Fluctuation of Exchange Rates Caused by Monetary Policy Divergence: Empirical Analysis between China and USA

Runjia Gao *

Department of Economics, Duke University, Durham, 27708, USA

* Corresponding author: runjia.gao@duke.edu

Abstract. In the past ten years, because of the differences in economic history and social political scenarios between China and the US, the two countries have already experienced a divergence in monetary policy. Asides the domestic macroeconomic implications, the divergence would potentially cause changes and fluctuations between the exchange rates of the two currencies. Through theoretical analysis on macro and international economics as well as econometrics modelling utilizing Python and Stata-17, this research constructed a time series vector autoregression model quantifying the relationship between the USD/CNY exchange rate and monetary policy changes of both the US and China. This research found that the monetary policy changes in the two countries would not fundamentally change the USD/CNY exchange rate level but would cause fluctuations. Based on the findings, the article made recommendations for both central bankers and investors participating in the foreign exchange market to deal with the monetary policy divergence of the two major global economic entities.

Keywords: International Economics, Foreign Exchange Rates, USD/CNY, Monetary Policy.

1. Introduction

It is a common a practice for central banks around the world to cooperate and coordinate their monetary policies. However, as geopolitical competition intensified between major global powers in recent years, the formation of rivalling trade blocs and a potential long-term divergence in monetary policies by rivalling countries becomes increasingly possible. Following the 2008 Global Financial Crisis, the US Federal Reserve has long adopted an expansionary monetary policy with QE until 2016. As the Covid-19 pandemic caused another economic recession in the US in early 2020, the US government adopted an expansionary monetary policy and QE again to bail out the country's economy. The action had epically increased the US domestic M2 supply and caused high inflation [1]. To tackle the high inflation, the US Federal Reserve had initiated a radical interested rate hike from late 2021 to 2023 which is unprecedented in several decades. On the other hand, after enjoying a thirty-year-long economic development miracle after the 1978 Chinese Economic Reform, the country's rapid economic development had been slowed down after depleting its demographic dividend [2]. Since August 2008, the PBOC of China had adopted a prolonged period of expansionary monetary policy [3]. As the Chinese local Covid-19 epidemic and the Evergrande crisis further slumped the Chinese economy, China's PBOC further cut its interest rates as its American and European counterparts hiked their rates. As the monetary policy of the two major global economies diverged, there are several incidents that the USD/CNY exchange rates fluctuated greatly in recent years [4]. Additionally, as the geopolitical competition intensified between China and the US, the formation of multiple rivalling trade blocs which potentially adopt different monetary policies at the same time becomes increasingly possible. Moreover, as the American government abusively use its dollar hegemony and weaponize its currencies through sanctions, more and more countries are seeking de-dollarization and alternative currencies for trade security which added further uncertainties to the USD/CNY exchange rate [5]. As a result, this paper will analyze the effect of the US and Chinese monetary policy divergence on the USD/CNY exchange rate through building a vector autoregression model, conducting impulse responses, and making econometric forecasts through using Python and Stata-17.

The existing literatures had carried a series of research around how the monetary policies divergence between two countries would affect the foreign exchange rates. Specifically, Scholl and Uhilg found that the US monetary policy shocks would only cause short term exchange rate fluctuations but have minor long-term impact [6]. The authors quantified that for countries imposing no intervention on exchange rates, the US Dollar would normally appreciate and peak within one year following the initial US policy shock for the divergences with the UK and Germany respectively. The research by Park et al, focused the effect of US monetary policy uncertainty on Asian currencies [7]. The authors found that smaller countries with an export-oriented economy such as South Korea and Malaysia would experience more fluctuations in its currencies' exchange rate with the US Dollar compared to larger countries like China. Finally, Davis and Zlate took an applied approach and found that the central banks of developing nations and peripheral economies would not normally tolerate depreciation of the domestic currencies following an interest rate hike in the US or the Eurozone, but the magnitude of their policy responses would also be restricted by its domestic macroeconomics, capital accounts, and currency regimes [8].

