

The Analysis of Exchange Rate Fluctuations in China's Economic Fluctuations

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Abstract: This study focuses on the influenced factors of exchange rate fluctuations in China's economic fluctuations. Currently, the impact factors of exchange rate fluctuations within the economic system is becoming increasingly significant. The aim of this paper is to explore the factors influencing exchange rate fluctuations in the process of China's economic fluctuations, and to solve the specific impact mechanism and degree of China's economic fluctuations on exchange rate fluctuations. By constructing a dynamic model and combining macroeconomic data for empirical analysis, quantitative methods are used to investigate the degree of influence of China's economic development on exchange rate fluctuations, as well as the changing trends under different economic cycles. This study uses econometric methods, combined with time series analysis and regression analysis techniques, to conduct in-depth research on the impact of exchange rate fluctuations in China's economic fluctuations. At the same time, relevant theoretical models are used to explain and verify the research results, ensuring the scientific and reliable nature of the research methods. The results of the study show that the impact of exchange rate fluctuations in China's economic fluctuations cannot be ignored, and macroeconomic factors such as economic growth, export trade, and international competitiveness have a significant impact on exchange rate fluctuations in China. The study provides important reference for further improving China's economic policies, and provides a new theoretical perspective and empirical support for related fields of research.

Keywords: Exchange rate fluctuations; Economic fluctuations; GDP; Money supply.

1. Introduction

1.1. Research Background

Exchange rate fluctuations have long been a focal issue in China's economic landscape. As the Chinese economy continues to grow rapidly, the impact of exchange rate volatility on the domestic economy has become increasingly pronounced. As the world's largest developing economy, China's economic fluctuations and their influence on exchange rates have attracted widespread attention. The exchange rate, defined as the relative value of a nation's currency against others in international transactions, not only reflects a country's economic strength but also significantly affects domestic economic activities and international trade [1].

In recent years, China's economy has faced multiple internal and external pressures, including slowing global economic growth, escalating international trade frictions and barriers, geopolitical risks, and domestic pandemic-related shocks. These challenges have not only strained domestic economic conditions but also exerted substantial influence on the exchange rate.

Understanding and analyzing the impact of China's economic fluctuations on exchange rate movements is crucial for formulating effective economic policies and response strategies. Furthermore, China's exchange rate regime reforms and evolving economic relations with major global economies, such as the U.S., have profound implications for its exchange rate dynamics. For instance, adjustments in U.S. monetary policy may trigger global capital flows, thereby affecting China's exchange rate. Therefore, a macro-level analysis of how China's economic fluctuations influence exchange rate movements is essential.

In summary, the relationship between China's economic fluctuations and exchange rate dynamics is a complex and critical issue. A thorough investigation of this topic will enhance our understanding of China's economic mechanisms and provide theoretical and policy insights for sustainable economic development and exchange rate regime reforms.

1.2. International Research

Charles Engel (2016) reviewed the evolution of exchange rate dynamics models and proposed a new framework, emphasizing the roles of economic fundamentals, market expectations, and policy interventions. The study also noted that the impact of exchange rate movements may vary over time and across market conditions.

Adrien Verdelhan (2010) analyzed the long-term relationship between exchange rate movements and economic fundamentals, such as exports, imports, and inflation. The findings suggested that this relationship is unstable and subject to policy interventions and market expectations.

1.3. Research Content and Methodology

1.3.1. Research Content

This study focuses on the factors influencing exchange rate fluctuations amid China's economic volatility. It begins with an overview of economic fluctuations and exchange rate dynamics, followed by an in-depth analysis of their interplay. The study then identifies key determinants of exchange rate movements through empirical analysis and concludes with policy recommendations to guide exchange rate policy adjustments during economic fluctuations, thereby promoting stable economic growth and balanced international trade.

1.3.2. Research Methodology

Based on the qualitative analysis of factors influencing exchange rate fluctuations, this study further employs

mathematical statistical methods to establish regression function expressions between dependent and independent variables, followed by in-depth empirical analysis.

