Effect of Exchange Rate Volatility in Chinese Export and Import

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Abstract. The Federal Reserve and the European Federal Reserve enacted monetary measures to ameliorate the economic crisis as a result of COVID-19. China's import and export commerce will be impacted by the consequent exchange rate adjustments. The data used for this article includes changes in exchange rates, imports, and exports before and during the outbreak. It also examines the impacts of policy, import and export regulations, transportation costs, and other factors of exports on imports and exports. Additionally, it checks to see whether contractual effects cause J-curves in the short- and long-term for changes in currency rates and import/export movements. This paper provides empirical experience for the changes in imports and exports caused by the CNY exchange rate policy in the future based on the analysis of China's import and export data in these two regions caused by changes in exchange rates of Europe and US dollar against CNY over past 12 years.

Keywords: COVID-19; International finance; Import and export; Exchange rate; Global commerce

1. Introduction

Since the COVID-19 breakout, all nations have suffered economically to some degree. Due to changes in the exchange values of various currencies, international commerce is quite unstable. Since the COVID-19 pandemic's breakout, the world economy has experienced a significant shock. The World Commerce Organization (WTO) forecast that world trade would decline by 12.9% in an optimistic scenario and by 32% under a pessimistic scenario in April 2020. In view of the evolving scenario, the WTO released a freshly updated prediction in October 2020 that predicted a 9.2% decline in global commercial trade [1].

Over the two years that this pandemic has been going on, China has exported a significant amount of its industrial capacity, along with goods and services, to the rest of the globe[2]. The two primary trading partners for China are the United States and Europe. In order to better understand effects of exchange rate volatility on China's imports and exports during this phase of quantitative easing, this article undertakes a thorough analysis of the previous ten years in Europe and the United States. China's imports and exports are impacted by changes in exchange rates between other currencies and the CNY, which might provide useful quantitative information for future forecasting of China's import and export volume.

Businesses and governments all around the globe take currency appreciation and devaluation seriously when it comes to activities with various effects, such as importing and exporting local goods, etc. Numerous studies are conducted by academic scholars to investigate how changes in exchange rates impact both imports and exports within nations. The relative prices of imported and exported commodity prices are the major source of how changes in foreign exchange rates affect imports and exports. The price of goods denominated in the local currency will increase relative to foreign consumers as a result of the local currency's appreciation, according to traditional theories of international finance. This will lead to a decrease in demand, which will then result in a decrease in domestic exports. The local currency's depreciation will promote exports from the nation. However, in this traditional approach, the elasticity of demand for import and export goods is not taken into account. As a result, this article will discuss the precise effects of exchange rate variations throughout various time periods on China's import and export volume factors.

2. Literature Review

In the past few years, global central banks have carried out quantitative easing to deal with the impact of COVID-19 on major economies around the world, and in this context, global currency exchange rates have also undergone great changes, and production and consumption Relationships have also changed as a result. As the first country to suppress the spread of the epidemic, China's role in the global industrial chain has also undergone major changes. The impact of exchange rate appreciation, the impact of international trade contracts, and the impact of exchange rate fluctuations caused by freight charges on foreign trade under the epidemic. The impact of exchange rate changes on China's import and export controls. Some possibilities and suggestions for exchange rate fluctuations are presented from the perspective of Chinese merchants' value chain. Feng (2022) uses systematic GMM estimates to investigate the impact of the COVID-19 pandemic and related government responses to changes in exchange rate policy across countries between January 13, 2020, and July 21, 2020 [3]. He draw the conclusion that the rise in the number of confirmed instances does considerably enhance exchange rate volatility. The government has taken measures to reduce currency fluctuation, including shutting down schools, limiting internal travel, and running propaganda campaigns. Wang (2021) gathered data on recent sales accounts, structural changes in export items, recent changes in the CNY exchange rate, recent changes in China's inflation rate, and recent changes in China's GDP and examined the key CNY changes from 2020 to 2021. What's more, according to the report, China is regaining its footing after the effects of the new crown pandemic [4]. Demands for production and consumption are progressively relaxed while the economy continues to grow healthily. Chinese exporters' responses to changes in the CNY exchange rate are discussed in-depth at the firm level by Li et al. (2022) [5]. The research examined the relationship between the CNY's exchange rate and exports using the data. A somewhat high exchange rate will thus result in pricing in foreign currencies, and the volume response will be small but considerable. In contrast, while delivery rates are still high, exporters' improved productivity tends to drive up market pricing. Import volume, distribution expenses, income levels in the nations of destination, and foreign ownership are a few other sources of factors that are crucial. Wang (2021) investigates the impact of imported intermediate inputs on the export price elasticity to exchange rates. The first step in this study's theoretical framework is the construction of a theoretical model to explain how changes in import input costs and exchange rates impact export prices through two distinct channels: First, the direct marginal cost channel. In this channel, changing the marginal cost of exporting products affects the main motivation of exporters to upgrade or downgrade export products. Second, qualitative channels affect export pricing by changing the quality of the product. These two channels have opposite effects on the exchange rate of export price elasticity. Due to the rapid emergence of the disease, the world economy has been stagnating for a while. But several nations have made efforts to encourage a strong economic rebound. The research examined how China and the US affected the world economy after the virus broke out and discovered that China and the US's political decisions had the most influence on the course of economic globalization. The balance of payments will also be impacted by Feng (2022), which analyzes the exchange rate variation of CNY import price using the GARCH model and VAR model. The study found that the risks associated with the RMB exchange rate directly affect the import price index, with higher import prices leading to a substantial increase in the volatility of trade, and such volatility would lead to lower international pricing of trade [6]. At the same time, other factors will also be greatly affected, including GDP, foreign exchange reserves, commodity prices, inflation rate and balance of payments are the variables that have the greatest impact on the exchange rate of RMB against the US dollar. According to Wei et al. (2021), the CNY exchange rate changed as a result of the aforementioned factors. The data from June 2009 to June 2014 are used as a research sample to assess the influence of CNY exchange rate variations on China's balance of payments using empirical analysis [7]. This is done when the CNY exchange rate swings significantly. According to the empirical findings, the actual effective exchange rate of the CNY and other variables are long-term steady. China's exchange rate affects the balance of payments, according to Exchange Rates and the Balance of Payments and Balance of Payments. In