The respective researchers of the three articles above have well studied the effect of the US monetary policy changes towards the exchange rates between the US Dollar and currencies of other nations as well as demonstrated the monetary policy responses of the central banks of developing nations. However, the previous researchers did not analyze and failed to incorporate how the changes in US monetary policy would affect the exchange rates against currencies from countries who actively take intervention in the foreign exchange market and are potentially in a different stage of the economic cycle compared to the US, an example of such country is China [9, 10]. Moreover, as the geopolitical competition intensified between rivalry global powers, namely China and the US, in recent years, the reduced cooperation between the monetary authorities of these two rivaling countries as well as the de-dollarization and Renminbi internationalization movement could further bring uncertainties to the exchange rate of the two currencies. As a result, this article is aimed to analyze the fluctuations between the exchange rates of the US Dollar against the Chinese Yuan, who fulfills all the aforementioned conditions, in order to fill in the gaps of the previous papers. This research would also have real world implications as it could not only assist central bankers and policy makers to reduce the exchange rate fluctuations, but also help investors participating in the foreign exchange market and companies doing international trade to hedge against exchange rate related risks.

The following parts of this article will be organized as the following: Section 2 is the research design, which contains data descriptions, unit root test, and model specifications. Section 3 is the empirical results and analysis which contains the vector autoregression model results, impulse response results, and econometric forecasts. Section 4 is discussion, which contains the main findings of this research and recommendations for central bankers as well as investors who actively participates in the foreign exchange market. Finally, Section 5 is the conclusion of this article.

2. Research Design

2.1. Data Sources & Dataset Construction

To fully incorporate at least one monetary and macroeconomics cycle, this article will incorporate ten years of time-series data for all the variables of interests. Given July 14th, 2023, is the starting date for this research, the article will retrieve ten years of available data until July 15th, 2013, to capture any changes and fluctuations regarding the variables of interest in the nearest ten years.

The dependent variable of this self-constructed time-series dataset is the USD/CNY on shore exchange rates. Since all other regressors are either monthly or quarterly data, this article will adopt the monthly average USD/CNY exchange rate found on the website X-Rates [11]. The reason for abandoning the quarterly average exchange rate data is that quarterly data is less effective in capturing the exchange rate fluctuations as both the US Dollar and the Chinese Yuan are actively traded in the exchange market.

One of the most effective tools within the monetary policy toolkit of the US Federal Reserve is changing the Fed Fund Rate. Similar to the Fed Fund Rate of the US, the People's Bank of China could hike or cut the One-year LPR rate to achieve the same agenda. As shifts in monetary policies could cause changes and fluctuations in the foreign exchange rates, the US FFR and China's One-year LPR becomes the main regressors. The monthly data for the US Effective FFR is collected from the FRED database. Since there is only daily data available for China's One-year LPR available online, the arithmetic mean monthly LPR rate is then manually calculated from the existing daily data. Additionally, because of the lack of a complete dataset for China's LPR rates, two separate data sources covering the data in different periods are combined to create the full dataset. The One-year LPR from July 15th, 2013, to October 17th, 2013, is gathered from a Reuters news article [12]. The one-year LPR from October 18th, 2013, to July 14th, 2023, are collected from two separated reports from the Bank of China's official website [13, 14].

Besides interest rates, the changes in the M2/GDP ratios also affects the changes and fluctuations in the foreign exchange rates since it not only reveals the overall currency supply, but also contains measurements of the country's macroeconomic outlook. Given the lack of dataset for M2/GDP monthly data for both the US and China, the values adopted within this article are manually calculated using the original M2 and GDP values for both countries. The M2 supply of the US is the monthly data collected from the FRED database [15]. However, since there are only quarterly values for the US GDP on FRED, the monthly values needed for the US GDP had been padded into the dataset by expanding the quarterly data for three months [16]. The monthly data for China's M2 supply has been collected from the website East Money Information [17]. Finally, the monthly data for China's GDP is collected from Sina Finance [18].

2.2. Data Visualization

Before formally starting the quantitative modelling, this paper performed data visualization using Python to compare the changes in interest rate and the M2/GDP ratio between China and the US.

