

The Impact of Capital Account Opening on RMB Internationalization

-- Based on the Analysis of Systemic Financial Risk Transmission Mechanism

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Abstract: At this stage, the internationalization of RMB is inseparable from the opening of capital account, and in this process, it is bound to face the challenge of systemic financial risks. Based on SV-TVP-VAR model, this paper makes a time variant analysis on the systemic financial transmission mechanism of capital account opening Affecting RMB internationalization. It is found that the opening of capital account promotes the development of RMB internationalization, and the international use of RMB will force the expansion of capital account opening. Further research shows that the current capital account is not easy to fully open, capital account convertibility intensifies the spillover of macroeconomic risks and external market risks, and macro prudential supervision needs to be improved. The restraint of capital account opening on monetary liquidity risk and asset bubble risk shows time varying characteristics, and the long-term development of RMB internationalization urgently needs to deepen the reform of financial system.

Keywords: Capital account opening, Internationalization of the Renminbi, Systemic financial risks, SV-TVP-VAR model.

1. Introduction

With the rapid rise of China's economy, the world economic pattern has undergone great changes, and the vulnerability and risk of the international monetary system dominated by the US dollar have become increasingly prominent. A series of actions, such as the Sino US trade war in 2018, the "unrestricted" quantitative easing in 2020 and the economic sanctions against Russia in 2022, have made more and more countries realize the disadvantages of the single monetary system under the hegemony of the US dollar, and the internationalization of RMB has ushered in new development opportunities.

In recent years, with the gradual opening of the capital account and the continuous improvement of the level of RMB internationalization, the RMB internationalization report 2022 shows that the share of RMB international payment has increased to 2.7%, surpassing the yen as the fourth payment currency in the world. At present, the internationalization of RMB is in a critical stage, and the opening of capital account is also facing important choices [1]. A higher level of financial openness has created a cost advantage for RMB cross-border settlement, but it also brings systemic financial risks. The impact of international capital flows on systemic risks at different stages is different [2]. Therefore, it is of great significance to investigate the impact of systemic financial risks on RMB cross-border settlement under the opening of capital account for promoting RMB internationalization.

China's capital account opening time is not long, and scholars at home and abroad have not yet reached a conclusion on the impact of capital account opening on systemic risk. Some scholars believe that capital account opening can steadily curb the growth of systemic financial risks in the short term [3]; Opening the capital account before the financial crisis is conducive to risk mitigation [4]. Some scholars also believe that exchange rate fluctuations, external

shocks and soaring capital inflows brought about by the opening of the capital account have all increased systemic financial risks and even triggered a financial crisis [5-7]. The systemic risk arising from capital flows will affect the international use of local currency through financial institutions [8]. In the process of promoting the internationalization of RMB, it may lead to the spread of macro financial risks and form a cumulative effect [9-10]. In addition, the risk level of the currency itself is also an important reference for the currency anchor [11]. RMB internationalization is currently in its infancy, and we should firmly hold the bottom line that systemic risks do not occur [12].

In the past, few studies have put capital account opening, systemic financial risk and RMB internationalization under the same variable parameter framework, and the classification impact of systemic risk has not been fully considered. In view of the intervention of China's capital control in the economy, the relationship between the subjects may change over time [13]. Therefore, this paper chooses SV-TVP-VAR model to analyze the dynamic relationship between the above three.

2. Research design

2.1. Model design

In order to overcome the setting of unchanged parameters of traditional VAR model, SV-TVP-VAR model is introduced in this paper. An SVAR model is introduced, as shown in equation 1.

$$A_0 Y_t = F_1 Y_{t-1} + F_2 Y_{t-2} + \dots + F_s Y_{t-s} + \mu_t \quad (t = s + 1, \dots, n) \quad (1)$$

Where Y_t is a $k \times 1$ -dimensional vector, $F_1 \dots F_s$ for $K \times K$ -dimensional coefficient matrix, disturbance term μ_t is $k \times 1$ -dimensional vector, coefficient matrix A and diagonal matrix σ are shown in equation 2:

$$A = \begin{bmatrix} 1 & 0 & \cdots & 0 \\ \alpha_{21} & 1 & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ \alpha_{k1} & \cdots & \alpha_{k,k-1} & 1 \end{bmatrix}, \Sigma = \begin{bmatrix} \sigma_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \sigma_k \end{bmatrix} \quad (2)$$

Multiply both sides of a by matrix A-1, and simplify equation 1 to equation 3.

$$y_t = B_1 y_{t-s} + \cdots + B_s y_{t-s} + A^{-1} \sum \varepsilon_t, \varepsilon_t \sim N(0, I_k) \quad (3)$$

Further collate equation 3 and introduce time varying parameters to obtain a new model, as shown in equation 4.

$$y_t = X_t \beta_t + A_t^{-1} \sum \varepsilon_t \quad (4)$$

It is assumed that the time varying parameters obey a first order random walk process, as shown in equation 5.

