

The Impact of RMB Exchange Rate and Stock Price on Short-term Capital Flow

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Abstract. Recently, many hot moneys have flowed into our country, and the occurrence of the financial crisis has aggravated the uncertainty of short-term capital flows, which has attracted extensive attention from the government and academia. This paper uses step-by-step OLS method to empirically analyze the impact of RMB exchange rate and stock price on China's short-term international capital flows from 1994 to 2016 by controlling Sino-US interest rate spreads and macroeconomic conditions. The empirical results show that the RMB exchange rate has no significant correlation with short-term international capital flows, but the change of stock price will affect it. The stock price rises, the short-term international capital outflow increases. Macroeconomic indicators will also affect the short-term international capital flow in China, and there is a positive correlation between them, but the impact of China-US spreads is not obvious.

Keywords: Short-term International Capital Flow; RMB Exchange Rate; Stock Price; Stepwise Multivariate Regression Model.

1. Introduction

Since China's accession to the WTO, with the further opening of the economy and financial market, China's economy has entered the ranks of rapid growth, and there has been a sustained large-scale surplus in capital account. Beginning in 2003, due to the steady growth of China's economy and the expectation of the international community for the appreciation of RMB, the inflow of short-term international capital has increased dramatically, and many hot monies has entered China through various channels. In July 2005, China launched the reform of exchange rate marketization and began to implement a managed floating exchange rate system. The RMB price gradually returns to the normal track, and the expectation of RMB appreciation weakens. Therefore, the short-term international capital flows in China are in a net outflow state from 2005 to 2007. After the financial crisis in 2008, many short-term liquidities were impacted, and some international capital subjects had to withdraw funds to resist the impact of the financial crisis, which led to the continued flight of domestic short-term international capital. In 2009, in response to the impact of the financial crisis on the virtual economy and the real economy, our government issued a 4 trillion-yuan investment plan, which caused good expectations, and caused a large influx of short-term international liquidity into China [1]. In 2011, the debt crisis in Europe worsened, asset prices in emerging markets fell, foreign exchange in China continued to decline, and short-term international capital outflows. Nowadays, the form of the world economy is more complex and developed economies are seeking economic recovery. China is also facing the problem of economic restructuring. The situation of short-term international capital flows will become more complex in the future.

Short-term capital flow has the characteristics of quick profit and liquidity. On the one hand, large-scale inflow will cause the rapid growth of international reserves and weaken the independence of monetary policy and promote the bubble of domestic capital market. On the other hand, when the economic and policy environment changes, due to the motivation of seeking profits and avoiding risks, the reversal of capital flow will bring about shocks in the foreign exchange market, the lending market and the securities market, which will further damage the macro-economy. In the process of economic development and deepening foreign exchanges, China's capital account control will

gradually be liberalized, which means that the possibility and harm of short-term capital shocks will continue to increase.

As an important macroeconomic variable, RMB exchange rate, stock price and short-term international capital flow have aroused widespread discussion and attention in the academic circles under the background of increasing internal and external imbalance pressure in China. Analyzing the impact of RMB exchange rate and stock price on short-term capital flow has important theoretical and practical significance for taking targeted measures to effectively prevent the adverse impact of large fluctuations of short-term capital flow on China's economy and improve macroeconomic stability [2]. The significance of this paper lies in: (1) Empirical study on the impact of RMB exchange rate and stock price on short-term international capital flow within a unified framework; (2) Considering that macroeconomic variables such as interest rate and economic growth may affect exchange rate and stock price, the traditional OLS measurement method and vector autoregressive (VAR) model cannot effectively estimate the impact of RMB exchange rate and stock price on short-term international capital flows. Therefore, based on controlling interest rates, economic growth and other factors, this paper uses multiple regression model to overcome this shortcoming, and accurately estimates the impact of RMB exchange rate and stock price on China's short-term international capital flows.