China, the pandemic was first successfully contained and did not spread further. The second reason is that the CNY has been more expensive when compared to the US currency recently. Better than anticipated, China's economy is recovering, and its growth is resilient in every way. The U.S. dollar index is increasing its slide, which is the third factor. Wu noted that the COVID-19 breakout in early 2020 has exacerbated global economic instability as a result of the various nations' efforts to contain the pandemic. A two-way fluctuation tendency of first depreciating and then appreciating could be seen in the CNY currency rate. Wu examined how the exchange rate affected interest rates based on the CNY's two-way volatility and made an attempt to forecast the central bank's reaction strategy. The purpose of this study is to provide some theoretical support for Chinese businessmen's export trade strategy in the future by discussing the effects of exchange rate fluctuations and further delving into their causes. The lag time impact of currency rate on export/import is also particularly explored in this article at the same time.

3. Methodology

The main research method used in this article is a linear regression model. According to Feng, Li, Qiao (2022), the import and export of a country is not only related to the change of currency value, but also related to the total GDP of the country [8]. Therefore, In order to identify the impact of changes in the exchange rate of EUR/CNY and USD/CNY on China's imports and exports from 2010 to 2022, the model is designed as the following form:

$$\Delta Export\ (\%)_t = \alpha + \beta \times \Delta Exchange\ rate(\%)_t + \varepsilon \quad (1)$$

$$\Delta Import\ (\%)_t = \alpha + \beta \times \Delta Exchange\ rate(\%)_t + \varepsilon \quad (2)$$

According to Lu (2005), the impact of CNY exchange rate fluctuations on imports and exports has a J-curve effect [9]. When a nation's currency weakens, imports increase in price while exports drop in price, widening the trade imbalance. Due to the comparatively low pricing, export sales of the nation soon started to increase significantly. Domestic customers are also beginning to purchase more products made locally since they are more reasonably priced than those imported.

Even after the devaluation, the trade balance between the nation and its trading partners will eventually improve. Due to the inescapable delay in satisfying increased demand for the country's exports, the depreciation of the country's currency had an immediate detrimental effect.

An inverted J-curve could appear when the value of a nation's currency increases. Exports of the nation increased in price overnight for the importing nation [10]. A higher currency will reduce the competitiveness of their exports if other nations can satisfy the demand for cheaper pricing. As imports are more affordable compared to domestically made items, local people may also choose to purchase them.

Therefore, in order to understand the specific time of China's delay effect, in this article, this paper also designed a lag-time regression mode to test that the current exchange rate change has a stronger explanation of how long later the import and export data will be.

$$\Delta Export\ (\%)_t = \alpha + \beta \times \Delta Exchange\ rate(\%)_{t-n} + \varepsilon \quad (3)$$

$$\Delta Import\ (\%)_t = \alpha + \beta \times \Delta Exchange\ rate(\%)_{t-n} + \varepsilon \quad (4)$$

4. Data Resource and Results Analysis

This section mainly introduces the data used in the above models and the conclusion analysis of multiple regression models.

