# Macroeconomic Analysis of China, Japan and the United States Based on Exchange Rate Spillover Effects of Economic Policies

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**Abstract:** Since February, the Federal Reserve has launched two rounds of quantitative easing policy to increase market liquidity by innovating different financial products. At the same time, China's macroeconomic variables also fluctuate mainly in the form of economic overheating and inflation. With the continuous progress of global economic integration, economic exchanges between countries are becoming increasingly close. A country's monetary policy not only has an impact on its own economy, but also has an impact on other countries through trade channels, capital flow channels, and interest rate and exchange rate channels. As a world economic power closely linked to China's economy, Japan has been implementing quantitative easing monetary policy since its implementation. A large amount of liquidity has been injected into the domestic economy and it is closely linked economic system. Under this great economic background, China can be expected to have close economic ties with China.

## 1. Introduction

From the practice of the unconventional monetary policy in the world's major developed countries, the quantitative easing monetary policy was first put forward by the Bank of Japan[1]. Between 2001 and 2006, the Bank of Japan has reduced the benchmark interest rate to zero in the long run of deflation, and the quantitative purchase of medium and long term treasury bonds is a typical "quantitative easing" monetary policy[2]. Taking the countries with fixed exchange rate system as an example, it is considered that there are many uncertainties in achieving the macro-economic goals of these countries[3-5]. This is mainly due to the increasing dependence among economies[6]. The exchange rate of the major currencies fluctuated sharply, and the fluctuation of exchange rate between us dollar, euro and yen increased significantly[7]. With the gradual opening of the economy and the gradual liberalization of capital account in various countries, Under the circumstances of closer economic intercourse and economic cooperation among countries[8-9].

## 2. Overview of Theory

According to the exchange rate theory, the bilateral exchange rate between the two currencies is determined by the basic economic factors of a country relative to another country. For example, the determinants of the exchange rate of RMB against the US dollar are China's labor productivity relative to the United States, China's government expenditure relative to the United States, and China's relative monetary supply to the United States. The spillover effect is essentially a kind of externality, and the spillover effect of monetary policy is that the monetary policy adopted by a country will affect the country or the third party except it. Traditional economic theory holds that under normal circumstances, the central bank's interest rate cut will lead to a general decline in the rate of return on securities. The basic economic factors of one country and the basic economic factors of another country have opposite directions to the bilateral exchange rate between the two currencies. The state formulating exchange rate policy generally focuses on the equilibrium and dislocation of

 

multilateral effective exchange rate.

It is observed from 1 figures and Figure 2 that there is a close relationship between the US monetary policy variables and China's monetary policy variables. The quantitative easing monetary policy of the United States affects China's monetary policy variables by changing the index of policy variables, and further affects the macroeconomic variables of China.

