Application of risk matrix in RMB internationalization

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Abstract: In the paper, nine major risks of RMB internationalization are analyzed on the basis of related finance theory, a risk assessment matrix is established, and corresponding risk control measures are proposed finally. Domestic and foreign perspectives are utilized for respectively determining the risk as capital flight risk, international settlement risk, non-performing asset increase risk, securities market fluctuation risk, economic policy coordination risk, foreign debt increase risk, acquisition and merger risk, overseas investment risk and currency substitution risk. Expert scoring method and analytic hierarchy process are utilized for determining risk quantized value and weight, and establishing risk matrix.

1. Introduction

 (A) Background purpose

Currently, RMB has become the second largest trade financing currency and the fifth largest payment currency and the seventh largest foreign exchange currency all over the world. It is necessary to actively study related issues about RMB internationalization. After Bretton Woods system was established, the disadvantages of the international monetary system with the dollar as the center gradually disappear. The problem is Triffin dilemma, namely the contradiction between exchange rate stability maintenance of U.S. dollar as the international settlement currency and international payment balance maintenance in U.S. RMB internationalization is a double-edged sword, which can bring both opportunities and challenges. Its risk is also inevitable. If it is not emphasized, it will bring impact to financial system and economic development of the country, and even bring impact to world monetary system, and more severe financial crisis is likely to happen. Therefore, we need to analyze financial risk of RMB internationalization, thereby reducing impact to domestic economic system.

 (B) Research status

Scholars also analyze the risk that may be generated by RMB internationalization more comprehensively. Gao Haihong and Yu Yongding (2010) believe that the regulation ability of China monetary policy will be weakened under the condition of RMB internationalization. RMB internationalisation will bring frequent flow of international interest arbitrage capital. When interest arbitrage capital flows in large scale, the regulation effect of domestic monetary policy will be greatly discounted, and the large-scale flow is also unfavorable to the sound operation of financial markets in China. Wang Yuanlong (2009) believes that RMB internationalization will interfere with the stability of China economy and finance. Therefore, China financial supervision and regulation ability should be strengthened with the gradual development of RMB internationalization.

2. RMB internationalization risk identification

RMB internationalization risks mainly include domestic risks and foreign risks. Domestic risks include capital flight risk, foreign debt increase risk, non-performing asset increase risk, securities market fluctuation risk and economic policy coordination risk. Foreign risks include international settlement risk, acquisition and merger risk, overseas investment risk, international settlement risk and currency substitution risk.

 (A) Capital flight risk

It is believed according to IMF experience research that international balance of payment has greater problem if the value of errors and omission items is more than 5% of the trade value or greater than 2% of the foreign exchange expenditures, namely large-scale capital flight appears. The net error and omission showed positive value at the beginning of the century in China. It shows that capital flight was not serious, negative value appeared since 2008, which was almost always more than 5% of the trade volume or greater than 2% of foreign exchange expenditure. It indicates that capital flight is severe, which may be related to exchange rate reform after 2005, appropriate opening of capital account and stock market crash in 2008.

(B) Foreign debt increase risk

The borrowing of foreign debt is also increasing constantly with gradual opening of China capital account, and there is a trend of increasing scale. The scale of foreign debt depends on the national economy overall development level, macro-strategy, affordability, etc. The debt rate depends on domestic economy development speed, structure and solvency. Currently, China national economy is in the stage of rapid development. The growth rate has remained at the above high level in recent years. If a lot of foreign debts are borrowed at the time of rapid economic development, the economic development will face larger debt repayment pressure in the next stage. The overall level of economic development can also cause a negative impact.

(C) Non-performing asset increase risk

Foreign capital will enter the banking system directly or indirectly, and bank loanable funds are increased after free flow of capital. in the absence of effective financial regulation, Banks will relax risk constraints and be heavily involved in high risk industries or departments. A lot of loans are invested in real estate, securities and other high-yielding areas. The asset prices of these departments expand rapidly, and it will cause rapid increase of economic bubble composition in one country. When the bubble bursts, a large number of non-performing assets may be generated.

(D) Securities market fluctuation risk

The opening of the capital account will lead to inflow of foreign securities capital and inflow of much speculative capital, thereby increasing the risk of the financial system. Firstly, foreign investment and speculators' participation in domestic securities market will enhance the connection between domestic securities market and the securities market of developed countries. Secondly, the capital magnification will be increased, and the risk of attacking the market will be increased with the emergence of more financial derivatives.