To analyze the impact of exchange rate fluctuations on imports and exports, this paper collected and used monthly data and exchange rate data on China's imports and exports to the US and Europe

from January 2014 to August 2022. The main data source is Bloomberg. These data are placed below in the form of a line graph.

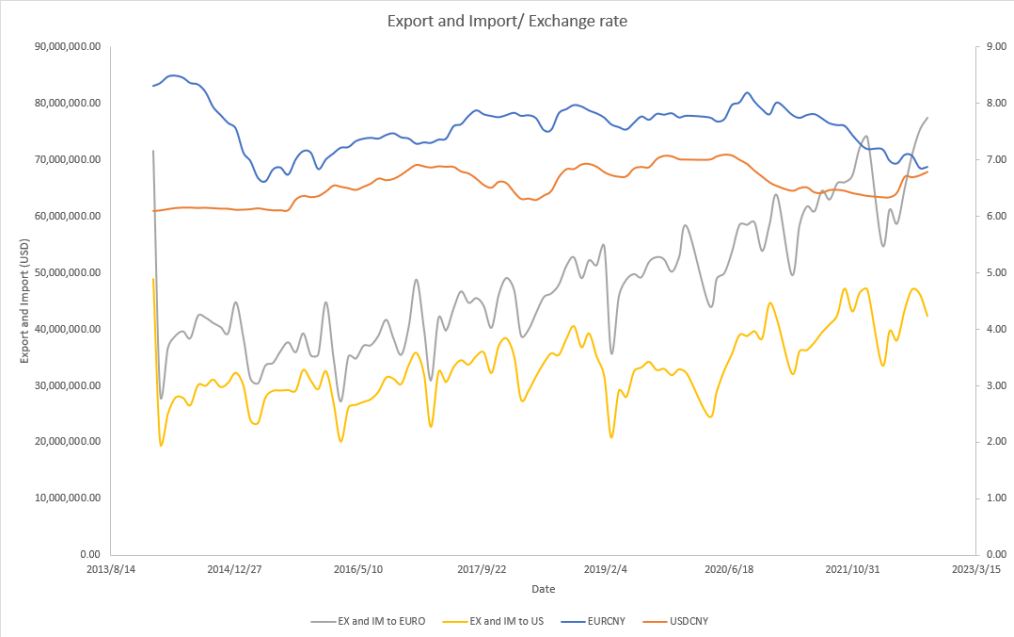

Figure 1. Export and Import/ Exchange rate

As can be seen from Figure 1, China's import and export data has been showing an upward trend in the past 10 years.

The exchange rate of the CNY against Europe and the United States has appeared in several stages. From 2013 to 2015 and from 2020 to the present, the renminbi has experienced a unilateral decline in foreign currencies. As the central banks around the world have tightened monetary policies, this will cause foreign exchange to flow back from China to the United States and Europe to obtain higher interest yields which lead to the devaluation of the CNY.

In order to verify the specific impact of CNY exchange rate on trade in the past 10 years, the results of six linear regression models are listed below.

4.1 Model 1: Relationship between Export/Import amount to European Union and EUR/CNY

Table 1: Model 1 Regression Results

Regression Analysis	
Multiple R	0.1216
R Square	0.0148
Adjusted R Square	0.0046
Standard error	0.1327
Observations	99

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.0257	0.0257	1.4569	0.2304
Residuals	97	1.7089	0.0176		
Total	98	1.7346			

	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.0128	0.0134	0.9529	0.3430	-0.0138	0.0394
EURCNY(%)	0.9639	0.7985	1.2070	0.2304	-0.6210	2.5487

4.2 Model 2: Relationship between Export/Import amount to American and USD/CNY

Table 2: Model 2 Regression Results

Regression Analysis	
Multiple R	0.1717
R Square	0.0295
Adjusted R Square	0.0195
Standard error	0.1390
Observations	99.0000

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.0569	0.0569	2.9456	0.0893
Residuals	97	1.8752	0.0193		
Total	98	1.9322			

	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.0072	0.0141	0.5104	0.6109	-0.0207	0.0351
USDCNY(%)	2.1948	1.2788	1.7163	0.0893	-0.3433	4.7329

4.3 Model 3: Relationship between Export amount to European Union and EUR/CNY

Table 3: Model 3 Regression Results

Regression Analysis	
Multiple R	0.17
R Square	0.03
Adjusted R Square	0.02
Standard error	0.15
Observations	99.00

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.0595	0.0595	2.8225	0.0962
Residuals	97	2.0456	0.0211		
Total	98	2.1052			

	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.0168	0.0147	1.1474	0.2540	-0.0123	0.0460
EURCNY(%)	1.4678	0.8737	1.6800	0.0962	-0.2662	3.2018

