

# The Influence of Sino-US Trade Friction on RMB Exchange Rate Fluctuation

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## ABSTRACT

Based on the relevant data of RMB exchange rate from 2015 to 2020, this paper calculates the fluctuation of RMB exchange rate before and after Sino-US trade friction through GARCH model. Then combined with the date of trade friction to analyse the impact of friction events on the fluctuation of RMB exchange rate. Finally, the influence of exchange rate fluctuations is analysed through the horizontal values and deviation results of national and classified export data. Through the analysis we found that during the period of trade friction, the occurrence of major events has a certain impact on the exchange rate. In this case, a small change in the exchange rate has a positive impact on trade exports, while a large change in the exchange rate has a short-term negative impact. Specifically, food products, capital - and technology-intensive products and labor-intensive products are significantly affected by exchange rate fluctuations. Accordingly, relevant Suggestions should be put forward for trading enterprises.

**Keywords:** *Trade friction, exchange rate fluctuation, export trade*

## 1. BACKGROUND

Due to the structural contradictions between China and the United States, the expansion of the trade deficit and the negative expectations of the United States on the future trade environment, globalization has aroused strong dissatisfaction in the United States. The US government attempted to safeguard its national interests by imposing tariff sanctions and other trade protection measures. After launching the section 301 investigation against China on August 18, 2017, the US government formally imposed a 25% tariff on us \$34 billion of Chinese imports on July 6, 2018, launching the largest trade friction in economic history. As of November 2019, China and the United States have held more than a dozen rounds of consultations on the topics of technology transfer, intellectual property rights protection, non-tariff barriers, structural issues (including export subsidies, subsidies for state-owned enterprises) and trade balance. In this process, Sino-US trade frictions have long gone beyond the scope of trade and gradually evolved into tariff friction, investment friction, technical friction, exchange rate friction and financial friction. As the two largest economies in the world, trade frictions between the two countries affect both the trend of the RMB exchange rate and international trade.

## 2. THEORY AND HYPOTHESIS

There is no consistent conclusion in theory or empirical research on the discussion of exchange rate fluctuations

and trade relations so far. There are three conclusions to theoretically analyse the impact of exchange rate fluctuations on export trade: 1. The impact is negative. 2. The impact is positive. 3. The impact is uncertain.

The conclusions of empirical analysis on the relationship between exchange rate fluctuations and exports are also different due to different selected countries, different sample intervals, different variable measures, and different calculation methods. Pan Hongyu (2007) [1] through co-integration test and other methods found that there was a long-term significant negative correlation between China's real exports to the United States and real exchange rate volatility. However, in Li Penglin and Tang Jun's (2018) [2] empirical study the real exchange rate volatility had a limited impact on the import and export of China-US trade.

Since macro data does not reflect heterogeneity, researchers at home and abroad began to pay attention to the micro data research. However, there is no consensus on the micro level as well. Some scholars have found that exchange rate changes had no significant impact on enterprises' export trade. However, Zhang Tianding and Lu Jinqiu (2020) [3] concluded that the fluctuation of RMB exchange rate had a significant negative impact.

In conclusion, there is no consistent conclusion on the relationship between exchange rate fluctuations and trade in both theoretical and empirical research, nor in macro and micro research. In view of the lack of analysis of exchange rate fluctuation and its impact in the context of current trade friction, this paper examines the impact of exchange rate fluctuation on China's trade against the

background of trade friction, and combines the macro aggregate data with the micro data of the industry.

Cao Wei and Luo Jianqiang (2020) [4] believe that the more prominent the fluctuation of RMB exchange rate is, the more the export trade of Chinese enterprises will decrease correspondingly. Zhang Bowei and Tian Shuo (2014) [5] concluded that a large appreciation of RMB would hinder exports, while a small depreciation and appreciation would promote exports. Accordingly, the hypothesis of this paper is put forward: a change in the level of RMB exchange rate over a certain range will have a negative impact on the export of listed enterprises in China, while a small range of level change will have a positive impact.