(E) Difficult coordination between exchange rate policy and monetary policy

China national conditions show that it is impossible to abandon the independence of monetary policy in China. Though Central Bank can perform relatively independent monetary policy, it should be passively intervened since it has the function of maintaining foreign exchange market balance to keep the exchange rate floating in a certain interval under the condition of selecting interval floating exchange rate system. The independence of the monetary policy must be limited to certain degree.

(F) Overseas investment risk

Overseas investment will encounter a variety of risks, mainly including operating risk, foreign exchange risk, political risk and management risk. Operating risk further includes: purchasing - input risk, production process risk, output-sales risk, legal risk and technical risk. Exchange rate risk includes: trade risk, conversion risk and usual risk. Political risk includes: social unrest risk, discriminatory intervention risk, nationalization risk and exchange restriction risk. Management risk includes: cross-culture management risk, integrated management risk, religious belief risk and employee personal safety risk.

(G) Acquisition and merger risk

Overseas mergers and acquisitions belong to a double-edged sword. In recent years, there have been many cases that Chinese enterprises have made great efforts to carry out overseas investment unsuccessfully. Overseas mergers and acquisitions have brought both opportunities and potential crisis to Chinese enterprises. The identification and classification of acquisition and merger risks will help enterprises in reducing acquisition and merger risk. Acquisition and merger risk includes systematic risk and non-systematic risk, wherein systematic risk includes: political risk, legal risk,

interest rate exchange rate risk, information asymmetry risk, and non-systematic risk includes: strategic error risk, financial risk, pricing risk and integration risk.

(H) International settlement risk

Exchange rate fluctuation is particularly important to international settlement. The other party can't immediately remit frequently during enterprise foreign trade business. There is always a payment term, thereby leading to certain risk in the time, including foreign trade settlement risk and commercial bank settlement risk, wherein foreign trade settlement risks include: trade risk, operating risk and asset liability risk. Commercial bank settlement risks include: exchange risk, management risk, and asset liability risk.

(I) Currency substitution risk

Single international currency does not cause currency competition, but it has hidden dangers to the financial system. Various international currencies are beneficial to compensate for the defects of single currency and establish international monetary diversification. However, the emergence of any international currency in the world is bound to be squeezed by other currencies. The emergence of euro, yen and RMB have been pressured by U.S. dollar. If RMB internationalization cannot be improved in stability, can not be accepted by the world successfully, and exert its role, it will only be eliminated by competitors, which is not conducive to economic development.

3. Establishment of RMB internationalization risk assessment matrix

Risk matrix is a method with simple operation and qualitative-quantitative combination. It can be used for RMB internationalization risk assessment after certain improvement. First of all, risk matrix can be applied for presenting financial risk of RMB internationalization more clearly. Secondly, key risks can be observed and prevented through quantifying risk and identifying risk as the most critical risk for the project impact.

(A) Determination of the content in each column.

Risk matrix is composed of several contents including risk R, impact I, risk probability RP, risk rating RR and risk weight RW as shown in the following table:

Table 1 Risk matrix content

Risk R	Impact I		Risk probability RP	Risk rating RR		Risk weight RW
	Quantized value	Rating		Quantized value	Rating	

(1) Risk R

Risk R includes capital flight risk, foreign debt increase risk, non-performing asset increase risk, securities market fluctuation risk, economic policy coordination risk, currency substitution risk, overseas investment risk, acquisition and merger risk as well as international settlement risk. They are respectively set as R1, R2, R3, R4, R5, R6, R7, R8 and R9.

(2) Risk impact I

The impact size during item occurrence is described as shown in the following table:

Table 2 Risk impact

Risk impact rating	Quantized value	Description
Negligible	0-1	There is almost no risk impact.
Slight	1-2	There is slight impact, and RMB internationalization reaches the standard.
Moderate	2-3	There is moderate impact, and RMB internationalization partially reaches the standard.
Severe	3-4	Economic development is hindered, and RMB internationalization is failed basically.
Critical	4-5	Economic recession is available, and RMB internationalization is failed.

(3) Risk probability RP

The probability of risk item occurrence is described as shown in the following table:

Table 3 Risk probability

Risk probability	Description
[0,0.1]	Almost no probability
(0.1,0.3]	Low probability
(0.3,0.7]	Mild probability
(0.7,0.9]	High probability
(0.9,1]	Extremely high probability

(4) Risk rating RR

Risk rating quantized value is jointly determined by risk impact value and risk probability, which can be calculated according to the following table:

Table 4 Risk rating comparison table

	Negligible	Slight	Moderate	Severe	Critical
[0,0.1]	0	(0,0.5)	(0.5,1)	(1,1.5)	(2,2.5)
(0.1,0.3]	0	(0,0.5)	(1,1.5)	(1.5,2)	(2.5,3)
(0.3,0.7]	(0,0.5)	(0.5,1)	(1.5,2)	(2,3)	(3,4)
(0.7,0.9]	(0,0.5)	(1,1.5)	(2,2.5)	(3,3.5)	(4,4.5)
(0.9,1]	(0.5,1)	(1.5,2)	(2.5,3)	(3.5,4)	(4.5,5)