2. Theoretical Analysis of China's Economic Fluctuations and Exchange Rate Movements

2.1. Theoretical Analysis of Exchange Rate Fluctuations

2.1.1. Impact of External Environmental Factors on Exchange Rate Fluctuations

(1) International Trade Conditions

International trade conditions in the external environment have a significant impact on exchange rate fluctuations during China's economic volatility. We will analyze the impact of economic conditions, changes in trade policies, and global trade trends of major trading partners on economic fluctuations. In particular, we will focus on China's trade dependence on and its changes with major trading partners such as the United States, the European Union, and ASEAN, and their impact on exchange rates. International trade conditions include the economic status of major trading partners, changes in trade policies, and global trade trends [2]. Positive international trade conditions usually boost China's exports, increase foreign exchange earnings, and provide some support to economic fluctuations; while trade deficits may exert certain pressure on economic fluctuations [3].

Foreign Direct Investment (FDI)

Foreign direct investment is one of the important factors in the external environment. It not only affects China's economic growth and industrial restructuring, but also has a certain degree of impact on economic fluctuations. The mechanism through which FDI affects economic fluctuations includes its impact on capital flows and exchange rate expectations [4]. Large-scale foreign direct investment may lead to RMB appreciation, as capital inflows increase the demand for RMB, thereby pushing up the exchange rate. We will study the impact of FDI on exchange rates, including the correlation between capital inflows and exchange rate fluctuations, as well as the relationship between the scale of FDI and exchange rate fluctuations. As a form of capital inflow, FDI increases demand for domestic currency, which may lead to currency appreciation. In some cases, FDI inflows may bring about increased exports (for example, when foreign companies produce goods in China and export them), which may further strengthen the trend of currency appreciation. However, if FDI is mainly concentrated in service industries or industries that do not involve significant exports, this balancing effect may be less obvious [5].

Volatility in International Financial Markets

Volatility in international financial markets also has a significant impact on China's exchange rate. Among these factors, fluctuations in major international currencies, changes in risk preferences in international financial markets, and volatility in international commodity prices are particularly important for economic fluctuations. Volatility in international financial markets, such as the US dollar index, the EUR/USD exchange rate, and international crude oil prices, will directly affect exchange rate fluctuations. For example, a rise in the US dollar index may lead to RMB depreciation, as investors sell RMB to buy US dollars.

2.1.2. Impact of Domestic Economic Factors on Exchange Rate Fluctuations

(1) Trade Conditions

Among domestic economic factors, China's import and export trade conditions have a significant impact on exchange rate fluctuations. We will analyze the impact of the scale and structure of exports and imports on economic fluctuations, with particular attention to the mechanism through which trade surpluses or deficits affect exchange rates. Trade conditions have a direct impact on economic fluctuations.

Monetary Policy

China's monetary policy has a direct impact on exchange rate fluctuations. We will analyze the impact of the People's Bank of China's monetary policy adjustments on economic fluctuations, including the impact of interest rate levels, money supply, and foreign exchange reserves on exchange rates. For example, monetary tightening may lead to RMB appreciation, while monetary easing may lead to RMB depreciation [6]. Changes in monetary policy directly affect exchange rates, mainly through the following channels:

(a) Interest rate adjustments: When the central bank raises interest rates, foreign capital tends to flow into high-interest assets, increasing demand for the currency and thus pushing up its value. Conversely, if the central bank cuts interest rates, it may reduce foreign investment due to lower returns, potentially leading to currency depreciation.

(b) Market expectations: Market expectations of future monetary policy also affect exchange rates. If the market expects the central bank to tighten policy, it may drive currency appreciation in advance. Conversely, expectations of future easing may lead to premature currency depreciation.

(c) Credit risk and investor sentiment: Monetary policy may affect a country's credit risk and investors' risk appetite. For example, excessively loose monetary policy may raise inflation concerns, increase the country's credit risk, and lead to currency depreciation. On the other hand, prudent monetary policy may enhance investor confidence in the national economy and promote currency appreciation.

(d) Relative to other countries' policies: Exchange rates are relative prices, so a country's monetary policy must be compared with those of its major trading partners. If other countries simultaneously adopt loose policies, the impact of a single country's loose policy on the exchange rate may be smaller.

Economic Policies

Among domestic economic factors, macroeconomic policies also have a significant impact on exchange rate fluctuations. We will analyze the impact of China's macroeconomic regulation policies on economic fluctuations, including the potential impact of fiscal policies and industrial policies on exchange rates [7]. Macroeconomic policies also have an important impact on exchange rate fluctuations. The regulation of fiscal policies and industrial policies will affect exchange rate fluctuations [8]. For example, expansionary fiscal policies may lead to RMB depreciation, while adjustments to industrial policies may have an appreciation or depreciation effect on the RMB.