This paper first calculates the fluctuation of RMB exchange rate before and after Sino-US trade friction, and then further observes its influence. Then we analyse the influence of exchange rate fluctuation on China's import and export under Sino-US trade friction. Finally, some suggestions are put forward for the trade enterprises.

### 3. CALCULATION OF RMB EXCHANGE RATE FLUCTUATIONS

#### 3.1. Description of the Method

This paper firstly adopts GARCH model to measure the fluctuation of RMB exchange rate. ARCH model, fully called Autoregressive conditional heteroscedasticity model, resolves the problem created by traditional econometric assumptions about time series variables, on the assumption that variance is constant. The second hypothesis of traditional econometrics on time series variables: it is assumed that the fluctuation amplitude (variance) of time series variables is fixed, which is not consistent with reality. For example, it has long been found that the fluctuation amplitude of stock returns changes with time, rather than being constant.

Returns or return residuals are represented by  $\epsilon_t$ , assuming  $\epsilon_t = \sigma_t z_t$ , here  $z_t \sim iidN(0, 1)$  (i.e., an independent identically distributed normal distribution with expectation of 0 and variance of 1) and here sequence  $\sigma_t^2$  is modeled as  $\sigma_t^2 = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \dots + \alpha_p \epsilon_{t-p}^2$ . Where  $\alpha_0 > 0, \alpha_i \geq 0, i > 0$ , that is, the returns of each period are combined with a non-negative linear combination, and the constant term is positive. If the variance is represented by ARMA model, the ARCH model's deformation is GARCH model (Bollerslev, 1986).

The GARCH (P, Q) model is:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \dots + \alpha_q \epsilon_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \dots + \beta_p \sigma_{t-p}^2$$
  
 GARCH model can accurately simulate the change of volatility of time series variables, and it is widely used in empirical research of financial engineering, especially in the theory of Value at Risk.

#### 3.2. Calculation Results and Analysis

##### 3.2.1. Stage 1:2015 ~2017

The result measured by GARCH model is shown in Figure 1. It can be seen that the RMB exchange rate first rose steadily at this stage, during which the RMB exchange rate fluctuated greatly, and then began to decline from about 6.9 to about 6.6. The exchange rate fluctuated between 6.1162 and 6.9526. In this stage, the maximum value of volatility is 0.0006383 and the minimum value is 0.0000755.

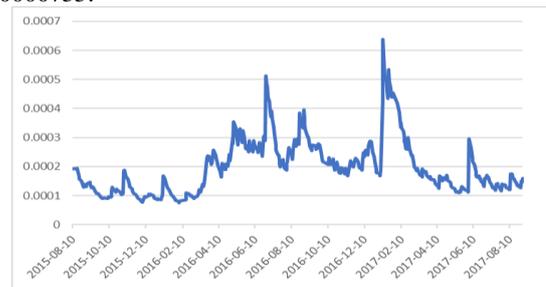


Figure 1 The volatility of the RMB against the DOLLAR measured by the GARCH model in the stage 1

Data source: collated and drawn according to wind database.

##### 3.2.2. Stage 2:2017 ~2019.11

The result is shown in Figure 2. The RMB exchange rate showed a large fluctuation at this stage. The exchange rate was unstable from August to the end of 2017. Before May 2018, the exchange rate dropped from 6.6 to 6.3, and rose from May 2018 to the beginning of 2019, indicating a large fluctuation in this year. From January to May in 2019, the exchange rate dropped from 6.8 to 6.7, which was a relatively stable decline. Later, the exchange rate of RMB rose again, breaking 7 in August, and the fluctuation increased during this rising period. Afterwards, the fluctuation range decreased from August to November, and the overall exchange rate changes tended to be stable.

