

# The Security of China's Huge Foreign Exchange Reserves:

## An Analysis from the Perspective of Structural Optimization

Kai Shi, and Li Nie

**Abstract**—It is an important issue of improving the structure of foreign exchange reserves. We discuss the issue of foreign exchange reserves security from the perspective of structural optimization. For Chinese authorities, five aspects of adjustment mechanisms, namely currency composition optimization, assets scale adjustment, investment structure improvement, collaborative management between reserves and foreign debts and investment term structure rationalization, should be comprehensively used to mitigate risks accompanied by the continued accumulation of huge foreign exchange reserves.

**Keywords**—Foreign Exchange Reserves, Security, Structural Optimization

### I. Introduction

Through the reform and opening of three decade years, China has accumulated 3.6 trillion dollars foreign exchange reserves, ranking the first in the world. In the era of financial globalization and world economic integration, there will be three dimensions of risks. First, there is the risk from depreciation of the U.S. dollar. Since the RMB exchange rate reform began from 21 July, 2005, the cumulative depreciation of the U.S. dollar against the RMB has exceeded 20%, which means the loss of China's foreign exchange reserves existed in the form of the U.S. dollar assets is beyond 20%. Second, the risk of foreign exchange reserve investment grows bigger and bigger. As we all know, one of the priority aims of the foreign exchange reserves management is to avoid risks and to preserve and increase the value of foreign assets. Thus, it should only involve the relatively secure treasury bonds market, but not reach the highly risky stock market. While according to relevant reports, 20% of China foreign exchange reserves about 3760 billion dollars has been used to buy the secondary mortgage bonds of Fannie Mae and Freddie Mac.

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Dr. Kai Shi  
School of Economics, Northeast Normal University  
P.R. China

Li Nie  
Graduate School of Commerce and Management Administration, Hitotsubashi University  
Japan

If they cannot get the aid and supports from the U.S. government, this part of investments will become the direct loss of China foreign assets. Moreover, although the U.S. government starts the relief, much indirect influence due to the large fiscal deficits and the depreciation of the U.S. dollar strikes down the yields of the U.S. treasuries and erodes the investment of China's foreign exchange reserves heavily. Third, there is also the risk from the appreciation of RMB. Along with the appreciation, the price of exports in terms of U.S. dollars will rise while the price of imports in terms of Yuan will fall, and thus it will ruin the price competitiveness of China's external economy. After the break out of the Sub-prime Crisis and the RMB exchange rate reform, the pressure facing China's exports strengthens and the demand of exports plummets. At the same time, under the background of new international trade protectionism and RMB appreciation, the influx of hot money increases the risk of bubble economy intensively. It is really important to study the issue of structural optimization about China's foreign exchange reserves investment considering for the huge external risks that consist of 20% depreciation, 20% ill-health and 60% inefficiency.

### II. Previous Work

For the time beings, the relevant literatures about foreign exchange reserves structure concentrates on the currency structure especially the causes of current currency composition.

The consensus about the currency composition includes:

- a. The authorities should make the arrangements of the reserves currency composition according to the needs of international trade and external payments.
- b. The reserves currency composition should correspond to the external debts structure.
- c. The reserves currency composition should meet the needs of foreign exchange market intervention.
- d. It should be diversified of the foreign exchange reserves composition.
- e. The authorities should increase holdings of the currencies in up-trend and decrease holdings of those in downward trend.
- f. The authorities should amplify the proportion of the currencies with little fluctuations and reduce the more volatile currencies.

g. On the aspects of the liquidity composition of foreign assets, it is commonly accepted to hold adequate highly liquid assets in order to fulfil the transaction demands. The other foreign reserves should be composed of both liquidity and profitable assets reasonably so as to gain more returns as well as maintain liquidity.

Theoretically, the relevant studies about foreign exchange reserves composition can be divided into four categories: *Portfolio Theory*; *Heller-Knight model*; *Dooley model*; and *Strategy Management of Foreign Exchange Reserves*. Portfolio Theory obtains the optimal assets combination of different currencies through the comparativeness about risks and returns, that is, to find out the combination of the highest returns given the same risks, or get the combination of the least risks given the same returns. Heller-Knight model discussed the influence of exchange rate arrangement and trade payments on the reserves currency composition, from the perspective of functions and features of foreign exchange reserves. Apparently, Heller-Knight model is more realistic than the portfolio theory. It is implied in Dooley model that the transaction costs has bigger impacts on the currency allocations than the considerations of risks and benefits, and thus the mean-variance framework of portfolio theory should be abandoned while the econometric models based on the regression analysis should be utilized. Comparatively speaking, Dooley model is more complicated and more realistic than Heller-Knight model. The strategy management theory of foreign exchange reserves believes that the central bank should build up a strategy combination of different reserve assets to achieve the optimal management of foreign exchange reserves from three different dimensions.

