Impact of exchange rate volatility on the Agricultural Export Revenues: evidence from China-USA trade

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**Abstract:** The research states that there is an impact of exchange rate volatility on the agricultural export revenues of China. The agricultural sector is one of the most important industries in China, which contributes significantly to the GDP. However, the nation also exports a substantial level of products to the United States. Given the recent global shocks, the study aims to analyse the impact of exchange rate volatility on China's agricultural export revenue. Using agricultural export data as well as macroeconomic data from China between 1994 and 2023, a quantitative analysis has been performed to understand the relationship between exchange rates and agricultural exports. An OLS regression is used as the primary method to examine the linear relationship, while ARDL and NARDL models are applied to explore the long-term and asymmetric effects of exchange rate volatility. Based on this, it has been found that higher levels of exchange rate instability significantly reduce both agricultural export volumes and total export revenues. Agricultural export revenues reduce by -2.7539 percentage points, whereas total exports decrease by 1.5692 percentage points. ARDL and NARDL model finds negative impact of ERV shocks on agricultural export revenue. These results highlight the importance of exchange rate stability in maintaining China’s agricultural trade performance, as maintaining exchange rate risk is key for government.

**Keywords:** Currency Volatility, OLS Regression, Agricultural Production, International Trade Theory, Agricultural Exports.

1. Introduction

1.1 Background

The agricultural sector in China is one of the most important industries in the economy. According to the study by Carter et al. (2011), agricultural productivity in China increased from 3 billion tonnes in 1978 to over 5 billion tonnes in 2009. This growth in agricultural productivity is strongly affected by technical improvement and the influx of foreign capital to China from abroad. According to a study by Wang et al. (2019), China has increased 3.1 percent of agricultural productivity due to foreign capital. This reflects the growth in China's agricultural sector in recent decades. As per Erten and Leight (2021), the Chinese economy acceded to the World Trade Organization (WTO) after its liberalization policy. However, with this accession to the WTO, new avenues also opened up for China to export agricultural products. Furthermore, another study by Long (2021) reveals that the Chinese economy has been active in the export of agricultural products such as tea and live pigs, whereas exports of products such as apples have also grown substantially. As per Long (2021), the TC Index of Tea remained between 0.600 and 0.900. For live pigs, it remained around 6.947. Finally, the RCA Index of Apples improved and reached index values around 0.800 and 1.250. This shows the growing strength of China’s agricultural exports in recent years. Moreover, the nation has also invested thoroughly in growing its agricultural trade ties through the Belt and Road Initiative (BRI). As per Zhou and Tong (2022), China built 60 new trade ties with developing nations. These ties presented the nation with opportunities to enter new markets and enhance their trade. As a result, this shows the growing dominance of trade from China in recent times.

Despite China being a high-exporting nation for agricultural products, especially to the United States, there are substantial problems that China faces with respect to international trade. As per the study by Chen (2011), the RMB depreciation against the yen will hinder the export of agricultural products from China. This is one of the key problems of exports from China that will be discussed in the paper. Moreover, the research by Erten and Leight (2021) also reveals that there have been persistent barriers to trade with currency shocks after the accession of China into the WTO. This also impacted the total exports of agricultural products. The same paper by Erten and Leight (2021) also reveals that there has been a rise in agricultural tariffs for the nation. This has further impacted the output of the exports from the nation in due time. Furthermore, the shocks in the exchange rate have also impacted the nation's trade levels. As per Li and Umair (2023), the volatility spillover effects cause adverse effects on the price levels of exports. As a result, it leads to a reduction in trade for the nation. Overall, these structural effects of exchange rate volatility cause the reduction in trade from China.

The primary reason for undertaking this research is to understand the impact of exchange rate volatility on agricultural revenues, given the increasing exposure of the agricultural sector of the nation to ER volatility. Moreover, the comparison is done with respect to trade with the United States, as it remains the largest agricultural trading partner with China. Given the increasing ER fluctuations, it is necessary to understand how the same affects export revenues to coin policies for sustained agricultural trade performance.

The research objective is to analyze the trends in agricultural exports in China. Moreover, the study will also analyze the impact of exchange rate volatility (ERV) on agricultural export revenues from China.

The primary question of the study is to analyze whether volatility in the rate of exchange has any impact on agricultural exports from China to the rest of the trading partners.

The first chapter of the study provides a background on Chinese agricultural exports over the years. The second chapter discusses the theoretical structure and analyzes the literature on the impact of currency fluctuations on agricultural exports from developing countries. The third chapter discusses the methodology using regression analysis. Finally, results are discussed as instability in exchange rate impacts agricultural exports and total exports.

2. Literature Review

2.1 Conceptual Framework

2.1.1 Theory on International Trade

The International Trade Theory is one of the key concepts used in the paper as it determines the patterns of trade between countries. According to a study by Shuai and Wang (2011), the trade dependency of developed nations on developing nations plays an integral role in the enhancement of agricultural exports. This is because, developing nations have low labor costs, and with technology integration, productivity could be increased. This would also lead to the enhancement in the export of commodities from countries thus leading to international trade. However, the exposure to international trade also exposes certain developing countries to exchange rate fluctuations and other shocks within the globalized economy. As per Benguria and Taylor (2020), economic shocks create negative demand shocks within economics. This leads to a mismatch in demand and supply equilibrium and eventually impacts the supply side as well. As a result, this often leads to losses for producers within the economy as well. Therefore, this shows that International Trade is highly sensitive to economic shocks.