When analyzing the correlation between monetary policy and exchange rates, it is necessary to consider the impact of the above channels and their interactions. In addition, it should be noted that exchange rates are affected by various factors such as the global economic environment, political events, and natural disasters. Monetary policy is only one of these factors. Therefore, the analysis of exchange rate

fluctuations should be comprehensive, taking into account all possible influencing factors.

3. Empirical Analysis of China's Economic Fluctuations and Exchange Rate Movements

3.1. Variable Selection and Data Sources

3.1.1. Data Description

Based on theoretical analysis, this paper selects the following five main factors affecting exchange rate movements as explanatory variables: net export volume (X1), gross domestic product (X2), money supply (X3), foreign direct investment (X4), and foreign exchange reserve scale (X5). The RMB/USD exchange rate Y is selected as the explained variable. The sample data are annual data from 2000 to 2022, all sourced from the National Bureau of

Statistics' "China Statistical Yearbook" [12].

3.1.2. Data Processing

Due to unit differences among variables, this study adopts "100 million USD" as the unified unit. The annual average exchange rate for each year is selected as the explained variable.

3.2. Model Construction

Since taking logarithms of time series can reduce variable scales and mitigate heteroscedasticity effects, the following model is established:

$$\ln Y = C + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \delta \quad (3.1)$$

Where: C is the constant term, β_1 - β_5 are parameters to be estimated, δ is the error term

3.3. Correlation Analysis of Variables

Table 1. Correlation Analysis

	lnY	lnX ₁	lnX ₂	lnX ₃	lnX ₄	lnX ₅
lnY	1.000000	-0.725433	-0.838313	0.879534	-0.902682	-0.939077
lnX ₁	-0.725413	1.000000	0.872137	0.867424	0.812009	0.840531
lnX ₂	-0.838313	0.872137	1.000000	0.995800	0.885898	0.840531
lnX ₃	0.879534	0.867424	0.995800	1.000000	0.902240	0.939394
lnX ₄	-0.902682	0.812009	0.885898	0.902240	1.000000	0.936018
lnX ₅	-0.939077	0.840531	0.840531	0.939394	0.936018	1.000000

Correlation Analysis Results:

The table presents the correlation analysis between the selected independent variables and the dependent variable. Correlation analysis examines the relationships between variables through correlation coefficients. The results indicate: The correlation coefficient between lnY and lnX1 is -0.73, showing a positive correlation between total net exports and the exchange rate; The correlation coefficient between lnY and lnX2 is -0.84, indicating a positive correlation between GDP and the exchange rate; The correlation coefficient between lnY and lnX3 is 0.88, demonstrating a negative correlation between money supply and the exchange rate; The correlation coefficient between lnY and lnX4 is -0.90, revealing a positive correlation between foreign direct investment and the exchange rate; The correlation coefficient between lnY and lnX5 is -0.94, suggesting a positive correlation between foreign exchange reserve scale and the exchange rate. Key observations: The correlation coefficients between lnY and lnX4/lnX5 exceed 0.9, indicating strong correlations; The correlations between lnY and lnX1/lnX2/lnX3 are also relatively strong.

3.4. VAR Model

This study employs a VAR model to analyze the influencing factors of RMB exchange rate movements.

3.4.1. Unit Root Test

As the selected data are time series, which are generally non-stationary, a unit root test is conducted prior to analysis to select stationary variables for regression [13], thereby avoiding spurious regression in the regression equation. This study adopts the ADF test to determine the stationarity of each series. The ADF test results for lnY are as follows:

Table 2. ADF Unit Root Test Results for lnY

		t-Statistic	c
Augmented Dickey-Fuller test statistic		-0.834903	0.3410
Test critical values	1% level	-2.692358	
	5% level	-1.960171	
	10% level	-1.607051	

The t-statistic value is $t = -0.834903$. At the 1%, 5%, and 10% significance levels, the critical values for the unit root test are -2.69, -1.96, and -1.607, respectively. Since the t-statistic exceeds all critical values, we fail to reject the null hypothesis, indicating that lnY contains a unit root. To address this issue, this study applies first-order differencing to the lnY series and conducts another ADF test on the processed data. The results are as follows:

Table 3. First-Order Differencing Results of lnY

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.522562	0.0148
Test critical values	1% level	-2.692358	
	5% level	-1.960171	
	10% level	-1.607051	

The results now show that the t-statistic is smaller than the critical values at both the 5% and 10% significance levels, with a p-value of 0.0148 (less than 0.05). We therefore reject the null hypothesis and conclude that the series no longer contains a unit root and has become stationary.

