

The Impact of China's Epidemic Policy Liberalization on Exchange Rate

Yiling Luo

Faculty of Science and Technology, Beijing Normal University - Hong Kong Baptist University
United International College, Zhuhai, 519087, China

s230005041@mail.uic.edu.cn

Abstract. On December 7, 2022, the Chinese government announced full liberalization of the epidemic policy. Since the outbreak of COVID-19, China has implemented a "zero infection" policy for more than two years. The liberalization of the epidemic policy affects China's economy and other aspects significantly. This paper selected the exchange rate of RMB against USD in China and intercepted its exchange rate data from January 2020 to the end of 2023. The ARIMA model was used to model and analyze the data, so as to study how the reopening policy impact on RMB exchange rate. This article finds that the reopening policy will increase the exchange rate of RMB in following period. Finally, some suggestions are put forward for the formulation of future policies. Article suggests policy maker identifying problems and modify policies in time to reduce the recognition and decision-making lag. At same time investors are advised to follow the exchange rate changes and increase foreign investment.

Keywords: Reopening policy; Unit Root Test; ARIMA.

1. Introduction

A zero-COVID policy prevents the virus from spreading within a country. The government has adopted a combination of isolation, contact tracing and mass testing to reduce the number of infected people and eliminate the virus as soon as possible [1]. Although it has effectively reduced infection rates and maintained social stability, by reason of the large-scale isolation, China's economy has suffered a "shutdown" in the short term [2]. By 2022, a new variant strain, Omicron, was created that was more contagious and milder. Two years of lockdown measures negatively affected economic activity. It plays a major role in leading to job losses, a significant drop in spending and deteriorating local economic conditions. Similar effects have been documented in different countries[3]. In addition, the "zero infection" policy has a huge impact on people's daily life, including food short-ages and isolation from the world. Finally, at the end of 2022, it was decided to gradually deregulate.

China's exchange rate is affected by many factors, including domestic economic conditions, the international trade environment, monetary policy, and fluctuations in global financial markets. China's coronavirus policy opening could help revive economic activity and boost trade, which could increase demand for China's currency and drive the yuan's appreciation [4]. On the other hand, if the opening up of the epidemic policy leads to more capital outflow from China, or there are concerns about China's economic prospects, this may lead to the depreciation of the yuan.

This study aims to explore what influence will happen to exchange rate caused by the liberalization of epidemic policy. Specifically, essay will look at how RMB exchange rate was affected during the outbreak and after the government liberalized its pandemic policy. To provide a better basis for policy makers and market participants to adapt to future uncertain economic environment and mitigate exchange rate fluctuations on the economy.

The following parts will organize as: Section 2 is making a literature review regarding China's zero-COVID policies, exchange rate and the impact of exchange rate changes. Section 3 introduces research methods including data select and transformation, Unit Root Test and ARIMA model setting. Find the results of model and give some explanations in Section 4. Next in section 5 will discuss the research inspiration and how policy maker and investors should view the result of this study. In part 6 will gives the main conclusion of this article.

2. Literature Review

2.1. China's Zero-COVID Policies

Covid-19 outbreak at the end of 2019. For the sake of fully contain the novel coronavirus spreading, China instituted a "zero coronavirus" policy in early 2020. Policy measures include lockdowns and quarantines, mass testing, mandatory protective measures, enhanced border control, and universal vaccination [5]. The advantage of a zero-coronavirus policy is that it can effectively contain the spread of the epidemic and protect public health. Help restore economic and social order in short term. However, such policies may also face challenges, such as the high cost of policy implementation, restrictions on socio-economic activities, and restrictions on individual freedoms. In the aspect of economic, thanks for the zero-COVID policy, the economic in China did not has a immense loss in 2021. But in 2022, China made a stricter policy because of the Omicron variant appeared, which led to experience a 3.9% loss in GDP in China [6]. Therefore, the government needs to make a balance between epidemic prevention and control and social stability and adopt flexible policy measures to cope with the epidemic situation at different stages.