2.1.2 Currency Exchange Theory

The shocks in the currency exchange rates also impact trade globally. As per Auboin and Ruta (2013), exchange rate shocks have a short-term impact on price levels. This is because when there is a depreciation of the currency of foreign partners, the exports become more expensive. As a result, the demand for commodities reduces and a disequilibrium is created in the economy. Furthermore, shocks in the currency rates can also impact the cost structures of domestic producers. As per Agenor (1991), the appreciation in the exchange rate of domestic currency could lead to producers cutting costs of production. This would lead to a reduction in the final price of commodities and would boost exports. However, the same creates a substantial level of market failure within the economy through deadweight losses. Overall, the currency exchange theory is integral in understanding the impact of exchange rate shocks on agricultural exports from a nation.

2.2 Relation between ER and International Trade

The currency rates between countries help to determine the level of trade that is done between economies. The study by Kang and Dagli (2018) shows that there is a 35.3 percent impact of the currency rates on the value of exports from a nation. The results of the study have been concluded by using a gravity model and data for trade between two countries and currency rates for 72 countries between 2001 and 2015. The reason behind the statistical impact of the exchange rate on trade is that the exchange rate determines the final price of goods and commodities in foreign markets (Demir & Razmi, 2022). An appreciation in the exchange rate of trading partners leads to exports being cheaper than the domestic economy. As a result, this boosts the export levels from the domestic country to its trading partner. The volatility in exchange rates also impacts the export levels from various industries across the world. According to Lal et al. (2023), it could be realized that the exchange rate volatility leads to a negative impact on exports from various industrial sectors. The main reason behind such a fall in export level is that the exchange rate volatility impacts the perspective of consumers on future prices. As a result, risk-averse consumers opt out of consumption activities leading to a fall in demand. Thus, the export levels are also impacted negatively. The same has also been highlighted in another study by Dada (2021), who revealed that currency volatility has a negative and significant effect on trade because of the reaction of consumers and investors to the news of exchange rate volatility. Consumers react more to adverse news than positive news (Noh et al., 2025). As a result of this, the trade is eventually impacted negatively. The fluctuations in the exchange rate also impact the dynamics of the export market. As per Huang (2017), the volatility growth of RMB by 10 per cent leads to an increased likelihood of exporters leaving the market by 0.14 per cent to 0.19 per cent. Moreover, this also implies that new entrants of exporters to the market would reduce by 70 per cent. as a result, this shows that exchange rate volatility could also impact exporter head. This can impact the total exports from the Chinese economy as well. Based on these insights the following research hypothesis could be formulated:

* H0: The currency fluctuation leads to a significant fall in exports.
* H1: The currency fluctuation does not lead to a significant fall in exports.

2.3 Relation between Currency Fluctuation and Exports of Agricultural Products from Developing Nations

Like the impact on other industries, the foreign exchange rate fluctuation also has a relevant impact on the export of agriculture-based products from developing nations. As per Nguyen (2022), the export of products such as rice and coffee could not reach the potential export levels because of exchange rate fluctuations in Vietnam. This could be analysed using the gravity model using data on exchange rate, macroeconomic factors and agricultural productivity and exports from Vietnam. The increase in exchange rate fluctuations increases the volatility in the market and the same discourages consumers from activities. The same diminishes the export levels and hinders agricultural exports from reaching the potential levels in developing nations such as Vietnam. A similar result is also found in the Chinese economy. A study by Abdullahi et al. (2022), found that there has been an adverse effect on the export of agricultural products from China because of currency depreciation. This currency fluctuation impacted the level of comparative advantage held by China with respect to agricultural exports, as the currency volatility led to an increase in the price of agricultural products in international markets. As a result, consumers opted for other countries, which eventually impacted the agricultural exports from China negatively. Furthermore, the same study by Abdullahi et al. (2022) also found that there has been a 51% gap in its agriculture exports with its trading partners. This further shows that exchange rate volatility plays a critical role in the determination of agricultural exports from developing countries. Another study by Mao (2019) finds that an appreciation in the real exchange rate by 1 per cent would create a 1.6 per cent fall in total export values of agricultural products. This result is concluded by using a firm-product-country level data from China. Based on this literature, the following hypothesis could be drawn.

* H0: The ER fluctuation statistically impacts the trade for agricultural-based products.
* H1: The ER fluctuation does not have a statistical impact on agricultural-based products.

2.4 Research Gap

From the literature, it could be assessed that studies like Abdullahi et al. (2022), used a gravity model to understand the gap in its agriculture exports due to exchange rate volatility in China. Moreover, papers like Dada (2021), provided a greater theoretical overview on how exchange rate volatility impacts the export levels and trade. However, there is a substantial gap in the literature to analyze the absolute impact of Currency market turbulence on agricultural exports from China. The same gap is addressed in the study using the latest data available.