In the table, abscissa represents risk impact, ordinate represents risk probability, values in the table represent risk rating quantized values, 0 to 1.5 refers to low risk, 1.5 to 3 refers to moderate risk, and 3 to 5 refers to high risk. However, risk rating in the table is a value scope, and linear interpolation method should be used for calculation in order to determine concrete risk rating quantized value. The impact quantized value of one risk is set as $I_i \in [I_m, I_n]$, risk probability is $RP_i \in [RP_m, RP_n]$, and risk rating $RR_i \in [RR_m, RR_n]$ can be calculated according to table 4:

$$RR_i = RR_m + \frac{(I_i - I_m)(RP_i - RP_m)}{(I_n - I_m)(RP_n - RP_m)}(RR_n - RR_m) \quad (1)$$

Risk rating quantized value can be obtained according to the above formula.

(5) Risk weight RW

RMB internationalization risk is composed of many subsets. The importance of each concrete subset is different. Corresponding weight of different risks should be abundant in order to measure the risk importance of different risk items.

Firstly, Borda order value method is used for sorting all risk items according to risk impact and probability, N is set as total quantity of risks, i is a specific risk, k represents criterion, it represents analysis under risk impact during k=1, it represents analysis under risk probability during k=2, and RR_{ik} represents risk i rating under criteria k, namely:

$$b_i = \sum_{k=1}^{2} (N - RR_{ik}) \quad (2)$$

Borda value means risk quantity more critical than risk i, thereby sorting specific risks according to risk probability and rating, thereby avoiding subjectivity to certain degree.

Next, analytic hierarchy process is utilized for scoring and comparing different risks two by two according to Borda value, thereby obtaining risk judgment matrix. Finally, weight of different risks can be calculated, thereby obtaining total risks.

$$RRT = \sum_{i=1}^{9} RR_i \times RW_i \quad (3)$$

Wherein, RRT refers to total risk quantized value.

(B) Determination of risk impact rating, probability and rating quantized value

Risk rating, probability, the following Borda value and risk judgment matrix are obtained through expert scoring. The impact quantized value and probability of all risk items are scored through long-term academic research and experience accumulation of the expert team. The result of all people

is obtained through adopting arithmetic mean value. It is assumed that risk impact quantized value is (3.3,3.5,2.3,2.5,2.1,3.2,3.1,4.2,2), and risk probability is (0.8,0.8,0.5,0.6,0.8,0.6,0.6,0.4,0.7).

The risk rating quantized value is obtained according to table 5-4 and formula 5-1: RR1=3.075, RR2=3.125, RR3=1.575, RR4=1.6875, RR5=2.025, RR6=2.15, RR7=2.075, RR8=2.6 and RR9=0.5.

(C) Determination of risk weight

Firstly, Borda order number method is applied for sorting risk items, which is obtained through I and RP values as well as formula 5-2, such as R1. Risk quantity higher than R1 impact degree is 2, namely RR11=2, the risk quantity higher than R1 probability is 0, therefore b1=9-2+9-0=16. Similarly, b2=17, b3=5, b4=9, b5=11, b6=11, b7=10, b8=10 and b9=7, therefore Borda order value is 1, 0, 8, 6, 2, 2, 4, 4 and 7. Expert group is invited to score and compare different risks two by two according to order value. The average value is obtained. It is assumed that the judgment matrix is constructed as follows:

$$A = \begin{bmatrix} 1 & \frac{1}{2} & 8 & 6 & 2 & 2 & 4 & 4 & 7 \\ 2 & 1 & 9 & 7 & 3 & 3 & 5 & 5 & 8 \\ \frac{1}{8} & \frac{1}{9} & 1 & \frac{1}{3} & \frac{1}{7} & \frac{1}{7} & \frac{1}{5} & \frac{1}{5} & \frac{1}{2} \\ \frac{1}{6} & \frac{1}{7} & 3 & 1 & \frac{1}{5} & \frac{1}{5} & \frac{1}{3} & \frac{1}{3} & 2 \\ \frac{1}{2} & \frac{1}{3} & 7 & 5 & 1 & 1 & 3 & 3 & 6 \\ \frac{1}{2} & \frac{1}{3} & 7 & 5 & 1 & 1 & 3 & 3 & 6 \\ \frac{1}{4} & \frac{1}{5} & 5 & 3 & \frac{1}{3} & \frac{1}{3} & 1 & 1 & 4 \\ \frac{1}{4} & \frac{1}{5} & 5 & 3 & \frac{1}{3} & \frac{1}{3} & 1 & 1 & 4 \\ \frac{1}{7} & \frac{1}{8} & 2 & \frac{1}{2} & \frac{1}{6} & \frac{1}{6} & \frac{1}{4} & \frac{1}{4} & 1 \end{bmatrix} \quad (4)$$

