

Analysis of The Impact between Fluctuations in the Exchange Rate of RMB against The U.S. Dollar and China's Export Business

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Abstract. In this project, when the exchange rate of RMB against the U.S. dollar rises in the trade between China and the United States, due to the decline in the income of export goods, the decline in total export value will lead to a decrease in the number of dollars exchanged by China, and on the contrary, the income from imports will increase, so Imports also increase, causing more dollars to be spent. In this way, after a certain period, the total amount of U.S. dollars held by China will decrease, which will lead to an increase in China's demand for U.S. dollars, which will lead to the appreciation of the U.S. dollar, that is, the exchange rate of the RMB against the U.S. dollar will decline.

Keywords: RMB; USD; Exchange Rate.

1. Introduction

The nature of fluctuations in the exchange rates of two countries reflects the economic relationship between the countries. The United States and China are the world's leading economies, and the trade war between them concerns the interests of both countries. The trade restrictions implemented by the United States on China have hit China's exports to the United States, which are one of the important engines of China's economy. The United States is in a strong position in the trade war, so the natural decline in the yuan's exchange rate against the dollar seems to result from market adjustment. However, whether there is a necessary link between the fluctuation of the RMB exchange rate against the U.S. dollar and the import and export business needs to be convincing through quantitative analysis of the data. This project attempts to use the historical data of China's export total value and the historical data of the exchange rate of RMB and the U.S. dollar after 1990 to analyze and discuss the factors that affect the two factors and to predict the trend of the impact of the rising exchange rate of the RMB against the U.S. dollar on China's export business.

2. Research Methods

The analysis methods used in this project are correlation analysis and linear regression analysis. Correlation analysis is a simple and easy way to measure the relationship between quantitative data. It can analyze the relationship between variables and the strength of the relationship. Before the correlation analysis, the first project tries to understand the general relationship between variables through the scatter plot. The variables will show as discrete points randomly distributed on the scatter plot in the correlation analysis. For example, it can be roughly seen from the scatter diagram analysis that when X increases, Y will increase significantly, and there is a positive correlation between the fluctuation of the exchange rate of RMB against the U.S. dollar and China's export business. Correlation analysis and regression analysis have different research purposes. Correlation analysis is used to describe whether there is a relationship between variables, while regression analysis is to study the impact of the relationship. Regression analysis was performed when there was a significant association between the two variables. Only when there is a correlation can there be a regression-influence relationship. If there is no correlation, there should not be an influence relationship.

3. Data Analysis

The data required for this project are mainly divided into two categories: historical data on China's export total value and historical data on RMB and USD exchange rate. It should be noted that the exchange rates of the U.S. dollar and the RMB are constantly changing; only the exchange rate changes within a certain range. Therefore, when the exchange rate of the U.S. dollar and the RMB falls, the supply and demand relationship between the two currencies and the government authorities changes the monetary policy will cause exchange rate changes between the two currencies. Many complex factors affect the exchange rate, including long-term and short-term factors. Exchange rate changes are the result of the combined action of multiple factors. The above factors will act simultaneously, and individual factors may also play a decisive role; multiple factors may produce synergistic effects or offset each other. The following Figure 1 is the historical data trend from 1990 to the present Dollar-Yuan exchange rate; Figure 2 is the data trend of China's export data and the percentage of GDP from 1990 to the present. "Exports in China averaged 74.57 USD Billion from 1981 until 2021" (Trading Economics, 2022).

