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The Impact of U.S. Economic Policy Uncertainty on the RMB: U.S. Dollar Exchange Rate

- Case of China-US Trade War

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Abstract: On 6 July 2018, the United States began to impose 25% tariffs on $34 billion of Chinese goods. The trade war between China and the United States was officially launched. It lasted for more than a year, during which the two sides experienced six mutual tariff increases, which significantly impacted a few fields in China and the United States. This paper selects the RMB exchange rate to the US dollar as the research object; and takes the return of the RMB exchange rate as the data basis for modelling and analysis, intercepts its return data in the five years before and after the US-China trade war, taking the time when the United States imposed six additional tariffs on China as a dummy variable, and analyses the data by using the ARMA-GARCH model to study the impact of the RMB exchange rate by this trade war and to make predictions development of the RMB exchange rate, which will then make suggestions for China's economic.

Keywords: tariffs, trade war, exchange rate, ARMA-GARCH, China

1. Introduction

1.1. Background

Exchange rate volatility is a central element of the global economic system and results from constant changes in the value of one currency compared to another. These changes are critical in international trade, investment decisions, and monetary policy [1]. Changes in a country's exchange rate not only affect investors in the foreign exchange market but also have an impact on the economic decisions of a wide range of market players, such as domestic businesses, consumers, importers, and exporters [2]. Within this framework, comprehending the origins of variations in the RMB exchange rate, enhancing the precision of predictions and tracking such fluctuations take on added practical importance. It is not only for macro-level decision-making by the Chinese authorities but also for the production and investment choices of micro-level economic actors.

Traditional exchange rate determination models based on macroeconomic fundamentals have needed to be more accurate in explaining and predicting exchange rate fluctuations for a long time

[3] and [4]. As a factor other than economic fundamentals, uncertainty in national economic policies may be one of the essential potential sources driving exchange rate volatility. The existence of economic policy uncertainty can lead to exchange rate volatility by causing divergence in investors' expectations in the foreign exchange market about the economic fundamentals that determine the value of the exchange rate [5].

1.2. Motivation

The RMB to USD exchange rate is one of China's most crucial bilateral exchange rates and significantly impacts China's foreign trade environment and trade policy. A strong correlation exists between US economic policy uncertainty and exchange rate fluctuation [6].

The US-China trade war is a concentrated manifestation of changes in US economic policy towards China. Since 6 July 2018, the U.S. government has imposed tariffs of varying proportions on Chinese exports on six occasions, causing significant volatility in the exchange rate between the RMB and the USD during this period. And affected by the constant and repeated trade frictions between the US and China. The RMB exchange rate has shown event-driven characteristics overall in recent years, with important events in the US-China trade situation often becoming the starting point or inflection point for phase changes in the RMB and continuing to shape exchange rate movements in the period following the relevant events.

To explore whether U.S. economic policy uncertainty contributes to fluctuations in the RMB exchange rate, we must consider the potential for U.S.-China trade tensions to exert substantial influence over exchange rate stability. The nature of this influence, whether it exhibits a linear pattern, is another aspect requiring careful examination. Furthermore, understanding the underlying processes at play is crucial. In the context of the recent uptick in RMB exchange rate volatility, particularly amid U.S.-China trade disputes, a thorough investigation into the effects of U.S. economic policy ambiguity on RMB exchange rate fluctuations becomes imperative. Such an analysis is poised to shed light on the intricate, time-sensitive nature of RMB exchange rate movements. Moreover, it aims to enhance the forecasting, monitoring, and management of volatility in the RMB's foreign exchange market. Additionally, this research could offer invaluable guidance for Chinese businesses and policymakers in anticipating and cushioning against the risks associated with the RMB's exchange rate instabilities, particularly those arising from escalating uncertainties in U.S. economic policies. Therefore, the implications and contributions of this study are both significant and practical.

The remainder of this paper will first review the current research literature and summarize the strengths, weaknesses, and shortcomings to be innovative, followed by an empirical analysis. This part will first conduct data collection, then use the existing data for model construction, and finally use an ARMA-GARCH model with six dummy variables to study the impact of the US tariff increase on China. Finally, the results are integrated and interpreted using an ARMA-GARCH model with six dummy variables to study the fluctuation of the RMB to USD exchange rate around six specific time points and to analyze whether it has a long-term impact. The paper concludes with a summary of the entire paper and references.