$$\begin{aligned} \beta_{t+1} &= \beta_t + \mu_{\beta t} \\ \alpha_{t+1} &= \alpha_t + \mu_{\alpha t} \\ h_{t+1} &= h_t + \mu_{h t} \end{aligned}$$

$$\begin{bmatrix} E_t \\ \mu_{\beta t} \\ \mu_{\alpha t} \\ \mu_{h t} \end{bmatrix} \sim N(0, \begin{bmatrix} I & 0 & 0 & 0 \\ 0 & \Sigma_{\beta} & 0 & 0 \\ 0 & 0 & \Sigma_{\alpha} & 0 \\ 0 & 0 & 0 & \Sigma_h \end{bmatrix}), \quad (5)$$

$$\begin{aligned} \beta_{s+1} &\sim N(\mu_{\beta_0}, \Sigma_{\beta_0}), \quad \alpha_{s+1} \sim N(\mu_{\alpha_0}, \Sigma_{\alpha_0}), \\ h_{s+1} &\sim N(\mu_{h_0}, \Sigma_{h_0}), \quad t = s + 1, \dots, n \end{aligned}$$

So far, the model has been deduced, and the MCMC method is used to estimate the posteriori distribution of parameters to solve the error of model estimation.

2.2. Variable selection and data sources

This paper selects the quarterly data from 2012-2022 as the research sample, which comes from wind database and reset database. Select short-term capital flows as the proxy variable of capital account opening, and refer to Hu Yiwen's research for specific methods [14]; Select RMB cross-border settlement as the proxy variable of RMB internationalization; The construction of systemic financial risk index pool refers to Guo Na's research [15], and the details are shown in Table 1.

Table 1. Systemic financial risk indicator pool

Primary indicators	Secondary indicators	Indicator significance	Relationship to risk
Macroeconomic risks (Marco)	GDP growth rate	A country's overall economic situation	N
	Deficit growth rate	Deficit growth weakens resilience	P
	CPI Growth rate	Inflation	N
	Growth rate of industrial added value	Marginal contribution of industrial production	N
	Growth rate of fixed assets investment	Marginal contribution of fixed asset reproduction	N
Currency liquidity risk (CIR)	Quasi monetary growth rate	Potential purchasing power growth	N
	One-year time deposit rate	Supply and demand of short-term funds in financial markets	P
	Benchmark one-year lending rate	Profit distribution relationship between enterprises and banks	P
	Loan growth	Increased lending could lead to bad debts	P
	Interbank offered rate	Short-term supply and demand of funds in financial markets	P
External market risk (EXT)	M2 Growth rate	Changes in purchasing power levels	N
	Foreign direct investment Growth rate	Increase investment and strengthen risk resilience	N
	Import growth	Increased imports stimulate foreign trade	N
	Real effective exchange rate index	The international value of a country's currency	P
	Growth rate of foreign exchange reserves	Increase reserves and strengthen risk prevention	N
Asset bubble risk (bub)	Export growth	Increased exports drive trade spillover	N
	Balance of payments	Capital flows as a share of international trade	N
	Shanghai Composite Index quarterly yield	Stock market return on investment	P
	Average p/E ratio of Shanghai Stock Exchange	Market to earnings ratio	P
	Shenzhen index yield	Stock market return on investment ratio	P
Asset bubble risk (bub)	Shenzhen average p/E ratio	Market to earnings ratio	P
	Growth rate of real estate investment	Investment situation of real estate industry	N
	Residential price growth	Real estate market price level	P

3. Empirical Analysis

This paper uses TVP-VAR model to examine the dynamic time varying relationship between capital account opening and RMB internationalization, further studies the systemic financial risk transmission mechanism of capital account opening Affecting RMB internationalization, and captures the

time varying and structural mutation characteristics between variables.

3.1. Stability test and parameter estimation

In order to ensure the stability of the data, the original variables are differentially processed to obtain a stable time series, and the results are shown in Table 2.

Table 2. ADF test results

variable	mean value	standard deviation	minimum value	Max	ADF statistic	Inspection results
Cao	6.285	0.707	4.461	7.446	-2.591	Erratic
Δ Cao	0.046	0.601	-1.608	1.027	-6.600***	stable
Marco	3.724	0.216	3.064	4.025	-3.493	Erratic
Δ Marco	0.018	0.125	-0.242	0.479	-12.387***	stable
Cir	1.107	0.211	0.737	1.457	-2.750	Erratic
Δ Cir	-0.128	0.134	-0.514	0.348	-4.254***	stable
Ext	1.569	0.011	1.544	1.585	-1.858	Erratic
Δ Ext	0.002	0.006	-0.024	0.012	-4.570***	stable
Bub	3.673	0.507	2.960	4.784	-2.376	Erratic
Δ Bub	0.007	0.235	-0.449	0.591	-4.657***	stable
RCBS	5.556	0.262	4.744	5.841	-1.037	Erratic
Δ RCBS	0.025	0.076	-0.122	0.258	-4.793***	stable

As can be seen from table 1, all variables are first order simple integers, which meet the premise of follow-up research. The TVP-VAR model is constructed by OxMetrics

software, and the second order lag is selected for 2000 MCMC simulation iterations. The parameter estimation results are shown in Table 3 and figure 1.