Interest Rate M2/GDP Value

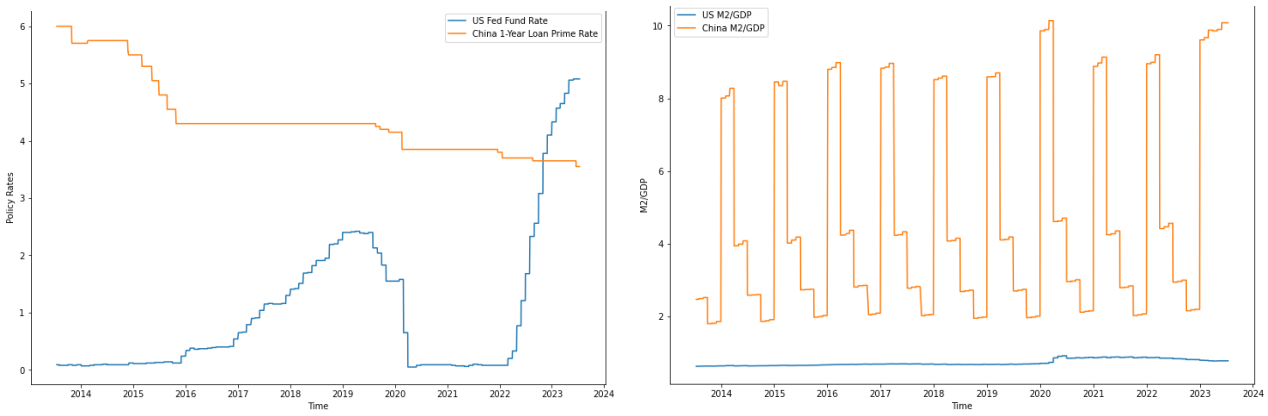

Figure 1. Data Visualization

As shown in Figure 1, it is observable that the US has completed a full monetary cycle during the given time span and is potentially in the transitioning stage between a contractionary monetary policy and an expansionary policy now. In contrast, China's PBOC kept cutting the interest rate to boost the economy within this given time span, proofing the fact that the two countries are in different stages of the macroeconomic and monetary cycle.

The M2/GDP ratio of both China and the US exhibited similar patterns in which both values kept increasing within the time span except some sharp spikes at the beginning of 2020 when the rapid spread of the Covid-19 virus caused another economic recession globally. However, compared to the American M2/GDP ratios, the Chinese ratio exhibited more periodicity within a given year possibly due to the statistical technique the Chinese statisticians adopted. Additionally, the Chinese M2/GDP

ratio is much higher than that of the US, suggesting that a potential problem of currency over-issuance is present in China.

2.3. Unit Root Test

Before conducting the vector autoregression model, running impulse responses, and making econometric forecasts, this research performs an augmented Dickey-Fuller test to check for the stationarity of the time-series data collected. As a result, the following hypothesis test is then performed:

Ho: The variables contain unit roots, and thus are non-stationary.

Ha: The variables are generated by a stationary process.

Table 1. ADF test

Variables	t-statistic	p-value
Monthly Average USD/CNY	-8.804	0.0000
USA		
Effective FFR	-12.054	0.0000
M2/GDP	-8.396	0.0000
China		
One-year LPR	-9.066	0.0000
M2/GDP	-2.817	0.1909

As listed in table 1, the p-value for the M2/GDP ratio of China is 0.1909, the rejection of the null hypothesis failed both at the 5% and 10% significance level, suggesting that the seires of China's M2/GDP ratio data is non-stationary.

However, the p-value for all the other variables of interest are all 0.0000, which are all smaller than 0.05 and thus are statistically significant, suggesting that the time-series data of all the other variables of interest are generated by a stationary process. Since taking the logarithm value of the Chinese M2/GDP ratio still cannot reduce the p-value to below 0.10, the research will precede by using the original data values.

2.4. VAR Model Specifications

The vector autoregression model, as displayed below, is an econometric model that combines multiple variables and is commonly used in econometric forecasting.

$$\begin{pmatrix}\gamma_{1t}\\ \gamma_{2t}\end{pmatrix} = \begin{pmatrix}\beta_{10}\\ \beta_{20}\end{pmatrix} + \begin{pmatrix}\beta_{11}\\ \beta_{21}\end{pmatrix} y_{1,t-1} + \cdots + \begin{pmatrix}\beta_{1p}\\ \beta_{2p}\end{pmatrix} y_{1,t-p} + \begin{pmatrix}\gamma_{11}\\ \gamma_{21}\end{pmatrix} y_{2,t-1} + \cdots + \begin{pmatrix}\gamma_{1p}\\ \gamma_{2p}\end{pmatrix} y_{2,t-p} + \begin{pmatrix}\varepsilon_{1t}\\ \epsilon_{2t}\end{pmatrix} \quad (1)$$

Through combining all the variables of interest, the econometric forecast would then be mutually consistent, and thus a multivariate time-series is created. Additionally, researchers can also add additional explanatory variables into the regression freely due to its properties. Given that the vector autoregression model is a common model used by the previous researchers when studying similar topics, this research will precede by adopting the vector autoregression model.