2.2. Exchange Rate

The exchange rate is the ratio or comparison between the currency of one country and that of another. It can also be regarded as the value of the currency of one country against another. A number of factors may change the exchange rate between any two currencies, including national economic conditions, the level of market interest rates, trade conditions, and government policies. In economic conditions, economic growth rate, inflation level, unemployment rate and current account balance will affect the currency value of a country, and thus affect the exchange rate [7]. The level of interest rates is an important factor in attracting international capital inflows or outflows. Higher interest rates typically attract more capital inflows, which support the value of the local currency. While lower interest rates can cause capital outflows, depressing the value of the currency. A country's trade activity also has an important impact on its exchange rate. The size of exports and imports, trade surpluses or deficits, and trade relations with major trading partner countries all affect the value of a currency [8]. Government policies such as monetary policy, fiscal policy and foreign exchange control measures directly affect a country's exchange rate. For example. Central bank intervention, money supply regulation and government fiscal expenditure can all have an impact on the exchange rate.

2.3. The Impact of Exchange Rate Changes

Exchange rates change can have an extensive influence on a country's economy and society. Impact on exports and imports: exchange rate changes directly affect a country's exports and imports. When the domestic currency appreciates, the price of domestic goods in the international market increases, which may lead to a decrease in exports and an increase in imports [9]. Conversely, a weaker currency may make exports more competitive but also increase the cost of imports. Exchange rate also influence inflation, economic growth, employment, financial position and corporate earnings.

3. Research Design

3.1. Data Sources

Using Investing to collect data that request in this study. Over 100,000 types of financial assets such as foreign exchange and digital currencies are provided in it. Larger than 70 countries and regions all over the world are covered. Daily and monthly closing price data of RMB against USD from January 24, 2020, to the end of 2023 were collected. In order to study whether the liberalization of the epidemic policy has an impact on the RMB exchange rate, data processing is needed. Log the data before deregulation (December 7, 2022), that is, convert the data to $\ln(1+x)$. The analysis is then

carried out on a logarithmic scale to construct model and predict the exchange rate changes in the period after the liberalization of controls.

3.2. Unit Root Test

In order to test whether this time series data is stationary, ADF test is used for completing it. Assumed that the null hypothesis is unit root exist, that is, the data is not stable.

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \delta_2 \Delta y_{t-2} + \dots + \delta_{p-1} \Delta y_{t-(p-1)} + \varepsilon_t \quad (1)$$

In the above formular, Δy_t is the first difference of a time series at time t-1. y_{t-1} is the lag 1 of the time series. t is the time trend term. $\alpha, \beta, \gamma, \delta_1 \dots \delta_{p-1}$, are parameters to be estimated. ε_t is the white noise error term.

Table 1 Stationarity test

	t-statistic	p-value
Daily exchange rate (RMB to USD)		
Ln yield	-0.374	0.9876
First order difference	-19.759	0.0000
Weekly exchange rate (RMB to USD)		
Ln yield	-0.716	0.9721
First order difference	-7.255	0.0000

According to the result in Table 1, cannot rejected null hypothesis both in daily and weekly exchange rate. So, the data is non-stationary. After first order difference, the t-statistic are smaller than 1% critical value. The p-value are equal to 0.0000 both in daily and weekly exchange rate. So the null hypothesis can be rejected and the data is stationary [10].

3.3. ARIMA Model Setting

For a time series y_t where t represents time, the ARIMA (p, d, q) model can be shown as:

$$(1 - \phi_1 B - \phi_2 B^2 - \dots - \phi_p B^p)(1 - B)^d y_t = (1 + \theta_1 B + \theta_2 B^2 + \dots + \theta_q B^q) \varepsilon_t \quad (2)$$

Where $\phi_1, \phi_2, \dots, \phi_p$ are the coefficient of autocorrelation (AR). $\theta_1, \theta_2, \dots, \theta_q$ are the coefficient of smooth average (MA). B is the difference operator, and B^d means to make a d sub difference on a time series. ε_t is a white noise error term, assumed to be an independent equally distributed random variable with 0 mean and σ^2 variance.

