The Status of Cross-border RMB Settlement and Its Influencing Factors: Evidence from Panel Data

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Abstract—**In order to explore the current situation of cross-border RMB settlement and its influencing factors, this paper applies gravity model in empirical analysis. The results are as follows; the amount of cross-border RMB settlement is positively correlated with China's GDP, bilateral trade volume between China and border trading countries, and whether there is a positive correlation between China and its trade cooperation countries. Besides, cross-border RMBB settlement is negatively correlated with exchange rate fluctuation and geographical distance. Taking account of empirical results, this paper puts forward corresponding suggestions.**

Keywords—cross-border RMB settlement; gravity model; influencing factors

I. INTRODUCTION

Since China has been playing more and more important role in world economy and international trade, RMB is used more in international settlement. Many neighboring countries have gradually begun to use RMB as a tool for settlement and payment. Following the three international currencies, that is US dollar, Euro and Japanese yen, RMB gradually plays an important role in cross-border trade.

Cross-border RMB settlement pilot began to be set upin several cities in 2009, which is RMB's first step towards the currency internationalization stage. The settlement pilot expanded to a number of regions across the country in 2011. 2010 to 2014 is a period of steady progress in the development of cross-border RMB settlement. In terms of the scale, the amount of RMB settlement has maintained a steady growth in international trade. By the end of 2014, the amount of cross-border RMB receipts and payments was about 10 trillion yuan. From 2015 to 2016, it was a period of rapid development and by the end of 2015, the amount of RMB receipts and payments under the current account had reached 7 trillion yuan.

Although the cross-border RMB settlement has been developing rapidly since the establishment of the settlement pilot projects, it has also encountered some corresponding problems in the process of development. For example, the cross-border RMB settlement volume is relatively low, and the regional distribution is unbalanced. All these problems reflect that the development of cross-border RMB is still in its infancy. As we all know, if a country's currency becomes an international currency, then this will bring a greater opportunity to the economy of a country, and the development of RMB at this stage still has a certain gap from becoming the international currency. Therefore, for the economy development and RMB internationalization, it is imperative to solve these problems, and exploring the factors restricting the development of cross-border RMB settlement is particularly important to solve these problems.

II. LITERATURE REVIEW

The study on currency choice of valuation and settlement in international trade originates from the collapse and disintegration of Bretton Woods system in the last century. According to Grassman (1976), the developed industrialized countries have a large degree of decision-making power over the exchange rate, which affects the redistribution of the benefits of imports and exports, so it is easy for the country's currency to become a strong currency and more likely to become an internationally increasing the share of the renminbi in the international market[1]. Shuqin (2011) points out that RMB settlement of cross-border trade is of great significance to the change of China's status in the world.

While cross-border RMB settlement has had a positive impact, it has also caused some problems. According to the study, the RMB settlement of cross-border trade currently faces two major problems. One is that the proportion of import and export settlement is uneven, and the amount of import settlement is far greater than that of export. Second, the settlement area is too concentrated in Hong Kong and Singapore and other countries and regions. Wang Hui and Zhao Yaping (2013) point out that the current RMB internationalization model is full of risks. Under the current situation, this model not only increases China's foreign exchange reserves, but also brings great pressure on opening up the capital account[2]..

There are many factors that influence the development of RMB in cross-border trade. Cao Yong (2007) shows that the share of China's trade scale is an important factor at present in the world trade. Liu qi (2011) finds that the choice of international trade settlement currency is affected by many factors, including the transaction cost of settlement currency, the substitutability of export products, the market share and the developed level of the exchange rate and financial market[3]. Wu qing (2010) points out that the RMB capital account currently cannot be freely convertible, which hinders the development of RMB settlement of cross-border trade to a certain extent[4]. Cao Lei (2012) studies the challenges encountered in RMB settlement of cross-border trade in China

and discussed the causes of the problem. The research shows that the development of a country's financial market, the size of the offshore RMB market and the bargaining power of foreign enterprises in China are the main factors restricting the settlement of cross-border trade in RMB.

With the improvement of China's international status and the prosperity of trade, the issue of RMB internationalization has gradually appeared, many scholars at home and abroad have done research on this, so the relevant theoretical literature of this paper is relatively rich. However, most papers study the cross-border RMB trade settlement volume by theory, and the possible contribution of this paper is the empirical analysis. This paper selected the specific countries and China's trade amount to analyze, the data is more representative. The deficiency of this paper is that it is difficult to obtain enough data.

III. CURRENT SITUATION OF CROSS-BORDER RMB SETTLEMENT

A. The expansion of the scale of cross-border RMB settlement trade

From the establishment of the pilot in 2009 to the expansion of the scope of the pilot in 2010, the volume of trade settlement began to grow rapidly. The establishment of the pilot in 2009, the current account RMB cash amount is relatively small, from table I we can see that the cash amount is RMB 2.56 billion in 2009, in 2010 the amount of receipts and payments rapidly increased to RMB 350.1 billion. In a year's time, the amount of money between the two years is nearly 137 times, and the strong support of the government has led to a rapid increase in cross-border RMB receipts and payments. Current account receipts and payments also continued to grow over the next few years. In 2011, the amount of money increased from RMB350.1 billion in 2010 to RMB 1.58893 trillion. However, the amount of money received and paid in 2016 has declined to some extent. The total amount of RMB receipts and payments under the current account is RMB 5.23 trillion and 4.12 trillion was received and paid in goods trade. During the same period, the proportion of cross-border receipts and payments in goods trade, local and foreign currencies was RMB 16.9 , while trade in services and other current account receipts and payments amounted to RMB 1.11 trillion and an increase of 31.2 percent over the same period last year. It can also be concluded from table I that the share of trade in goods is high, with the exception of 2009; other years were greater than 80 percent. In 2012, it reached to 90.4 percent.

