

# Research on the Linkage between RMB Interest Rate and Exchange Rate

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## ABSTRACT

This study uses a vector autoregressive (VAR) model to investigate the relationship between the exchange rate (EX) and RMB interest rate (I). The research starts with a review of pertinent theoretical frameworks and then conducts an empirical analysis with historical data to determine the long-term interactions between these two macroeconomic factors in the Chinese market. The empirical findings demonstrate the extent to which the I affects EX as well as the reciprocal relationship between EX and I. The stability of the linkage is further explored using variance decomposition and impulse response analysis. In addition to offering policymakers a foundation for regulating monetary policy, this study offers a fresh viewpoint on the macroeconomic dynamics of China.

## KEYWORDS

RMB; Interest rate; Exchange rate; Interactivity; VAR model

## 1. INTRODUCTION

In today's globalization, the formulation of monetary policy should not only focus on the domestic economy, but also consider the international market. In this context, as a country with a huge economic volume, China's monetary policy formulation naturally attracts global attention. RMB interest rate and exchange rate are two important tools of monetary policy regulation, and their interaction and dynamic effects have been the focus of academic research and policy analysis. Understanding the linkage mechanism of the two is of great significance to stabilize the financial market, formulate effective monetary policy and prevent and deal with potential financial risks. In recent years, with the accelerated pace of RMB internationalization and the reform of foreign exchange market, RMB exchange rate and interest rate market have become more representative and reference value. In this case, it becomes particularly important to study the linkage between I and EX.

In this paper, VAR model is constructed to analyze the relevant data, aiming to reveal the dynamic relationship between these two variables. In order to fully understand this linkage, this study will use Eviews13 to conduct co-integration testing, impulse response analysis and variance decomposition, hoping to provide valuable references for policy makers.

## 2. LITERATURE REVIEW

In terms of the relationship between interest rates and exchange rates, Jin Juan and Li Fuyou believed that under the condition of open economy, the free flow of capital and the free exchange of currency will make the domestic and foreign currency market and foreign exchange market integrate. As the

adjustment tool of the above-mentioned market and the main means of monetary policy, there is a dynamic feedback mechanism of interaction and mutual transmission between interest rate and exchange rate [1]. Jin Xin provided a detailed explanation of the relationship between the two prior to and following the "8.11" exchange rate reform by utilizing a number of classical economic theories, including interest rate parity theory and the Mundell-Fleming model. The analysis concludes that the RMB exchange rate has a price spillover effect on the interest rate regardless of when it occurred—that is, before or after the "August 11" exchange rate reform—and that this effect is more pronounced following it. But before and after exchange rate reform, there is no price spillover effect between the two [2]. Besides, Wang Bangju, conducted empirical analysis and demonstration of RMB exchange rate fluctuation and its relationship with interest rate after the reform of China's foreign exchange system in 1994, and research using Granger causality test and co-integration test, believes that interest rate parity theory is not applicable in China, that is, the correlation between the two is weak [3]. Some academics, however, think there is a significant correlation between the two. For instance, Zuo Yifan believes that in practice, interest rate and exchange rate, as two forms of currency price, are interrelated and interact with each other. After logical and theoretical explanation of the relationship between interest rate and exchange rate, the author selects part of interest rate and exchange rate data in the market and establishes VAR model for empirical analysis [4]. Yang Lin also conducted research and concluded that a stronger long-term relationship between I and EX exists and that the influence of the I on EX outweighs that of the exchange rate on interest rates. Wang Yuhua, Hui Xiaofeng, et al. discovered through empirical study that the exchange rate has a significant short-term impact on interest rates and that the relations between the two variables has strong nonlinear transfer dynamic characteristics. Based on Dornhusch's long-term equilibrium model, Zheng Zheng built a VEC model and conducted an empirical analysis of the linkage relationship between RMB interest rate and exchange rate from 1978 to 2010 through co-integration test, causality test, impulse response analysis and variance decomposition. The research shows that there is a two-way and long-term negative relationship between RMB interest rate and exchange rate, and the influence of RMB interest rate on exchange rate is more significant [5].