3. Methodology

3.1 Design of the Research

A quantitative research design is used to analyze the impact of currency rate volatility on the outflow of agricultural products. As per the study by Bloomfield and Fisher (2019), the quantitative research design allows to test of the statistical significance using data and analysis of the research hypothesis. An OLS Regression methodology has been considered for the same (Archontoulis & Miguez, 2015).

3.2 Data and Sources

The study considers data trade between China and the USA. This is because as per the WITS (2025), the United States had the highest level of Agricultural Raw Materials exports from China. The absolute value for the same was 0.97 million USD, which was approximately 8.90 percent of the total agricultural trade. Hence, the currency shocks between the USA and China have been considered in the paper. The period of the study is considered between 1994 and 2023. This is one of the most dynamic periods in the world with respect to global trade, as many countries joined the WTO during this period. Moreover, the period between 1994 and 2023 also saw a number of structural shocks with respect to global crises (Şengül, 2023). Hence, this led to the usage of the time period for the study. Although the period 1994 to 2023 captures global trade liberalization trends, it also encompasses recent shocks such as the COVID-19 pandemic and the Russia-Ukraine conflict (Chortane et al., 2022). Thus, this justifies the usage of the time frame.

Table 1: Variables and Abbreviation Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables |  | Indicators | Source | Abbreviation |
| Dependent Variable |  |  |  |  |
| Agricultural Export Revenue |  | Agricultural Exports | (World Bank, 2025) | Agro ER |
| Total Export |  | Export of Goods and Services |  | Total EXP |
| Independent Variable |  |  |  |  |
| RMB/USD |  | Chinese Yuan Renminbi to U.S. Dollar Spot Exchange Rate | (FRED, 2025) | ER |
| Exchange Rate Volatility |  |  | Derived using Equation 1 | ERV |
| Control Variables |  |  |  |  |
| Interest Rate |  | Interest Rate (% Annual) | (World Bank, 2025) | INT Rate |
| Foreign Investment Inflow |  | FDI Inflow (% of GDP) annual | (World Bank, 2025) | FDI Inflow |
| CPI Inflation |  | Consumer Price Index (% growth) annual | (World Bank, 2025) | INF Rate |

3.3 Exchange Rate Volatility Estimation.

The currency volatility has been calculated using the ARCH (1) model. According to Marisetty (2024), the consideration of the ARCH model is integral while accounting for volatility as it provides a time-variant estimate of the volatility over the period of the study. This means the ARCH model allows the variance to change over time depending on past information. Hence, given the structure of the data, an ARCH (1) model has been used to find the volatility within the currency of RMB/USD. This is shown in the following equation:

**Equation 1: Derivation of the Exchange Rate Volatility for RMB/USD**

3.4 Model Specification

The hypothesis of the study is to analyze whether currency fluctuations have a negative impact on the total exports and agricultural exports from China.

3.4.1 Model 1: Total Exports

**Equation 2: Currency Volatility on Exports from China**

3.4.2 Model 2: Agricultural Export Revenue

**Equation 3: Currency Volatility on Agro-Export Revenue from China**

3.4 Estimation Technique

The study first applies Ordinary Least Squares (OLS) regression as the primary estimation method. This allows for initial assessment of the linear impact of exchange rate volatility (ERV) on export variables. Alita et al. (2021), reveal that a regression model controls for multiple influencing factors simultaneously. Hence, this allows for initial assessment of the linear impact of exchange rate volatility (ERV) on export variables.

With the exchange rate volatility modelling and the base model with OLS regression being shown, the study also uses an ARDL model and an NARDL model in order to find the short-run and long-run relationships between the variables. As per Saleem et al. (2020), ARDL model allows variables to be a mixture of I(0) and I(1). Using these integrating factors, the study captures short-run and long-run dynamics. Furthermore, the NARDL model examines the positive and negative changes within the exchange rate volatility using the non-linear ARDL model.

4. Analysis

4.1 Univariate Analysis

The results of the Aggregate Statistics is shown in Table 2.

Table 2: Aggregate statistics of the Variables

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Number of Obs. | Mean | S. Dev | Minimum | Maximum |
| Agro ER | 27 | 6.81E+09 | 3.81E+09 | 2.13E+09 | 1.35E+10 |
| Total EXP | 27 | 1.56E+12 | 1.2E+12 | 1.32E+11 | 3.72E+12 |
| ER | 27 | 7.3696 | 0.8648 | 6.1478 | 8.3700 |
| ERV | 27 | -0.0030 | 0.0294 | -0.0657 | 0.0569 |
| INF Rate | 27 | 2.6204 | 3.4673 | -1.4015 | 16.7912 |
| INT Rate | 27 | 2.6707 | 2.5785 | -1.4127 | 7.3565 |
| FDI Inflow | 27 | 3.0619 | 1.3250 | 0.2401 | 4.8809 |

Summary statistics in Table 2 show that there are a total of 27 observations considered in the study. This means that data for 27 years has been considered in the time series model. The statistics show mean revenue from Agro ER is 6.81 billion RMB. Total Exp has a value of 1560.0 billion RMB from China. The ER mean value is 7.3696 RMB/USD whereas the ERV has an average of -0.0030. The average value of the INF Rate is 2.6204 whereas the mean of the INT Rate is 2.6707. Finally, the FDI Inflow mean is recorded as 3.0619 percent.

