
The Size and the Main Determinants of China's Official Currency Reserves in the Period 1990-2019

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Abstract:

Purpose: This paper aims to analyze the size of China's Central Bank's foreign exchange reserves and the main determinants of changes in China's foreign reserves. The publication attempts to prove two theses. According to the first thesis, the current foreign exchange reserves level in China has been higher than the optimal level suggested by the foreign exchange reserves adequacy ratios. However, in line with the second thesis, the most important factors determining China's foreign exchange reserves were changes in the value of imports and changes in the level of China's short-term foreign debt.

Design/Methodology/Approach: The study uses a research method based on literature studies in the field of banking and international finance and econometric methods (the classic least squares method). The selection of these research methods and their use are elements of the author's approach to the problem of the optimal level of foreign exchange reserves in China.

Findings: Research revealed that for almost the entire period 1990-2019, the value of China's foreign exchange reserves was higher than the optimal values, as suggested by the adequacy ratios of currency reserves. The exceptions were the ratio of the optimal level of foreign exchange reserves, calculated as 20% of the M2 money supply, and the ratio calculated by the IMF methodology for countries with constant exchange rates. China's relatively high foreign exchange reserves were adequately hedged against the possible effects of economic crises, while the relatively high level of these reserves led to their low profitability. The analysis results indicated that changes in the value of China's foreign exchange reserves were, to the greatest extent, determined by the inflow of foreign direct investment and changes in import expenditure.

Practical Implications: The discussion on the accumulation of foreign reserves should have practical implications and be set to eliminate threats, not to individual economies but to maintain global financial stability in the world. On the other hand, the currency reserves adequacy indicators themselves should be used flexibly and should reflect individual countries' economic specificities.

Originality: So far, no such comprehensive research has been carried out on the magnitude and determinants of China's foreign reserves changes. What is more, the analysis covers a long period of research (1990-2019) and is based on the proprietary model, estimated with the use of econometric tools.

Keywords: Foreign exchange reserves, macroeconomic stability central bank.

JEL Codes: B22, E58, F31.

Paper Type: Research article.

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1. Introduction

The dynamic growth of the official currency reserves in the last dozen or so years has contributed to the increased interest in the optimal level of currency reserves and their possible impact on the economy. According to the current definition of the International Monetary Fund (IMF), foreign exchange reserves are all official reserve assets constituting liquid foreign currency assets that remain at the disposal of a country's monetary authority. Thus, according to this definition, a country's foreign reserves include special Drawing Rights (SDR), reserve position in the IMF, and assets denominated in foreign currencies (cash, bank deposits, government financial instruments, bills and bonds, money market instruments, derivative financial instruments, equity securities, and other assets) (IMF, 1993).

The purpose of this study is to analyze the size of the Chinese central bank's foreign exchange reserves and the main factors determining changes in the level of foreign reserves in China. The publication attempts to prove two theses. According to the first thesis, the current foreign exchange reserves level in China has been higher than the optimal level suggested by the foreign exchange reserves adequacy ratios. However, in line with the second thesis, the most important factors determining China's foreign exchange reserves were changes in the value of imports and changes in the level of China's short-term foreign debt. The study uses a research method based on literature studies in the field of banking and international finance and econometric methods (the classic least squares method). The selection of these research methods and their use are elements of the author's approach to the problem of the optimal level of foreign exchange reserves in China. All statistical data used in the study had an annual frequency, covered the period from 1990 to 2019, and came from the World Bank's statistical database - World Development Indicators (WDI).

2. The Essence and Reasons for Having Foreign Currency Reserves

As defined by the IMF, "reserve assets consist of those external assets that are readily available and controlled by a country's monetary authorities in order to finance a country's payment imbalance directly, to indirectly regulate the extent of the imbalance through foreign exchange interventions affecting the exchange rate and (or) used for other purposes" (IMF, 1993). The central bank's foreign exchange reserves' purpose is to guarantee the credibility and financial stability of a country, including its financial liquidity and the security of foreign exchange transactions. The size and structure of foreign exchange reserves should also guarantee the possibility of conducting an effective monetary and exchange rate policy in the country (Tingting and Jiajie, 2020; Carstina *et al.*, 2015; Thalassinos *et al.*, 2015).