In order to indicating the type of ARIMA model used, using integer values to substitute the parameters. p, d, and q are typical notation for ARIMA models [11]. Notation p in a model refers to how many lag observations are there; it also called the lag order. d is the number of times the raw observations are differenced, and q is the order of the moving average.

4. Empirical Results and Analysis

4.1. Order Determination

In this section, ACF and PACF are used to determine the lag orders of AR(p) and MA(q).

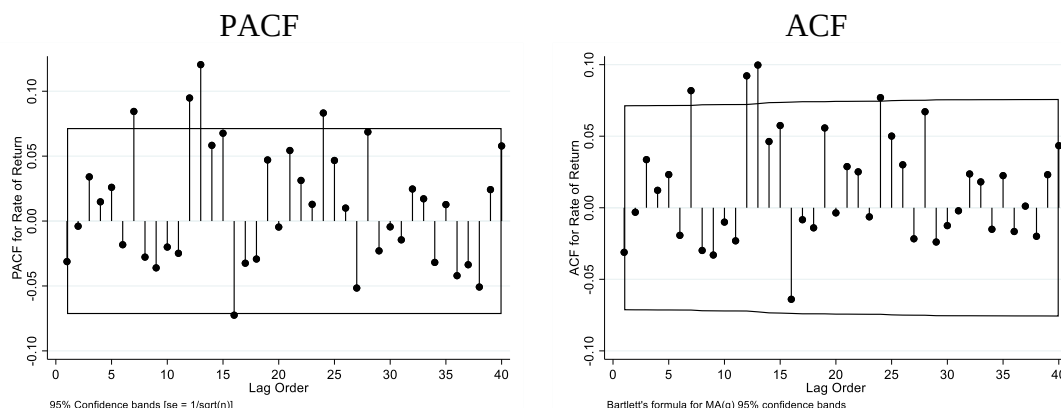


Figure 1 Daily exchange rate (RMB to USD)

Photo credit: Original

According to Figure 1, for daily exchange rate, the first part beyond the critical values is 7 for both ACF and PACF plots, demonstrating that both AR and MA have order 7. Therefore, p and q are both 7.

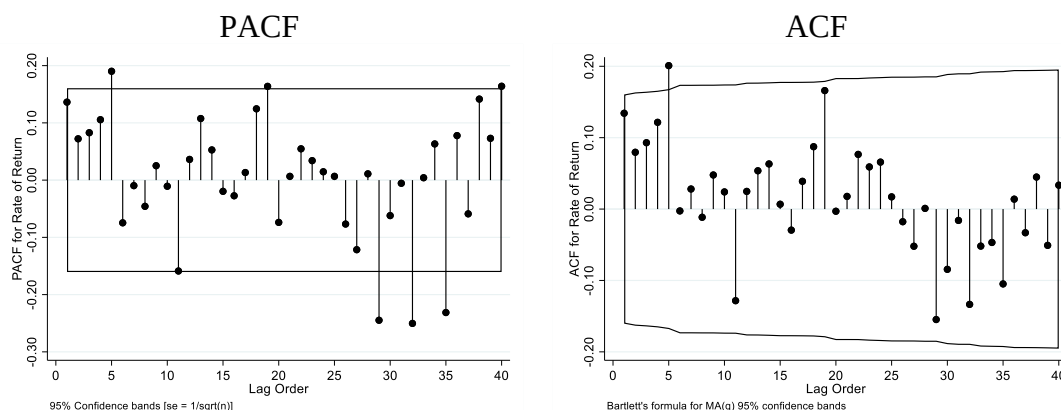


Figure 2 Weekly exchange rate (RMB to USD)

Photo credit: Original

In Figure 2, for the weekly exchange rate, the critical value is 5, so both AR and MA are ordering in 5. The value of p and q are 5. Since the data differenced for one time, I equal to 1.

Then, in order to evaluate the model fit quality, using the Portmanteau test to test whether the sequence is satisfy the normal distribution. The null hypothesis is the series belongs to white noise.