Table 3: Dickey-Fuller Test Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Base Model | | Difference | |
| Variable | Test Statistic | MacKinnon p-value | Test Statistic | MacKinnon p-value |
| Agro ER | -0.478 | 0.8963 | -3.516 | 0.0076 |
| Total EXP | -0.012 | 0.9575 | -6.332# | 0.0000# |
| ER | -1.534 | 0.5165 | -2.899 | 0.0454 |
| ERV | -3.444 | 0.0096 | -6.556 | 0.0000 |
| INF Rate | -4.556 | 0.0002 | -3.950 | 0.0017 |
| INT Rate | -3.489 | 0.0083 | -5.092 | 0.0000 |
| FDI Inflow | 0.052 | 0.9626 | -3.075 | 0.0285 |

#: Second-order difference has been considered for the variable.

Table 3 shows the test statistic and probability values for the Dickey-Fuller (d-fuller) test. From the d-fuller test statistic, it could be realized that the p-values are not significant at the base level. Hence, the first difference was used to analyze the impact of RMB/USD shocks on China's agricultural exports. For Total EXP the second difference order has been considered for removing unit root.

4.2 Multivariate Analysis

4.2.1 Impact of ER Volatility on Total Exports

The multivariate analysis in part 4.2.1 shows the impact that the ERV has on the Total EXP for China. Using the multivariate analysis, it is understood that ERV has an adverse impact on the Total EXP. The parameter estimate is -0.6669. The INT Rate also has a detrimental impact on the Total EXP with an estimated coefficient of -0.1049. Finally, INF has a negative coefficient of -0.0868 on Total EXP, and FDI has a coefficient of -0.2217.

4.2.2 Impact of ER Volatility on Agricultural Exports

Table 5 shows the regression analysis for the impact of ERV on the Agro ER from China. The statistics show that ERV has a -0.4686 factor impact on the Agro ER from China. The INT Rate also has a coefficient of -0.0106 on the Agro ER. Finally, the INF and FDI also have a negative parameter estimate of -0.0048 and -0.1072 on the Agro ER for China respectively.

*4.3 Post-Estimation Test*

The paper also provides post-estimation test results for checking problems on multicollinearity and heteroskedasticity. From Table 10, it has been understood that Model 1 has a total VIF of 1.87 and a Probability value of 0.6820 for the Breusch-Pagan Test. Table 11, shows that for Model 2, the VIF mean was also 1.87 and a p-value of 0.1238 for the Breusch-Pagan Test. Based on the results of the VIF and Breusch-Pagan Test, problems regarding multicollinearity and heteroskedasticity could be ruled out.

*4.4 ARDL and NARDL*

The short-run and long-term dynamics of the independent variables on the agricultural export revenues and export levels from China are found using the ARDL model. Table 6 shows the ARDL model results for Log\_Total EXP. From the table, it has been found that there are no significant cointegrating relationships over the long run. In the long run, the coefficient for ERV is -7.5153. For the Agro ER, the ARDL model in Table 7 shows that ERV has a long-term impact on it. The relation is negative with a coefficient of -0.7028, and is statistically significant. With respect to the NARDL model in Table 8, there are no significant long-term or short-term relationships that impact the positive or the negative components of ERV over time. However, for Agro ER, there is a significant impact of the negative component of the ERV on Agro ER. This could be understood as the coefficient is -0.4842 with a significant p-value.

5. Results and Discussions

The results of the analysis show that Agro ER has grown in China between 1994 and 2023. During that period, the Total EXP in the region also grew substantially. The same can be observed in Figure 1. There is a downward impact on the ER levels for RMB/USD during the period of the study. The ER Levels fell from 8.6397 to 7.0809 between 1994 and 2023. The ERV shows a substantial level of fluctuation during the timeline of the research. There have been significant volatility trends during 2007-08, 2016 and 2020-21. Furthermore, the INF Rate shows a falling trend from 1994 to 2023. A similar trend is also observed for the interest rate. In 1994 the interest rate was recorded at -7.9897 per cent. However, in 2023, the same was recorded at 4.9613 percent. Finally, FDI Inflow has shown a falling trend during the timeline, as FDI inflows reduced from 5.98 percent of GDP to 0.24 percent of GDP.

The multivariate analysis for ERV o the total exports are shown in Table 4.

Table 4: Regression Results of ERV on Log\_Total EXP

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable  (Log\_Total EXP) | Coef. | Std. Err. | t-Stat | P-Value | Lower confidence limit (95%) | Higher confidence limit (95%) |
| ERV | -0.6669 | 0.1283 | -5.2000 | 0.0000 | -0.9312 | -0.4026 |
| INT Rate | -0.1049 | 0.0412 | -2.5400 | 0.0180 | -0.1898 | -0.0200 |
| INF | -0.0868 | 0.0270 | -3.2200 | 0.0040 | -0.1423 | -0.0312 |
| FDI | -0.2217 | 0.1041 | -2.1300 | 0.0430 | -0.4361 | -0.0074 |
| Cons | 29.4723 | 0.2825 | 104.3100 | 0.0000 | 28.8904 | 30.0542 |

The multivariate analysis in Table 4 shows that ERV has a negative impact on the Total EXP from China. As the volatility in ER for RMB/USD increased by 1 percent, the Log\_Total EXP reduced by 0.67 percent. This relation is significant as the statistical power of the coefficient has a probability value of less than 0.05. INT Rate also has a negative impact on the Log\_Total EXP. When the interest rates rise by 1 unit, the value of the total outflow of exports from China decreases by 0.1049 percent. The rise in inflation also creates a fall in Log\_Total EXP by -0.0868 percent. Finally, FDI has a negative impact of -0.2217 per cent on Log\_Total EXP.