Table 3. parameter estimation results

parameter	mean value	standard deviation	95% confidence interval	Geweke	Invalidity factor
sb ₁	0.0227	0.0027	[0.0183, 0.0286]	0.816	3.27
sb ₂	0.0229	0.0027	[0.0183, 0.0288]	0.675	5.87
sa ₁	0.0981	0.0547	[0.0449, 0.2563]	0.038	65.54
sa ₂	0.0866	0.0389	[0.0437, 0.1841]	0.386	13.35
sh ₁	0.1896	0.1213	[0.0565, 0.5490]	0.558	63.51
sh ₂	0.1176	0.0669	[0.0504, 0.2991]	0.002	35.42

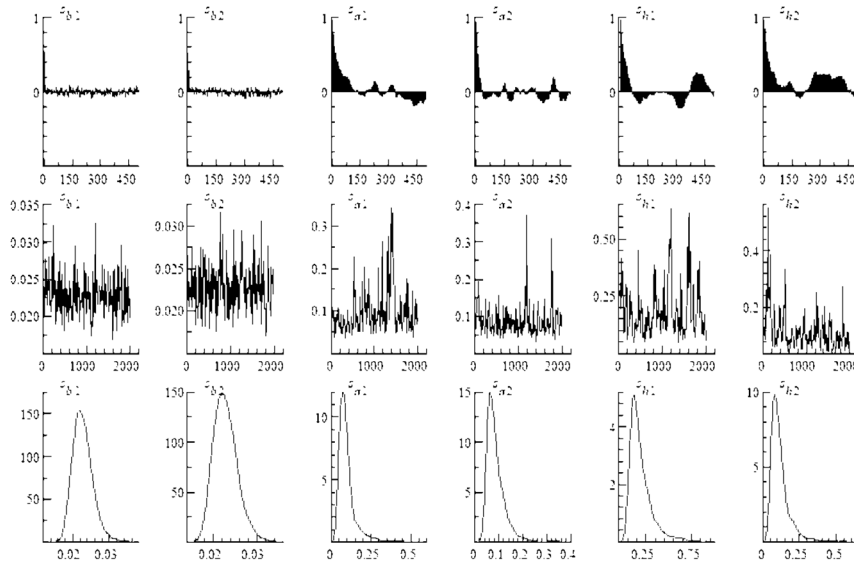


Figure 1. Autocorrelation coefficient, sample path and a posteriori distribution of parameter estimation

As can be seen from table 3, Geweke values are less than 1.96, and the largest ineffective factor is 65.54, that is, there are 30 unrelated samples in the sampling process, indicating that enough samples are extracted. As can be seen from Figure 1, the autocorrelation coefficient of the first row of samples continues to decline, indicating that the autocorrelation generated by iteration is eliminated. The parameters in the second row of sample paths show a "white noise" process, indicating that the parameters are independent of each other.

The third line of a posteriori density verifies the convergence again. To sum up, the sampling simulation results are effective.

3.2. Time varying random fluctuation analysis

The picture shows the random fluctuation characteristics of capital account opening, various systemic financial risks and RMB internationalization.