3. Empirical Result & Analysis

3.1. VAR Model Results

To determine the number of lags within the vector autoregression model, the following test is performed, and the number of lags is determined based on the information guidelines presented in the Table 2.

Table 2. VAR identification

lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	-356.932				.000527	6.6408	6.69086	6.76425
1	-133.71	466.43	25	0.000	.000014	3.00385	3.30425	3.74459
2	-23.3585	220.7	25	0.000	$2.9e^{-6}$	1.43777	1.9885	2.79579
3	82.5701	211.86	25	0.000	$6.6e^{-7}$	-.047158	.753899	1.92814
4	134.504	103.87	25	0.000	$4.1e^{-7}$	-.541351	.510036	2.05123
5	211.84	154.67	25	0.000	$1.6e^{-7}$	-1.50165	-1.9993*	1.70822*
6	241.849	60.019	25	0.000	$1.5e^{-7}$	-1.59356	-.041513	2.23359
7	275.216	66.734	25	0.000	$1.4e^{-7}$*	-1.74708	.055295	2.69735
8	294.341	38.25	25	0.044	$1.6e^{-7}$	-1.63928	.413432	3.42242
9	308.581	28.48	25	0.286	$2.2e^{-7}$	-1.44185	.861184	4.23714
10	399.828	62.494	25	0.000	$2.2e^{-7}$	-1.55648	.996892	4.7398
11	376.434	73.212	25	0.000	$2.0e^{-7}$	-1.76943	1.03427	5.14412
12	414.27	75.672*	25	0.000	$1.9e^{-7}$	-2.0045*	1.04907	5.52588

The vector autoregression model's identification information portrays the result of the likelihood ratio test. It suggested that with five lags, the HQIC and SBIC values are both significant. For simplicity, the vector autoregression model will be conducted with five lags, the least number of lags that is statistically significant. The result of the vector autoregression model is summarized in Table 3.

Table 3. VAR Regression Results

	Coefficient	Standard Error	Z	P	95% CI Low	95% CI High
Monthly Average USD/CNY						
Monthly Average USD/CNY						
L1	.1144502	.112192	1.02	0.308	-.1054421	.3323424
L2	-.4376285	.1006068	-4.35	0.000	-.6348141	-.2404429
L3	.4880981	.1023754	4.77	0.000	.2874461	.6887502
L4	-.2320637	.1098809	-2.11	0.035	-.4474264	-.016701
L5	-.440711	.1102184	-4.00	0.000	-.6567352	-.2246868
US Effective FFR						
L1	-.1416302	.031733	-4.46	0.000	-.2038259	-.0794346
L2	.0278481	.0369096	0.75	0.451	-.0444935	.1001896
L3	-.0211568	.0360112	-0.59	0.557	-.0917375	.0494239
L4	.0414905	.0348791	1.19	0.234	-.0268712	.1098523
L5	.003756	.0356554	0.11	0.916	-0.066127	.0736394
US M2/GDP						
L1	-2.70284	.5721648	-4.72	0.000	-3.824262	-1.581418
L2	1.059412	.608668	1.74	0.082	-.1338253	2.252109
L3	-1.339602	.6051541	-2.21	0.027	-2.525682	-.1535215
L4	.7720407	.6051541	1.28	0.202	-.4138943	1.957976
L5	-.5128391	.5859894	-0.88	0.381	-1.661357	.6356789
China One-year LPR						
L1	-.3134996	.1014454	-3.09	0.002	-.512329	-.1146702
L2	.165958	.1053234	-1.58	0.115	-.371388	.040472
L3	.0535004	.0965248	0.55	0.579	-.1356846	.2426855
L4	-.0504741	.0777623	-0.65	0.516	-.2028853	.1019372
L5	.0379124	.0779249	0.49	0.627	-.1148175	.1906432
China M2/GDP						
L1	.0086873	.0107543	0.81	0.419	-.0123098	.0297654
L2	-.0079457	.0135403	-0.59	0.557	-.344842	.0185928
L3	-.0121361	.0110807	-1.10	0.273	-.0338538	.0095816
L4	-.0088297	.0108618	-0.81	0.416	-0.030119	0.0124591
L5	.0022344	.0094868	0.24	0.814	-.0163594	.0208281

The result of the vector autoregression model suggested that the value of dependent variable, Monthly Average USD/CNY, is related to its historical values since its second and third lag are both statistically significant. The first regressor, the US Effective FFR, is statistically significant at its first lag and has an inverse relationship with the dependent variable. The second regressor, US M2/GDP, is statistically significant at its first and third lag, which both have a negative coefficient. The third regressor, China's One-year LPR, is statistically significant at its first lag, and has an inverse relationship with the dependent variable. The only regressor that is statistically insignificant for all lags is China's M2/GDP ratio which might be caused by its periodicity.