Yaahp analytic hierarchy process software is applied. A is input into judgment matrix, consistency check is carried out CR=0.0325, the consistency is better, which is qualified in test. The following weight is obtained:

RW=(0.2097,0.3003,0.0178,0.0334,0.1409,0.1409,0.0666,0.0666,0.0239)

Total risk is further calculated according to the above formula RRT=2.58, and it belongs to moderate risk. Wherein, securities market fluctuation risk and non-performing asset increase risk have the highest rating, and they should be specially prevented.

4. RMB internationalization risk control

(A) Capital flow risk control

Capital flow is controlled mainly through strengthening the monitoring ability of cross-border capital. A perfect capital flow monitoring system is established, capital inflow and outflow are slowly opened, the use of large-amount capital should be traced and managed in real time. Large-scale capital outflow tax even can be levied. Capital control is an important method for preventing foreign economic disturbances from our country for the vast number of developing countries. China is 'immune' in 1997 Southeast Asian financial crisis due to the relatively strict capital control.

(B) Foreign debt increase risk control

Firstly, the foreign debt maturity structure should be optimized. Secondly, the domestic currency foreign debt is included in the statistics, thereby improving the transparency of foreign debt data. National Foreign Exchange Administration has classified and counted China foreign debts since 2015 according to the special standards released by IMF data for more comprehensive and accurate reflection of the overall scale of foreign debt. Thirdly, foreign debt deleveraging process is gradually slowing down. Fourthly, the implementation of cross-border financing facilitation policy will promote the stabilization of foreign debt.

(C) Non-performing asset risk control

The concentration ratio of loans should be strictly controlled. Industry financing limit is set. Industry concentration ratio risk should be prevented. Even those industries or areas with less risk

should undergo limit management, loans should not be excessively input into a few areas. The credit risk management system should be further adjusted. The operation flow of the credit business should be perfected. The loan examination and approval right should be collected upwards moderately on the premise of guaranteeing the efficiency. The loan marketing is separated from approval and examination. The management behavior of branches are constrained.

(D) Securities market risk control

It is necessary to increase the warning on systemic risk and pay attention to the proportion of capital investment for traders. There is always uncertain factor in the operation of the stock market. Winning or loss prevention should be prepared well. The financial legal framework should be established and perfected for the government, thereby making clear market positioning of different financial institutions, distinguishing the characteristics between institution regulation and function regulation, and increasing the monitoring on foreign capital inflow.

(E) Overseas investment risk control

It is necessary to establish and perfect political risk assessment and early warning mechanism, build an information service platform, encourage enterprises to go out, improve risk guarantee mechanism, and encourage enterprises to participate in overseas investment insurance for the government. It is necessary to perfect company internal structure, add risk management department, and introduce advanced risk management concept for enterprises.A unified risk management system should be established for parent company and subsidiary.

(F) Merger and acquisition risk control

When enterprises choose the merger and acquisition targets, target enterprises in line with own long-term strategy should be selected in order to select the merger and acquisition target correctly. Enterprises must select own positioning correctly: own production and business status, financial conditions, market positioning, target customer group, own advantages and disadvantages should be clearly and accurately assessed, long-term development strategy of the enterprise should be determined, and business strategy and market integration should be synchronous.

(G) International settlement risk control

Enterprises and banks should formulate foreign exchange risk management strategy and establish foreign exchange risk management system. China overseas investment enterprises should focus on foreign exchange instead of foreign exchange risk income, which is related to foreign exchange risk limit undertaken by Chinese enterprises. For example, Chinese enterprises can use forward foreign exchange trading, futures, factoring and other means to reduce the losses caused by exchange rate fluctuations.

(H) Currency substitution risk control

The key to currency substitution reduction lies in maintaining the stability of price and exchange rate, and enhancing the confidence of economic subjects to hold their own currencies. The capital account should be opened step by step gradually, thereby preventing capital flow from getting out of control, implementing sound monetary policy, maintaining the stability of RMB exchange rate, and increasing people's confidence in exchange rate stability. In addition, it is necessary to strengthen regional economic cooperation, and make RMB the central currency in the region from point to face, thereby gradually realizing RMB internationalization.

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