Table 5: Regression Results of ERV on Log\_ Agro ER

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable (Log\_ Agro ER) | Coef. | Std. Err. | t-Stat | P-Value | Lower confidence limit (95%) | Higher confidence limit (95%) |
| ERV | -0.4686 | 0.0733 | -6.3900 | 0.0000 | -0.6203 | -0.3170 |
| INT Rate | -0.0106 | 0.0239 | -0.4400 | 0.6620 | -0.0600 | 0.0388 |
| INF | -0.0048 | 0.0150 | -0.3200 | 0.7520 | -0.0357 | 0.0262 |
| FDI | -0.1072 | 0.0582 | -1.8400 | 0.0780 | -0.2277 | 0.0132 |
| Cons | 23.3219 | 0.1562 | 149.3400 | 0.0000 | 22.9988 | 23.6450 |

The analysis in Table 5 shows when ERV increases, the Log\_ Agro ER is impacted adversely. A 1-point growth in volatility leads to a -0.4686 percent decline in agricultural trade revenue. The INT Rate also has a negative impact on Log\_ Agro ER. This is because when the INT Rate is raised by a point, the Agrarian export revenue falls by -0.0106 percent. INF has a negative effect of-0.0048 percent on Log\_ Agro ER. Finally, the interaction between FDI and Log\_ Agro ER shows a negative impact of -0.1072 percent.

To complement the baseline OLS results, ARDL and NARDL models are used to evaluate whether exchange rate volatility has a persistent or asymmetric long-run effect on export performance. The ARDL Model finds no short-term impact, which is significant in nature. However, in the long run, the rise in ERV creates a -0.7028 percent reduction in Log\_ Agro ER. This confirms the impact of shocks to ERV. As a result, the ARDL model confirms a significant long-run negative relationship between ERV and agricultural exports (coefficient = -0.7028, p < 0.05), consistent with the OLS results. Using the NARDL model, the Log\_ Agro ER is impacted negatively by 0.4843 percent due to negative shocks of the ERV. This suggests that exporters are more sensitive to depreciation risks.

The results of the analysis reveal that the RMB/USD Shock has an adverse impact on the total exports from China. This could be understood as an increase in EV by 1 unit causing a fall in total exports by 1.5 percent. As per Lal et al. (2023), the volatility in currency creates uncertainty among consumers regarding future prices. This creates a risk-averse consumption pattern which reduces the demand in global markets. As a result, this advocates for a reduction in total exports from China. Furthermore, the results also show that there is an adverse relationship between the volatility of currencies and the export of agricultural products from China. This relation is appropriate as RMB/USD volatility shows a negative coefficient on the agricultural export levels. This could be explained by the study using Abdullahi et al. (2022). The study concludes that currency volatility adversely affects the export of agricultural commodities. This is because the shocks in prices lead to a rise in the prices of agricultural products. This leads to price-sensitive buyers to halt consumption with a price increase. Additionally, Figure 1 indicates a declining trend in the RMB/USD exchange rate. This means that there has been an appreciation in the RMB value against USD. As a result, the prices of exports increase. Thus, this makes Chinese agri exports more expensive for buyers in the US. As a result, the demand for the same decreases and the export falls.

Furthermore, the NARDL model finds that an increase in negative ER Shocks leads to a reduction in agriculture export revenue. This is explained by Dada (2021) and Noh (2025), that exporters respond more strongly to negative news than positive changes in exchange rates. In order to maintain loss aversion, the exporters drive out of the ventures. Huang (2017) also found similar stances as the likelihood of exporters leaving the market increases with exchange rate shocks. Furthermore, there is also a long-run elasticity of agricultural exports to ERV in China. This is consistent of the findings by Mao (2019), who found that appreciation in the real exchange rate leads to fall in export values at the firm level. Overall, these explain the impacts of exchange rate volatility on the agricultural export revenues in China.

6. Conclusion

6.1 Summary of the Study

In conclusion, currency impact negatively both total exports and agricultural product exports from China to the USA. With respect to the results, both the null hypothesis considered in the research could be confirmed. A growth in currency volatility creates a negative effect on the total exports and exports of agricultural products from China. The policy rates of interest also negatively impact the total exports and the agricultural exports from China.

6.3 Policy Implications and Recommendations

The findings of the study also provide substantial policy implications towards the central banks in order to stabilise the exchange rate volatilities. This would ensure that the revenue towards the export sector is maintained because of the controlling of shocks. Moreover, it is also suggested for governments to start maintaining exchange rate risk. This would help the exporters mitigate such shocks. Based on these policy implications, the government of China and the welfare of the exporters of agricultural products would be protected.

