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A Quantitative Analysis of China's Foreign Exchange during the Trade Disputes between China and the United States

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Abstract

As the two most influential countries in the world, China and the United States have a decisive influence on the global economy. In the trade disputes between China and the United States, the fluctuation of China's foreign exchange has also been deeply affected. This paper analyzes the foreign exchange fluctuations in China and the United States, China and Europe, China and Japan, and Hong Kong under the influence of the trade disputes by adding the policy variables of the trade disputes between China and the United States. The time series is selected from October 17, 2017 to May 17, 2019. The results show that the time series data of four kinds of RMB exchange rate do not obey the law of normal distribution, and their fluctuations have obvious clustering and long memory characteristics and have the characteristics of peak and thick tail. Through the establishment and prediction of econometric mode VaR model is carried out to provide certain reference significance for investors and regulators.

Keywords

GARCH model; VaR model; four types of currency; R studio.

1. Introduction

1.1. The Trade Disputes between China and the United States

With the deepening development of economic globalization and financial integration, countries have become more and more closely connected. Exchange rate, as a basic macro price variable, has a great impact on the trend of macro economy. In the context of economic globalization and frequent global trade exchanges, various economies are increasingly interconnected. The two trade disputess in history have had a great impact on the exchange rate. One was the currency wars and trade disputess that followed the great Crash of 1929; The other was the plaza Accord of the 1980s. Following the inauguration of new US President Donald Trump, his rhetoric on launching a trade disputes against China. Because of the huge volume of China-Us trade, any change in the terms of trade may have unexpected consequences, such as the impact of the fluctuation of RMB exchange rate on the import and export enterprises. Therefore, the trade disputes between China and the US has become one of the events that the import and export enterprises pay high attention to.

Since the trade disputes, China's exchange rate has changed frequently. Since January 22, 2018, China and the United States have been engaged in a trade disputes over tariffs. During the campaign, US President Donald Trump vowed to correct China's "chronic abuse of the broken international system and unfair practices". In January 2018, the Trump administrations declared "global safeguards for imports of large washing machines and photovoltaic products for four and three years, respectively, with tariffs of up to 30% and 50%, respectively." In February 2018, the Trump administrations declared "an anti-dumping duty of 109.95 percent on imports of cast iron sewer fittings from China". On February 27, 2018, the US Department of Commerce announced that "anti-dumping duties ranging from 48.64% to 106.09% and countervailing duties ranging from 17.14% to 80.97% have been imposed on Chinese aluminum foil manufacturers". On March 9, 2018, Trump formally signed into law the tariffs,

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which "impose tariffs of 25 percent on steel and 10 percent on aluminum. Escalating trade disputes, until December 1, 2018, in the Argentine capital, Buenos Aires, the two heads of state of China and the United States held a historic meeting dinner, the two heads of state indicating the bilateral economic and trade team stepped up and reach an agreement, cancel trade frictions since imposing tariffs, bilateral economic and trade relations back on track as soon as possible, to achieve a win-win situation. But on May 10, 2019, the U.S. abruptly reversed course, raising the current 10% tariff on $200 billions of Chinese imports to 25%.

Since the start of the trade disputes between China and the United States, the fluctuation of the RMB has become more and more drastic. Experts pointed out that the outbreak and escalation of the trade disputes between China and the US is one of the important reasons for the recent sharp fluctuations of the RMB exchange rate. Different from the devalution of RMB from 2015 to 2016, this time, thanks to a series of factors such as the release of capital outflow pressure, the timely launch of counter-cyclical regulation policies by the Central bank, and the increase of RMB assets by overseas institutions, the current round of RMB depreciation pressure did not turn into sustained depreciation expectations. As the trade disputes continues to escalate, we should thoroughly analyze it and make contingency plans.

GARCH model is a general model used to describe the volatility characteristics of market return rate, because it can reflect the yield fluctuation character such as cluster and heteroscedasticity. In this paper, unlike the general GARCH model, we add policy variables Ct to reflect the policy impact over this time period.

1.2. Literature Review

The advantages of the GARCH model are obvious, and the model is more brief and recognized than the ARCH model. However, it is not an easy task to determine the order of GARCH model, and a lot of empirical evidence proves that the GARCH (1,1) model with low order can fully describe the GARCH error. For example, Agnieszka Markiwicz (2012) [1] focused on the GARCH family model and the random fluctuation model and believed that the key to the debate on which model to adopt was the memorization of time series. Wei Hongyan (2014)[2] analyzed the average weekly exchange rate data of RMB against US dollar and believed that RMB gradually appreciated. Feng Beilin(2015)[3], after the analysis of the substantial depreciation of the yuan against the dollar in the short term, studies have shown that the effects of exchange rate changes have the feature of complexity and diversity, and points out the future direction of the reform of fiscal policy should pay more attention to government play its social and economic structure adjustment and the influence of the "quality" in the field of income distribution and so on, improve fiscal policy in terms of structure adjustment of precision . Mingzhu Liao[4] USES the ARIMA model to predict the linear subjects of the sequence, and then USES the BP neural network model to estimate the nonlinear residuals and fuse them together to form a combined model. For the prediction of RMB exchange rate, the research finds that the combined model is superior to the single model.