After building the vector autoregression model, the residuals of the regression model are then tested to find out if the problem of autocorrelation exists and if they follow normal distribution through performing the VAR stability test.

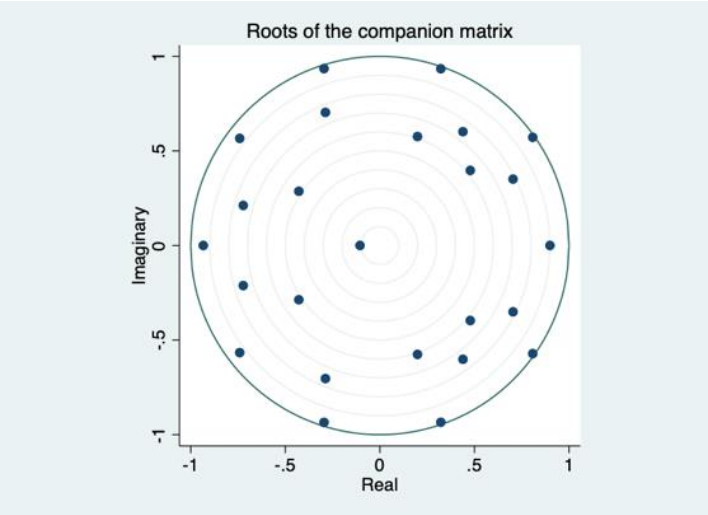

Figure 2. VAR stability

The roots of the companion matrix as displayed in Figure 2 show that despite having some points lying close to the edge of the unit circle, the result has suggested that all the eigenvalues lie within the region enclosed by the unit circle, prooving that the stationary process requirement for the vector autoregression model is fulfilled.

3.2. Impulse & Response

The impulse & response diagrams are displayed in Figure 3. The four sub-diagrams as categorized by different countries in each column are arranged in the way that follows: the graphs on the first row are the effect of interest rate changes on the USD/CNY exchange rate, and the graphs on the second row are the effect of the M2/GDP ratio changes on the USD/CNY exchange rates.