Table 2 Residual test

Model	Q- statistic	Prob > chi2
ARIMA(7,1,7) (Daily)	36.0929	0.6468
ARIMA(5,1,5)(Weekly)	28.1540	0.9203

Table 2 shows the result of Residual test, it is obvious that 0.6468 and 0.9203 are both larger than 0.1. So the null hypothesis can't be rejected, both of the series belong to white noise.

4.2. Forecast Results and Interpretation

Using the actual value of exchange rate before the December 7, 2022, to forecast the value of exchange rate after that day. Then compare the actual value of exchange rate after December 7, 2022, with fitted value to see the difference.

Table 3 Daily exchange rate forecasting result

	Actual value	Fitted value	Difference	Difference (%)
2022-11-28	0.13874629			
2022-11-29	0.13972725			
2022-11-30	0.14108551			
2022-12-01	0.14199705			
2022-12-02	0.14247044			
2022-12-05	0.14365752			
2022-12-06	0.14298992			
2022-12-07	0.14346791	0.14297272	0.000495	0.35%
2022-12-08	0.14357708	0.14309107	0.000486	0.34%
2022-12-09	0.14376285	0.14313692	0.000626	0.44%
2022-12-12	0.14332192	0.14310661	0.000215	0.15%
2022-12-13	0.14402996	0.14316277	0.000867	0.61%
2022-12-14	0.14388903	0.14330686	0.000582	0.41%
2022-12-15	0.1434391	0.14327554	0.000164	0.11%

Table 3 shows the actual value, the result of fitted value and the difference. Based on the daily exchange rate, it is clear that actual value is higher than predicted value in the following 9 days. That is, after the reopening policy the exchange rate of RMB higher than no policy influence. It can be seen that the liberalization of the epidemic policy has a positive impact on China's exchange rate.

The following two figures (Figure 3 and Figure 4) shows this index in line chart, it is more intuitive to see the result.



Figure 3 Actual value and predicted value (daily model)

Photo credit: Original

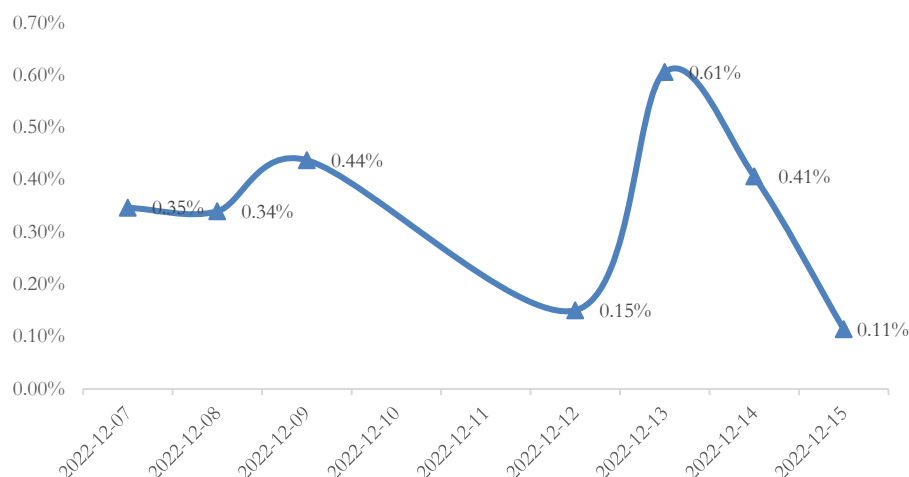


Figure 4 Difference (%) between actual and predicted value, daily model
Photo credit: Original

Further change of exchange rate can be seen in weekly model. As Table 4 exhibits, the first two week after the policy implementation, the difference exchange rate are negative. Nevertheless, the difference has a marked improvement.