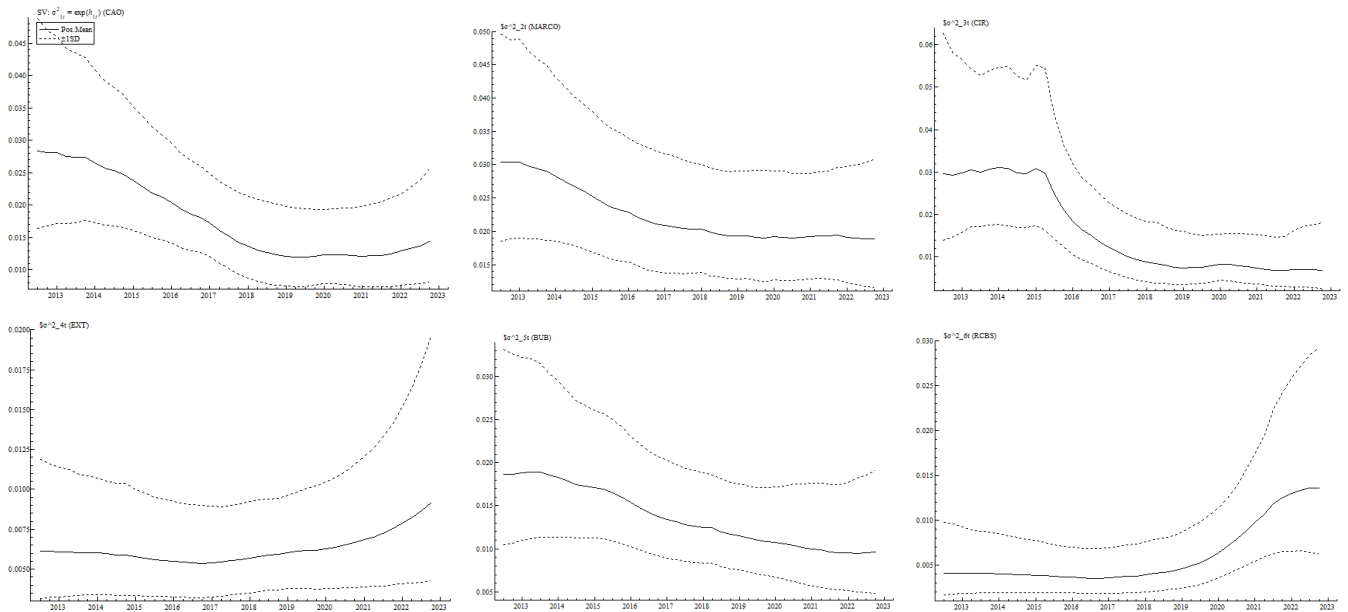


Figure 2. Time varying trend of variable volatility

As can be seen from the chart, the random volatility of capital account opening has been decreasing in recent years, and the confidence interval has also converged. At this stage, the Chinese government actively promotes the steady and prudent opening of capital account and promotes the process of RMB internationalization. The random volatility of macroeconomic risks has been reduced in the long run, but it has been basically flat since 2018. Trade frictions between China and the United States continue to this day. The complex internal and external economic situation has increased the difficulty of macroeconomic regulation and control. The random volatility of monetary liquidity risk was at a higher level before 2015, and then gradually fell back and stabilized at a lower level, thanks to the managed floating exchange rate system based on market supply and demand, adjusted with reference to a basket of currencies and formed after the 811 foreign exchange reform, which is more in line with China's national conditions. The random volatility of external market risks has shown an upward trend since 2020. From the public

health crisis to the geopolitical crisis, the world is experiencing unprecedented changes in a century, which has greatly aggravated the variability and complexity of external markets. The random volatility of asset bubble risk is in a downward trend as a whole. After the financial crisis, the central bank pays more and more attention to restraining asset bubbles while formulating monetary policy, and constantly strengthens financial supervision. The random volatility of RMB internationalization has risen significantly in recent years. With the continuous improvement of China's economic strength, RMB internationalization has also ushered in a key stage of development.

3.3. Overall impulse response analysis

Figure 3 shows the impulse response function of different lead times between capital account opening and RMB internationalization, and figure 3 shows the impulse utility function at different time points.

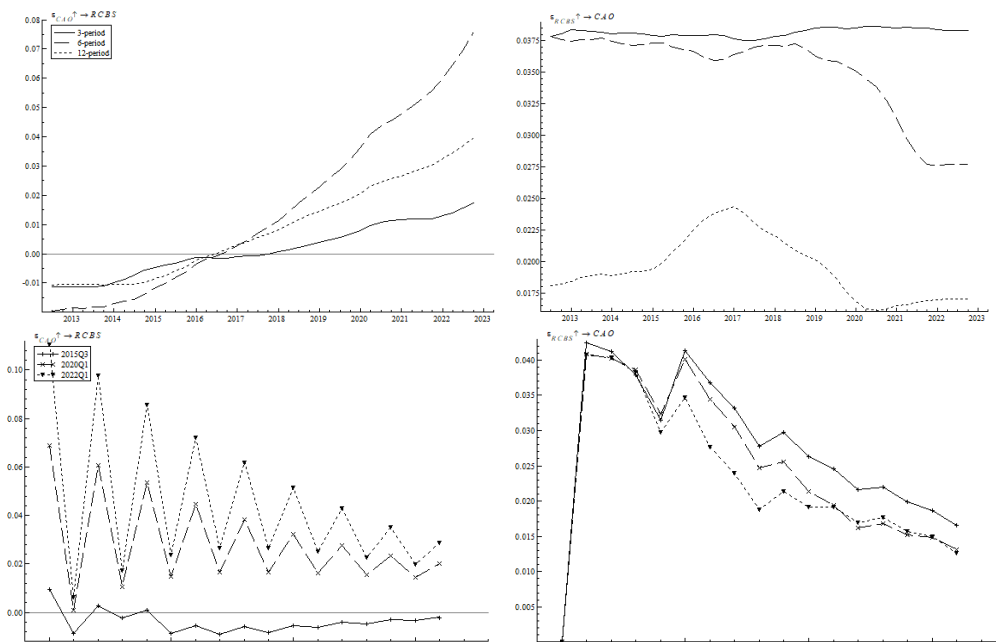


Figure 3. overall impulse response results

As can be seen from Figure 3: (1) the gradual opening of the capital account has significantly promoted the development of RMB internationalization after 2016, and its promoting role has continued to expand, indicating that the smooth introduction of the Shanghai Hong Kong stock connect and Shenzhen Hong Kong stock connect mechanisms since 2014 and the successful implementation of the national strategy represented by "one belt and one road" have accelerated the pace of RMB capital account convertibility, and the scope and scale of RMB use in international trade have steadily increased. With the development of RMB cross-border settlement, the international status of RMB is rising, attracting a large number of foreign capital inflows and pushing back the opening of capital account, and the impact will last for a long time. (2) The impulse response results at different time points show that the opening of capital account promotes the international use of RMB in most moments, but after the impact in the third quarter of 2015, the response results fluctuated and continued to be negative in the fourth

period, which may be due to the insufficient opening of China's capital account, the gradual convergence of domestic market and international financial fluctuations, and the impact of external systemic financial risks. The stock market crashed and once affected RMB assets. The impulse response of RMB internationalization to capital account opening is similar, and the impact gradually disappears after the first phase of synchronous peak, indicating that with the expansion of RMB settlement scale, in order to alleviate the institutional constraints on international capital flows, higher requirements are put forward for capital account opening.