2. Literature review

2.1. Factors Influencing and Forecasting Exchange Rate Volatility

Exploring and understanding the variables that sway exchange rate volatility is a pivotal aspect of international finance. Knowing what influences exchange rates allows nations to anticipate shifts in these rates more accurately, thereby enabling them to craft economic policies that mitigate risks from exchange rate fluctuations and foster economic and trade growth [7] and [8]. Key elements impacting the RMB to USD exchange rate encompass differences in inflation rates, price levels of commodities, disparities in economic growth rates, and the status of foreign exchange reserves and the balance of payments [9]. [10] applied econometric techniques to assess the effects of GDP and the consumer price index (CPI) on the RMB exchange rate. Similarly, [11] explored the effects of various factors, including foreign exchange reserves, the U.S. unemployment rate, and business confidence on the exchange rate, pinpointing foreign exchange reserves as a critical determinant for forecasting exchange rate movements and implementing macroeconomic controls. This analysis helps tailor the RMB's alignment with market development needs. In another study, [12] evaluated the influence of GDP growth, the interest rate spread between the RMB and the USD, inflation rates, and foreign exchange reserves on the RMB exchange rate, finding a significant impact from foreign exchange reserves on its volatility. [13]further reinforced this by suggesting through the exchange rate overshooting model that foreign exchange reserves are a primary influencer of RMB exchange rate fluctuations.

Moreover, [14] focused on modelling exchange rate volatility through various macro-fundamental frameworks, incorporating conditional information from diverse macroeconomic indicators to elucidate and forecast exchange rate fluctuations. These indicators include really economic and monetary fundamentals, commodity prices, implied volatility from foreign exchange options, and sovereign credit default swaps. It forms a comprehensive body of research dedicated to forecasting exchange rate volatility via varied macro-fundamental models, showcasing the depth of analysis in this field.

2.2. The Impact of economic policy uncertainty and the US-China trade war on exchange rates

Following economic reforms and opening policies in 1978, China has witnessed explosive economic growth, marked by a substantial rise in foreign trade activities. Particularly notable has been the increase in goods exported to the United States up until 2018, which resulted in a significant trade imbalance favoring China, and subsequently, this imbalance became a critical factor in the emergence of trade disputes between China and the United States [15] and [16]. The concept of economic policy uncertainty has been identified as a critical, albeit indirect, factor influencing short-term fluctuations in exchange rates. The seminal work by [17] utilizing monthly data sets demonstrated that an upsurge in economic policy uncertainty is correlated with increased exchange rate volatility. Further exploring this dynamic, [18] employed a DCC-GARCH model to uncover a sustained negative relationship between economic policy uncertainty in the United States and the exchange rates of several countries, with China being notably affected. [19] also contributed to this field by showing that monthly fluctuations in economic policy uncertainty affect the volatility of exchange rate returns, although not on the exchange rate values themselves.

The tense trade relations between the U.S. and China, a direct manifestation of economic policy uncertainty, have been shown to significantly affect exchange rate volatility [20] and [21]. utilized a GAS-copula model to illustrate how the mutual imposition of tariffs during the US-China trade conflict leads to a depreciation of the RMB and the currencies of China's key trading partners against the U.S. dollar. Additionally, [22] applied an EGARCH model to reveal that the US-China trade tensions have induced asymmetric shocks on the RMB exchange rate, with negative news having a more significant impact than positive developments, and the effects of trade sanctions on the RMB's value surpassing those of trade negotiations.

2.3. Current Research Methods and Models

[23] examined the short-term fluctuations in the RMB's value by deploying an Autoregressive Integrated Moving Average (ARIMA) model. This model was utilized to forecast the future trends in

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the RMB's value against the U.S. dollar, effectively mitigating the serial correlation inherent in asset returns. In a concurrent investigation, [24] delved into the effects of RMB exchange rate fluctuations through the lens of an Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model. His research, focusing on the repercussions of trade tensions between the U.S. and China on the RMB's stability, posited that a blend of linear and nonlinear models enhances exchange rate forecasts. Furthermore, [25] introduced a novel, computationally lean approach for model estimation, simulation, and forecast bolstered by vine copula graphs. Their method's robustness was affirmed via theoretical and simulated validations.

Meanwhile, [26] investigated the cascades of systemic risk among stock markets in East Asia, Europe, and the United States amid the COVID-19 pandemic, utilizing the Copula CoVaR model to map out direct risk transmissions and scrutinizing indirect pathways via R-vine structures. Chao Yang and Wee-Yeap Lau (2023) also leveraged the R-vine copula framework to analyze the dynamics between the US-China trade skirmish and the RMB's valuation. Their findings highlighted that heightened U.S. tariffs on Chinese goods precipitate a depreciation in the RMB. Yet, trade imbalances predominantly influenced exchange rate volatility.

2.4. Summary of Literature Review

Recent investigations into economic policy uncertainty and exchange rate volatility dynamics have yielded notable insights. Key findings highlight that the ambiguity surrounding U.S. economic policies is pivotal in influencing the RMB exchange rate fluctuations, manifesting through volatility and mean spillover effects. Furthermore, it has been observed that the negative repercussions of U.S. economic policy uncertainty on the RMB exchange rate are more pronounced than the positive ones, suggesting a tendency for the RMB to depreciate in the short run due to unfavorable economic policy shifts in the U.S. Despite these advancements, there remain areas ripe for further exploration. Many studies focus on currencies from developed nations with market-determined exchange rates, like the U.S. dollar and the British pound, leaving the RMB less examined. Additionally, there is a cavity in the literature regarding the granular impact of specific economic policy alterations during the U.S.-China trade tensions on the RMB exchange rate, making comparing their short-term and long-term effects challenging.