The ADF test results for lnX2, lnX3, lnX4, and lnX5 are presented in the following table:

Table 4. ADF Unit Root Test Results

Variable	t-critical value	5%	10%	P-value	Conclusion
LnX ₂	1.189165	-1.960171	-1.607051	0.9334	Non-stationary
DlnX ₂	-0.567309	-1.962813	-1.606129	0.04580	Stationary
DdlnX ₂	-4.205620	-1.964418	-1.605603	0.0003	Stationary
LnX ₃	0.338066	-1.960171	-1.607051	0.7725	Non-stationary
DlnX ₃	-0.621283	-1.960171	-1.607051	0.4580	Non-stationary
DdlnX ₃	-4.205620	-1.962813	-1.606129	0.0003	Stationary
LnX ₄	1.042932	-1.959071	-1.607456	0.9157	Non-stationary
DlnX ₄	-4.107357	-1.960717	-1.607051	0.0003	Stationary
DdlnX ₄	-7.442645	-1.961409	-1.606610	0.0000	Stationary
LnX ₅	0.176421	-1.960171	-1.607051	0.7262	Non-stationary
DlnX ₅	-1.292782	-1.960171	-1.607051	0.1740	Non-stationary
DdlnX ₅	-4.424659	-1.961409	-1.606610	0.0002	Stationary

3.4.2. Johansen Cointegration Test

Table 5. Johansen Cointegration Test Results

Hypothesized No. of CE (s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.929665	88.29224	47.85613	0.0000
At most 1*	0.828094	40.51140	29.79707	0.0020
At most 2	0.332808	8.816915	15.49471	0.3826
At most 3	0.081626	1.532713	3.841465	0.2157

The test results indicate the presence of two cointegration relationships.

3.4.3. Granger Causality Test

Table 6. Granger Causality Test

Null Hypothesis	Obs	F-Statistic	Prob.
lnX ₁ does not Granger Cause lnY	17	0.13179	0.8778
lnY does not Granger Cause lnX ₁		1.30117	0.3080
lnX ₂ does not Granger Cause lnY	19	6.05714	0.0127
lnY does not Granger Cause lnX ₂		1.88596	0.1883
lnX ₃ does not Granger Cause lnY	19	1.66417	0.0247
lnY does not Granger Cause lnX ₃		0.80788	0.4655
lnX ₄ does not Granger Cause lnY	19	3.08651	0.0775
lnY does not Granger Cause lnX ₄		0.20289	0.8187
lnX ₅ does not Granger Cause lnY	19	3.40444	0.0324
lnY does not Granger Cause lnX ₅		1.20826	0.3280

At the given significance level: For the null hypothesis "lnX₁ does not Granger-cause lnY", the p-value is greater than 0.05, thus we fail to reject the null hypothesis. This suggests that changes in the trade balance (lnX₁) cannot adequately explain fluctuations in the RMB/USD exchange rate. For the null hypothesis "lnX₂ does not Granger-cause lnY", the p-value is less than 0.05, leading us to reject the null hypothesis. This indicates that GDP growth (lnX₂) is a significant factor causing RMB exchange rate movements. For the null hypothesis "lnX₃ does not Granger-cause lnY", the p-value is less than 0.05, so we reject the null hypothesis. This demonstrates that money supply changes (lnX₃) can effectively explain RMB exchange rate fluctuations. For the null hypothesis "lnX₄ does not Granger-cause lnY", the p-value is greater than 0.05, therefore we fail to reject the null hypothesis. This implies that foreign direct investment (lnX₄) does not sufficiently explain exchange rate movements. For the null hypothesis "lnX₅ does not Granger-cause lnY", the p-value is less than 0.05, leading us to reject the null

hypothesis. This shows that foreign exchange reserve levels (lnX₅) can reasonably explain exchange rate variations.