4. Further Transmission Mechanism Analysis

4.1. Macroeconomic risk transmission mechanism

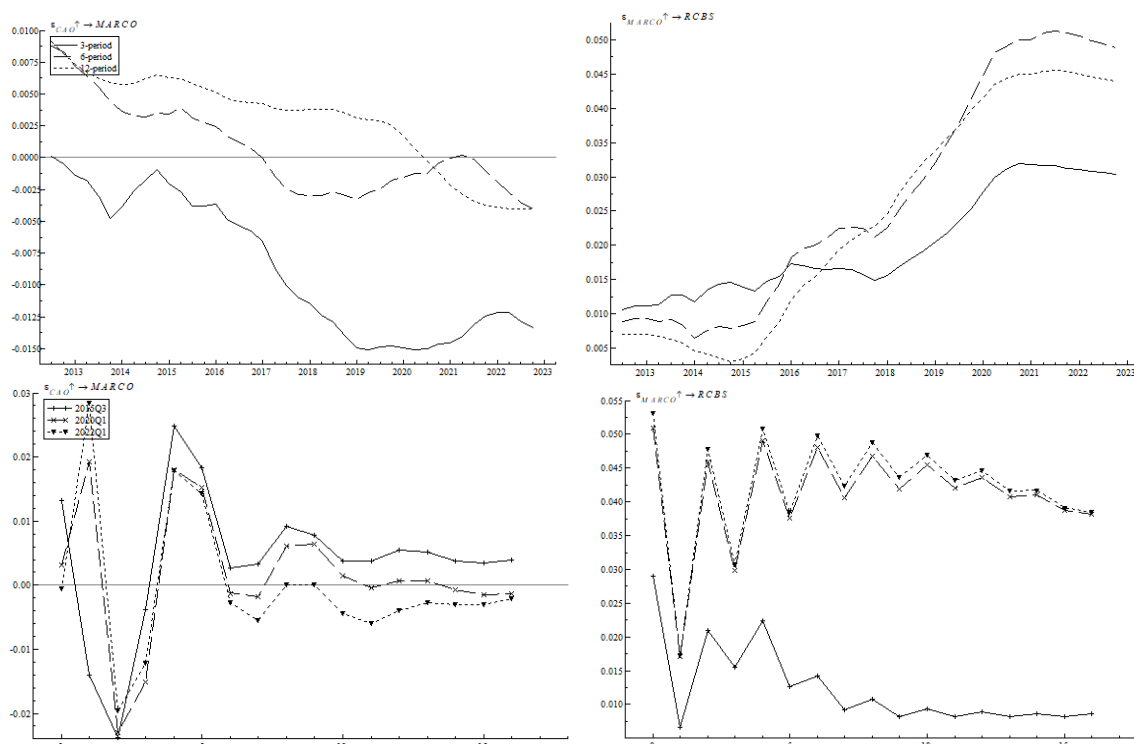


Figure 4. impulse results of macroeconomic risk mechanism

As can be seen from Figure 4: (1) there is some heterogeneity in the impulse response of capital account opening to macroeconomic risks in different lead times, which is manifested in that capital account opening can restrain macroeconomic risks in the short term, but the inhibitory effect is not significant in the medium and long term, or even spread the risk, because macro-economy is mainly affected by the internal and external economic environment, and the degree of opening up can only play a temporary role. The spread of macroeconomic risks and the internationalization of RMB go hand in hand, indicating that the liberalization of capital account is conducive to breaking the traditional "ternary paradox", boosting the economy and promoting the application of RMB in international trade settlement. (2) The impulse response results at different time points show that under the background of extreme situation,

the constraints of capital account opening on macroeconomic risks are becoming more and more unstable, and the alternating fluctuation of positive and negative directions shows that opening up only inhibits the spread of macroeconomic risks in the early stage, and the impact of external shocks in the later stage may in turn aggravate risk spillover. Based on the background of macroeconomic risk diffusion in different periods, the international settlement level of RMB has also been improved, indicating that the opportunities and challenges brought by economic development under the opening of capital account coexist.