2. Empirical Analysis

2.1 Variable Selection and Data Sources

Based on the existing literature and the above analysis, this paper chooses the following variables to make a quantitative analysis of the factors affecting China's short-term international capital.

1. Interpreted variables: short-term international capital flows (STCF). This paper chooses the modified indirect method to calculate the short-term international capital flow. The formula is: $STCF = IFES - CAS - NIFDI - IFD$, among them, IFES, CAS, NIFDI and IFD represent the increment of foreign exchange, current account surplus, net inflow of foreign direct investment, and increment of foreign debt, respectively[3]. All data are from the Zhongjing Network.

2. Explanatory variables.

(1) Renminbi nominal exchange rate (NER). Since the RMB exchange rate is pegged to the US dollar before the exchange rate reform, the US dollar still accounts for a large proportion of a basket of currencies after the exchange rate reform, this paper chooses the nominal exchange rate of RMB to the US dollar as the representative of the RMB exchange rate. Renminbi exchange rate is expressed by direct pricing method, and the data comes from China Economic Network.

(2) Stock price(P). This paper chooses the Shanghai A-share index as the proxy variable of the stock price, because the Shanghai A-share index reflects the overall change of the stock price of the listed A-share, which is representative. The data comes from the Reiss database.

3. Control variables. Referring to the empirical literature on the impact of RMB exchange rate and stock price on short-term capital flow at home and abroad, this paper chooses the following control variables:

(1) China-US spreads (DR). Because the US dollar occupies a dominant position in the international financial market, here we choose the Sino-US spreads to represent the difference of interest rates between China and foreign countries: $DR = Ich - Ius$, where Ich represents the one-year fixed deposit rate of our country, and the data comes from Reiss database; Ius represents the one-year US dollar Libor (London interbank lending rate), and the data comes from Hexin. Net. Because both the Federal Funds Rate and the US Dollar Libor occur in the interbank market, they are essentially market interest rates. Due to the central bank's formulation, the fixed deposit rate in China cannot be regarded as the market interest rate. Considering the availability of historical data, this paper still uses the one-year fixed deposit rate minus the one-year dollar Libor, which can reflect most of the Sino-US spreads.

(2) The macroeconomic situation (SIGN). This paper chooses the consistent index of macroeconomic prosperity to represent the macroeconomic operation, which includes production,

employment, income distribution, demand and other aspects of economic activities. It can comprehensively reflect the overall economic operation changes. The data comes from Wind information.

(3) Virtual variable (Dum05). Considering the possible structural changes brought about by the floating exchange rate reform of the RMB exchange rate in 2005, the dummy variable Dum05 is added. Before 2005, it was 0, the others were 1. Based on the implementation of exchange rate merger in 1994, the sample interval selected in this paper is the annual data from 1994 to 2016.

2.2 Model Establishment

According to the theoretical analysis of the motivation of short-term international capital flows, it is concluded that the short-term international capital flows in China are mainly influenced by RMB exchange rate, stock price, Sino-US interest margin, macroeconomic conditions and other factors. If other factors remain unchanged, when the RMB exchange rate against the US dollar declines, the expectation of the international community for RMB appreciation weakens and the possibility of short-term international capital outflow increases, so the change of RMB exchange rate is in the same direction as that of short-term international capital flow. When the stock price rises, the decline of stock return leads to the decrease of short-term international capital, which is negatively correlated. The bigger the gap between domestic and foreign interest rates, the more short-term international capital entering our country for arbitraging the spread income [4]. Compared with the weak economic growth of developed countries, China's stable macroeconomic situation is one of the motivations of attracting capital inflow. So, the macroeconomic situation is positively correlated with short-term international capital flows. Renminbi exchange rate reform affects the change of RMB exchange rate, but has no direct connection with short-term international capital flows.

In order to accurately estimate the impact of RMB exchange rate and stock price on short-term international capital flows, this paper establishes two sets of regression models: one is the control group, without considering the impact of other variables on short-term international capital flows; the other is the experimental group, considering the role of control variables. By comparing the results of the two groups of experiments, we can draw a more accurate conclusion about the impact of RMB exchange rate and stock price on short-term international capital flows in China.