Table 7. Regression Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob
lnX ₂	0.002431	0.019047	0.127639	0.0199
lnX ₃	-0.614014	0.082094	-7.479412	0.0021
lnX ₅	0.636886	0.103525	6.152015	0.0000
C	2.328012	0.134842	17.26474	0.0000

Based on the above analysis, since lnX₁ and lnX₄ cannot adequately explain lnY, they are excluded from the regression equation, yielding the following results:

$$\ln Y = 0.002431 \ln X_2 - 0.614014 \ln X_3 + 0.636886 \ln X_5 + 2.328012 \quad (3.2)$$

$$(0.019047) (0.082094) (0.103525) (0.134842)$$

$$t = (0.127639) (-7.479412) (6.152015) (17.26474)$$

$$R^2 = 0.930270 \text{ Adjusted } R^2 = 0.919259 \text{ F} = 84.49257 \text{ n} = 23$$

As can be seen from the above calculation results, the R² is 0.930270 and the adjusted R² is 0.919259, which indicates that the model has a very good fit. In addition, the F-test result is significant, further verifying the good fit of the model. According to the regression equation (3.2), an increase of one unit in lnX₂ leads to a decrease of 0.002431 units in lnY; an increase of one unit in lnX₃ leads to a decrease of 0.614014 units in lnY; an increase of one unit in lnX₅ leads to an increase of 0.636886 units in lnY. That is, the exchange rate appreciates with the increase in GDP, depreciates with the increase in money supply, and appreciates with the increase in the scale of foreign exchange reserves.

4. Conclusions and Recommendations

4.1. Conclusions

Based on theoretical analysis, this paper constructs a VAR model using the trade balance, gross domestic product (GDP), and money supply as indicators of economic fluctuations. It also empirically analyzes the impact of exchange rate changes on economic fluctuations in China through Granger causality tests. The main conclusions are as follows:

(1) China's strong comprehensive national power is an important safeguard for economic fluctuations. Frequent foreign trade and international settlements are practical demands for economic fluctuations. Exchange rate

fluctuations also have a significant impact on economic fluctuations, especially when economic fluctuations are in the early stages. If China's exchange rate reform cannot adapt to economic fluctuations, it may have an impact on China's macroeconomy, thereby causing the level of economic fluctuations to regress.

(2) The empirical analysis results show that there is a positive correlation between China's GDP and exchange rate changes. The exchange rate increases with the growth of GDP, and the RMB appreciates. There is a negative correlation between China's money supply and exchange rate. The money supply can indirectly affect the exchange rate by influencing the relative inflation rate, relative interest rate, and expected exchange rate. It can also directly affect the exchange rate by influencing the total demand and supply of money. The larger the scale of foreign exchange reserves, the greater the demand for the domestic currency, and the more the domestic currency appreciates.

4.2. Policy Recommendations

Based on the research of this paper, the following suggestions can be made for the reform of China's exchange rate formation mechanism and the improvement of the level of economic fluctuations:

(1) Exchange rate marketization reform should still follow a gradual approach to make exchange rate fluctuations more flexible. Therefore, China should continue to maintain a managed floating exchange rate system based on market supply and demand, which can buffer external shocks through exchange rate fluctuations. For China, if a fully free-floating exchange rate system is to be directly chosen at this stage, it must be based on a liquid foreign exchange market and a strong financial regulatory system. Otherwise, it will bring great risks, which may cause large exchange rate fluctuations. Speculators will engage in speculation, increasing the probability of currency crises and leading to macroeconomic deterioration.

(2) Promote exports. Exports are an important pillar of China's economy and are of great significance for promoting the growth and stability of GDP. The government can promote exports by reducing tariffs and increasing export tax rebates, thereby increasing foreign exchange earnings and stabilizing the exchange rate. Control imports. The impact of imports on GDP and exchange rate cannot be ignored. The government can control imports by restricting imports and strengthening quality supervision, thereby reducing foreign exchange expenditure and stabilizing the exchange rate.

(3) Adopt appropriate monetary policies to stabilize the money supply. The impact of money supply on exchange rate and GDP is also very important. The government should stabilize the money supply through reasonable monetary policies to maintain exchange rate stability and promote GDP growth.

(4) Optimize the trade structure and increase foreign exchange earnings. The government can adjust the trade structure, strengthen the production and export of high value-added products, improve the quality and added value of export products, and increase foreign exchange earnings, thereby increasing the scale of foreign exchange reserves. In addition, the government can also encourage enterprises to go global, actively engage in foreign investment, increase overseas income, and further increase the scale of foreign

exchange reserves.

In summary, the government should take comprehensive measures to deal with the relationship between GDP, foreign exchange reserves, money supply, and exchange rate. By optimizing the trade structure and adopting appropriate monetary policies to stabilize the money supply, the stability and development of the economy can be promoted.

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