Table 4 Weekly exchange rate forecasting result

	Actual value	Fitted value	Difference	Difference (%)
2022-11-06	0.14071427			
2022-11-13	0.14046522			
2022-11-20	0.13958293			
2022-11-27	0.14247044			
2022-12-04	0.14376285			
2022-12-11	0.14345556	0.14359157	-0.00014	-0.09%
2022-12-18	0.14310246	0.14365837	-0.00056	-0.39%
2022-12-25	0.14498637	0.14362123	0.001365	0.95%
2023-01-01	0.14626298	0.14473434	0.001529	1.06%
2023-01-08	0.14923146	0.14492671	0.004305	2.97%

Figure 5 and Figure 6 also give visible look of the results.

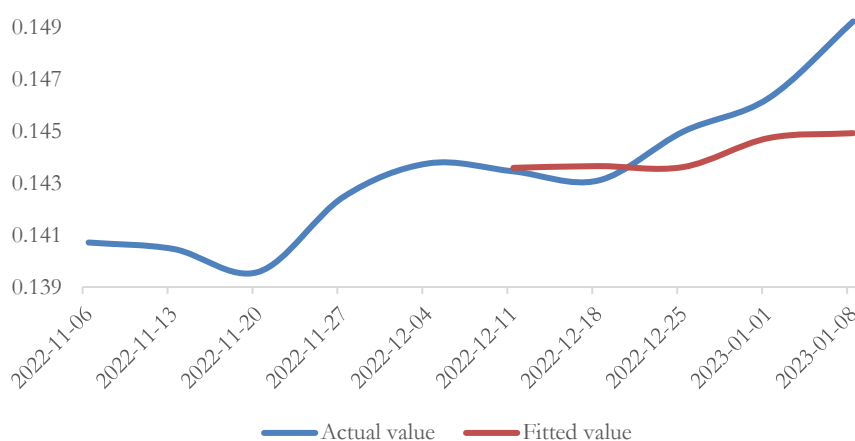


Figure 5 Actual value and predicted value (weekly model)
Photo credit: Original

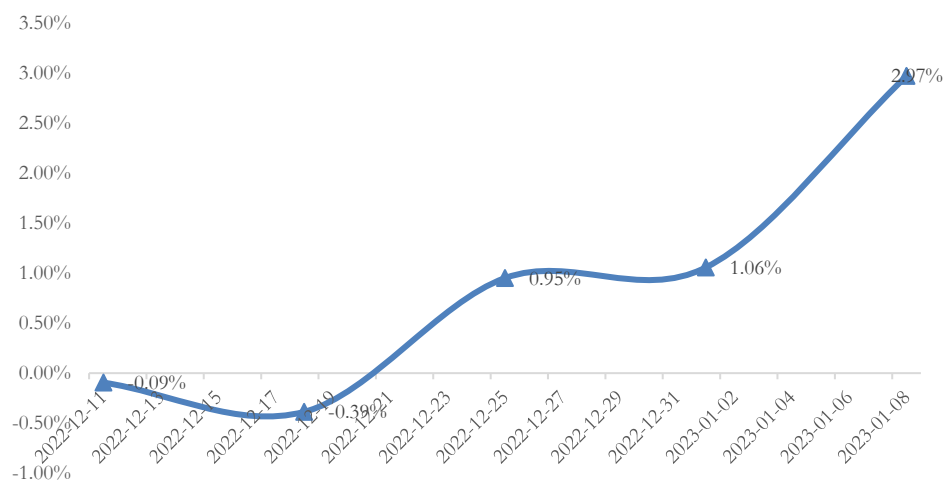


Figure 6 Difference (%) between actual and predicted value, weekly model
Photo credit: Original

The reason why exchange rate decrease in first two weeks might be policy lag. After the policy is declared, common policy lag including implementation lag and response lag.

There is a reaction time after a macroeconomic event happen. Then the government and central bank will implement fiscal or monetary policy. The delay between them is implementation lag. Policy implementation may need to be accomplished through legislative, administrative or other forms of decision-making processes, which may take time [12].

Between taking the action and generating a real effect, there is amount of time called response lag or effect lag. After the policies of monetary and fiscal are introduced, time is needed for them to have actual effect on economy. The effect of the policy may not be immediate, but it will take some time to take effect [13].