There is no clear answer to which institution (government or central bank) should hold national foreign reserves. For most countries, the central bank owns foreign exchange reserves; that is, they are recorded on the balance sheet of the central bank, and the country's monetary authorities make the final management decisions. At the same time, there is a group of countries, incl. The government makes United States,

United Kingdom, Japan, where the government formally owns foreign exchange reserves and their management's final decisions. However, regardless of who owns the foreign exchange reserves, they are almost always managed by the country's central bank as owner or as an agent where the state owns them. An exception to this rule may be when the foreign exchange reserves are fully or partially managed as an investment fund or a fund for future generations. In this case, foreign exchange reserve owners generally want to be managed by a specialized financial institution (Thalassinos and Kiriazidis, 2003). However, no matter who manages a country's foreign reserves, they are treated on an equal footing by the IMF (Nugée, 2000).

Economic literature distinguishes several basic goals for central banks to maintain foreign exchange reserves. First, foreign exchange reserves are held to support the domestic currency formally. This is a very traditional motive for holding reserves, especially gold reserves. This type of use of reserves was common during the gold currency system's functioning and in the Bretton Woods currency system. After the collapse of the Bretton Woods system, central bank holding of gold reserves became less common, although gold as formal collateral for the national currency has never completely disappeared. At the same time, with the Bretton Woods monetary system's termination, the use of foreign currency reserves by the monetary authorities has increased to guarantee confidence in national currencies. Second, foreign exchange reserves are used by central banks as tools of monetary and exchange rate policy. This is most evident in those countries with fixed exchange rate systems. Moreover, even countries with floating exchange rate systems may use foreign exchange reserves to intervene in the foreign exchange market when the market rate significantly deviates from the long-run equilibrium rate (Moses *et al.*, 2015). Third, the central bank's foreign reserves can protect against threats or catastrophe by using the reserves as a fund to finance economic recovery and reconstruction. This use of foreign exchange reserves can be essential for small countries that are not large enough to guarantee an adequate security level. Fourth, a central bank's foreign exchange reserves can be used as an investment fund primarily for financial gain.

However, this factor may constitute an important premise for holding foreign exchange reserves only for some countries, as obtaining financial benefits from foreign exchange reserves may only constitute a kind of "side effect" for most economies. Analyzes carried out among the IMF member states indicate that over 80% of the surveyed countries create foreign exchange reserves to secure liquidity in the event of crises. 60% of the analyzed countries also indicate that the purpose of creating foreign exchange reserves is to limit the volatility of the exchange rate (IMF, 2011). The literature on the subject indicates that the primary goal of managing the central bank's foreign exchange reserves is to maximize the long-term profitability of foreign exchange reserves within the acceptable level of financial risk. The central bank's foreign exchange reserves management should be an ongoing process, requiring active adjustment of the central bank to the changing market and institutional conditions.

Sometimes the country's monetary authorities, to simultaneously guarantee adequate liquidity and profitability of the country's foreign exchange reserves, create special investment funds to achieve optimal profitability of the funds held (Norway, Korea, Singapore). Central banks sometimes solve this problem by simply breaking down their foreign exchange reserves into smaller parts (tranches), i.e., a liquid tranche and an investment (Chile). Each of these tranches is managed separately to meet specific priorities. The country's monetary authority has three potential options for increasing liquidity and ensuring the economy's long-term solvency. The first way is to reduce a country's short-term foreign liabilities, the second way is to increase the accumulation of foreign exchange reserves, and the third option is to secure an external credit line that can be used in the event of certain threats (Rodrik, 2006).

In the last two decades, especially emerging economies have accumulated large international reserves. The pooling of reserves helped ease consumption during the 2007 global financial crisis and allowed some countries to manage large outflows without a costly crisis (IMF, 2011). Maintaining an appropriate level of foreign reserves is treated as one of the main indicators of the country's economic stability in the eyes of local and foreign financial institutions, enterprises, households, and rating agencies. Increasing the size of the domestic foreign exchange reserves thus increases the country's economic authorities' ability to cope with the existing economic, financial, and political shocks. The large size of the domestic foreign exchange reserves also contributes to reducing interest rates on foreign currency loans.