The first control group

$$\text{Model 1: } STCF = \beta_0 + \beta_1 NER + \varepsilon$$

$$\text{Model 2: } STCF = \beta_0 + \beta_1 P + \varepsilon$$

$$\text{Model 3: } STCF = \beta_0 + \beta_1 NER + \beta_2 P + \varepsilon$$

The second experimental group

$$\text{Model 4: } STCF = \beta_0 + \beta_1 NER + \beta_3 DR + \beta_4 SIGN + \beta_5 D_{UM05} + \varepsilon$$

$$\text{Model 5: } STCF = \beta_0 + \beta_2 P + \beta_3 DR + \beta_4 SIGN + \varepsilon$$

$$\text{Model 6: } STCF = \beta_0 + \beta_1 NER + \beta_2 P + \beta_3 DR + \beta_4 SIGN + \beta_5 D_{UM05} + \varepsilon$$

Among them, $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ correspond to different values in different models. Model 1 and model 4 form a group. By comparing with model 1, we can see whether the addition of control variables makes the estimation of the impact of RMB exchange rate on short-term international capital flows more accurate. Model 2 and model 5 form a group to analyze the impact of stock prices on short-term international capital flows, in which model 5 does not include the control variable D_{UM05} , because the RMB exchange rate reform has no direct impact on short-term international capital flow and has nothing to do with stock price, if joined, it may make the standard of stock price become larger and the coefficient is not significant. Model 3 and Model 6 form a group to analyze the impact of RMB exchange rate and stock price on short-term international capital flow.

2.3 Empirical Test

2.3.1 Stability Test

The variables selected above are time series data, there may be stationarity problem, that is to say, "false regression", so before establishing the model with time series data, we first test the relative variables with ADP and PP unit root to judge their stationarity. The test results are shown in the Fig.

1. The results show that, at the 5% significant level, short-term international capital flows (STCF), stock prices (P), interest spreads between China and the United States (DR) and macroeconomic conditions (SIGN) are stationary series under the unit root test of ADF and PP, and Renminbi Exchange Rate (NER) is first-order monolithic under two-unit root tests and is stationary at 10% significance level after first-order difference. At the saliency level, it is a stationary sequence. Therefore, when we do regression analysis, we need to amend the exchange rate of RMB to the change of the exchange rate of RMB, and then make regression analysis on this basis.

Fig. 1 ADF and PP test results

Variable	(c,t,k)	ADF	Prob	(c,t,b)	PP	Prob
STCF	(c,t,0)	-4.27	0.0141	(c,t,1)	-4.27	0.0142
NER	(c,0,1)	-1.24	0.6379	(c,0,2)	-0.81	0.7967
Δ NER	(0,0,0)	-1.89	0.0571	(0,0,1)	-1.96	0.0494
P	(c,t,0)	-4.14	0.0185	(c,t,1)	-4.14	0.0185
DR	(c,0,1)	-3.85	0.0088	(0,0,0)	-2.18	0.0310
SIGN	(c,0,0)	-3.28	0.0288	(c,0,1)	-3.29	0.0278

Note: (C, T, K) (C,0, K) (0,0, K) respectively indicates that the regression equation contains constant term and time trend term, only constant term, no constant term and time trend term, and K represents the lag order selected according to SIC criterion. When (C, T, B) (C,0, B) (0,0, B) respectively denotes PP unit root test, the regression equation contains constant term and time trend term, only constant term, no constant term and time trend term, B stands for Newey-West bandwidth.

2.3.2 Stepwise Multivariate Regression

In order to test the effect of RMB exchange rate fluctuation and stock price on short-term international capital flow separately, this paper adopts a step-by-step multiple regression model. The results of regression are shown in the Fig. 2.