4.2. Monetary liquidity risk transmission mechanism

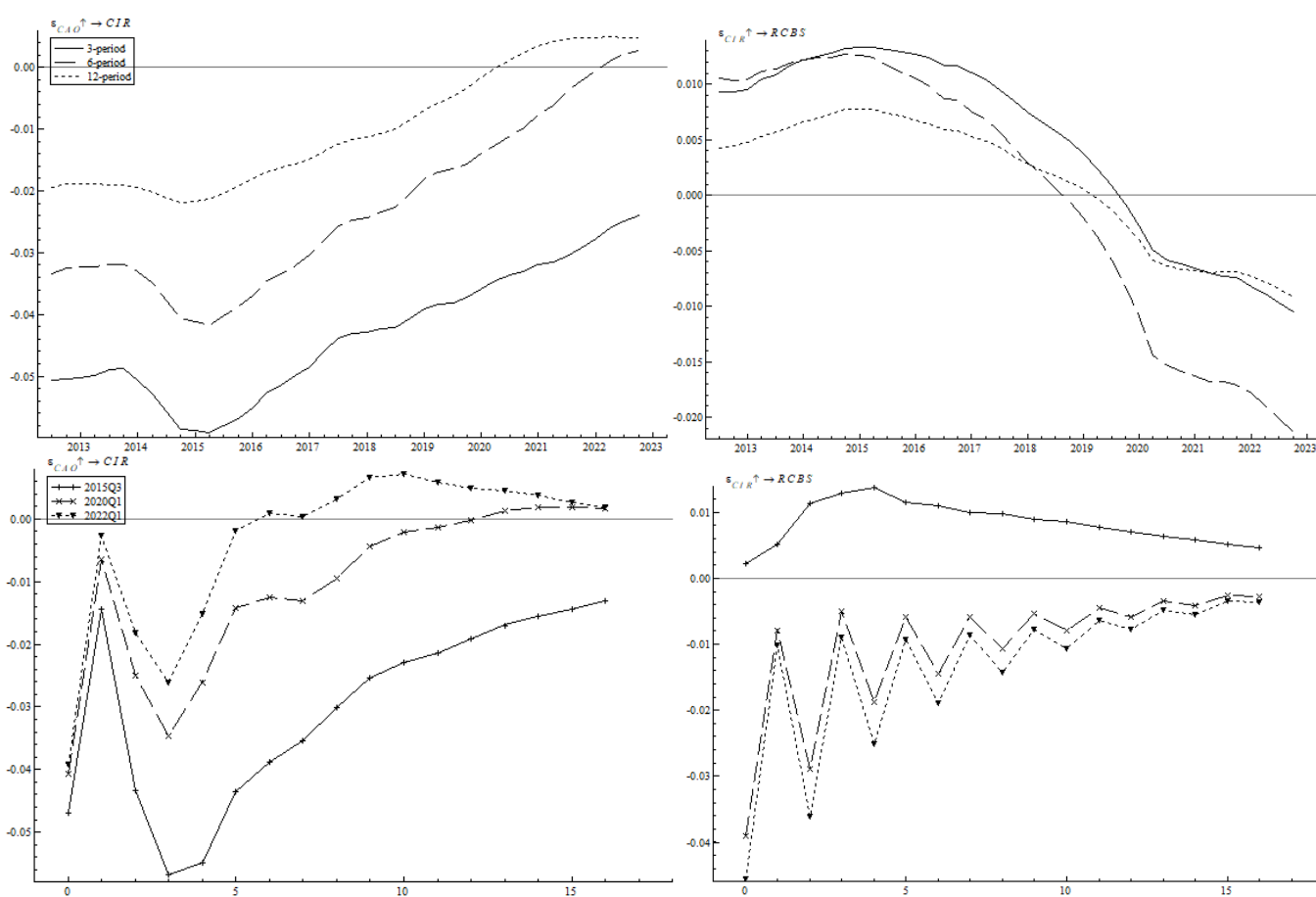


Figure 5. impulse results of monetary liquidity risk mechanism

As can be seen from Figure 5: (1) capital account opening has restrained monetary liquidity risk to a considerable extent, and this impact has gradually decreased over time, indicating that the orderly promotion of financial opening has improved the circulation efficiency of cross-border funds, and the gradual improvement of the domestic financial system in line with international standards has reduced the impact of overseas capital flows, which is conducive to the market digesting the accumulated liquidity risk. The impact of liquidity monetary risk on RMB internationalization has changed greatly, and the positive effect shown in the early stage has changed from concentrated to negative around 2019, indicating that the opening of capital account in the initial stage is not enough to curb the spread of monetary liquidity risk in the financial market. With the deepening of financial system reform such as interest rate liberalization and exchange rate marketization, the level of marketization of the financial system has been significantly improved to strengthen the level of risk prevention, And it will take some time for the transmission from financial regulation to the real economy. (2) Impulse response results at different time points show that capital account opening effectively inhibits monetary liquidity risk, which significantly weakens the international use of RMB, verifies the transmission mechanism of "capital account opening monetary liquidity risk RMB internationalization", and the reasonable explanation for the abnormal results in the third quarter of 2015 is the capital mismatch caused by liquidity premium before the outbreak of the stock market crash, and a large

number of overseas speculative capital flows into China.

4.3. External market risk transmission mechanism

As can be seen from Figure 6: (1) capital account opening has intensified the spread of external market risk fundamentals, and this trend has slowed down only in recent years. Due to the expansion of financial opening, which has changed the original strict capital control pattern, external market disturbances are very easy to impact the financial stability of the domestic market. In addition, the two-way opening of the capital market may lead to cross market contagion of internal and external risks [16]. The impact of external market risks has greatly weakened the level of RMB internationalization. Considering that the current international environment is becoming more and more complex, the popularity of unilateralism, protectionism, hegemonism and anti globalization has led to increasingly fierce international monetary competition, and the difficulty of RMB international use to break through the network effect has further increased. (2) The impulse response results at different time points can be seen that the external market risks brought about by the opening of the capital account are decreasing year by year. In view of the continuous improvement of the dual pillar regulatory framework of monetary policy and macro Prudential policy, the impact of the outbreak of the war between Russia and Ukraine in 2022 is no longer significant after the third period, indicating that macro Prudential management can effectively alleviate

external risks. The impact of RMB internationalization on external market risks shows a reverse trend, indicating that external market risks are not conducive to the increase of RMB asset scale. The transmission mechanism of "capital

account opening external market risk RMB internationalization" has not been confirmed, indicating that China's capital account is not easy to fully open at present, which needs to be regulated by macro prudential policies.