6.3 Limitations of the Study

One of the primary limitations of the study is that the study only considers the impact of Forex fluctuations on the agricultural exports of China toward its primary trading partners. However, both the trading partners considered in the study are developed economies. This leads to a substantial gap as the impact of the same on developing economies is not considered. Another limitation of the study is that more dynamic models such as the gravity model could be used in the study for estimation. There are also limitations with respect to the number of datapoints used in the study as the time-period of the paper is limited. This limits the study from using GARCH model for calculating ER volatility.

6.4 Directions for Future Research

Future research could incorporate data from both developed and developing economies to gain a greater understanding of the impact of currency rate fluctuations on China's agricultural exports. Moreover, dynamic models including gravity models could be used for estimation purposes.

**Data Availability Statement:** The data that support the findings of this study are openly available in Zenodo at https://doi.org/ 10.5281/zenodo.15063765, reference number15063765

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

References

Abdullahi, N. M., Zhang, Q., Shahriar, S., Irshad, M. S., Ado, A. B., & Huo, X. (2022). Examining the determinants and efficiency of China’s agricultural exports using a stochastic frontier gravity model. *PLoS One*, *17*(9), e0274187. <https://doi.org/10.1371/journal.pone.0274187>

Agenor, P. R. (1991). Output, devaluation and the real exchange rate in developing countries. *Review of World Economics*, *127*(1), 18-41. <https://doi.org/10.1007/BF02707309>

Alita, D., Putra, A. D., & Darwis, D. (2021). Analysis of classic assumption test and multiple linear regression coefficient test for employee structural office recommendation. *IJCCS (Indonesian Journal of Computing and Cybernetics Systems)*, *15*(3), 295-306. <https://doi.org/10.22146/ijccs.65586>

Archontoulis, S. V., & Miguez, F. E. (2015). Nonlinear regression models and applications in agricultural research. *Agronomy Journal*, *107*(2), 786-798. <https://doi.org/10.2134/agronj2012.0506>

Auboin, M., & Ruta, M. (2013). The relationship between exchange rates and international trade: a literature review. *World Trade Review*, *12*(3), 577-605. <https://doi.org/10.1017/S1474745613000025>

Benguria, F., & Taylor, A. M. (2020). After the panic: Are financial crises demand or supply shocks? Evidence from international trade. *American Economic Review: Insights*, *2*(4), 509-526. DOI: 10.1257/aeri.20190533

Bloomfield, J., & Fisher, M. J. (2019). Quantitative research design. *Journal of the Australasian Rehabilitation Nurses Association*, *22*(2), 27-30. DOI: 10.33235/jarna.22.2.27-30

Carter, C. A., Zhong, F., & Zhu, J. (2012). Advances in Chinese agriculture and its global implications. *Applied Economic Perspectives and Policy*, *34*(1), 1-36. <https://doi.org/10.1093/aepp/ppr047>

Chen, L. (2011). The effect of China's RMB exchange rate movement on its agricultural export: A case study of export to Japan. *China Agricultural Economic Review*, *3*(1), 26-41. <https://doi.org/10.1108/17561371111103525>

Chortane, S. G., & Pandey, D. K. (2022). Does the Russia-Ukraine war lead to currency asymmetries? A US dollar tale. *The Journal of Economic Asymmetries*, *26*. <https://doi.org/10.1016/j.jeca.2022.e00265>

Dada, J. T. (2021). The asymmetric effect of exchange rate volatility on trade in sub-Saharan African countries. *Journal of Economic and Administrative Sciences*, *37*(2), 149-162. <https://doi.org/10.1108/JEAS-09-2019-0101>

Demir, F., & Razmi, A. (2022). The real exchange rate and development theory, evidence, issues and challenges. *Journal of Economic Surveys*, *36*(2), 386-428. <https://doi.org/10.1111/joes.12418>

Erten, B., & Leight, J. (2021). Exporting out of agriculture: The impact of WTO accession on structural transformation in China. *Review of Economics and Statistics*, *103*(2), 364-380.

FRED. (2025). *Chinese Yuan Renminbi to U.S. Dollar Spot Exchange Rate. [Data set].* Federal Reserve of St. Louis. <https://fred.stlouisfed.org/series/EXCHUS>

Huang, X. (2017). Exchange rate movements and export market dynamics: evidence from China. *Economics*, *11*(1).

Kang, J. W., & Dagli, S. (2018). International trade and exchange rates. *Journal of Applied Economics*, *21*(1), 84-105. <https://doi.org/10.1080/15140326.2018.1526878>

Lal, M., Kumar, S., Pandey, D. K., Rai, V. K., & Lim, W. M. (2023). Exchange rate volatility and international trade. *Journal of Business Research*, *167*, 114156. <https://doi.org/10.1016/j.jbusres.2023.114156>

Li, Y., & Umair, M. (2023). The protective nature of gold during times of oil price volatility: an analysis of the COVID-19 pandemic. *The Extractive Industries and Society*, *15*. https://doi.org/10.1016/j.exis.2023.101284

Long, Y. (2021). Export competitiveness of agricultural products and agricultural sustainability in China. *Regional Sustainability*, *2*(3), 203-210. <https://doi.org/10.1016/j.regsus.2021.09.001>

Mao, R. (2019). Exchange rate effects on agricultural exports: A firm level investigation of China’s food industry. *China Agricultural Economic Review*, *11*(4), 600-621.