This paper proposes novel methodological and substantive approaches to bridge these gaps. Methodologically, it adopts a unique dataset comprising daily RMB to USD exchange rates five years before and after the onset of the U.S.-China trade war (2013-2023). It uses daily yield changes as proxies for exchange rate movements. This approach and the introduction of dummy variables offer a nuanced view of how each economic policy shift during the trade conflict influences the exchange rate. On the substantive front, the paper focuses on U.S.-China trade tensions as a concrete instance of monetary policy uncertainty. Given the frequent economic policy shifts between China and the U.S. during the trade tensions, with significant moves like tariffs on Chinese semiconductors and other goods, this study posits that analyzing these trade frictions provides a more transparent lens on how economic policy uncertainty impacts exchange rate fluctuations. By covering a decade surrounding the U.S.-China trade frictions, this research seeks to deliver conclusions with broader validity and more substantial persuasive power.

3. Hypothesis

In this section, this paper will develop hypotheses about the impact of US-China trade frictions on the RMB exchange rate, which will be reflected in the rest of the paper. The impact of economic policy uncertainty (EPU) on the volatility of exchange rate asset prices has also begun to attract attention in recent years. [27] found that monthly EPU significantly impacts the volatility of exchange rate returns but not the exchange rate returns themselves. However, the effect on exchange rate returns itself is insignificant. [28] used daily frequency EPU data to study and found that EPU significantly affects the GBP/USD exchange rate volatility in the current and the following periods. Based on the above study, then arrive at hypothesis 1.

Hypothesis 1: US-China trade frictions will increase the RMB to USD exchange rate volatility throughout the period.

Next, [29] show that the increase in US economic policy uncertainty will decrease RMB exchange rate stability in the short run. However, it will not negatively affect the medium and long run. Jiang et al. (2023) also show that increased economic policy uncertainty will cause RMB exchange rate volatility in the short run. However, the study of [30] is just the opposite; he empirically examines the effect of EPU on the volatility of the USD/CNY exchange rate and its forecasting role by using CARR-MIDAS-EPU model. The empirical results show that EPU has a significant positive effect on the long-term volatility of the USD/CNY exchange rate, i.e., an increase in the level of EPU exacerbates the long-term volatility of the USD/CNY exchange rate. Therefore, this paper sets hypotheses 2 and 3 to investigate whether the volatility of the RMB exchange rate caused by the US-China trade friction is persistent.

Hypothesis 2: Each of the six U.S. tariff hikes on China will result in significant short-term exchange rate volatility, and this effect will vary depending on the strength of the tariff hikes.

Hypothesis 3: The volatility of the RMB exchange rate caused by the US-China trade frictions is not persistent and the volatility of the RMB to USD exchange rate will level off after the trade war ends.

Finally, by introducing dummy variables, [31] find that the exit of the Fed's quantitative easing policy triggers an increase in financial market arbitrage and short-term cross-border capital flows, which leads to a rise in depreciation pressure on the renminbi exchange rate. [32], using the Fed announcements as a proxy variable for U.S. monetary policy uncertainty, studied the impact of monetary policy shocks on the exchange rate returns and found that excess returns increase with rising monetary policy uncertainty. [33] further find that the US, Europe, and Japan are the leading exporters of international spillovers from economic policy uncertainty. China is one of the biggest victims. [34] stated that non-market behavioral factors of China's economic policy uncertainty and foreign exchange intervention are the causes of exchange rate movements affecting the renminbi, leading to the RMB depreciation; in summary, the article obtains hypothesis 4.

Hypothesis 4: There is a significant negative correlation between US-China trade frictions and the RMB real effective exchange rate index, and US-China trade frictions will lead to a depreciation of the RMB.

4. Data source

This paper primarily uses wind and the Chinese national database to obtain the required data [35] and [36]. The primary data include daily data on the rate of return on exchange from 1 January 2013 to 31 December 2023. The main reason the article chose 2013 to 2023 as the time for the study is to compare the exchange rate changes before and after the trade friction between China and the U.S. For this article, if the report wants to explore the short-term and long-term effects of trade friction on the exchange rate, the exchange rate before and after the trade friction between China and the U.S. needs to be compared with the time when it occurs and the reason for choosing five years before and after is to make sure that the sample size is large enough to avoid uncertainty. This paper also focuses on the exchange rate fluctuations and exchange rate changes before and after the point in time when the U.S. issued six policies related to tariff increases on China, set as dummy variables D1 to D6, and use them as the primary research object to study the impact of economic policy uncertainty on exchange rates in trade wars.