### **3. EMPIRICAL ANALYSIS**

#### **3.1. Data Selection**

In this study, the monthly weighted inter-bank lending rate  $r$  and real effective exchange rate  $reer$  from January 2019 to November 2023 are selected as variables for empirical analysis. Data from the official website of the People's Bank of China and BIS (Bank for International Settlements) website

#### **3.2. Stationarity Test, Lag Order Selection and VAR Model Stability Test**

##### **3.2.1. Stationarity test**

Unit root test is needed to ensure the stationarity of time series data when constructing VAR model. In this paper, ADF test method is used to ensure the stability and accuracy of the model. The ADF test results of the two original variables showed that both P values were greater than 0.05, indicating that they did not pass the stationarity test. Then, the first-order difference is obtained,  $dr$  and  $dreer$  are obtained, and ADF test is conducted again, as shown in Table 1. As can be seen from the table, both P-values are less than 0.05, indicating that the first-order difference data passes the stationarity test. These variables are therefore a first order single integer sequence.

**Table 1.** ADF test results for variables dr and dreer

Variables	ADF value	P value	(C, T, K)
dr	-7.222759	0.0000	(C, T, O)
dreer	-5.484115	0.0002	(C, T, 1)

### 3.2.2. Co-integration test

Pseudo-regression is ruled out because both variables are first-order single integral variables based on the unit root test results. Subsequently, the Jonhansen co-integration test is employed to ascertain the existence of a long-term equilibrium relationship between the two; Table 2 presents the findings. There are two co-integration relations between the RMB interest rate and the exchange rate, as shown by the table's central measurement, suggesting that there is at least one long-term equilibrium co-integration relationship between the two variables.

**Table 2.** Jonhansen test results for variables dr and dreer

Hypothesized		Trace	0.05	Prob.**
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None *	0.523066	61.89799	15.49471	0.0000
At most 1 *	0.305765	20.43693	3.841465	0.0000

### 3.2.3. Determine the order of lag

Determining the correct lag order is helpful for VAR model to accurately capture the dynamic relationship between variables. If the lag order is set too low, the model may miss important historical information, resulting in autocorrelation in the residual sequence. Conversely, if there are too many lag orders, the model may include some unnecessary or noisy information. In addition, selecting the appropriate lag order is also helpful to improve the estimation accuracy of VAR model parameters. Table 3 shows the LR, FPE, AIC, SC, and HQ values in order 1-5. As can be seen from the table, when K=1, there are two criteria to choose from, and when K=2, there are three criteria to choose from. Therefore, we determine that the final lag order is K=2.

**Table 3.** The result of lag order selection

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-82.63810	NA	0.090146	3.269362	3.418063*	3.326546*
2	-77.28067	9.906182*	0.085688*	30218139*	3.515541	3.332505
3	-74.61493	4.727930	0.090237	3.268488	3.714592	3.440038
4	-74.08518	0.899567	0.103140	3.399441	3.994246	3.628174
5	-72.48193	2.601494	0.113413	3.489884	4.233391	3.775801

### 3.2.4. VAR model stability test

The VAR model requires that shocks to the system have only temporary effects, not permanent ones. If the absolute value of the eigenroot is greater than or equal to 1, the system will become explosive and the impact of the shock will not decay with time. Therefore, we need to test its stability, and the standard is that the absolute value of all eigenroots is less than 1. With a graph, it can be expressed as, all feature roots fall within the unit. Figure 1 shows the test results. It can be seen that the VAR model is stable.

Inverse Roots of AR Characteristic Polynomial

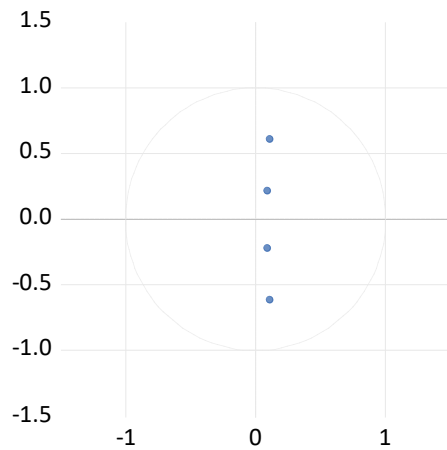


Figure 1. Test results of feature roots

### 3.3. Impulse Response and Variance Decomposition

#### 3.3.1. Impulse response analysis

The impulse response function and variance decomposition are next needed in order to comprehend the two variables' mutual effect and force of action in more detail. The impulse response curve is shown in Figure 2. Based on the data, it is evident that the third period (-5%) experiences the highest negative impact of interest rate on the effective exchange rate. Only 1% of the total will be beneficial. As may be observed, there is little correlation between I and EX. With an 11% increase, the second period saw the biggest positive impact of the EX on I. -12% is the highest possible negative effect. Clearly, interest rates have a bigger impact on effective exchange rates than effective exchange rates have on interest rates.