USA China

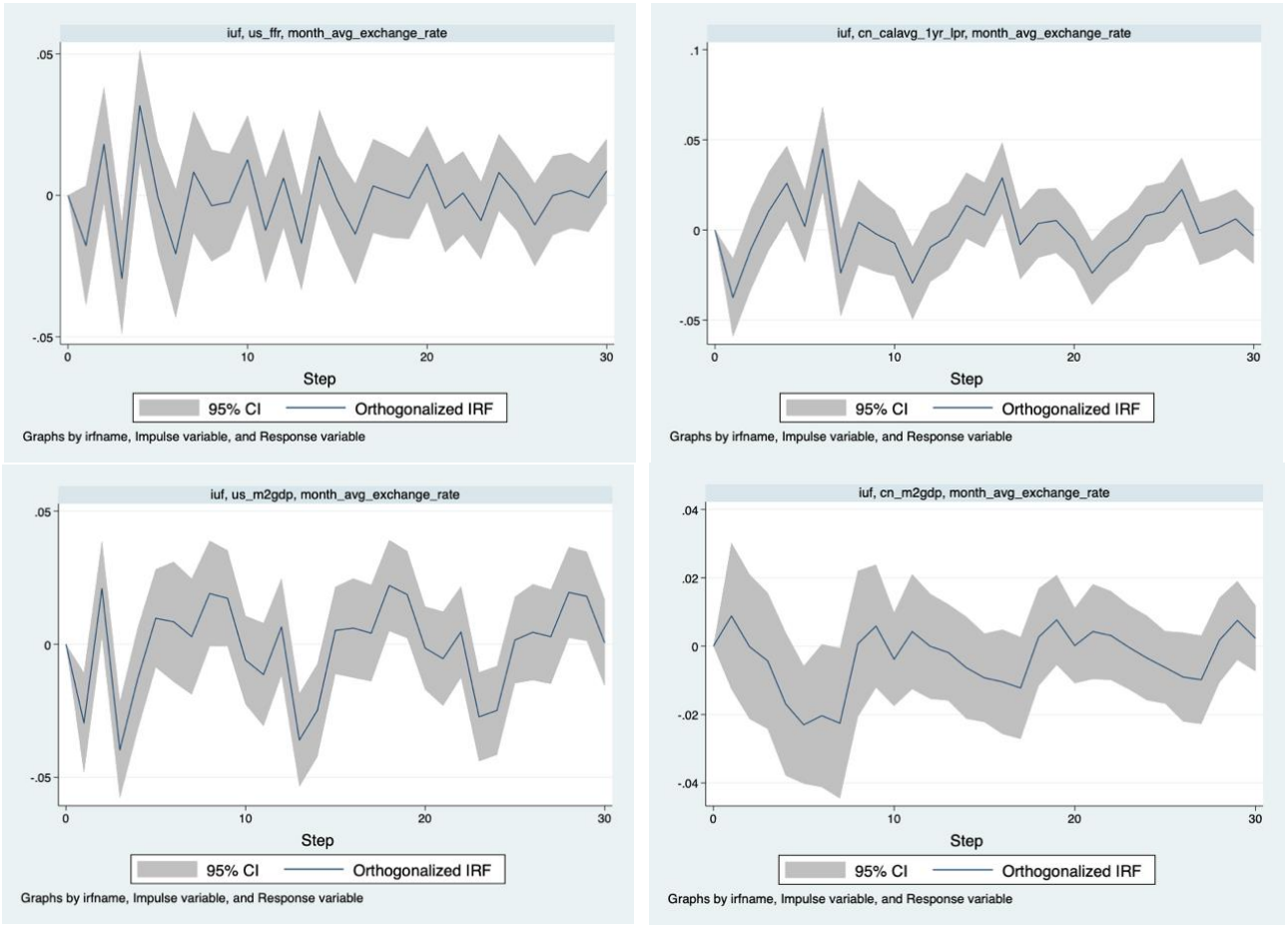

Figure 3. Impulse & Response

The results of the diagrams above have suggested that as the Chinese regulators both directly and indirectly interfere in deciding the exchange rates between the two currencies, and given the fact that the Chinese Yuan is at least partially pegged with the US Dollar de facto, the changes of all the regressors including the US Effective FFR, China's One-year LPR, US M2/GDP ratio, and China's M2/GDP ratio will not cause any fundamental changes in the exchange rate level between the US Dollar and the Chinese Yuan [19].

However, as displayed in the diagrams of Figure 3, the changes of the four regressors would all cause fluctuations in the USD/CNY exchange rates. Additionally, the magnitude of fluctuations caused by the initial shocks of these regressors would gradually diminish overtime, until the exchange rate re-stabilizes.

3.3. Econometric Forecast

After conducting the regression analysis and impulse response, an econometric forecast will be performed to predict the future trends of the USD/CNY exchange rate for the next 50 months after July 2023.

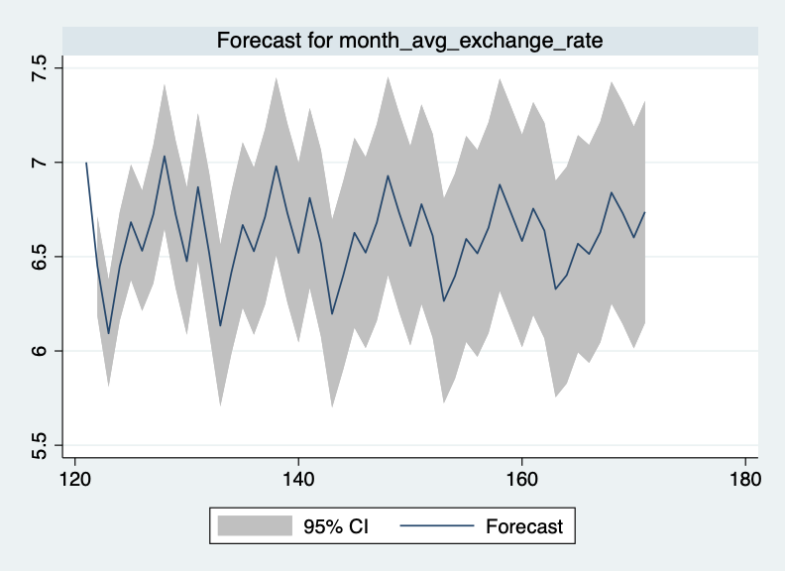

Figure 4. PACF and ACF

As displayed in Figure 4, the econometric forecast indicated that the mean value for the USD/CNY monthly average exchange rate is around 6.5 with constant fluctuations. From the econometric model, ceteris paribus, it is 95% confident to predict that the mean value of the USD/CNY monthly average exchange rate would be between 5.5 to 7.5 within the 50 months following July 2023.