5. Conclusion

In the existing literature, China's zero covid policy has limited China's development in the long run. After the liberalization of the epidemic policy, China's economy and interest rate have recovered, and the exchange rate has also improved. This paper makes the result that the exchange rate after the liberalization of the epidemic policy is higher than that without the liberalization. It is consistent with the results in the literature. Compared with the literature, this paper is more inclined to study the impact of policies on exchange rates, so as to give suggestions to policy makers and investors. The literature tends to analyze the influence of this policy on China's economic level.

It can be seen from this paper that using policies to reduce the infection rate of the epidemic may be helpful to economic development in the short term. However, the long-term implementation of blockade and isolation and the strengthening of border control have a limiting effect on economic development.

Through this paper, policy maker should timely discover and adjust policies to reduce the time lag in recognition and decision-making. Solve the current problem quickly, so that can keep the country's economic developing steadily.

For domestic investors, recognizing that the policy will raise the domestic exchange rate, they should export less and import more products. For foreign investors, they should increase investment in the country and increase exports.

This study aims to look into the impact of reopening epidemic policy in exchange rate of China. In order to achieve this goal, this paper establishes ARIMA model to predict the exchange rate when there is no policy influence and compares the exchange rate when there is actually policy influence. Finally, receive the conclusion. The final result of this study is: The policies China has implemented in

response to the COVID-19 epidemic have limited the country's economic development and other aspects. China's exchange rate has risen since the policy was liberalized. Hence the liberalization policy has a positive effect on economic development in China.

References

- [1] Burki T. Dynamic zero COVID policy in the fight against COVID. *The Lancet Respiratory Medicine*, 2022, 10(6): e58-e59.
- [2] Liu Z, Hu B. China's economy under COVID-19: Short-term shocks and long-term changes. *Modern Economy*, 2020, 11(4): 908-919. 10.4236/me.2020.114068
- [3] Yeyati E L, Filippini F. Social and economic impact of COVID-19. Brookings Institution, 2021. <https://www.aidsdatahub.org/sites/default/files/resource/background-paper-13-economic-impact-2021.pdf>
- [4] Liu K. COVID-19 and the Chinese economy: impacts, policy responses and implications[M]//*The Political Economy of Covid-19*. Routledge, 2022: 200-222. <https://doi.org/10.4324/9781003307440>
- [5] What is China's "zero-covid" policy? (2022-11-28) [2024-3-1]. <https://www.voanews.com/a/what-is-china-s-zero-covid-policy-/6854291.html>
- [6] Gong D, Shang Z, Su Y, et al. Economic impacts of China's zero-COVID policies. *China Economic Review*, 2024, 83: 102101.
- [7] Ramasamy R, Abar S K. Influence of macroeconomic variables on exchange rates. *Journal of economics, Business and Management*, 2015, 3(2): 276-281. <https://www.joebm.com/papers/194-W10044.pdf>
- [8] Keho Y. The impact of trade openness on economic growth: The case of Cote d'Ivoire [J]. *Cogent Economics & Finance*, 2017, 5(1): 1332820.
- [9] Effects of Exchange Rates. (2021-9-24) [2024-3-1]. <https://www.investopedia.com/articles/forex/053115/understand-indirect-effects-exchange-rates.asp>
- [10] Mushtaq R. Augmented dickey fuller test[J]. 2011.
- [11] Fattah J, Ezzine L, Aman Z, et al. Forecasting of demand using ARIMA model. *International Journal of Engineering Business Management*, 2018, 10: 1847979018808673. <https://journals.sagepub.com/doi/full/10.1177/1847979018808673>
- [12] Implementation Lag: What it Means, How it Works. (2021-3-29) [2024-3-1]. https://www.investopedia.com/terms/i/implementation_lag.asp
- [13] Response Lag: What it is, How it Works, FAQ. (2023-7-29) [2024-3-1]. https://www.investopedia.com/terms/r/response_lag.asp