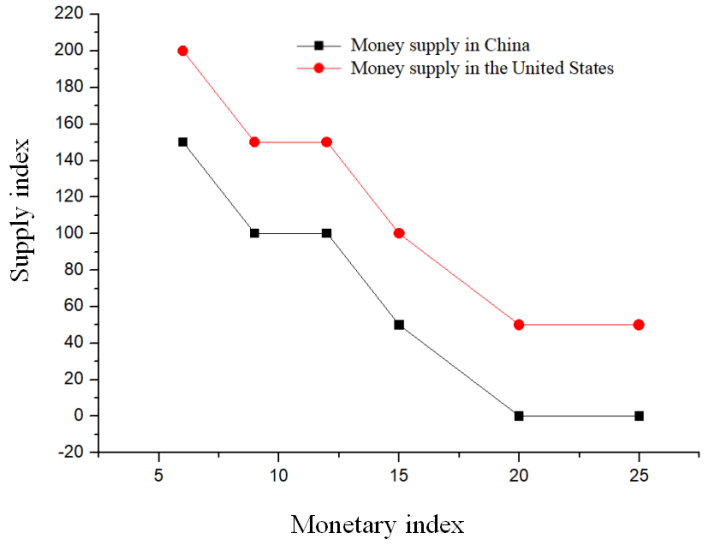


Figure 1 Trend map of China and the US money supply

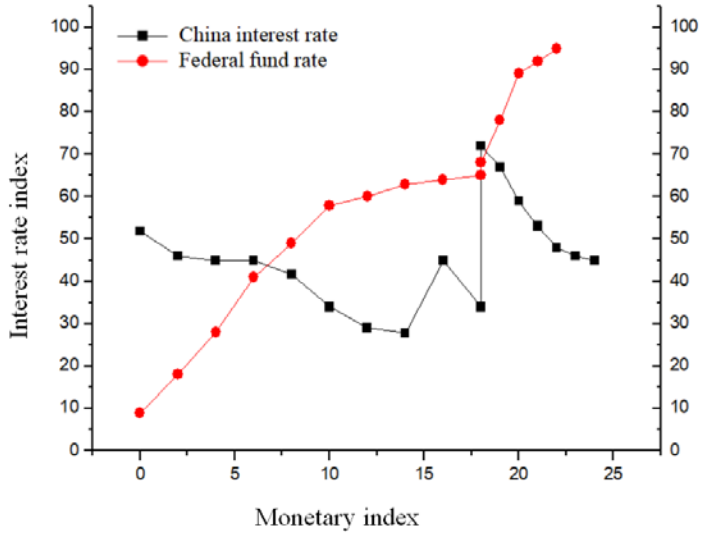


Figure 2 Interest rate trend chart in China and the United States

At present, the theoretical analysis of the spillover effect of monetary policy is mainly based on the two theoretical frameworks of Mundell - Fleming (M-F) model and the new open economic Macroeconomics model (NOEM).

With the deepening of economic openness, the economic ties between countries are becoming more and more closely, and any country or economy must take into account the impact of external shocks in the formulation of economic policies. As we study the spillover effects of American non conventional monetary policy on China's macro-economy, according to the above definition, the policy tool of unconventional monetary policy is the balance sheet of the Federal Reserve. The assumption of sticky price is used to replace the original fixed price hypothesis, while the perfect expectation hypothesis is added. A dynamic exchange rate model is built to extend the MF model. This new theoretical framework is called the MF model.

Under the framework of the MF model, we do the following analysis of the changes in the

monetary policy of one country on the macroeconomic effects of the other countries, such as the two countries such as the United States and China. In static state, the M-F model can be represented as the form shown in the equation (1) to form (3). Among them, *D* is output, *i* is interest rate, a is current account difference, *b* is exchange rate, *j* is nominal money demand, Y is nominal money supply, ln is the corresponding foreign variable.

$$D_i = a + \sum_{j=1}^{n} b_j p_j + r_i Y + u \tag{1}$$

$$D_i = a + \sum_{j=1}^{n} b_j \ln(p_j) + r_i \ln(Y) + u \tag{2}$$

$$\ln(D_i) = a + \sum_{j=1}^{n} b_j \ln(p_j) + r_i \ln(Y) + u \tag{3}$$

The model uses money to enter the utility function to integrate money directly into the model, and leisure and output are negatively correlated. So output is included in the individual's preference in the form of negative utility, so the individual's lifetime utility function is related to the individual consumption index, the money balance held and the output. The specific form is as follows (4). Among them, $w_{ij}$ represents the composite consumer goods consumed by broker i in the period j, which is defined as:

$$w_{ij} = w_{ij} + a(\frac{X_i}{m} - w_{ij}) \tag{4}$$

And agent *i* consumption of commodity *f*. The definition of the domestic overall price reduction index *E* is as follows:

$$E_{RME} = \sqrt{\frac{1}{P}\sum_{p=1}^{P}(E_P)^2} \tag{5}$$

As can be seen from table 1, the United States is China's largest exporter and China's third largest importer, second only to Japan and South Korea. At the same time, China is the third largest exporter of the United States, second only to Canada and Mexico, and the largest importer of the United States. To remove geographical factors, trade between China and the United States is very close, which also creates conditions for the overflow of US monetary policy.

Table 1 Main country (region) value of import and export in the United States

| Exit | | | Imported | | |
|---|---|---|---|---|---|
| Export final destination country (place) | Amount (million dollars) | Proportion (%) | Import destination country (land) | Amount (million dollars) | Proportion (%) |
| Canada | 291541 | 17.9 | China | 423217 | 15.6 |
| Mexico | 215651 | 12.0 | Canada | 319489 | 12.0 |
| China | 155359 | 7.5 | Mexico | 253697 | 15.2 |
| Japan | 75021 | 4.9 | Japan | 156519 | 6.9 |
| Britain | 51241 | 3.9 | Germany | 100924 | 4.5 |
| Germany | 49561 | 3.5 | Britain | 64891 | 3.0 |
| Gross value | 838374 | 49.7 | Gross value | 1318737 | 57.2 |

The spillover effect of monetary policy is influenced by many factors, such as the openness of a country's economic policy, the international flow of capital account, the arrangement of the exchange

rate system and the ability of the industrial structure and the economy to bear the impact. The basic economic factors of a country and the basic economic factors of the world have opposite directions to the effective exchange rate of the country. How to embody the basic economic elements of the world becomes a difficult problem. In order to avoid this difficult problem, many studies regard the basic economic elements of the world as invariable. Or simply ignore the basic economic factors of the world, and choose the decisive factor of the effective exchange rate of a country as the fundamental economic factor of the country.