Fig. 2 Stepwise multiple regression results

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	-651.17	-46.08	-24.59	-15150.24	-2.25	-15093.61	-8691.06
Δ NER	506.61	-	413.06	588.41	-	631.38	-
P	-	-0.29***	-0.29***	-	-2.25**	0.039	-0.28**
DR	-	-	-	83.24	-0.90	395.68	-
SIGN	-	-	-	154.18*	2.25**	153.05*	87.36***
Dum05	-	-	-	-1194.78*	-	-1258.638*	-
Adj-R2	-0.035	0.13	0.078	0.71	0.345	0.623	0.317
F-value	0.29	4.28***	1.89	10.49*	3.34**	7.950*	4.646**

Note: 1% significance is expressed by *, 5% by **, and 10% by ***.

The stepwise multiple regression results show that when the change of RMB exchange rate is taken as an explanatory variable alone (Model 1), its coefficient is positive (i.e., RMB depreciation, short-term increase in international capital flows). But it is still not significant at the 10% significant level, and the original hypothesis cannot be rejected. Even after adding the control variable (model 4), the goodness of fit increases, but it is still insignificant. Therefore, there is no significant relationship between short-term international capital flows and the change of RMB exchange rate. When stock price is used as explanatory variable alone (model 2), its coefficient is negative (i.e., stock price rises, short-term international capital flows decrease) and is significant at 10% significance level, rejecting the original hypothesis. But after adding control variable (model 5), the performance is not significant, which indicates that there may be some independent explanatory variables in the control variables. The incorporation of irrelevant explanatory variables makes the standard of stock price become larger and less significant. According to the results in model 5, we can assume that the Sino-US spreads are

irrelevant variables. Verifying them, we get model 7. The results show that the stock price P is significant and the coefficient is negative. Therefore, there is a significant correlation between stock price changes and short-term international capital flows, that is, stock prices rise, short-term international capital flows decline. When RMB exchange rate change and stock price are both explanatory variables, the coefficient of RMB exchange rate change is not significant, and the coefficient of stock price is significant and negative. After adding control variables, the coefficients of the two variables are not significant, which is consistent with their results as explanatory variables alone. The control variable DR has always been insignificant, while $SIGN$ is significant, which shows that there is no significant relationship between China-US spreads and short-term international capital flows, and that macroeconomic conditions have a significant and positive impact on short-term international capital flows. Therefore, it can be concluded that there is no significant correlation between the change of RMB exchange rate and the short-term international capital flow, while the stock price rises and the short-term international capital flow decreases.

3 Conclusion

Through the establishment of multiple regression model for the variables of short-term international capital flow, RMB exchange rate, stock price, Sino-US interest margin, macroeconomic situation and RMB exchange rate system reform, the empirical analysis shows that the change of RMB exchange rate has no significant impact on short-term international capital flow, which is inconsistent with previous theoretical analysis. The impact of stock price on short-term international capital flows is negative, the larger the price, the lower the stock return and the lower the short-term international capital inflows. The impact of China-US spreads on short-term international capital flows is not significant, and there is a positive correlation between domestic macroeconomic conditions and short-term international capital flows. If macroeconomic changes are too large, it will cause a country's short-term capital flows to fluctuate too much, affecting a country's economy. Based on the conclusions, the following policy recommendations are put forward:

(1) Strengthen the supervision of cross-border capital flows. Capital flow has great influence on the stability of domestic economy. At present, the impact of the international financial crisis is continuing. The situation of capital flow in China is very uncertain. Preventing large-scale capital inflow or outflow is the primary task of foreign exchange supervision [5]. The entry of international long-term investment should be encouraged, and the restriction on short-term investment flows should be strengthened to prevent the impact of hot money on the stability of China's foreign exchange market.

(2) Stabilize the overall economic market of our country. The change of stock price directly affects the short-term international capital flow of our country, and the stability of stock market is based on a stable economic environment. Moreover, changes in macroeconomic conditions will also affect a country's short-term international capital flows. Therefore, we strive to create a good and stable economic environment and complete the transformation of China's economic structure as soon as possible.

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