4.4 Model 4: Relationship between Import amount to European Union and EUR/CNY

Table 4: Model 4 Regression Results

Regression Analysis	
Multiple R	0.0241
R Square	0.0006
Adjusted R Square	-0.0097
Standard error	0.1617
Observations	99.0000

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.0015	0.0015	0.0562	0.8132
Residuals	97	2.5354	0.0261		
Total	98	2.5369			

	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.0139	0.0163	0.8478	0.3986	-0.0186	0.0463
EURCNY(%)	0.2305	0.9726	0.2370	0.8132	-1.6999	2.1609

4.5 Model 5: Relationship between Export amount to American and USD/CNY

Table 5: Model 5 Regression Results

Regression Analysis	
Multiple R	0.1758
R Square	0.0309
Adjusted R Square	0.0209
Standard error	0.1523
Observations	99.0000

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.0717	0.0717	3.0935	0.0818
Residuals	97	2.2493	0.0232		
Total	98	2.3210			

	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.0108	0.0154	0.7001	0.4855	-0.0198	0.0413
USDCNY(%)	2.4634	1.4006	1.7588	0.0818	-0.3164	5.2432

4.6 Model 6: Relationship between Import amount to American and USD/CNY

Table 6: Model 6 Regression Results

Regression Analysis	
Multiple R	0.0936
R Square	0.0088
Adjusted R Square	-0.0015
Standard error	0.3566
Observations	99.0000

ANOVA

	df	SS	MS	F	Significance F
Regression	1.0000	0.1090	0.1090	0.8574	0.3568
Residuals	97.0000	12.3342	0.1272		
Total	98.0000	12.4432			

	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.1502	0.0360	4.1681	0.0001	0.0787	0.2217
USDCNY(%)	3.0370	3.2798	0.9260	0.3568	-3.4724	9.5464

The results of the six regression models are listed above. In this section, this paper will analyze the six results and draw corresponding conclusions.

First, from the regression results of Model 1 and Model 2, we can find that the depreciation of the CNY will indeed increase the total import and export volume, and the depreciation of the CNY will have a more unilateral stimulus effect on increasing the total trade volume with the United States. From the analysis of the regression coefficient, for every 1% depreciation of the CNY against the euro, China's total import and export volume to Europe will increase by 0.96%; and for every 1% depreciation of the CNY, China's total import and export volume to the United States will increase by 2.19%, and these two data All are statistically significant at 90% confidence. This means that when comparing the demand for Chinese products in Europe and the United States, the United States is more sensitive to China's commodity prices, and its commodity elasticity is also greater.

Second, in the next four models, we need to explore the specific impact of the total import and export volume of Europe and the United States on the CNY exchange rate. From the regression coefficients and p-values of Model 4 and Model 6, it can be concluded that although the depreciation of the CNY will have a positive stimulating effect on the total imports of European and American products, its p-values are 0.81 and 0.35, respectively, indicating that the two None of the regression coefficients of the model can be statistically supported, so we cannot draw specific conclusions on the changes in the CNY exchange rate and China's impact on the import volume of the two regions. However, Model 3 and Model 5 can very well prove that the depreciation of the CNY exchange rate can form an effective stimulus for the increase of China's exports to Europe and the United States. In Model 3, the regression coefficient is 1.47, which indicates that for every 1% depreciation of the CNY against the Euro, China's exports to Europe will increase by 1.47%; at the same time, the regression coefficient of Model 5 is 2.46, which indicates that for every 1% depreciation of the CNY against the US dollar, China's total exports to the United States will increase by 2.46%.

Imbs and Mejean (2016) discovered that the demand side of the economy controls trade elasticity [11]. The ability of customers to choose between domestic and imported items determines how this total import and export volume reacts to changes in relative pricing. They provide frugal and quasi-structural estimates of trade elasticity using their sectoral version system, which employs conventional constant elasticity of substitution (CES) demand. Combined with the views given by

the two authors, the United States is more dependent on products produced in China, and its demand can be affected by price fluctuations.

5. Conclusion

In this article, this paper explore whether there is a significant relationship between exchange rate fluctuations and the total value of imports and exports by collecting and using the CNY exchange rate and China's import and export data to Europe and the US stock market from 2014 to 2020. Using linear regression as the main research method, this paper made a statistical summary of the correlation between changes in the import value and export value of the two regions and changes in the CNY exchange rate. From the analysis results, the devaluation of the CNY against the other country's currency will indeed cause an expansion of the total import and export value of the other country, but its main effect is that the devaluation of the CNY can effectively stimulate the export value of the other country. At the same time, the demand for Chinese-made products in the United States has increased significantly with the depreciation of the renminbi than in Europe. Therefore, based on price elasticity in economics, this paper concludes in this article that the United States is more sensitive to the price of Chinese products.

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