## 3. The Practice of Quantitative Easing Monetary Policy in Japan

When studying quantitative easing monetary policy, we have to start with the hypothesis of liquidity trap. The "liquidity trap" is a state of affairs: even if the central bank drops interest rates to a very low level, the demand for cash money is unlimited. But if a country's economy is in serious recession and recession, the economy will have very low or even zero nominal interest rates. If so, it means that the country's economy has fallen into the so-called "liquidity trap" proposed by Keynes. That is to say, when a country's economy falls into a serious recession and depression, the effect of monetary policy implemented at this time is ineffective.

Japan's economy has been in a prolonged recession, and GDP growth in Japan has dropped from 7% in 2010 to 0.2% in 2015. Price rises have been below 2% for many years since 2013 (see figure 3).

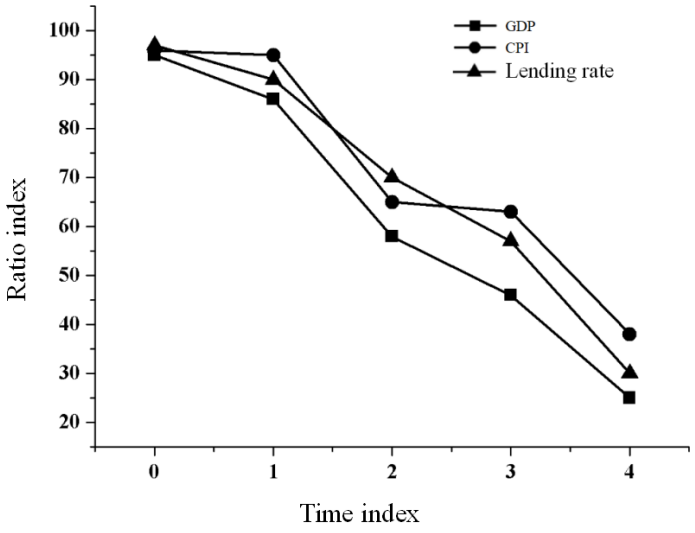


Figure 3 The performance of Japan's economy

Quantitative easing monetary policy is in the financial or economic crisis, or a country in a long period of economic depression and deflation. The policy authorities have adopted the "unconventional" monetary policy to boost the economy, rebuild investors, consumer confidence and get rid of a series of problems such as deflation. "Unconventional" is embodied in the instruments of monetary policy. A more comprehensive definition of "unconventional" monetary policy. The prominent feature of unconventional monetary policy is that the central bank actively uses their balance sheet rather than short-term (such as overnight) interest rates to affect direct market prices and conditions.

Before the implementation of quantitative easing monetary policy in the United States, the contribution rate of China's money supply to its own innovation was over 83%. The contribution rate of three variables to China's money supply changes is less than that of the United States, but after the implementation of quantitative easing monetary policy. The contribution rate of China's money supply to its new innovation has dropped to around. As shown in Table 2.

Table 2 Variance decomposition results of China's money supply

| | Before the implementation of QE policy | | | | After the implementation of QE policy | | | |
|---|---|---|---|---|---|---|---|---|
| Period of variable | Money supply in China | Federal fund interest rate | Back wall supply in the United States | Fed's balance sheet | Money supply in China | Federal fund interest rate | Back wall supply in the United States | Fed's balance sheet |
| 1 | 99.21 | 0.021 | 0.000 | 0.367 | 98.56 | 0.597 | 0.000 | 0.109 |
| 2 | 92.26 | 0.597 | 7.569 | 1.201 | 79.56 | 2.397 | 13.15 | 1.269 |
| 3 | 85.26 | 1.598 | 7.956 | 1.957 | 70.19 | 5.259 | 15.21 | 5.267 |
| 4 | 87.26 | 3.269 | 8.096 | 5.269 | 53.29 | 7.597 | 22.69 | 10.26 |
| 5 | 88.59 | 2.264 | 8.561 | 4.269 | 55.29 | 9.590 | 20.91 | 15.28 |
| 6 | 84.56 | 2.971 | 7.856 | 3.258 | 50.26 | 9.471 | 14.87 | 20.57 |
| 7 | 83.59 | 2.594 | 7.267 | 4.298 | 47.59 | 11.26 | 15.29 | 20.59 |
| 8 | 85.29 | 2.152 | 9.002 | 4.231 | 49.56 | 10.29 | 19.59 | 20.19 |

The change in the operational objectives of monetary policy. The objective of monetary policy in the past is to regulate economic variables on the basis of benchmark interest rates. During this period, the base money supply of the Bank of Japan increased year by year, and the rate of overnight lending was basically maintained at zero. As shown in Figure 4.