5. Methodology

5.1. Descriptive statistics

Table 1: Descriptive statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Return	2,557	.0000526	0.00221	-0.0140	0.0186
ln_Return	2,557	.0000501	0.00221	-0.0141	0.0184

From the above descriptive statistics, it can be seen that the average RMB exchange rate return is 0.0000526 (or 0.00526%) out of the 2557 samples, with the lowest value of -1.4% and the highest value of 1.86%, and the average ln_Return is 0.005%, which means that the RMB has appreciated on average by a small amount relative to the US dollar from 2013 to 2023, which may be due to the fact that China has a large trade surplus relative to the US, and it is the direct cause of the US trade war against China.

5.2. ARMA-GARCH model

5.2.1. Model specification: ARMA

$$x_t = \emptyset_0 + \sum_{i=1}^{p} \emptyset_i x_t - i + \alpha_i - \sum_{i=1}^{q} \emptyset_i a_t - i \tag{1}$$

From above, we can see that, $\sum_{i=1}^{p} \emptyset_i x_t - i$ represents the AR(p) model, which uses the historical rate of return on exchange to forecast the future; while $\alpha_i - \sum_{i=1}^{q} \emptyset_i a_t - i$ uses past volatility to estimate the future and the last part of the model.

Specifically, in this paper, the AR model uses daily data on the rate of return on exchange from January 2013 to December 2023 for the study, while the MA model uses the error term to predict the future.

5.2.2. ADF test

After completing the model construction, this paper firstly performs a unit root test on the model, where the original hypothesis is that the model is not smooth. After the ADF test, it shows that from the image below, the p-value was significant at the 0.01 level, so we can reject the original hypothesis that the model is stable and feasible.

Table 2: ADF test

Variables	t-statistic	p-value
	Ln index	
Return (RMB)	-35.336	0.0000***
	Ln Yield	
Return (RMB)	-63.069	0.0000***

5.2.3. Model specification: GARCH

Subsequently, the research develops an ARMA-GARCH model to analyze the exchange return rate over a decade. Concurrently, it incorporates the instances of the six tariff increases levied by the U.S. on China during the trade conflict as dummy variables, denoted as D1 through D6, which are integrated into the model for evaluative purposes. This approach enables the study to examine the association between the US-China trade tensions and the RMB to USD exchange rate.

The GARCH (p, q) model is set as follows:

$$\alpha_t^2 = \alpha_0 + \alpha_1 {\varepsilon_{t-1}}^2 + \ldots + \alpha_q {\varepsilon_{t-q}}^2 + \gamma_1 {\sigma_{t-1}}^2 + \ldots + \gamma_p {\sigma_{t-p}}^2 + \beta_1 D_1 + \cdots \beta_6 D_6 \tag{2}$$

From the segment above, $\alpha_1 {\varepsilon_{t-1}}^2 + \ldots + \alpha_q {\varepsilon_{t-q}}^2$, constitutes the ARCH component, where σ_t^2 is the time-varying conditional variance of the error term ε_t. This variance is responsive to the squared error terms of preceding p periods. The latter segment, $\beta_1 D_1 + \cdots \beta_6 D_6$, encapsulates the effects of introducing six distinct dummy variables. These represent the successive tariff increases by the US on Chinese goods during the trade conflict and their influence on the RMB to USD exchange return rate.

The GARCH model builds upon the ARCH framework by incorporating autoregressive elements into the conditional variance, denoted here as $\gamma_1 {\sigma_{t-1}}^2 + \ldots + \gamma_p {\sigma_{t-p}}^2$, forming the GARCH component of the equation. The purpose of the GARCH model is to condense the parameter count, streamlining the ARCH(p) model to a GARCH (1,1) format through iteration in this analysis.