Thus, the appropriate level of foreign exchange reserves is an important factor in determining the degree of a country's credibility in dealing with non-economic shocks (Bank of Israel, 2011). Determining the optimal level of foreign exchange reserves is not an easy task. In this study, the optimal level of foreign exchange reserves is defined as the level that guarantees the achievement of the objectives for which foreign exchange reserves are held while ensuring optimal reserve maintenance costs, security, liquidity, and financial stability of the country. The optimal level of foreign exchange reserves determined in this way is consistent with the definitions of optimal foreign exchange reserves quoted in domestic and foreign literature on the subject (Szpringer, 2005).

The optimal level of foreign exchange reserves is determined by equating marginal benefits and costs resulting from the reserves held. The benefits of having foreign currency reserves include a decrease in the risk of a financial crisis and the costs include the need to sterilize foreign exchange reserves.

The optimal level of a country's foreign reserves depends on the country's exchange rate system. In the fixed exchange rate system, the central bank is obliged to stabilize the exchange rate of its own currency against a foreign currency or a set basket of currencies. Therefore, the level of foreign exchange reserves significantly determines the country's creditworthiness. Hence, in the system of fixed exchange rates, the monetary authorities are required to have a higher level of foreign exchange reserves than in the system of floating exchange rates because in the system of floating

exchange rates, foreign exchange interventions are not carried out at all, or they are made relatively rarely (Szpringer, 2005).

However, in a floating exchange rate regime, a country's foreign reserves are often used to ensure adequate liquidity in the market in crisis times, not to lose confidence in the domestic market by foreign investors. The optimal level of a country's foreign reserves also depends on several other factors, including the size of a central bank's balance sheet, the opportunity costs of maintaining an unsecured portfolio of foreign assets, the relative depth of domestic and foreign currency markets, the size and openness of the domestic economy, and the extent to which the domestic economy is dependent. from external short-term financing sources.

The optimal level of foreign exchange reserves is determined using various methods, ranging from heuristic methods to regression analysis and ending with optimization models. Traditional or heuristic methods of determining the optimal level of foreign exchange reserves relate the number of reserves to potential imbalances in the balance of payments. However, the optimal levels of countries' foreign reserves so determined were developed only for countries with fixed or managed floating exchange rate systems (De Beaufort *et al.*, 2001). The most common way to determine the optimal level of a country's foreign exchange reserves is to make these reserves dependent on the value of imported goods and services (Triffin, 1947). Namely, according to the so-called As a rule of thumb, the country's monetary authorities are required to hold foreign exchange reserves of at least the value of three-month imports. Thus, this method of measuring the optimal level of reserves makes the level of foreign exchange reserves dependent on the size and degree of openness of a country's economy.

$$Ra = \frac{Rs}{M} \quad (1)$$

where:

Ra - the optimal level of foreign exchange reserves;

Rs - the level of foreign exchange reserves;

M - import expenses.

However, according to the so-called as a rule of Greenspan-Guidotti, the level of a country's foreign reserves should fully cover the total, short-term foreign debt of the country (Greenspan, 1999).

$$Ra = \frac{Rs}{M} + Dt \quad (2)$$

where:

Dt - short-term foreign debt of the country.

An alternative way to determine the optimal level of a country's foreign reserves focuses on the relationship between foreign reserves and the financial sector. Thus, according to this approach, the level of a country's foreign reserves depends on monetary aggregates such as, for example, the monetary base (Kaminsky, 1999). In

this case, the ratio of the country's foreign exchange reserves to the M2 monetary aggregate should be between 5% and 20%.

$$Ra = \frac{Rs}{M2} \quad (3)$$

where:

M2 - money aggregate M2.