1.3. Organization of the Text

The first part of this paper introduces the research background and the real time of the research. In the second part, the metrological theory and model are summarized, and then the third and fourth parts are used for econometric analysis. After the above research, the fifth part is used to draw Suggestions and conclusions.

2. Measurement Theories and Models

2.1. GARCH Model

GARCH models are usually used to model autoregressive models of random perturbations and are considered to be the most effective heteroscedasticity sequences for you and the model.

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GARCH model is derived in order to prevent the higher later order in ARCH model and reduce the number of parameter estimation. The basic form of obeying GARCH(P, Q) is as follows:

$$r_t = \mu_t + \varepsilon_t; \tag{1}$$

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots + \alpha_q \varepsilon_{t-1}^2 + \theta_1 h_{t-1} + \cdots + \theta_p h_{t-p}. \tag{2}$$

In practice, GARCH (1,1) model can describe a large number of financial time series data. Traders can predict the variance of the current period by establishing the weighted average (constant) of the long-term mean, the expected variance of the previous period (GARCH term), and the variability information observed in previous periods (ARCH term). If the rising or falling asset returns are unexpectedly large, traders will increase their expectations for the variance of the next period. In this paper, we consider the impact of the actual Trade disputes between China and the United States on the exchange rate, so we introduce the policy variable Ct and change the GATCH model to:

$$r_t = \mu_t + \varepsilon_t; \tag{3}$$

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots + \alpha_q \varepsilon_{t-1}^2 + \theta_1 h_{t-1} + \cdots + \theta_p h_{t-p} + aC_t. \tag{4}$$

2.2. Var Model

The GARCH model is applied to calculate the VaR value as follows:

$$\text{VaR} = Z_\alpha h_t \sqrt{t}. \tag{5}$$

Among them, Z_α is the number of GED distribution under the condition that the significance level is 99%. According to the calculation, the value of Z_α is 1.4300086, t is the holding period, h, thus the VaR value of each trading day can be estimated. Then the mean value, standard deviation, maximum value and minimum value of VaR can be obtained.

3. Data Processing and Modeling

3.1. Data Selection

This paper analyzes and forecasts the foreign exchange data of China and the United States, China and Europe, China and Japan, and Hong Kong and China from a few months before the trade disputes begins to today. The data are drawn from the State Bureau of Foreign Exchange Statistics. It is clear that none of the four sets of foreign exchange data is a smooth process. Therefore, we first processed the logarithmic difference and analyzed the return rate of foreign exchange {rt=100log(YT/YT -1)}.

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3.2. Preliminary Analysis and Test of Data

3.2.1. Make a Preliminary Analysis of the Data Using Eviews Software

Table 1: Basic data analysis

	USD/RMB	EUR/RMB	JPY/RMB	HKD/RMB
Mean	0.011475	-0.002647	0.016900	0.010110
Median	0.037635	0.015706	-0.008344	0.034278
Maximum	0.898052	0.994044	2.097303	0.893638
Minimum	-0.71114	-1.441582	-1.2634	-0.687208
Std. Dev.	0.241376	0.344017	0.435982	0.238986
Skewness	-0.152128	-0.277408	0.543487	-0.085283
Kurtosis	3.938843	4.083483	4.336463	3.821647
Jarque-Bera	15.62456	23.76983	47.60598	11.29649
Probability	0.000405	0.000007	0.000000	0.003524

The skewness and grace of the four types of foreign exchange returns do not meet the requirements of normal distribution, and the JB statistic is large, with the characteristics of a sharp peak and a thick tail.

3.2.2. Stationarity Test

Table 2: Stationarity test

	t-Statistic	P
USD/RMB	-17.30703	0.0000
EUR/RMB	-18.64192	0.0000
JPY/RMB	-19.11593	0.0000
HKD/RMB	-17.30563	0.0000

Test Critical values:1% level: -3.447169.5% level: -2.868848.10% Level: -2.57073.

According to the above model, it can be known that the ADF test statistics of the four kinds of logarithmic rate of return series of exchange rates are all smaller than the critical value at the levels of 1%, 5% and 10%, then the null hypothesis is rejected, indicating that the logarithmic rate of return of these five kinds of exchange rates are all stationary series.