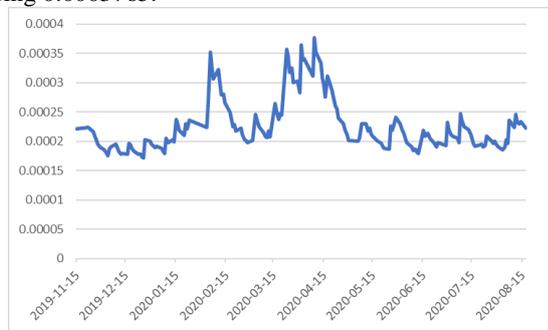


Figure 2 The volatility of the RMB against the DOLLAR measured by the GARCH model in the stage 2

The fluctuation range of the exchange rate in the second stage is 6.2764 to 7.0884, with the maximum value being 0.0283 and the minimum value being 0.0075.

### 3.2.3. Stage 3: 2019.11 ~2020.08

The result is shown in Figure 3. In the early stage of the third phase, the RMB exchange rate was relatively stable, with the exchange rate basically changing around 7 and the exchange rate changing relatively gently. From February to April in 2020, the fluctuation of RMB exchange rate increased, ranging from 6.9 to 7.1. During this period, the exchange rate was unstable and fluctuated from high to low, changing rapidly. From May to August in 2020, the exchange rate first rose and then fell. The exchange rate changed steadily during this period. In stage 3, the exchange rate fluctuated between 6.8606 and 7.1316, with the maximum value being 0.0283 and the minimum value being 0.0003765.



**Figure 3** The volatility of the RMB against the DOLLAR measured by the GARCH model in the stage 3

## 4. THE IMPACT OF SINO-US TRADE FRICTION ON THE RMB EXCHANGE RATE

Based on the description of the trend and volatility of RMB exchange rate, this paper focuses on the analysis of the volatility around each friction point to observe the impact of news events on the exchange rate volatility.

Based on the analysis of the GARCH of the RMB exchange rate against the US dollar, the RMB exchange rate volatility during the observation period is divided into five ranges, namely, the low range (1-20 quantile), the low range (21-40 quantile), the middle range (41-60 quantile), the middle range (61-80 quantile) and the high range (81-100 quantile).

Table 1 shows that Sino-US trade friction news has a significant impact on the RMB exchange rate fluctuation in 2018, but no special impact in 2019. Fourteen typical incidents of China-us trade frictions have occurred in 2018. There are seven incidents, in their day and four days later, the exchange rate fluctuations in the whole observation period was at high-grade, For 6 incidents, on

the day of their announcement and the following 4 days, the volatility of RMB/USD changed from the third to the fifth, showing a mid-high trend. There was only one incident in which the RMB dollar volatility rose from the second to the fifth range, indicating a shift from low to high. In 2019, the former seven trade friction incident broke out, the volatility of the RMB against the US dollar was in the mid-range and low-range. After the incidents of September, the volatility of the RMB against the dollar was in a low range, suggesting that there was a stronger expectation of negotiations and agreements between the US and China, and the news had a significant smoothing effect on currency movements, rather than exacerbating them as before.

Through the analysis, we find that every trade friction news event between China and the US in 2018 will aggravate the fluctuation of RMB dollar. In 2019, especially in the second half of the year, with the progress of China-US trade negotiations, the RMB exchange rate volatility has been relatively stable.

**Table 1** Volatility levels of RMB exchange rate on the press release date and 4-day-after Sino-US trade frictions

time	U.S. dollar	time	U.S. dollar
2017.08.18 ~T+4	22222	2018.12.14~T+4	55555
2018.03.23 ~T+4	43354	2019.03.31~T+4	23222
2018.06.15 ~T+4	34354	2019.05.10~T+4	13254
2018.07.06~T+4	55555	2019.06.01~T+4	22111
2018.07.11~T+4	55555	2019.07.04~T+4	22232
2018.07.16~T+4	55555	2019.07.09~T+4	32132
2018.08.02~T+4	55555	2019.08.15~T+4	33333
2018.08.23~T+4	55555	2019.08.24~T+4	22322
2018.09.06~T+4	55555	2019.09.01~T+4	22111
2018.09.09~T+4	44444	2019.09.12~T+4	11111
2018.09.18~T+4	55544	2019.09.25~T+4	11111
2018.09.21~T+4	44333	2019.10.12~T+4	11111
2018.09.24~T+4	43333	2019.11.07~T+4	21111
2018.12.01~T+4	22554	2019.12.15~T+4	12111

1 represents the first to 20th quantile of volatility;2 represents the 21st to 40th quantile of volatility;3 represents the 41st to 60th quantile of volatility;4 represents the 61st to 80th quantile of volatility;5 represents the 81st to 100th quantile of volatility.