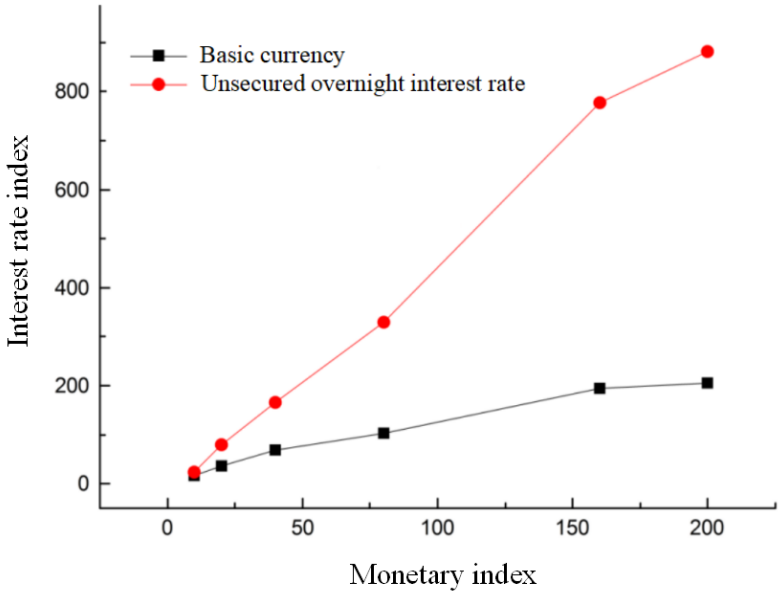


Figure 4 Japan's basic money supply and unsecured overnight lending rate in the period of zero interest rate and quantitative easing monetary policy

On this basis, we further develop and perfect the theory of liquidity trap and put forward the so-called generalized liquidity trap theory. The theory holds that if a country's economy continues to decline in aggregate demand and nominal interest rates have fallen to zero. We can basically assert that the country's economy may have fallen into a broad sense of liquidity and can not extricate itself. From the perspective of operational means, the central bank changed its previous policy measures based on policy interest rate, and sought for more flexible monetary policy tools. Through the innovation of monetary policy tools, large quantities of government or private capital are injected into the market to inject large quantities of liquidity. The expected effect of deflation will make the expectation of a country's economic future become the real reality of the country's economy.

The face of economic difficulties, the Japanese government has implemented fiscal stimulus policies, expanding government expenditure. But this has little effect, and for days after the debt crisis foreshadowed. Therefore, the Japanese government began to change strategy, the implementation of a series of monetary policy, trying to save the Japanese economy out of recession. The specific content and operation as shown in table 3.

Table 3 A survey of Japanese monetary policy

| Monetary policy | Content |
|---|---|
| Zero interest rate policy | The interest rate of unsecured overnight borrowing fell to 0.03%. |
| First round of quantitative easing monetary policy | The intermediate target of monetary policy: money supply (original target is interest rate); operation objective: the current account balance of commercial banks in Japanese banks.<br>The Bank of Japan promises to continue to provide liquidity to the market and maintain core CPI stability above 0.<br>Vigorously promote the asset purchase plan. To buy long term bonds, temporary purchase of private securities, limit the amount of commercial banks to buy shares, small size of the purchase of asset backed securities and commercial paper. |
| Reopening the quantitative easing monetary policy | Reduce the unsecured overnight lending rate.<br>The Bank of Japan has an asset purchase plan. |

## 4. Conclusion

The exchange rate spillover effect exists in China, Japan and the United States in fiscal policy and monetary policy. Exchange rate coordination among countries requires coordination of macroeconomic policies among big powers. China, Japan and the United States should strengthen macroeconomic policy coordination. On the basis of reviewing the history of quantitative easing monetary policy in Japan, the basic theoretical model of monetary policy spillover effect is carded and discussed. Furthermore, through the establishment of a measurement model, the spillover effect of quantitative easing monetary policy on China's output has been examined, analyzed and studied. When the United States implements a tight monetary policy, it will promote the growth of China's output in the short term. The results of the impulse response in the long-term linear model and the nonlinear model are different. In the short term, the exchange rate appreciation spillover effect exists in the expansion of monetary policy in Japan and the United States.

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