On the other hand, according to the concept of S. G. Shcherbakov, three variables can be distinguished that significantly determine the level of the country's optimal foreign exchange reserves, namely import liabilities, the value of a country's short-term foreign debt and the size of the monetary base (Shcherbakov, 2002).

$$Ra = M + Dt + M2 \quad (4)$$

In turn, in his empirical research, S. Zeng stated that the demand for foreign exchange reserves should be related to the size of imports, the level of a country's foreign debt, and the inflow of foreign direct investment (Zeng, 2012). Therefore, the optimal level of the country's foreign reserves can be presented as the following expression:

$$Ra = M + D + FDI \quad (5)$$

where:

D - country's foreign debt;

FDI - inflow of foreign direct investment.

The IMF proposed new measures of the optimal level of foreign exchange reserves, called risk-weighted metrics. This metric is constructed based on the estimated relative riskiness of different potential drains on reserves. The distributions are estimated separately for fixed and floating exchange rate regimes. The benchmark requires reserves coverage in the range of 100% – 150% of the metric (Jovanovikj *et al.*, 2017). The construction of the benchmark is following:

Fixed exchange rate regime:

$$Ra = 0,3 * Dt + 0,15 * PL + 0,1 * M2 + 0,1 * X \quad (6)$$

Floating exchange rate regime:

$$Ra = 0,3 * Dt + 0,1 * PL + 0,05 * M2 + 0,05 * X \quad (7)$$

where:

X - receipts from export;

PL - foreign portfolio liabilities (equity liabilities).

The country should maintain foreign exchange reserves at the level determined by the possibilities of using them in an economic shock. Thus, the amount of foreign exchange reserves, in this case, depends both on the value of monthly import expenses and the value of capital flows (Bank of Israel, 2011). Research carried out by the IMF has confirmed that nearly half of the analyzed IMF member countries determine the optimal level of foreign exchange reserves about the volume of imports. On the other hand, about 40% of the surveyed countries define foreign exchange reserves as short-term foreign debt (IMF, 2011).

At the same time, it should be clearly emphasized that in practice there is no universal method of calculating the optimal level of a country's foreign exchange reserves. These methods have certain advantages, but they are also not without disadvantages. Therefore, in practice, various, often alternative methods are used to measure the optimal level of a country's foreign reserves.

3. Optimal Currency Reserves in the Light of the Results of Selected Empirical Analyzes

During the Great Economic Crisis in the 1930s, J.M. Keynes recommended using foreign reserves to mitigate the country's exposure to external shocks. Moreover, he called on world leaders to create a common international settlement system in which the main source of liquidity would be currency reserves linked to the value of trade turnover. This view was additionally supported by R. Triffin, who argued that the demand for foreign exchange reserves was linearly related to the increase in foreign trade turnover and recommended the use of the reserve adequacy index, making the value of a country's foreign exchange reserves dependent on the value of domestic imports (Triffin, 1947). The analysis carried out by the IMF indicated that the adequacy of foreign exchange reserves was related to the international credit system, the existing exchange rate regime, the nature of the monetary and fiscal policy pursued, the objectives of economic policy, and the level of economic development of the country.

The research results indicated that foreign trade is the largest item in the balance of payments, and therefore the number of foreign exchange reserves should depend on the size of foreign trade turnover. Analyzes conducted by H. Grubel suggested that the country's foreign exchange reserves' optimal level is determined by the quantitative theory of money (Grubel, 1971). Namely, since households and enterprises demand money to meet their obligations as measured by the value of national income, the government likewise reports demand for money to meet its obligations as measured by the value of domestic imports. Although the above analogy does not seem to be perfect, the ratio of the adequacy of foreign exchange reserves, which makes their value depends on imports, is still considered in the contemporary discussion on the optimal level of a country's foreign exchange reserves. J. Boorman and S. Ingves also suggested that the value of foreign exchange reserves should be at a level sufficient to repay three or four-month import liabilities (Boorman and Ingves, 2001).