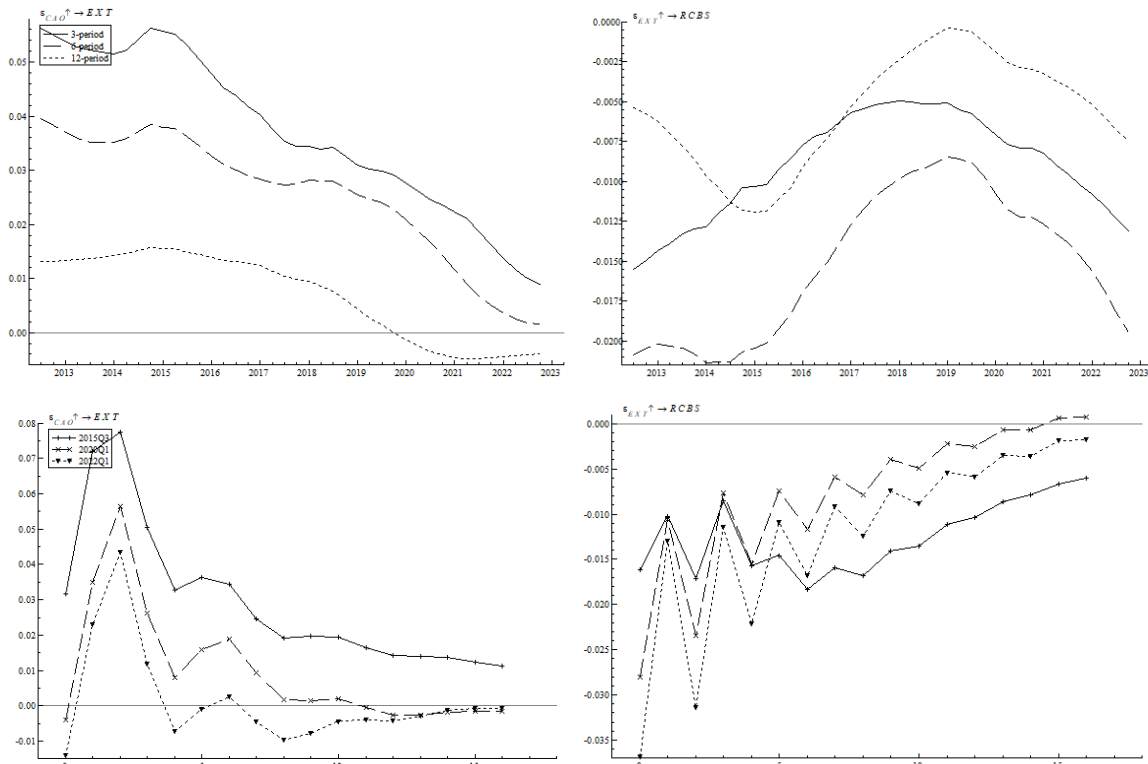


Figure 6. impulse results of external market risk mechanism

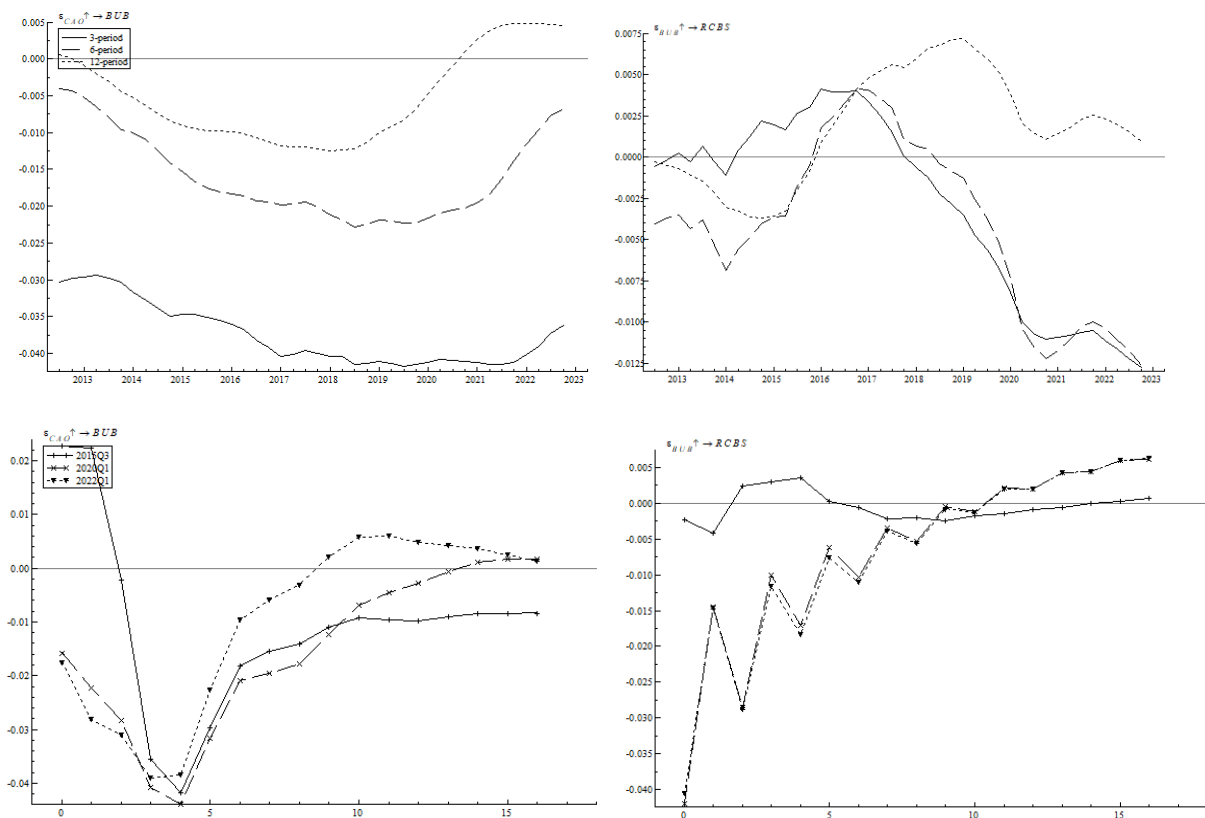


Figure 7. Impulse results of asset bubble risk mechanism

4.4. Asset bubble risk transmission mechanism

As can be seen from Figure 7: (1) the opening of the capital account has a significant inhibitory effect on the risk of asset bubbles, but the effect began to decline in 2019, especially in the long run, the risk of asset bubbles is on the rise. Considering that trade frictions between China and the United States, the outbreak of the covid-19 epidemic and brexit have forced the global financialization dividend to ebb in recent years, under the background of world finance, trade and real tightening, Faced with the bursting of asset bubbles, the role of capital control is limited. Asset bubble risk has weakened the internationalization level of RMB as a whole, but the three phase response shows obvious differences. Combined with the actual situation, the changes of impulse response mainly come from policy changes such as fiscal and taxation system reform and exchange rate system reform. The initial promulgation of the policy will shake the capital market, which is more sensitive to foreign investors. (2) The impulse response results at different time points show that the opening of capital account generally reduces the risk of asset bubbles, thanks to the free flow of capital factors under the open economy, and dilutes the asset bubbles caused by economic overheating by optimizing the allocation of resources. In addition, financial openness improves the efficiency of capital market information by improving the quality of enterprise information disclosure and effectively curbs the source of risk [17]. The rapid expansion of asset bubbles under different backgrounds has hindered the development of RMB internationalization. The temporary positive fluctuation in the third quarter of 2015 comes from the attraction of stock market bubbles to short-term capital, which echoes the previous analysis.

5. Conclusions

First, on the whole, the gradual opening of the capital account has promoted the development of RMB internationalization, and the international use of RMB has attracted foreign capital inflows and forced the expansion of capital account opening.

Secondly, while the opening of capital account drives the rapid development of the economy, it intensifies the spillover of macroeconomic risks, which brings opportunities and challenges to the development of RMB internationalization.