5.3. Research Design

5.3.1. PACF and ACF

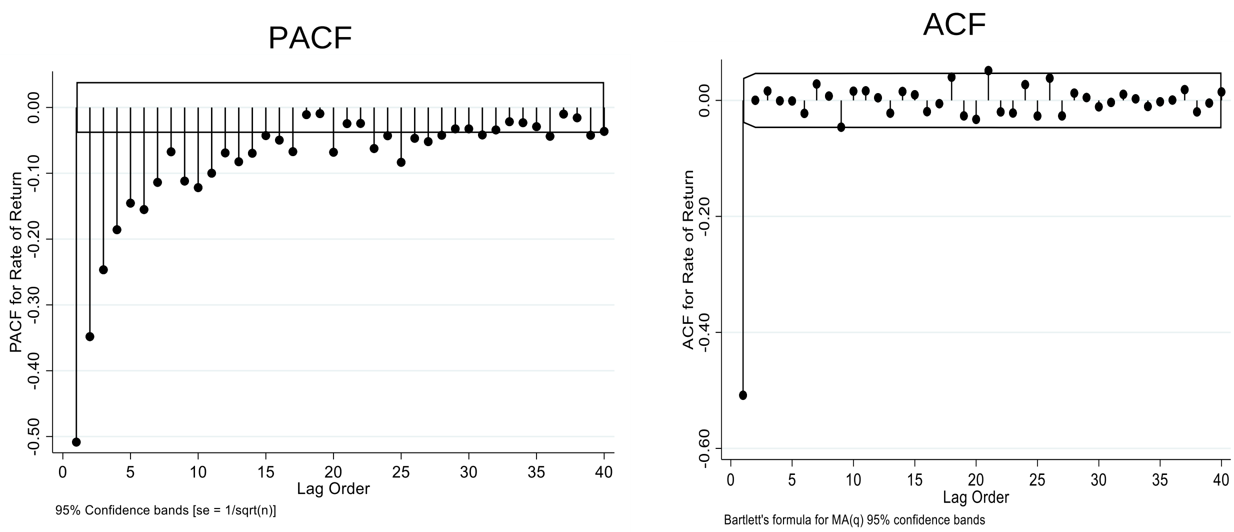

Figure 1: PACF and ACF, Return

Note: The dependent variable on the Y-axis represents the PACF and ACF for the logarithmic exchange rate returns between the RMB and USD. The X-axis shows the lag in periods. The zone between y=-0.1 and y=0.1 delineates the 95% confidence band for the AR(p) and MA(q) parameters.

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Initially, this study organizes the log returns of the initial semiconductor data and depicts these findings in the preceding figure. Observing the established lag sequence in the top row of Figure 1, the initial point that exceeds the bounds of the x-axis is at lag 2. Consequently, this suggests an AR(p) and MA(q) both in the second order, indicating the values of p and q are determined to be 2.

5.3.2. ARMA-GARCH

To better forecast the variance of future exchange rate returns, the ARCH model is next used to look at the characteristics of exchange rate returns volatility. The consequences are shown in Figure 3.

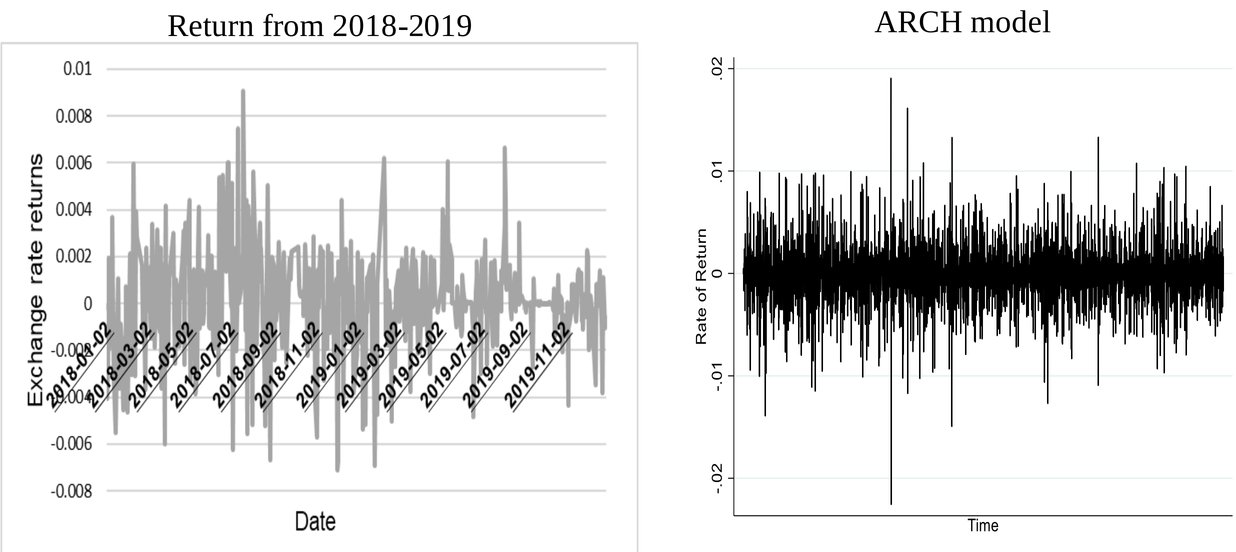

Figure 2: Yield trend

As seen from the left-hand side of Figure 2, the exchange rate returns of the RMB against the USD during the period of trade friction between the US and China, i.e., from the beginning of 2018 to the end of 2019, shows a great deal of volatility, and this is also demonstrated in the ARCH model on the right-hand side.

As seen in the right panel of Figure 2, there is significant conditional heteroskedasticity in exchange rate yields over time, as evidenced by the fact that yields fluctuate sharply in one period and less so in another. It implies that when the volatility (variance) is significant in the current or past periods, it is likely to be prominent in future periods. In contrast, when the volatility is small in the current or past periods, it is expected to be small in future periods.