4. Discussion

The main finding of this research is that the although the changes in the US Effective FFR, China's One-year LPR, US M2/GDP ratio, and China's M2/GDP ratio would not cause any fundamental changes in the USD/CNY exchange rate level given China's control in foreign reserve and other regulatory interference, the changes from these regressors would still cause huge fluctuations to the exchange rate within the short run after each initial shocks.

The findings of this article are complementary to the previous research done by Scholl and Uhilg where the researchers only conducted analysis on open economies assuming no government interference in the foreign exchange market. In contrast to the UK and Germany's free exchange markets, China's direct and indirect interference in the foreign exchange market and its de facto currency peg with the US Dollar would make the US Dollar's appreciation or depreciation trend against the Chinese Yuan impossible to last long after each policy shocks. Additionally, the finding of this article has proved the work of previous researchers including Park et al who indicated that the exchange rate of the currency for a larger country would be less effected by the US monetary policy shocks compared to smaller countries as this research found out that the US monetary policy shocks would not trigger any trend in the USD/CNY exchange rate in the long term. Finally, the research finding of this article proved the point made by Davis and Zlate that the central banks of developing nations will try to arrest the depreciation of its currency against the US Dollar or the Euro given a contractionary monetary policy from the developed nations. However, this article failed to take another step forward on finding out to what extend the central banks of peripheral nations can respond to the policies adopted by the central banks of the developed nations given China's high economic volume and its increasing economic and political influence in the world that disqualified China as a peripheral nation.

For central bankers, especially central banker of developing and peripheral countries, although it is possible to stabilize the exchange rates through various policies, it is still important to minimize the differences between the domestic macro and monetary cycle and that of the world, as prolonged monetary policy differences could still cause uncertainties for the exchange rates and be harmful to

the domestic macroeconomics. In addition, the central banker of developing nations should also closely monitor their M2/GDP ratios and try to avoid currency over-issuance when possible.

For investors who actively participates in the foreign exchange market, it is important to conduct comprehensive research on the currencies they intend to investment and avoid making decision simply in response to the monetary policy changes from central banks. More specifically, for the investors who are interested in the USD/CNY exchange rate, it is worth noting that this research has found out that there would not be any long-term appreciation or depreciation trend for the US Dollar against Chinese Yuan, ceteris paribus, despite a monetary policy divergence of the two central banks. However, given the high fluctuations of the exchange rate between the two currencies, intended investors could further investigate into short term speculation and arbitrage opportunities. However, potential investors should closely monitor the de-dollarization and Renminbi internationalization movements as the two trends could change the fundamentals of the two currencies [20].

5. Conclusion

In conclusion, the main discovery of this paper is that there would be no long-term fundamental changes in the USD/CNY exchange rates despite the monetary policy divergence by the two central banks. However, this paper also proofs that the changes in monetary policies from a central bank, a monetary policy divergence between central banks, and changes in the M2/GDP ratios would all cause short-term fluctuations in the exchange rate between the US Dollar and the Chinese Yuan.

The result of this research has multiple practical implications. First, it suggested that ordinary Chinese people do not need to panic about the long-term depreciation trend of the Chinese Yuan against the US Dollar caused by the monetary policy divergence as the research result suggests that this trend is impossible given the de facto currency regimes adopted by the PBOC. Besides, the research result indicated that for Chinese expats and Chinese students studying abroad demanding US Dollar, they should buy foreign currency when the US Dollar is relatively cheap. Additionally, for Chinese companies participating in international trade or are trading commodities in foreign currencies, they should consider using financial derivatives to hedge against unexpected fluctuations. Finally, a peripheral discovery of this research is that the Chinese central bankers should try to reduce the M2/GDP ratio as the country is currently experiencing the problem of currency over-issuance.

The conclusion of this article is made without incorporating several factors given the lack of quantitative data and other restrictions. Such factors that would potentially cause fluctuation or even fundamental changes in the USD/CNY exchange rate includes: the de-dollarization movement, the Renminbi internationalization movement, the possibility of the US debt default, the Evergrande crisis in China, the outcome of the war between Russia and Ukraine, as well as the macroeconomic outlook of China, the US, and other major global economies.