### 5. THE INFLUENCE OF EXCHANGE RATE FLUCTUATION ON TRADE UNDER THE BACKGROUND OF TRADE FRICTION

This paper selects national and classified import and export data from 2017 to 2019 to analyse the impact of exchange rate fluctuations on the export of Chinese enterprises under the background of trade friction.

It can be seen from Figure 4 that the export value fluctuated mainly at the beginning and end of 2017. The level is relatively stable in 2018. It fell sharply in early 2019, and then fell back to its previous level after a sharp rise in January-February 2020. Then, the export amount data of every three months is selected to calculate the deviation, and the results are shown in Figure 5.

We can find that from August to September in 2017, the impact of trade friction on exchange rate fluctuations was not severe, and the deviation of export amount during this period was low and the export rose steadily. It seems that a small fluctuation of exchange rate is conducive to the export behaviour. After a friction incident in March 2018, the level of exchange rate volatility was enhanced, the deviation of export amount increased, and export value reduced. It seems that the big change of RMB exchange rate has a negative impact on the export of Chinese enterprises. After the incident in June 2018, the exchange rate volatility significantly increased, and the volatility of export began to decline, with export rising steadily in June. In addition, the exchange rate volatility caused by the 10 events after June 2018 all increased significantly, but the export value rose steadily, which was not impacted by the intensified exchange rate fluctuations. This phenomenon is different from the hypothesis. The reasons for this are that when the trade friction just happened, the export enterprises had not taken relevant measures to avoid the impact of the intensified exchange rate fluctuation. After the incidents in March, enterprises realized the instability of exchange rate fluctuations, so they took measures in advance to diversify their foreign exchange risks in the future.

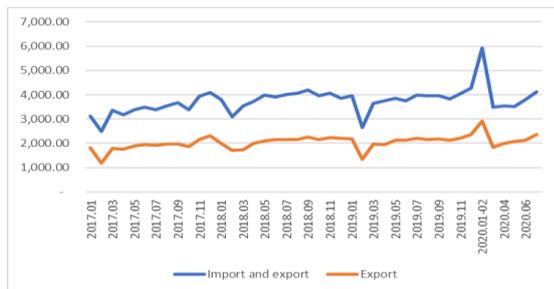


Figure 4 Monthly total value of national imports, exports and exports



Figure 5 Deviation and quadratic deviation of monthly gross national exports

Moreover, with the steady progress of "One Belt And One Road" construction, more and more enterprises feel that the anti-dumping investigation and other trade barriers they encounter when exporting to countries and regions along the "belt and road" are greatly reduced, increasing their export accordingly [6].

In 2019, especially in the second half of the year, the market regained confidence in the RMB against the US dollar, and the exchange rate of the RMB against the US dollar stabilized due to the achievement of the phased outcome of China-US trade negotiations. It can be seen from Figure 5 that the horizontal value is rising steadily, and from Figure 6 that the deviation has been decreasing from 65.18 to 8.62 after June 2019, which is relatively stable.

To sum up, the hypothesis is not completely correct. A small change in the exchange rate has a positive impact on trade exports, while a large change in the exchange rate will only bring negative impact in the short term. When enterprises have expectations about the future situation, the negative impact will be reduced in the long term.

Then, the data of classified export is analysed to avoid errors in macro data summary. According to Ma Junlu, Wang Bo and Yang Xinming (2010) [7], this paper makes a detailed classification of export data, which is shown in Figure 6.

It can be seen from Figure 6 that capital and technology-intensive products and labor-intensive products take up the largest proportion, and the trend of export amount of the two types are similar to that of total export. The remaining types did not show significant changes, so the dispersion of the export categories with a small proportion and that with a large proportion is calculated and plotted separately.