Based on the above-mentioned theories, many scholars have done numerous empirical researches. Dooley (1987) demonstrates that the currency composition of foreign exchange reserves is mainly influenced by the transaction motives. Dooley *et al.* (1989) examines the determinants of the currency composition of foreign exchange reserves for both industrial and developing countries. They found the currency composition of reserves during the period 1976-1985 was influenced by each country's exchange rate arrangements, trade flows with reserve-currency countries, and the currency in which its debt service payments are denominated. Roger (1993) finds that the currency composition of foreign exchange reserves of the mainly industrial countries changes with the foreign exchange market intervention. Eichengreen and Matheson (2000) found the striking stability over time of the relationship between the demand for reserves denominated in different currencies and its principal determinants: trade flows, financial flows and currency pegs. This seems to illustrate the international monetary system is in a mode of gradual, continuous evolution, while not of rapid, discontinuous change. Song and Chen (2001) simulated the currency composition of China's foreign exchange reserves through a basket of currencies consisting of *SDR*. Elias *et al.* (2006) developed a dynamic mean-variance optimization framework with portfolio rebalancing costs to estimate optimal portfolio weights among the main international currencies. Through making various assumptions on expected returns and the variance-covariance structure, they assessed

how the euro changed the allocation and performed simulations for the optimal currency allocations of four largest emerging market countries including Brazil, Russia, India and China, adding constraints that reflect a central bank's desire to hold a sizable portion of its portfolio in the currencies of its peg, foreign debt and international trade. The main results show that: first, the optimizer can match the large share of the U.S. dollar in reserves, when choosing dollar as the reference currency; second, the optimum portfolio shows a much lower weight for the euro than is observed; third, growth in issuance of euro-denominated securities, a rise in euro zone trade with key emerging markets, and increased use of the euro as a currency peg, would all work towards raising the optimal euro shares, with the last factor being quantitatively the most important.

Considering the unique characteristics of China's foreign exchange reserves management, we insist that the optimization of foreign exchange reserves includes not only the optimization of currency composition and assets allocation but also the improvement of investment scale, investment structure and time term structure as well as collaborative optimization between reserve structure and external debts in order to avoid the risks implied in huge foreign exchange reserves. Besides, the optimization and combination of different adjustment mechanisms, appropriate scale range of foreign exchange reserves as well as a series of optimization index should be investigated as quickly and carefully as possible.

### III. Security Issues facing China's Foreign Exchange Reserve and Solutions

The intrinsic issue of reserve security is the optimization of foreign exchange reserves composition in essence. It is of importance to keep the reserves in the optimal composition status in general and to adjust towards the optimal status whenever needed, in order to make sure the national foreign exchange reserves security under the float exchange rate system and complicated international economic conditions. We believe that it is better to study this from the following five different aspects about structural optimization and adjustment mechanisms.

#### A. The Currency Composition of Foreign Exchange Reserves and Its Optimization

Different from the dominance of U.S. dollars under the Bretton Woods system, current international currency reserves which consist of the U.S. dollar, euro, pound sterling and yen are diversified in essence. According to estimates, the U.S. dollar predominates and accounts for about 60-70%; euro is about 20-30%; pound sterling and yen together occupy other 10%. Besides, the shares of other strong currencies are relatively less. The shares of different currencies change with the fluctuations of the values of currencies. Generally

speaking, foreign exchange rate is the ratio of the exchange values of different currencies. One kind of currency appreciating means the other kind of currency depreciating. From the perspective of the ratio of different currency values, due to the simultaneous existing of both currency appreciating and depreciating during the transactions of foreign exchange market, it is the optimization of reserve currency composition that makes the value of national foreign exchange reserves stable. This kind of stability is accomplished by the offset of the relative change of reserve currency values. In the meanwhile, it is done that the authorities complete the maintenance and increase of the reserves. For this purpose, the following issues should be studied carefully:

First, how to determine reasonable composition of China's foreign exchange reserves and the proportioning of soft and hard currencies. In this stage, it is noticeable to make the arrangement for the composition of China's foreign exchange reserves consulting to the constitution of *SDR*.

Second, the system of optimal adjustments according to the change of reserve currency values should be built up.

### **B. The Appropriate Scale of China's Foreign Exchange Reserves and Its Adjustment**

Foreign exchange reserves have the functions of keeping external purchasing power, enhancing outside investment, providing financing guarantee, maintaining the stability of domestic currency and so on. Without adequate reserves, those functions will not play well. However, it is not better either to accumulate reserves as much as possible. Too many reserves will put pressures on domestic monetary policy and national foreign exchange policy; form the expectations about the appreciation; and ruin the price competitiveness of exports. Furthermore, it will induce the trade protectionism and trade war, causing trade friction. Moreover, too many reserves will also influence the efficiency of funds and squeeze the funds for production and construction. More importantly, it will cause the influx of hot money and thus form the inflationary pressures. Inappropriate foreign exchange reserves will influence the health of domestic economy. Thus, either too many reserves or inadequate reserves are not favorable.

It is worthy of studying that what are the appropriate scale and optimal structure of national foreign exchange reserves. Although there is lots of research about relevant topics, they are still immature econometric frameworks without considering the characteristics of different countries and the differential developing stage that each nation stays in. From the perspective of domestic currency stability, the optimization of foreign exchange reserves should refrain from the excessive appreciation and depreciation of domestic currency. From the perspective of economic growth, the standard of optimal management should be promoting economic growth and increasing employments. In addition, from the perspective of balanced development of internal and external economy, the economic imbalance should be avoided.