3.2.3. Heteroscedasticity Test

Table 3: Heteroscedasticity test

	USD/RMB	EUR/RMB	JPY/RMB	HKD/RMB
F-statistic	9.83374	8.45558	13.21114	15.45634
Probability	0.000027	0.0001	0.000043	0.000035

As can be seen from the test, heteroscedasticity exists in all four types of data.

Since the logarithmic return rates of the four types of data all meet the requirements of serial stability, non-heteroscedasticity and non-normal distribution, the GARCH model can be established.

3.3. GARCH Model Results

Recall the ups and downs of the Trade disputes between China and the United States in the past year. Set Ct as the control variable, when T <20181201,Ct=1; When the 20181202 < t <

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20190510, Ct = 0; When t≥20190510, Ct = 1. The estimated results are shown in the figure below.

Table 4: GARCH model results of USD/RMB and EUR/RMB

	USD/RMB		EUR/RMB	
	Estimate	t value	Estimate	t value
mu	0.14008	1.23642	-0.00521	-0.30898
omega	0.00484	1.39240	0.006447	1.29379
alpha	0.11863	2.16642	0.040475	1.78391
beta	0.80595	8.67152	0.904186	17.87398
a	0.00029	0.58065	0.00000	0.00000
loglikelihood	15.93115		-127.498	

Table 5: GARCH model results of USD/RMB and EUR/RMB

	JPY/RMB		HKD/RMB	
	Estimate	t value	Estimate	t value
mu	-0.00450	-0.21421	0.010219	0.89158
omega	0.016337	1.5314	0.004725	1.07435
alpha	0.055011	1.77513	0.100294	1.25497
beta	0.859131	12.66324	0.823716	5.56647
a	0.00000	0.00000	0.00000	0.000000
loglikelihood	-217.449		17.51125	

3.4. Var Model

Table 6: Results of Var model

	mean	min	max	var
USD/RMB	0.2003	-10.3009	13.1244	11.72242
EUR/RME	0.001348	-23.082339	17.0761	32.44851
JPY/RMB	0.2497	-25.0442	39.2167	66.97784
HKD/RMB	0.1706	-10.1912	13.0931	11.34007

4. Empirical Analysis

α reflects the impact of the previous external shocks on the exchange rate fluctuations. α of the four categories are all greater than zero with obvious long-term memory, indicating that the previous external shocks will aggravate the exchange rate fluctuations. β reflects whether the exchange rate system has the function of self-adjustment. The four types of β are all less than 1, indicating that the exchange rate has the function of self-stability. As α + β reflects the persistence of exchange rate fluctuations, it can be seen from the table that α+β of the four types of data is basically close to 1, which is very significant, indicating that the exchange rate yield would show A long lasting and large fluctuation under past fluctuations or shocks. As for the policy variables of China-Us trade, it can be found that China-Us trade only has a large impact on USB/RMB, while it has almost no impact on the other three categories.

As can be seen from the VaR results, The risks of USD/RMB and JYP/RMB are significantly higher than those of the other two categories. This may be due to the outbreak of the trade disputes between China and the United States, and the sharp fluctuations of the exchange rate between China and the United States. Moreover, the Japanese economy is more dependent on

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the United States than the other two categories, and due to its adjacency to China and its frequent trade activities, so its VaR is relatively high.

5. Suggestions and Conclusions

Through the empirical analysis of this paper, in this context, the RMB exchange rate is directly related to the business status of enterprises and is also closely related to all participants in the market. The empirical results show that the exchange rate yield series presents a significant "peak and thick tail", so the results of VaR measurement are more scientific and reasonable. As can be seen from the GARCH model, policy variables have influence to USD/RMB, with several other kinds of foreign exchange is affected, shows that in recent years, China's macro economy operation is moderate, China's development, currency market is steady, its influence can be even as the United States, other countries are not willing to follow the United States to China, still keep normal trade relationship with China. VaR indicates that in the case of a trade disputes between China and the US, the exchange rate risks between China and the US are relatively high and market participants need to be cautious.

The government should take measures to stabilize market expectations, such as adjusting the reserve requirement for remote purchase risk, limiting some RMB capital outflow and restarting the counter-cyclical factors in the RMB central parity pricing mechanism. In addition to the exchange rate policy itself, the regulators should accelerate the financial opening and coordinate with the relatively loose monetary policy. On the one hand, they should attract capital inflows and hedge against the pressure of capital outflow. On the other hand, they should stabilize the Sino-Us interest rate spread and help ease the pressure of depreciation.

Market participants should: from the perspective of enterprises, import and export enterprises should change their ideas from passively taking risks to actively managing risks. We should also learn to use financial knowledge, use exchange rate, debt preservation financial products to avoid exchange rate risk. As the backbone of the market, commercial Banks should strengthen exchanges and cooperation between Banks and enterprises, provide foreign trade enterprises with financial market products to hedge exchange rates and maintain their value, and help enterprises greatly save financial costs.

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