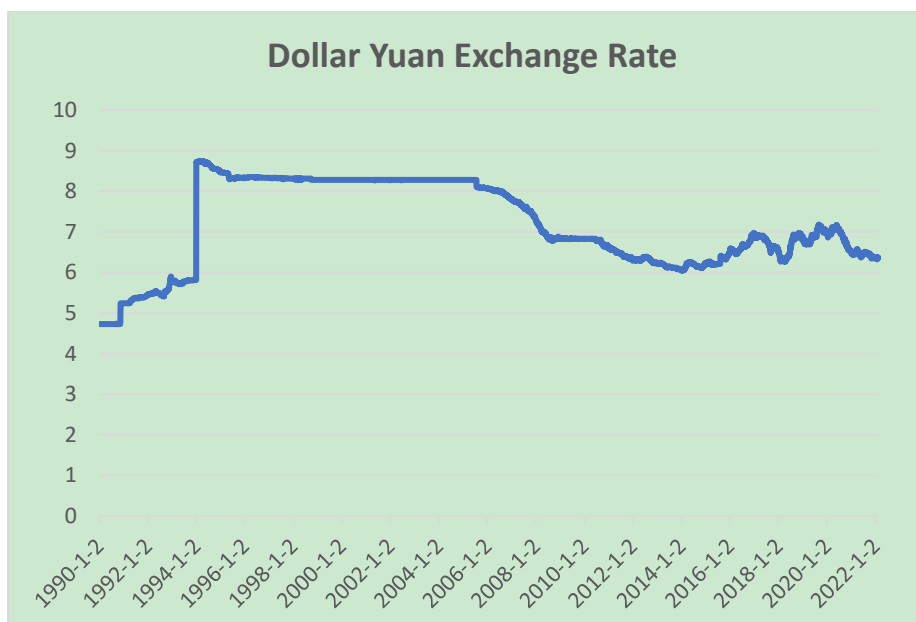


Figure 1. Dollar Yuan Exchange Rate

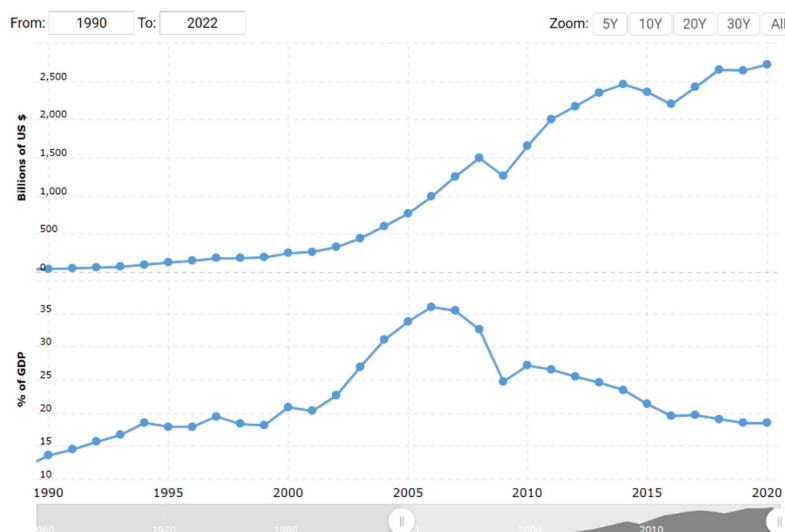


Figure 2. China Exports

(Retrieved from <https://www.macrotrends.net/countries/CHN/china/exports>)

In terms of data processing, this project retains the exchange rate value of RMB against the U.S. dollar in January every year from 1990 to 2020 and makes a scatter plot of this set of data and the total export value of the corresponding year. The results are shown in Figure 3:

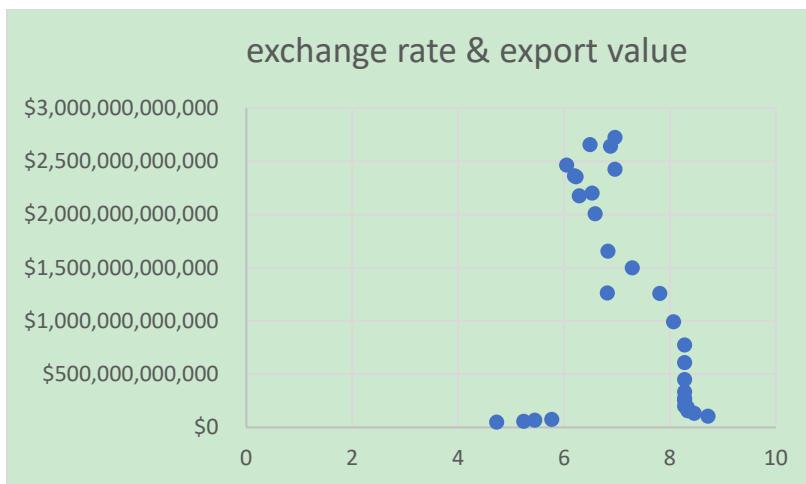


Figure 3. Correlation Analysis

It can be seen from the scatter diagram that the relationship between the two tends to be negatively correlated; that is, the exchange rate increases and the export value decreases. There are also fewer outliers in the scatterplot and are ignored. Then, regression analysis was performed on the relevant data, and the results were shown in Figure 4:

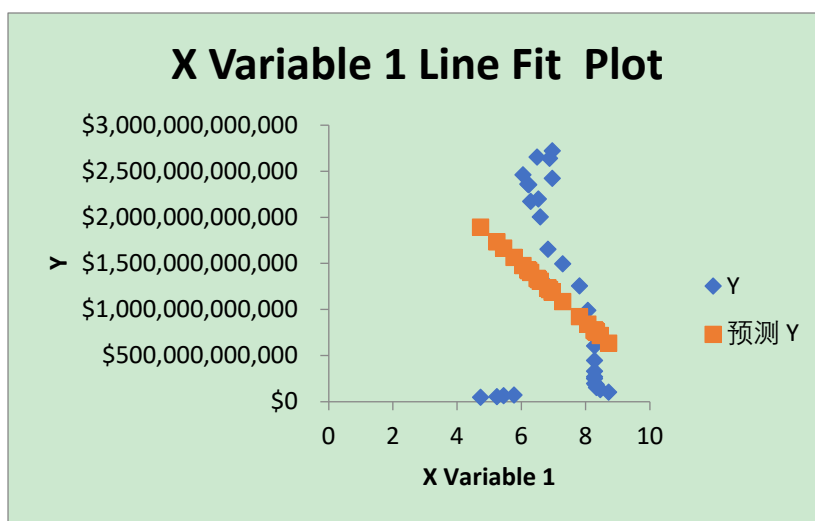


Figure 4. Regression Analysis

The exchange rate directly affects the money supply in the foreign exchange market, affecting the import and export of goods and services; this is the fundamental influence relationship. Analysis of the process of its impact: impact on exports: the exchange rate of RMB against the U.S. dollar increases > the RMB is more valuable > for the United States, Chinese goods and services that are priced in RMB become more expensive > inhibits the U.S. demand > suppresses the impact of exports of Chinese goods on imports. The exchange rate of RMB against the U.S. dollar has risen > the RMB is more valuable > for China, the goods and services of the United States have become relatively cheap > stimulated domestic demand in China > increased imports. Therefore, an increase in the RMB exchange rate is good for imports and not good for exports.

Table 1. Regression Analysis Summary Output

Regression statistics					
Multiple R	0.35309789				
R Square	0.12467812				
Adjusted R Square	0.094494607				
standard error	9.56228E+11				
Observations	31				
Variance Analysis					
	df	SS	MS	F	Significance F
regression analysis	1	3.77697E+24	3.78E+24	4.13067	0.051360316
residual	29	2.65168E+25	9.14E+23		
Summary	30	3.02937E+25			
	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	3.38715E+12	1.13102E+12	2.994784	0.005571	1.07396E+12
X Variable 1	-3.15394E+11	1.55183E+11	-2.0324	0.05136	-6.32779E+11