### **C. The Optimization about Reserve Investment Structure**

The product mix of reserves investment and currency composition constitute the major parts of the investment mix of foreign exchange reserves. The former aims to influence investment earnings; the later avoids the depreciation risk through the combinations of soft and hard currencies. The objective of holding adequate foreign exchange reserves is to take full use of external resources for domestic economic entities, to provide the assurance for the stability of domestic currency, and to promote economic growth. These functions imply that the main purpose of holding foreign exchange reserves investment is to keep the value of reserves stable, but not to gain extra risky profits. Thus, the reserves investment should not involve high-risk fields, such as venture capital, stock and subordinated bonds. We insist that most of the reserves which amounts about 90% even 100% should be invested on the fully mobile and relatively secure national bonds. Even that there is high possibility of great risky profits, only a small part of the reserves could be spent on the risky assets. It is no doubt that this kind of investment should still focus on the maintenance and increase of foreign exchange reserves. It is clearly unwise to spend 1/5 of the reserves on buying the bonds of Fannie Mae and Freddie Mac.

### **D. The Optimization accommodating to Foreign Debts Structure**

Foreign exchange reserves are viewed as the fundamental of foreign payments and international credits. Adequate foreign exchange reserves guarantee that the external funding could be used sufficiently. Inadequate reserves mean the decline of external financing capacity which may even cause the debt crisis, while excessive reserves imply inefficient use of foreign exchange resources. In one hand, lots of RMB equivalents to official foreign exchange reserves holdings add the risks of currency mismatch implied in the balance sheet of People's Bank of China. On the other hand, too few foreign debts are not conducive to making full use of international capitals and not helpful for offsetting the depreciation loss of foreign exchange reserves, if the appreciation of domestic currencies happens. For these reasons, determining the appropriate scale of foreign exchange reserves related to foreign debts and the optimal ratios among different reserve currencies are the very important key points. As of March, 2010, the foreign debts of China amount to 4432.36 billion dollars, increasing by 3.4% compared to those at the end of last year. The ratio of foreign debts against foreign exchange reserves is about 18.11%. Although it has increased compared to the ratio of 10.81% at the end of 2009, it is still significantly lower than the international security warning line of 100%. Apparently, China's foreign debts are in the absolutely secure status, but this is unable to offset the depreciation loss of foreign exchange reserves, obviously.



### E. *The Optimization about Investment Term Structure*

The term structure of foreign exchange reserves investment is also one of the most important mechanisms to keep reserves safe. In practice, for the purpose of avoiding the mismatch and reducing the uncertainty of reserve security, the term structure should be adjusted according to the changes of foreign debts structure, in order to match the holdings of long-term and short-run U.S. government bonds with the compositions of national foreign debts. Considering those loss from the RMB appreciation and the U.S. dollar depreciation, the increase of long-term foreign assets denominated in the U.S. dollar could not only withstand the investment loss but also make full use of the external resources. Moreover, the maturity time of foreign debts should be more reasonable, to avoid the risks of over-concentration about the needs of foreign debts payments. For this reason, an integrated framework of Asset-Liability Management relating to foreign reserves and external will be a powerful analysis tool.

### F. *The Integrated Use of Various Adjustment Mechanisms*

Based on the above-mentioned five adjustment mechanisms, it is necessary to investigate the integrated use of them. In addition, it is helpful to build up the indicator system of structural optimization about foreign exchange reserves to strengthen the management and mitigate risks.

### G. *The External Adjustment Mechanism of Structural Optimization*

It is not far enough to make adjustments only according to the plan of structural optimization discussed previously. Comprehensive security strategy and plan are still necessary. For the time beings, it is necessary to do such following works carefully: accelerating the transformation of the pattern of economic development and economic restructuring; promoting the internationalization of RMB gradually; participating in the international monetary system reform actively; coordinating the domestic and external economic development.

## iv. **Concluding Remarks**

It is no doubt that the issue of foreign exchange reserves security is really important for both developing and industrial countries in modern open economics. Foreign reserve is more than a buffer who maintains necessary imports and productivity in short term. As we have discussed above, at least five aspects of adjustment mechanisms, namely currency composition optimization, assets scale adjustment, investment structure improvement, collaborative management between reserves and foreign debts and investment term structure rationalization, should be comprehensively studied to ensure the national exchange reserves security. Anyhow, the issue of structural optimization is of importance to foreign exchange reserves management.

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### About Author (s):



Dr. Kai Shi is a Finance Lecturer at School of Economics, Northeast Normal University. He is also a Scientific and Technical Committee & Editorial Review Board Member of World Academy of Science, Engineering and Technology; a member of the editor board of *Journal of Business and Economic Management* and a reviewer for a number of peer-reviewed EconLit journals.



Miss Li Nie is a PhD candidate at Graduate School of Commerce and Management Administration, Hitotsubashi University. Her research interests lie in quantitative and empirical finance. Recently, she pays special attention to the issue of China foreign exchange reserve management.