On the other hand, R. Heller analyzed the necessary level of foreign exchange reserves in rational optimization of decisions. In his opinion, the optimal level of foreign exchange reserves is determined by the point at which the marginal utility of holding foreign exchange reserves is equal to the marginal cost of holding foreign exchange reserves. R. Heller also argued that his approach leads to the construction of a more reliable and consistent ratio of the adequacy of foreign exchange reserves than the indicators which make the number of foreign exchange reserves dependent on the value of imports (Heller, 1966). A. Greenspan proposed a different approach to the calculation of the optimal level of foreign exchange reserves. In line with his suggestion, the level of the country's foreign exchange reserves should depend on the value of the country's short-term debt (with maturities of less than one year). In his opinion, when calculating the level of foreign exchange reserves, one should also take into account the growing importance of international capital flows to emerging economies. A. Greenspan argued his position with the necessity to build appropriate trust among global creditors (Greenspan, 1999).

The research results carried out by Calvo, Izquierdo, Loo-Kung (2012) pointed out that on the eve of the global financial crisis, the level of world currency reserves was generally close to the optimal levels but significantly diversified geographically. Namely, in Latin America, the volume of foreign exchange reserves was closest to the optimal level, while the level of foreign exchange reserves in Eastern Europe was below their optimal level and in Asia above the optimal level. The authors of the analysis also suggested that the observed differences between countries in foreign reserves levels can be partly explained by the different perceptions of monetary authorities as a lender of last resort (Calvo *et al.*, 2012).

The research conducted by Bussiere, Cheng, Chinn, and Lisack (2013) on a group of 175 countries revealed the existence of a positive and significant impact of foreign exchange reserves of countries accumulated before the financial crisis of 2008-2009 on the real GDP growth rate during the financial crisis. The research results also confirmed that the foreign exchange reserves acted as a kind of buffer during economic crises.

Moreover, countries that had accumulated relatively high foreign exchange reserves before the financial crisis actively used them to defend the national currency against devaluation, finance domestic companies that experienced credit problems, and guarantee the country's solvency. Thus, the analysis results revealed that foreign exchange reserves could be used as a buffer to minimize the crisis's possible effects and be used as an active instrument supporting economic growth during the crisis (Bussiere *et al.*, 2013).

Also, research by K.M.E. Dominguez out of a group of 68 countries in the period 2000-2010 indicated that foreign exchange reserves played an important role in crisis management during the recent global economic crisis. While the overall level of foreign exchange reserves in most countries surveyed remained stable throughout the crisis, after adjusting these reserves for interest income and changing the way they

are valued, many emerging economies have significantly reduced their reserves. Moreover, the research results revealed that countries that, before the global economic crisis, had excessive foreign exchange reserves about the optimal values were more prone to actively use these reserves during the crisis (Dominguez, 2012).

4. The Optimal Level of Foreign Exchange Reserves in China and Main Determinants

The economic literature uses many different econometric models with the help of which attempts are made to estimate the influence of the main factors determining the level of foreign exchange reserves in selected countries. In this article, in order to analyze the optimal level of foreign exchange reserves in China and their main determinants, the model represented by the following equation was used:

$$Rs_t = c(1) + c(2) \cdot M2_t + c(3) \cdot FDI_t + c(4) \cdot M_t + c(5) \cdot Dt_t + \mu_t \quad (8)$$

where:

c (1) - constant term of the equation;

c (2)... c (5) - elasticity coefficients;

t - analysis period;

μ - random component.

The all-time series used in the above model had an annual frequency and covered the period from 1990 to 2019. Ultimately, the changes in the model's indicators were presented in the period shown in Figure 1.

The correlation coefficients calculated based on the above data between changes in the value of foreign exchange reserves and the M2 monetary aggregate, the inflow of foreign direct investment, import expenditure, and short-term foreign debt in China in 1990-2019 were at a relatively high level, which indicated a significant and positive linear between the studied variables. The highest value of the correlation coefficient was found between changes in foreign exchange reserves and import expenses. On the other hand, the lowest value of the linear dependence coefficient was found between changes in currency reserves and money supply, measured with the M2 aggregate (Table 1).