5.4. Research Results

Table 3: ARMA-GARCH estimation results, variance equation

Variables	Exchange rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy						
D1	-0.315***	-0.456	-0.456	-0.455	-0.455	-0.454
	(0.043)	(0.298)	(0.298)	(0.297)	(0.297)	(0.298)
D2		0.144	-0.119	-0.120	-0.120	-0.117
		(0.298)	(0.601)	(0.601)	(0.601)	(0.599)
D3			0.267	0.088	0.089	0.086

Table 3: (continued).

			(0.523)	(0.530)	(0.530)	(0.528)
D4				0.205**	0.212	0.213
				(0.096)	(0.217)	(0.217)
D5					-0.007	0.738**
					(0.201)	(0.370)
D6						-0.763**
						(0.315)
GARCH						
ARCH (-1)	0.404***	0.404***	0.405***	0.405***	0.401***	0.402***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
GARCH (-1)	-0.055***	-0.055***	-0.055***	-0.056***	-0.056***	-0.055***
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)
Constant	-11.825***	-11.825***	-11.825***	-11.822***	-11.821***	-11.824***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.041)	(0.040)

The analysis conducted in this study yields data in Table 2. Subsequent examination of the Table 3 reveals findings from the ARMA-GARCH estimation regarding returns on the semiconductor index. The analysis highlights that all ARCH and GARCH components are statistically significant. Further scrutiny of the variance equation discloses that the dummy variable D1 in the first column is notably substantial, suggesting an increase in volatility of the returns on China's semiconductors post the imposition of US tariffs, with a variance figure of 0.04, significant at a 1% level. It implies a considerable short-term disruption to China's semiconductor sector due to the US tariff policy. Inspection of other dummy variables, particularly in column (4), indicates that D4 is significantly positive, while D1's influence appears to wane, suggesting that the volatility post-D1 is predominantly attributed to the interval between D4 and D6. It may be tied to the extensive range of products affected by the fourth round of US tariffs on China, amounting to $20 billion and accompanied by a high % tariff rate of 25%.

The timing of this tariff increment on May 10, 2019, plays a pivotal role in the trade discussions between the US and China, amplifying its impact on China's semiconductor industry. Moreover, while D5 in column (5) is found to be non-significant, both D5 and D6 in column (6) emerge as significant. It is attributed to the complete model, which, incorporating all dummy variables from D1 through D6, delineates the interval for changes in semiconductor yields following the tariff hikes. The sequential addition of these dummy variables indicates the presence of a long-term effect if the final dummy variable in the complete model is significant. Hence, should D6 prove substantial, it could denote that the trade strife between the US and China might have a lasting influence on China's semiconductor industry. The study thus concludes that the US tariff escalation on China is expected to lead to an immediate surge in the volatility of semiconductor index returns and will potentially have a prolonged impact on the RMB exchange rate in the long haul.

However, at the same time, although the tariffs imposed by the U.S. on China will have a significant impact on the RMB exchange rate in both the short and long term, the correlation coefficients show that the U.S. tariffs imposed on China do not necessarily lead to a depreciation of the RMB relative to the U.S. dollar after the tariffs are imposed. Table 3 shows that the coefficients of D1 and D2 are both negative, indicating that in the early stage of the trade war between China and the U.S., the Chinese government's monetary policy did not respond in time to the tariffs imposed by the U.S., which led to the depreciation of the RMB against the U.S. dollar in the short term. However, after that, the coefficients of D3 and D4 are positive, indicating that the RMB appreciated against the U.S. dollar even if the U.S. government continued to impose tariffs on Chinese commodities. The coefficients of D3 and D4 are positive, indicating that the RMB still appreciates relative to the dollar even if the U.S. government continues to impose tariffs on Chinese goods. The coefficients on D3 and D4 are optimistic because the Chinese government introduced a series of countermeasures in the face of the U.S. tariffs. In the beginning of the extreme pressure of the United States, it seems to be an excellent choice to bear part of the pressure brought by rising tariffs through a moderate depreciation of the RMB; for example, the RMB exchange rate in mid-June 2018 increased to around 6.4 to around 6.9, but if the RMB falls below the seven mark only because of the trade war, the market's unilateral depreciation expectations may be aroused, which may trigger the market's confidence to collapse the negative impact of capital outflows and so on. Ultimately, the loss outweighs the gain [37]. After the RMB exchange rate approached 6.9 in August, the regulator offered a succession of initiatives to stabilize market expectations, including raising the reserve for forward purchasing risks to 20%, restricting some of the RMB outflows, and restarting the counter-cyclical factor in the RMB mid-price pricing mechanism, which indicate that the regulator does not want the RMB to deviate from the fundamentals and fall too quickly; and that the exchange rate is not a weapon to cope with the trade war [38].