Thirdly, the opening of capital account has effectively restrained the risk of monetary liquidity, but the incentive for RMB internationalization has achieved initial results with the deepening of financial system reform.

Fourthly, at present, China's capital account is not easy to open in an all-round way, and macro prudential supervision should be strengthened and improved.

Fifth, the constraints of capital account opening on the risk of asset bubbles have been reduced by the ebb of global financialization, so as to support the diminishing marginal benefits of RMB internationalization.

According to the above conclusions, we should steadily and prudently promote the gradual opening of the capital account. According to China's convertible capital account to promote the expansion of RMB cross-border flow channels, according to the order from current account to capital account, from direct investment to financial transactions, from institutions to individuals, the international monetary function

of RMB has been expanded from payment and settlement currency to reserve currency, investment and financing currency. And then we should strengthen policies to support the cross-border use of RMB. By improving policy support to attract capital flows to RMB assets, continuously improve the service level of cross-border RMB business, optimize the business environment, so that it can better serve the real economy and stabilize the macroeconomic market. Next, strengthen the regulatory role of monetary policy transmission on cross-border capital flows. On the basis of meeting the rules and transparency, we will continue to improve the framework of modern monetary policy. At the same time, we should establish an institutionalized monetary policy communication mechanism to prevent monetary liquidity risks by effectively managing and guiding expectations. Finally, implement macro prudential supervision. On the one hand, by improving the macro Prudential Management of cross-border capital flows with the integration of domestic and foreign currencies, we can resist the invasion of external market risks. On the other hand, macro prudence should be used to slow down the pro cyclical nature of the market and reduce the impact on financial stability after the asset bubble burst.

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