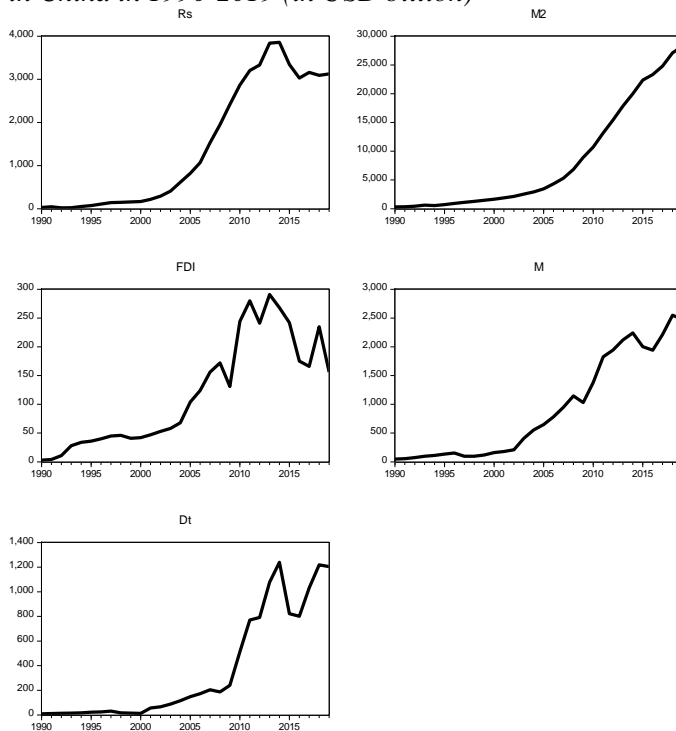
Table 1. Linear correlation coefficients for observations from the 1990-2019 sample

	Rs	M2	FDI	M	Dt
Rs	1	0.91	0.95	0.97	0.93
M2	0.91	1	0.80	0.97	0.96
FDI	0.95	0.80	1	0.91	0.85
M	0.97	0.97	0.91	1	0.97
Dt	0.93	0.96	0.85	0.97	1

* Critical value (for two-sided 5% critical area) = 0.4227 for n = 30

Source: Own calculations.

Figure 1. Changes in foreign exchange reserves, the M2 monetary aggregate, the inflow of foreign direct investment, import expenditure and short-term external debt in China in 1990-2019 (in USD billion)



Source: World Development Indicators (WDI), World Bank, Washington, 2020.

However, concluding the cause-and-effect relationships only based on a simple correlation analysis is incorrect, because in this case, for example, shocks in the economic policy are not distinguished from the effects of changes in the business cycle (Rybiński, 2007). Hence, an overly simplified analysis and incorrect from a methodological point of view could rather indicate a reverse relationship than suggested by the theory of economics. Therefore, the Granger causality test was performed first, the results of which are presented in the table below (Table 2).

Table 2. Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
M2 does not Granger Cause Rs	28	0.15386	0.8583
FDI does not Granger Cause Rs	28	0.75290	0.4823
M does not Granger Cause Rs	28	0.54888	0.5850
Dt does not Granger Cause Rs	28	4.38853	0.0243

Note: Lags 2.

Source: Own calculations.

The Granger causality test results showed that there were significant, one-way relationships between money supply and foreign exchange reserves, between inflow of foreign direct investments and foreign exchange reserves, and between import

expenses and foreign exchange reserves. On the other hand, the null hypothesis concerning the lack of short-term foreign debt impact on foreign exchange reserves was confirmed. Then, the model (6) was estimated using the classic least squares method. The results of the model estimation are presented in the table below (Table 3).

Table 3. Estimation results of equation (8) using Ordinary Least Squares

Dependent Variable: RS				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-223.6455	73.29613	-3.051259	0.0051
C(3)	6.584405	1.151556	5.717832	0.0000
C(4)	0.955795	0.120518	7.930711	0.0000
R-squared	0.973954	Mean dependent var		1437.867
Adjusted R-squared	0.972024	S.D. dependent var		1455.754
S.E. of regression	243.4883	Akaike info criterion		13.92265
Sum squared resid	1600737	Schwarz criterion		14.06277
Log likelihood	-205.8398	Hannan-Quinn criter.		13.96748
F-statistic	504.8075	Durbin-Watson stat		1.579596
Prob(F-statistic)	0.000000			

Source: Own study.