Though insignificant, the coefficients of D3 and D4 show that China has gradually adapted to the impact of the U.S. tariff hikes on the RMB after several tariff hikes and that the countermeasures have begun to bear fruit. However, although the RMB exchange rate showed a short-lived recovery in D3 and D4, Table 3 shows that the RMB still depreciated relative to the U.S. dollar in D5 and D6 when the U.S. imposed tariffs on China. The persistence of the depreciation was evident, which suggests that, in the face of the continued taxes imposed by the U.S., China still needs to respond with a more effective monetary policy.

6. Conclusion

This study delves into the dynamics between the Renminbi (RMB) and the U.S. dollar exchange rates amidst the trade tensions between China and the United States. By leveraging the ARMA-GARCH model to scrutinize monthly exchange rate data, mainly focusing on six significant tariff impositions by the U.S., this research uncovers the implications of such trade disputes on RMB's performance against the dollar. The analysis reveals a marked impact on both the short-term and long-term behavior of the RMB, highlighting how the fluctuating U.S. economic policies contribute to the volatility of the RMB exchange rate. The findings underscore the volatility's enduring influence on the RMB, propelled by the uncertainty surrounding U.S. economic directives.

Drawing from these insights, the paper proposes strategic recommendations for enhancing the resilience and international stature of the RMB. Primarily, it advocates for accelerating the RMB's marketization reforms to bolster its global circulation and deepen its market-oriented valuation mechanisms, thereby equipping the RMB to withstand market volatility better. Additionally, the analysis suggests that the ongoing unpredictability in U.S. economic policies could further amplify the volatility spillover effect on the RMB exchange rate, with potential adverse repercussions on China's economic framework through channels such as productivity, investment, consumption, and international trade.

In response, the study emphasizes the necessity for China to adopt a dual approach: On the international front, it calls for efforts to mitigate trade tensions with the U.S., aiming to diminish the uncertainties in U.S. economic and trade policies towards China. Domestically, the paper stresses the importance of expediting the development of the RMB foreign exchange derivatives market and fostering innovative exchange rate risk management instruments. Such measures are vital for equipping market participants with effective hedging strategies against the potential risks of U.S. policy uncertainties, thereby safeguarding China's foreign exchange market and macroeconomic equilibrium. This approach is deemed crucial in navigating the complexities of Sino-American trade relations over the long haul.

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References

[1] *Wang Panpan. (2021). China-US trade frictions, US economic policy uncertainty, and RMB exchange rate volatility. World Economic Research, (07).*
[2] *Yang, C., Lau, WY. (2023). Analysis of the impact of the trade war between China and America on the RMB exchange rate under the R-vine copula model from the perspective of the global value chain. Electron Commer Res.*
[3] *Gourio F, Siemer M, Verdelhan A. (2015). Uncertainty and International Capital Flows. SSRN Electronic Journal, 10.2139/ssrn.2626635.*
[4] *Baker S R., Bloom N., Davis S J. (2016). Measuring economic policy uncertainty. The Quarterly Journal of Economics, 131(4),1593-1636.*
[5] *JIANG Yuanying, CHEN Binxia, ZHOU Donghai. (2023). The dynamic evolution of the relationship between China's economic policy uncertainty, exchange rate, and international capital flows. Operations Research and Management, 32(05):98-105.*
[6] *Li, B., (2022). The predictability and analysis of the CNY to USD exchange rate based on the ARMA model. Proceedings of the 5th International Conference on Economic Management and Green Development. Springer, Singapore, (pp.534–541).*
[7] *Wang R, Morley B. (2018). Forecasting the Taylor Rule Exchange Rae Model Using Directional Change Tests. Quantitative Finance and Economics, 2(4): 931-951.*
[8] *Ahab M, Ahmad R, Ismail, et al. (2016). Does Exchange-rate Uncertainly Matter in the Malaysia-EU Bilateral Trade? An Industry Level Investigation. Empirical, 43(3): 461-485.*
[9] *LI, L., PAN, F. and WANG, C. (2019). Analysis of Influencing Factors of RMB Exchange Rate Trend Based on Least Square Method. Journal of Physics: Conference Series, 1168(3).*
[10] *Zhang, Y.X. (2015) Analysis of influencing factors of the RMB exchange rate. Chinese Business Theory, 31:85-90.*
[11] *Shao, M. J., Zhang, Y., Guo, T. (2018) Analysis of influencing factors of the RMB exchange rate. Value Engineering, 37:1-3.*
[12] *Liao, Z. Zh. (2018) Empirical analysis on the influencing factors of RMB exchange rate change. Times Finance, 12:7-12.*
[13] *Li, Y.F. (2017). Analysis of influencing factors of RMB exchange rate fluctuation--Based on the perspective of exchange rate overshoot model. Theory Monthly, 01:122-128.*
[14] *Giacomini, Raffaella; Rossi, Barbara. (2010). Forecast Comparisons in unstable environments. Journal of Applied Econometrics, 06:25-4.*
[15] *Chen. (2018). Background; Causes; Essence, and Chinese Countermeasures of the Sino-U.S. Trade War. Journal of Wuhan University (Philosophy and Social Science Edition),71(05):72-81.*
[16] *Li, Penglin, Tang Jun. (2018). An empirical study on the correlation between RMB exchange rate fluctuations and US-China merchandise trade - based on empirical data on US-China merchandise trade from 2006-2018. Investment Research, (10): 21-30.*
[17] *Krol. (2014). Economic Policy Uncertainty and Exchange Rate Volatility. International Finance, Volume 17, Issue 2.*
[18] *Kido Y. (2016). On the Link between the US Economic Policy Uncertainty and Exchange Rate. Economics Letters, 144:49-52.*
[19] *Balcilar M, Gupta R, Kyei C, et al. (2016). Does Economic Policy Uncertainty Predict Exchanges Rate Returns and Volatility? Evidence from a Nonparametric Causality-in-qualities Test. Open Economics Review, 27(2):229-250.*
[20] *Zhou Yinggang, Xiao Xiao. (2022). Exchange rate volatility, production networks, and stock market risk-An analysis based on the background of US-China trade friction. Financial Research, (07):115-134.*