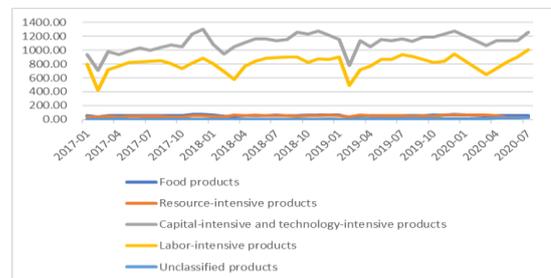
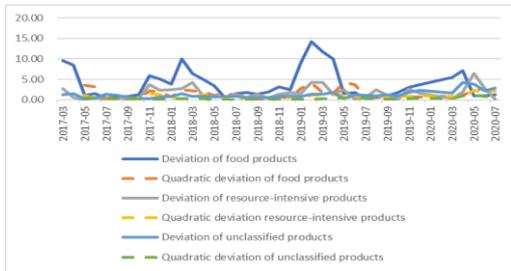
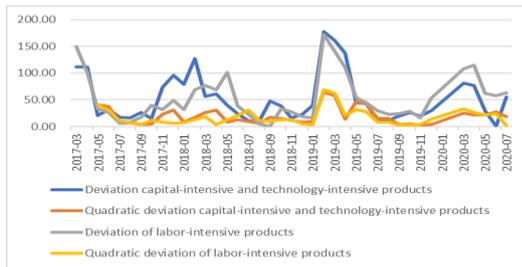


Figure 6 Monthly gross export value for different export types



**Figure 7** The deviation and quadratic deviation of the monthly total value of the smaller export classification



**Figure 8** The deviation and quadratic deviation of the monthly total value of the larger export classification

As is shown in the Figure 7 and 8, the fluctuation pattern of food export products, capital and technology-intensive products and labor-intensive products is basically consistent with the fluctuation of total exports. Through the results of the quadratic deviation, it can be found that the three curves of the result of quadratic deviation of is basically consistent with that of total quadratic deviation. We may consider that the effects of exchange rate fluctuations on these types of products are similar to those on total exports. However, under the resource-intensive products and manufacturing industry, unclassified commodities and traded goods are basically stable and have little impact from exchange rate fluctuations.

## 6. CONCLUSIONS AND SUGGESTIONS

This paper uses GARCH model to calculate and analyse the fluctuation situation of RMB exchange rate, and then analyses the influence of friction incidents on the fluctuation of RMB exchange rate. Finally, the conclusion is drawn: every trade friction news event between China and the US in 2018 will aggravate the fluctuation of RMB dollar. However, in 2019, the RMB exchange rate volatility is relatively stable. In this case, a small change in the exchange rate has a positive impact on trade exports, while a large change in the exchange rate will only have a negative impact in the short term, because in the long term, enterprises will have expectations of the future situation and will take appropriate tools to disperse future risks. On the micro level, it is mainly food products, capital and technology-intensive products and labor-intensive products that are greatly affected by exchange rate fluctuations.

Accordingly, relevant Suggestions are proposed for trading enterprises to deal with the impact of Sino-US trade frictions on the RMB exchange rate: On the one hand, trade enterprises should actively use financial instruments to avoid exchange rate risk during the period of friction. In view of the unclear attitude of the US side, the impact on the RMB exchange rate will not be ruled out in the future. Exporters, especially export enterprises of capital - and technology-intensive food products and labor-intensive products should actively deploy financial instruments to avoid exchange rate risks, such as adapting to multi-currency transactions and settling existing foreign currencies on the spot [8]. On the other hand, trading enterprises should diversify their choice of export regions and seize the opportunities provided by "The Belt and Road Initiative". By diversifying their choice of export regions, they can reduce their dependence on the United States, which is conducive to the diversification of risks and the reduction of the negative impact of trade frictions. The contribution of this paper is to discuss the influence of exchange rate fluctuation on trade friction in combination with the background of trade friction and put forward corresponding countermeasures for enterprises in combination with China's national conditions. The limitation of this paper is that there is no empirical analysis of trade changes, the lack of accurate analysis needs to be improved.

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