After estimating the model (8) with the use of OLS, it turned out that two independent variables of the model were statistically significant (the inflow of foreign direct investment and import expenses), and the next two independent variables were statistically insignificant, which resulted in the removal of these variables from the model. Ultimately, as shown in the table above, changes in China's foreign exchange reserves' value were determined by the inflow of foreign direct investment and changes in import spending. In addition to indicating the main factors determining changes in the value of foreign exchange reserves in China in the period 1990-2019, the table below shows the development of selected indicators of relative foreign exchange reserves in China in the analyzed period (Table 4).

Table 4. Selected relative ratios of China's foreign exchange reserves in the period 1990-2019

Period	M2 money supply / foreign exchange reserves (in%)	Foreign exchange reserves expressed in months of import	FDI inflow / foreign exchange reserves (in%)	Short-term debt / currency reserves (in%)
1990	1023	1,6	10	30
1991	793	1,2	9,1	25
1992	2100	3,5	52,4	66,7
1993	2814	4,5	127,3	68,2
1994	1026	2,1	64,2	32,1
1995	969	1,8	48	29,3
1996	855	1,4	37,4	23,4
1997	775	0,7	31,5	21,7
1998	856	0,7	30,9	11,4

1999	925	0,8	25,9	9,5
2000	977	1	25	7,7
2001	875	0,8	21,8	25,9
2002	735	0,7	18,2	22,7
2003	625	1	14,2	21,6
2004	477	0,9	11,1	18,9
2005	420	0,8	12,7	18
2006	406	0,7	11,6	16,2
2007	347	0,6	10,2	13,3
2008	351	0,6	8,8	9,6
2009	370	0,4	5,4	10
2010	374	0,5	8,5	17,9
2011	411	0,6	8,7	24,1
2012	463	0,6	7,2	23,8
2013	465	0,6	7,6	28
2014	518	0,6	6,9	32,1
2015	668	0,6	7,2	24,6
2016	770	0,6	5,8	26,4
2017	785	0,7	5,3	32,6
2018	876	0,8	7,6	39,4
2019	904	0,8	5	38,5

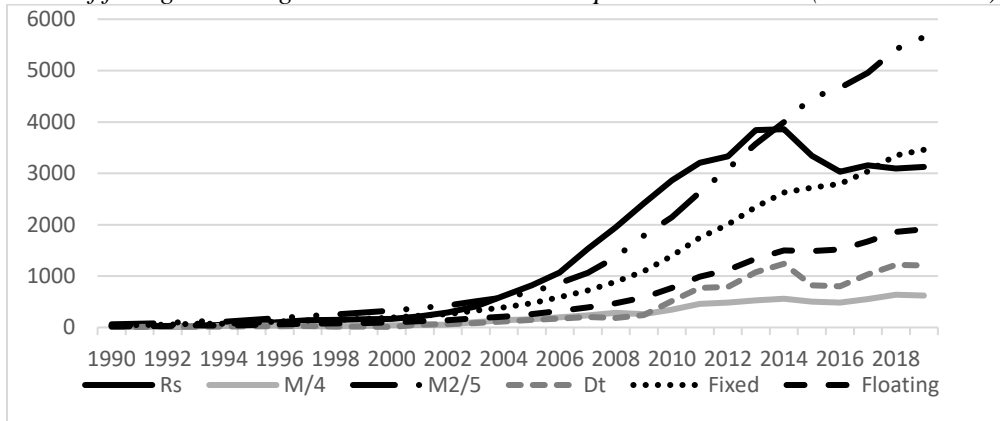
Source: World Development Indicators (WDI), World Bank, Washington, 2020.