Marisetty, N. (2024). Prediction of Popular Global Stock Indexes Volatility by Using ARCH/GARCH Models.

Nguyen, D. D. (2022). Determinants of Vietnam's rice and coffee exports: using stochastic frontier gravity model. *Journal of Asian Business and Economic Studies*, *29*(1), 19-34. <https://doi.org/10.1108/JABES-05-2020-0054>

Noh, S., So, E. C., & Zhu, C. (2025). Financial reporting and consumer behavior. *The Accounting Review*, *100*(1), 407-435. <https://doi.org/10.2308/TAR-2023-0293>

Saleem, H., Shabbir, M. S., & Bilal khan, M. (2020). The short-run and long-run dynamics among FDI, trade openness and economic growth: using a bootstrap ARDL test for co-integration in selected South Asian countries. *South Asian Journal of Business Studies*, *9*(2), 279-295. <https://doi.org/10.1108/SAJBS-07-2019-0124>

Shuai, C., & Wang, X. (2011). Comparative advantages and complementarity of Sino-US agricultural trade: An empirical analysis. *Agricultural Economics*, *57*(3), 118. DOI: 10.17221/46/2010-AGRICECON

Şengül, S. (2023). Financial Crises in the 1990s in the Light of Financial Regulations. *JOEEP: Journal of Emerging Economies and Policy*, *8*(1), 434-449.

Wang, Y., Xie, L., Zhang, Y., Wang, C., & Yu, K. (2019). Does FDI promote or inhibit the high-quality development of agriculture in China? An agricultural GTFP perspective. *Sustainability*, *11*(17), 4620. <https://doi.org/10.3390/su11174620>

WITS. (2025). *China Agricultural Raw Materials Exports by country and region in US$ Thousand 2022*. World Integrated Trade Solution. <https://wits.worldbank.org/CountryProfile/en/Country/CHN/Year/2022/TradeFlow/Export/Partner/all/Product/AgrRaw>

World Bank. (2025). *World Development Indicators. [Data set].* World Bank Group. <https://databank.worldbank.org/source/world-development-indicators>

Zhou, L., & Tong, G. (2022). Structural evolution and sustainability of agricultural trade between China and countries along the “Belt and Road”. *Sustainability*, *14*(15), 9512. <https://doi.org/10.3390/su14159512>

Appendix A Results of Estimation

Table 6: ARDL Model for Export

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Component** | **Variable** | **Coefficient** | **Std. Error** | **t-value** | **P>|t|** | **95% CI Lower** | **95% CI Upper** |
| Adjustment | Log\_TotalEXP | 0.0078 | 0.0440 | 0.1800 | 0.8600 | -0.0843 | 0.1000 |
| Long Run | ERV | -7.5153 | 37.7469 | -0.2000 | 0.8440 | -86.5204 | 71.4898 |
| Long Run | INR | 3.2872 | 18.8799 | 0.1700 | 0.8640 | -36.2288 | 42.8031 |
| Long Run | INF | 0.6182 | 3.7727 | 0.1600 | 0.8720 | -7.2782 | 8.5145 |
| Long Run | FDI | -2.7198 | 14.4907 | -0.1900 | 0.8530 | -33.0491 | 27.6096 |
| Short Run | D1.ERV | 0.0160 | 0.0363 | 0.4400 | 0.6650 | -0.0599 | 0.0919 |
| Short Run | D1.INR | -0.0065 | 0.0084 | -0.7700 | 0.4530 | -0.0241 | 0.0112 |
| Short Run | D1.INF | -0.0010 | 0.0087 | -0.1200 | 0.9070 | -0.0193 | 0.0172 |
| Short Run | D1.FDI | 0.0490 | 0.0292 | 1.6800 | 0.1090 | -0.0120 | 0.1100 |
| Constant | \_cons | -0.1299 | 1.2852 | -0.1000 | 0.9210 | -2.8199 | 2.5601 |

Table 7: ARDL Model for Agricultural Export Revenue

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Component** | **Variable** | **Coefficient** | **Std. Error** | **t-value** | **P>|t|** | **95% CI Lower** | **95% CI Upper** |
| Adjustment | L1.ln\_agro\_exports | -0.2471 | 0.1803 | -1.3700 | 0.1890 | -0.6294 | 0.1351 |
| Long Run | ERV | -0.7028 | 0.2089 | -3.3600 | 0.0040 | -1.1457 | -0.2600 |
| Long Run | INR | -0.1920 | 0.1655 | -1.1600 | 0.2630 | -0.5428 | 0.1588 |
| Long Run | INF | -0.0898 | 0.1084 | -0.8300 | 0.4200 | -0.3195 | 0.1400 |
| Long Run | FDI | 0.2246 | 0.2567 | 0.8700 | 0.3950 | -0.3197 | 0.7688 |
| Short Run | D1.ERV | 0.0395 | 0.0693 | 0.5700 | 0.5770 | -0.1074 | 0.1864 |
| Short Run | D1.INR | 0.0127 | 0.0157 | 0.8100 | 0.4290 | -0.0205 | 0.0459 |
| Short Run | D1.INF | 0.0048 | 0.0150 | 0.3200 | 0.7520 | -0.0270 | 0.0366 |
| Short Run | D1.FDI | -0.0443 | 0.0652 | -0.6800 | 0.5060 | -0.1826 | 0.0939 |
| Constant | \_cons | 5.7926 | 4.1731 | 1.3900 | 0.1840 | -3.0541 | 14.6393 |