Response to Cholesky One S.D. (d.f. adjusted) Innovations

95% CI using analytic asymptotic S.E.s

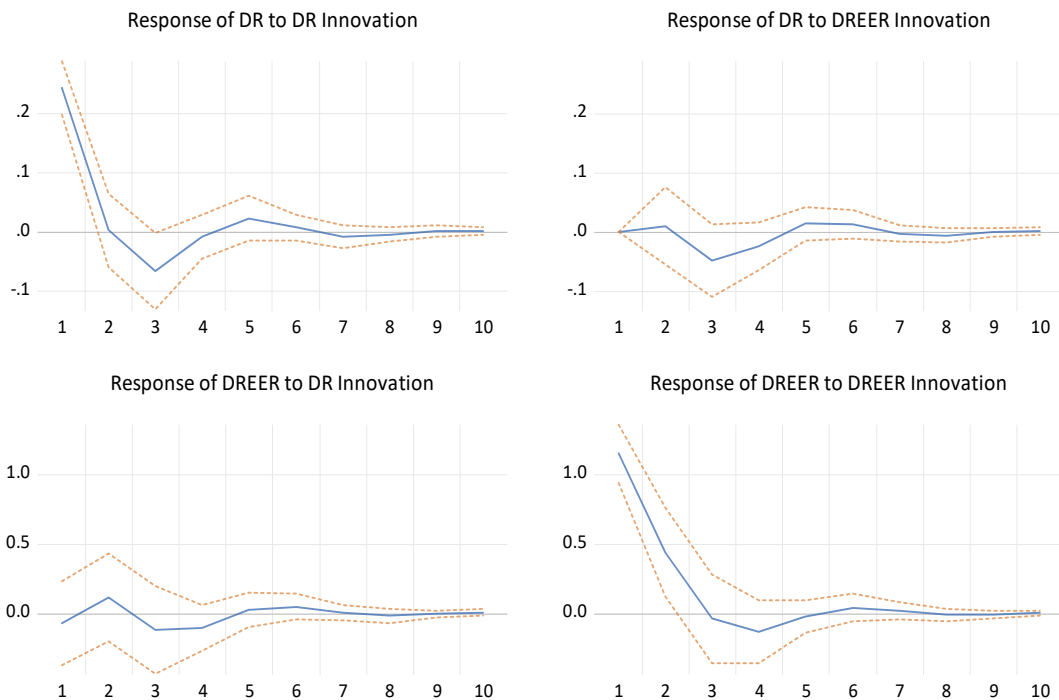


Figure 2. Impulse response curve

### 3.3.2. Variance decomposition

According to the variance decomposition results, the change in the I is observed to progressively decrease as a consequence of its own effect and to gradually increase as a result of the change in the EX, ultimately reaching 5.11%. The percentage is merely 2.91%, therefore the change in the I has little impact on EX. The variance decomposition result shows that the interest rate's contribution to the exchange rate is larger than the interest rate changes' impact on each other, and that both the interest rate's contribution to the exchange rate and its feedback effect on the interest rate are continuously rising.

## 4. CONCLUSION

By analyzing the VAR model built for the monthly data from January 2019 to November 2023, and through the stationarity test, cointegration test, pulse analysis and variance decomposition of variables, the following conclusions are drawn about the co-activity of RMB interest rate and exchange rate.

- (1) The results of the Jonhansen co-integration test indicate that the interest rate and exchange rate have a long-term co-integration connection.
- (2) Interest rates and exchange rates in RMBs are correlated in both directions, with interest rates having a greater influence on exchange rates than on interest rates.
- (3) Fluctuations in its own historical data are the main determinants of EX and I fluctuations. The contribution of I to EX and the feedback effect of EX on I are both increasing, and the contribution of EX to I is greater than the impact of changes in I on changes in EX

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