.300259	38.34252
S.E. equation	1.532772	0.753733	0.038725	0.765311	0.069036	0.780135
F-statistic	1.207829	3.231536	3.745002	3.826144	5.638297	3.746827
Mean dependent	100.5891	100.2010	0.287614	100.3769	0.629944	100.8260
S.D. dependent	1.546561	0.823622	0.043099	0.854188	0.081782	0.868321

According to the results of the model, one percent devaluation of our national currency increases the interest rate in the money market by 0.15%. Also, the devaluation of our national currency by 1% will increase the percentage of short-term deposits in national currency allocated by commercial banks by 0.14% and the percentage of short-term loans in national currency allocated by commercial banks by 0.15%, according to econometric analysis.

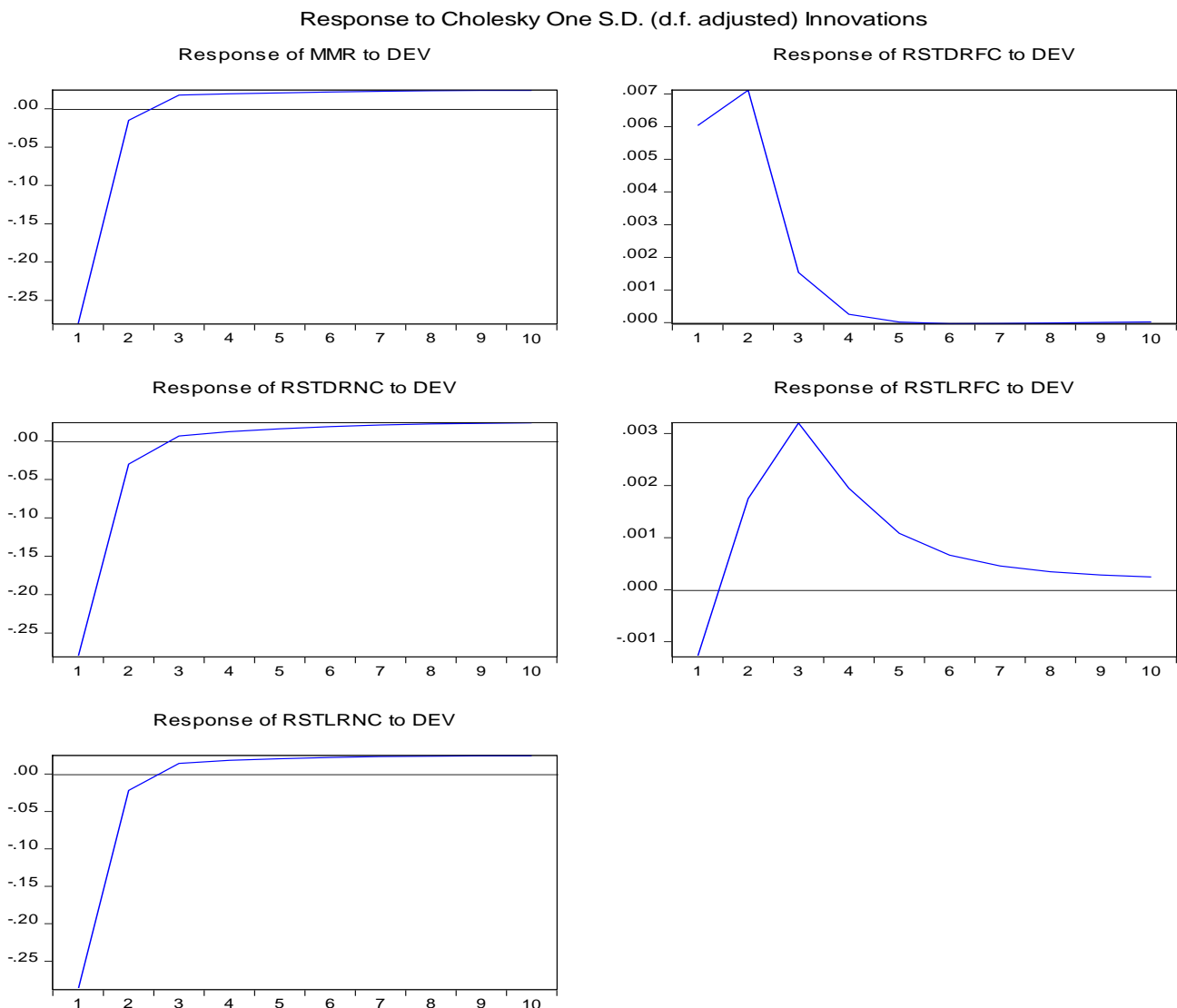


Figure. Impulse response of interest rates in the financial market to exchange rate changes⁸

If we analyze the impulse reaction of interest rates in the financial market to exchange rate changes, then interest rate in the money market, the percentage of short-term deposits in national currency allocated by commercial banks and the percentage of short-term loans in national currency allocated by commercial banks are positive. However, the devaluation of the exchange rate has the opposite effect on the percentage of short-term deposits in foreign currency allocated by commercial banks and the percentage of short-term loans in foreign currency allocated by commercial banks.

CONCLUSIONS AND SUGGESTIONS

We can conclude from the impulse reaction of interest rates in the financial market to the change in the exchange rate that the interest rate in the money market, the interest rate of short-term deposits in national currency allocated by commercial banks and the interest rate of short-term loans in national currency allocated by commercial banks are positive. However, the devaluation of the exchange rate has the opposite effect on the interest rate of short-term deposits in foreign currency allocated by commercial banks and the interest rate of short-term loans in foreign currency allocated by commercial banks.

⁸Formed based on the results of the model

In particular, the interest rate of short-term deposits in foreign currency allocated by commercial banks partially increased in the first month, and this interest rate reduced in the following months. Also, the devaluation of the exchange rate increased the interest rate of short-term loans in foreign currency allocated by commercial banks in the first 2 months, but decreased it in the following months. We can explain it as follows.

If the devaluation of our national currency occurs, then the profits of our entrepreneurs from foreign currency loans will decrease, and in some cases, these loans can cause harm. Because our entrepreneurs buy products or capital equipment from abroad with this financial resource by obtaining a loan in foreign currency. But the goods produced using this main tool or other types of products are sold in our national market. It is clear from this that our businessmen cover their loans in foreign currency with the profit they receive in national currency. Therefore, if the national currency is devalued, it will be difficult for our entrepreneurs to repay this loan and the demand for loans in foreign currency will decrease. We can see this from the 94% devaluation of our currency in 2017, which created a lot of problems for our entrepreneurs. In response, our commercial banks are forced to reduce the interest rate of loans in foreign currency. A decrease in the interest rate of loans in foreign currency also affects the interest rate of deposits in foreign currency allocated by banks. This effect occurs in a properly proportional form.

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