References

[1] Surz Ron. Money Printing and Inflation: Covid, Cryptocurrencies, and More. Nasdaq (2021-11-16) [2023-07-28]. https://www.nasdaq.com/articles/money-printing-and-inflation%3A-covid-cryptocurrencies-and-more.

[2] Gibson Liam. Is China's high-growth-era over forever? Aljazeera (2023-01-24) [2023-07-28]. https://www.aljazeera.com/features/2023/1/24/is-chinas-high-growth-era-over.

[3] Yueh Linda. A Stronger China. International Monetary Fund, June 2010, Volume 47, Number 2, https://www.imf.org/external/pubs/ft/fandd/2010/06/yueh.htm.

[4] Liang Si. Review of RMB exchange rates in 2022 and outlook for 2023. Bank of China Research Institute (2023-03-01) [2023-07-28]. https://pic.bankofchina.com/bocappd/rareport/202303/P020230301597707143896.pdf.

[5] Sen Julius. The Weaponisation of The Dollar Policy Option for Small Countries. LSE Ideas (2019-08) [2023-07-28] https://www.lse.ac.uk/ideas/Assets/Documents/updates/LSE-IDEAS-Weaponisation-Dollar.pdf.

[6] Almuth Scholl, Harald Uhilg. New evidence on the puzzles: Results from agnostic identification on monetary policy and exchange rates. Journal of International Economics, 2008, 76 (1): 1 - 13.

[7] Park, D., Qureshi, I., Tian, S. et al. Impact of US monetary policy uncertainty on Asian exchange rates. Econ Change Restruct, 2022, 55: 73 – 82.

[8] Davis Scott, Zlate Andrei. Monetary policy divergence and net capital flow: Accounting for endogenous policy responses, Journal of International Money and Finance, 2019, 94: 15 - 31.

[9] Lockett Hudson, Leng Cheng. China's new Renminbi tactics leave trader guessing. Financial Times (2023-01-05) [2023-07-28]. https://www-ft-com.ezp.lib.cam.ac.uk/content/5fb4ebd9 - 32ac - 43de - a481 - b83b5265d357.

[10] Fall Roddy. The economic cycle of China and the US is dislocated, is it the right time to allocate Chinese stocks? UBS Asset Management (2022-08-11) [2023-07-28] https://www.ubs.com/cn/sc/assetmanagement/insights/asset-class-perspectives/asset-allocation/articles/dislocation-of-sino-us-economic-cycle.html.

[11] X-Rates. Chinese Yuan per 1 US Dollar Monthly Averages. https://www.x-rates.com/average/?from=USD&to=CNY&amount=1&year=2013.

[12] Reuters Staff, China's main financial data list by December 23. Reuters (2013-12-23) [2023-07-28] https://www.reuters.com/article/idCNL3S0K20NY20131223.

[13] Bank of China. Historical data of Chinese loan base interest rates [2023-07-28] https://www.bankofchina.com/fimarkets/lilv/fd32/201310/t20131028_2578984.html.

[14] Bank of China. Historical data of Chinese LPR rates [2023-07-28] https://www.bankofchina.com/fimarkets/lilv/fd32/201310/t20131031_2591219.html.

[15] FRED Economic Data. M2 [2023-07-28] https: //fred.stlouisfed.org/series/M2SL.

[16] FRED Economic Data. Gross Domestic Product [2023-07-28] https://fred.stlouisfed.org/series/GDP.

[17] East Money Information. China currency supply [2023-07-28] https: //data.eastmoney.com/cjsj/hbgyl.html.

[18] Sina Finance. China macroeconomic data [2023-07-28] http://finance.sina.com.cn/mac/#nation-1 - 0 - 32 - 1.

[19] Picardo Elvis. Why China's Currency Tangos with the USD. Investopedia (2019-08-05) [2023-07-28] https://www.investopedia.com/articles/forex/09/chinas-peg-to-the-dollar.asp#:~:text=A%20cornerstone%20of%20China%27s%20economic,)%2C%20to%20the%20U.S.%20dollar.

[20] Helms Kevin. IMF Director: Iranians, Brazilians, Saudis Switching to Trade in Chinese Yuan as De-Dollarization Gains Momentum. Bitcoin.com (2023-06-27) [2023-07-28] https: //news.bitcoin.com/imf-director-iranians-brazilians-saudis-switching-to-trade-in-chinese-yuan-as-de-dollarization-gains-momentum/.