Table 2. Residual Output

Observations	Residual Y	Residual
1	1.89533E+12	-1.8462E+12
2	1.73448E+12	-1.67894E+12
3	1.66825E+12	-1.6014E+12
4	1.56732E+12	-1.49304E+12
5	6.3691E+11	-5.323E+11
6	7.18912E+11	-5.87052E+11
7	7.5676E+11	-6.0195E+11
8	7.59913E+11	-5.72463E+11
9	7.66221E+11	-5.77471E+11
10	7.75683E+11	-5.76983E+11
11	7.75683E+11	-5.22593E+11
12	7.75683E+11	-5.03623E+11
13	7.75683E+11	-4.42683E+11
14	7.75683E+11	-3.27723E+11
15	7.75683E+11	-1.68323E+11
16	7.75683E+11	-2343199408
17	8.41916E+11	1.49814E+11
18	9.23918E+11	3.34142E+11
19	1.08792E+12	4.09947E+11
20	1.23616E+12	26501290232
21	1.233E+12	4.21815E+11
22	1.3087E+12	6.97601E+11
23	1.40332E+12	7.71762E+11
24	1.42224E+12	9.32009E+11
25	1.47901E+12	9.83828E+11
26	1.4317E+12	9.30387E+11
27	1.32762E+12	8.72347E+11
28	1.19074E+12	1.23346E+12
29	1.33992E+12	1.31567E+12
30	1.21771E+12	1.42356E+12
31	1.19099E+12	1.53226E+12

In addition, from the clustering trend of yellow points in the scatter plot obtained after regression analysis (regression analysis predicted value), it can be seen that the increase in the exchange rate of RMB against the U.S. dollar has a strong correlation with China's export value.

4. Results and Predictions

From the above analysis, the following results can be drawn: the rise of the RMB exchange rate is beneficial to imports; on the contrary, the export will be affected by the RMB exchange rate, and the price of export commodities in foreign markets will increase, and the competitiveness will be weakened. Exchange rate fluctuations directly affect the export business in price and indirectly affect the export business through the impact on other variables such as interest rates, production costs, and other variables. Prices of imports fell due to the appreciation of the local currency. When a considerable proportion of imported goods are investment goods such as machinery, this price drop will directly reduce the cost of importing goods buyers, resulting in a reduction in the cost of related industries and an increase in output. When these industries are mainly engaged in the production of export products, the local currency price of exports will fall, which may offset the impact of the local currency's appreciation, and the export price will also fall. In addition, the impact of exchange rate changes on imports and exports is multifaceted: both the direct impact as predicted by standard analysis and the indirect impact due to the linkage of various sectors of the economy. At the same time, exchange rate changes affect the quantity or value of imports and exports and affect the purchase of imports and exports. And these impacts have different impacts on different economies. The improvement of the project also needs to analyze these impacts based on analyzing the import and export structure of each economy. In addition, the results of imports and exports and changes in prices are also influencing factors[1-3].

5. Conclusion

In terms of foreign trade activities, the changeable exchange rate is the biggest obstacle to the development of China's foreign trade activities and stable economic development. The internationalization of the RMB can reduce the changeable exchange rate problem in China's foreign trade to a certain extent. Although this situation cannot be completely eliminated, it has played a role in promoting the development of China's economy and foreign trade. The exchange rate will directly affect foreign trade, affecting the import and export value of one country to another country; conversely, when foreign trade is affected, the change in trade value will lead to changes in the currency held by one country in the currency of the other country, which will naturally affect the exchange rate. The exchange rate has changed. In this project, when the exchange rate of RMB against the U.S. dollar rises in the trade between China and the United States, due to the decline in the income of export goods, the decline in total export value will lead to a decrease in the number of dollars exchanged by China, and on the contrary, the income from imports will increase, so Imports also increase, causing more dollars to be spent. In this way, after a certain period, the total amount of U.S. dollars held by China will decrease, which will lead to an increase in China's demand for U.S. dollars, which will lead to the appreciation of the U.S. dollar, that is, the exchange rate of the RMB against the U.S. dollar will decline.

References

- [1] China Export Data retrieved from <https://www.macrotrends.net/countries/CHN/china/exports> Exchange Rate retrieved from <https://www.macrotrends.net/2575/us-dollar-yuan-exchange-rate-historical-chart>.
- [2] Pregelj M, Guguchia Z, Marie-Cécile de Weerd, et al. Probing spin fluctuations of the quantum phase transition in Ce3Al by muon spin rotation[J]. *Scientific Reports*, 2022, 12(1).
- [3] Daramola, Samuel, et al. "Numerical assessment of potential sea level rise impacts on coastal retreat along the Nigerian Mahin mud coast." *Journal of Coastal Conservation* 26.6(2022):1-18.