[21] *Chen Longmei. (2020). Determination of optimal fluctuation range of RMB exchange rate in the context of US-China trade friction. Business and Economic Research, (10):177-179.*

[22] *Chai, Linjie. (2019). A study on the impact of the China-US trade war on RMB exchange rate yields and volatility. School of Foreign Affairs.*

[23] *Li, B., (2022). The predictability and analysis of the CNY to USD exchange rate based on the ARMA model. Proceedings of the 5th International Conference on Economic Management and Green Development. Springer, Singapore, (pp.534–541).*

[24] *Liang, F., Zhang, H., & Fang, Y. (2022). The analysis of global RMB exchange rate forecasting and risk early warning using ARIMA and CNN model. Journal of Organizational and End User Computing (JOEUC), 34(8), 1–25.*

[25] *Nagler, T., Krüger, D., & Min, A. (2022). Stationary vine copula models for multivariate time series. Journal of Econometrics, 227(2), 305–324.*

[26] *Yu-chin Chen, Kenneth Rogoff. (2003). Commodity currencies. Journal of International Economics, Volume 60, Issue 1, May. Pages 133-160.*

[27] *Balcilar M, Gupta R, Kyei C, et al. (2016). Does Economic Policy Uncertainty Predict Exchanges Rate Returns and Volatility? Evidence from a Nonparametric Causality-in-qualities Test. Open Economics Review, 27(2):229-250.*

[28] *Bartsch Z. (2019). Economic Policy Uncertainty and Dollar-Pound Exchange Rate Return Volatility.*

[29] *Liu Qiang, Tao Shigui. (2022). External economic policy uncertainty and RMB exchange rate stability. Financial Forum, 27(03):63-72.*

[30] *Wu Xinyu,Xie Haibin,Ma Chaoqun. (2023). Economic policy uncertainty and RMB exchange rate volatility-an empirical study based on the CARR-MIDAS model. China Management Science: 1-14.*

[31] *Dou, F. F., Tian, S. H. (2016). US quantitative easing monetary policy exit and RMB exchange rate volatility-an empirical study based on market arbitrage behavior and central bank monetary policy factors. Shanghai Economic Research, (05):30-38.*

[32] *Mueller, P, Tahbaz-Salehi A., and Vedolin, A. (2017). Exchange rates and monetary policy uncertainty. Journal of Finance.72 (3):1213-1252.*

[33] *XIANG Gu Yue, ZHOU Xian Ping, TAN Ben Yan. (2019). Dynamic spillover effects of economic policy uncertainty across international borders-an empirical study based on a directional spillover model. Business Research, (03):95-104.*

[34] *Peng, Y. Yang and Luo, G. Q. (2019). An empirical study of factors influencing RMB exchange rate movements in the context of China-US trade friction shocks. Journal of Shanghai Lixin College of Accounting and Finance, (04), 9-20.*

[35] *Wind Information Co., Ltd. Available from: https://www.wind.com.cn/portal/en/WindIndex/detail.html?id=2.*

[36] *National Bureau of Statistics of China. Available from: https://data.stats.gov.cn/easyquery.htm?cn=E0103.*

[37] *CAMANHO NHAU H.REY H. (2018). Global Portfolio Rebalancing and Exchange Rates. National Bureau of Economic Research.*

[38] *Xiao Lisheng, Yang Jiaohui, Li Yingting, et al. (2021). China's economic fundamentals, central bank intervention, and RMB exchange rate expectations. World Economy, 44(09):51-76.*