The calculated relative ratios of the foreign exchange reserves in China showed that the value of foreign exchange reserves was relatively stable against the M2 monetary aggregate, the value of imports, and short-term external debt, but only since 1994. In turn, until the end of 1993, a dynamic increase in China's relative foreign exchange reserve ratios was observed, followed by a sharp drop in them in 1994. This situation resulted from the dynamic increase in the value of the foreign exchange reserves of the Chinese central bank, which resulted from China's growing expansion on the international market and following, including increasing financial revenues from trade and service trade. On the other hand, the share of the inflow of foreign direct investment about China's foreign exchange reserves' value decreased sharply in 1994 and then fluctuated significantly until the end of the analyzed period. On the other hand, the next figure shows the development of the Chinese foreign exchange reserve adequacy ratios in the period 1990-2019 to determine the optimality level of the foreign exchange reserves in the Chinese economy (Figure 2).

Considering the development of China's foreign exchange reserve adequacy ratios in the period 1990-2019, it can be seen that from 2004 to 2014, the value of China's foreign exchange reserves was higher than the optimal (adequate) values suggested by all the analyzed reserve adequacy ratios. On the other hand, in the remaining periods, i.e., from 1990 to 2003 and 2015 to 2019, the reserve optimality ratio, calculated as 20% of the M2 money supply, was higher than the actual foreign exchange reserves of the Chinese central bank. A similar situation took place about the ratio of optimal foreign exchange reserves, calculated by the International Monetary Fund's methodology for countries with constant exchange rates. Since

2017, China's foreign reserves have been below the value suggested by the IMF. In the case of the remaining optimality indicators of currency reserves, relating to countries with a floating exchange rate, the 3-month value of imports, and the value of short-term foreign debt, it can be noticed that the level of China's currency reserves exceeded the optimal values of reserves determined by the above-mentioned indicators several times.

Figure 2. Indicators of the adequacy of foreign exchange reserves and the actual value of foreign exchange reserves in China in the period 1990-2019 (in USD billion)



Source: World Development Indicators (WDI), World Bank, Washington, 2020.

On the one hand, this situation could prove that the Chinese economy was properly secured against the possible effects of financial and economic crises. On the other hand, too high foreign exchange reserves could impact the low profitability of these reserves and could also cause the risk of abuse and, consequently, increase the country's macroeconomic risk.

Moreover, the large number of foreign exchange reserves forced China's central bank to expand the money supply passively, thereby increasing inflationary pressure and making it difficult for the central bank to implement monetary policy. Therefore, in this historical period in which China has enormous foreign reserves, the country should take full advantage of foreign exchange reserves' role in maintaining financial security (Guangyou, *et al.*, 2018).

5. Conclusions

In economic theory and economic practice, many different indicators reflect different aspects of a country's need for foreign exchange reserves. However, the use of each of the indicators separately to determine the optimal level of foreign reserves may be limited, so all indicators should be taken together when determining a country's foreign reserve needs. The author's research carried out in this paper revealed that almost throughout the entire 1990-2019 period, the value of China's foreign exchange reserves was higher than the optimal values suggested by the foreign exchange

reserve adequacy ratios. The exceptions were the ratio of the optimal level of foreign exchange reserves, calculated as 20% of the M2 money supply, and the ratio calculated by the IMF methodology for countries with constant exchange rates. In this case, the levels of optimal foreign exchange reserves were in some years of the analyzed period higher than the Chinese central bank's actual foreign exchange reserves.

Nevertheless, China's relatively high foreign exchange reserves were adequately shielded from the possible effects of economic crises, while the relatively high level of these reserves led to their low profitability. Moreover, the conducted analysis results indicated that changes in the value of foreign exchange reserves in China were determined to the greatest extent by the inflow of foreign direct investment and changes in import expenditure. The research results are largely consistent with the results of analyses carried out by the IMF, which confirmed that about 50% of the IMF member states determine the optimal level of foreign exchange reserves about the value of imports and the value of the country's short-term foreign debt. It should also be emphasized that the ongoing discussion on the accumulation of foreign exchange reserves should be set in the context of eliminating threats, not to individual economies, but to maintain global financial stability in the world. On the other hand, the currency reserves adequacy indicators themselves should be used flexibly and should reflect individual countries' economic specificities.

While these findings do not deny that self-insurance is costly and should be seen as the second-best option in the context of imperfect international financial markets, it certainly sheds a different light on the costs and benefits that should influence the decision on the optimal number of reserves (Yeyati and Gómez, 2019).

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