Table 8: NARDL Model for Total Exports

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Component** | **Variable** | **Coefficient** | **Std. Error** | **t-value** | **P>|t|** | **95% CI Lower** | **95% CI Upper** |
| Adjustment | L1.ln\_exports | -0.0010 | 0.0633 | -0.0200 | 0.9880 | -0.1352 | 0.1333 |
| Long Run | ERV\_POS | 8.6207 | 435.3449 | 0.0200 | 0.9840 | -914.2693 | 931.5107 |
| Long Run | ERV\_NEG | 69.7871 | 4584.6400 | 0.0200 | 0.9880 | -9649.2150 | 9788.7900 |
| Long Run | INR | -34.9550 | 2263.2950 | -0.0200 | 0.9880 | -4832.9250 | 4763.0150 |
| Long Run | INF | 2.1721 | 149.2235 | 0.0100 | 0.9890 | -314.1677 | 318.5118 |
| Long Run | FDI | 11.6734 | 740.0505 | 0.0200 | 0.9880 | -1557.1640 | 1580.5100 |
| Short Run | D1.ERV\_POS | 0.4825 | 0.4792 | 1.0100 | 0.3290 | -0.5334 | 1.4983 |
| Short Run | D1.ERV\_NEG | 0.1476 | 0.0969 | 1.5200 | 0.1470 | -0.0578 | 0.3530 |
| Short Run | D1.INR | -0.0086 | 0.0107 | -0.8000 | 0.4350 | -0.0313 | 0.0141 |
| Short Run | D1.INF | -0.0104 | 0.0110 | -0.9400 | 0.3610 | -0.0338 | 0.0130 |
| Short Run | D1.FDI | 0.0266 | 0.0364 | 0.7300 | 0.4740 | -0.0504 | 0.1037 |
| Constant | \_cons | 0.3505 | 1.3262 | 0.2600 | 0.7950 | -2.4609 | 3.1618 |

Table 9: NARDL Model for Agricultural Export Revenue

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Component** | **Variable** | **Coefficient** | **Std. Error** | **t-value** | **P>|t|** | **95% CI Lower** | **95% CI Upper** |
| Adjustment | Log\_ Agro ER | -0.5418 | 0.2060 | -2.6300 | 0.0210 | -0.9869 | -0.0967 |
| Long Run | ERV\_POS | 1.8756 | 1.0962 | 1.7100 | 0.1110 | -0.4927 | 4.2439 |
| Long Run | ERV\_NEG | -0.4843 | 0.1048 | -4.6200 | 0.0000 | -0.7108 | -0.2578 |
| Long Run | INR | -0.1246 | 0.0547 | -2.2800 | 0.0400 | -0.2428 | -0.0064 |
| Long Run | INF | -0.0608 | 0.0451 | -1.3500 | 0.2000 | -0.1582 | 0.0366 |
| Long Run | FDI | 0.2978 | 0.1509 | 1.9700 | 0.0700 | -0.0282 | 0.6238 |
| Short Run | D1.ERV\_POS | 0.7286 | 0.8094 | 0.9000 | 0.3840 | -1.0200 | 2.4773 |
| Short Run | D1.ERV\_NEG | 0.0144 | 0.2179 | 0.0700 | 0.9480 | -0.4563 | 0.4851 |
| Short Run | D1.INR | 0.0301 | 0.0167 | 1.8000 | 0.0950 | -0.0060 | 0.0662 |
| Short Run | D1.INF | 0.0156 | 0.0159 | 0.9800 | 0.3440 | -0.0187 | 0.0499 |
| Short Run | D1.FDI | -0.1097 | 0.0761 | -1.4400 | 0.1730 | -0.2742 | 0.0548 |
| Constant | \_cons | 9.0248 | 4.1855 | 2.1600 | 0.0500 | -0.0175 | 18.0671 |

Appendix B Post-Estimation Test Results

Table 10: Test for VIF and B-Pagan for Multicollinearity and Heteroscedasticity for Model 1

|  |  |
| --- | --- |
| Variable | VIF |
| ERV | 2.54 |
| INT Rate | 2.68 |
| INF Rate | 2.87 |
| FDI | 2.97 |
| Mean VIF | 2.77 |
| Breusch-Pagan | |
| Chi(2) | 0.17 |
| Prob>Chi2 | 0.420 |

Table 11: Test for VIF and B-Pagan for Multicollinearity and Heteroscedasticity for Model 2

|  |  |
| --- | --- |
| Variable | VIF |
| ERV | 2.68 |
| INT Rate | 2.72 |
| INF Rate | 2.88 |
| FDI | 3.02 |
| Mean VIF | 2.84 |
| Breusch-Pagan | |
| Chi(2) | 2.37 |
| Prob>Chi2 | 0.1238 |

Appendix C: Trend Analysis of the Key Variables



Figure 1: Trend Analysis of Key Variables