TABLE I.   CURRENT ACCOUNT RECEIPTS AND PAYMENTS IN FROM 2009-2016 UNIT: CNY 100 MILLION

Year	Goods trade	Trade in services and others	Total
2009	19.5	6.1	25.6
2010	3034	467	3501
2011	13810.7	2078.6	15889.3
2012	26039.8	2757.5	28797.3
2013	41368.4	4999.4	46367.8
2014	58946.5	6563.7	65510.2
2015	63911.4	8432.2	72343.6
2016	41209.4	11065.4	52274.7
Total	248339.7	36369.9	284709.5

Source: People's Bank of China

B. The expansion of the scale of cross-border RMB settlement in investment

The amount of receipt and payment in RMB in investment has also increased in a certain amount. In 2010, it was in the initial stage of development, and the growth rate of investment slowed down. However, since 2011, there has been a breakthrough. In 2011, the amount of foreign direct investment was CNY 26.59 billion. Foreign direct investment increased by CNY 100.68 billion over the same period last year. This is mainly due to the government's policy to expand the RMB settlement pilot program, and more export enterprises are eligible to use RMB as the settlement amount in international trade. The amount of RMB was also growing in the next few years, the development in 2015 is even more obvious, foreign investment rapidly increased to CNY 736.17 billion. Although the growth rate was slower than 2013 and 2014, the increase was substantial. In 2016, foreign direct investment (OFDI) received and paid CNY 1.06 trillion yuan, an increase of 44.2% over the same period last year, while foreign direct investment (FDI) RMB received and paid CNY 1.4 trillion. Although the year-on-year decline is 11.9%, the total amount of RMB receipts and payments continues to rise in 2016.

TABLE II.   RMB RECEIPTS AND PAYMENTS OF CROSS-BORDER DIRECT INVESTMENT FROM 2010 TO 2016 UNIT: CNY 100 MILLION

Year	Outward direct investment	Foreign direct investment	Total
2010	56.8	223.6	280.4
2011	265.9	1006.8	1272.7
2012	311.9	2591.9	2903.8
2013	866.8	4570.9	5437.7
2014	2244.1	9605.5	11849.6
2015	7361.7	15871	23232.7
2016	10618.5	13987.7	24606.2
Total	21725.7	47857.4	69583.1

Source: People's Bank of China

C. Receipts and payments of cross-border RMB settlement in overseas areas

In 2014 and 2015, China and 192 other countries have RMB cross-border settlement, which rose to 239 in 2016. Hong Kong, China, has the highest share, more than 50, and has been increasing for three consecutive years. China also has continuous and frequent trade with 12 foreign regions, such as Hong Kong, Singapore and Taiwan. China's main and neighboring countries and regions such as Hong Kong, Macao, and Taiwan often have RMB transactions, while with developed countries that do not have high enthusiasm for the adoption of RMB the same as Europe and the United States, the volume of RMB business is quite small. But from the proportion of three years, the use of RMB of European and American countries for international trade settlement volume is increasing year by year, which shows that the internationalization process of RMB is advancing step by step, slowly approaching the status of international currency.

In 2009, the settlement pilot is determined, but the cross-border RMB settlement is in the initial stage of development and related measures are not perfect, which limits the development of cross-border RMB settlement to some extent. In 2010, the relevant departments issued a notice that the pilots of cross-border RMB settlement was expanded from the

original five cities to more than 20 provinces and cities throughout the country, while overseas, from the former Hong Kong, Macao and ASEAN regions to all countries and regions. This has significantly increased the total amount of settlement. In 2011, the domestic settlement pilots were expanded to the national scope once again, all regions can implement cross-border RMB settlement, but only a small number of qualified enterprises can truly implement the policy. In 2012, all import and export companies were able to settle their international trade by using RMB, which greatly facilitates the development of cross-border RMB settlement.

Although the cross-border RMB settlement continues to develop and great progress has been made in all aspects, what we can see is that the RMB in cross-border settlement has a lower starting point and a lower market share than other currencies. Most currency holders prefer to trade and invest in international currencies such as the US Dollar, Euro and Pound. This limits the development of RMB settlement of cross-border trade partly. In order to solve these problems and promote the rapid development of cross-border RMB settlement, it will be necessary to find the factors that affect the development of cross-border RMB settlement, and use empirical analysis to analyze the factors related to cross-border RMB settlement.

From the current situation of settlement of cross-border RMB, the paper concludes the main problems of RMB settlement:

Firstly, the cross-border settlement volume of RMB is fairly low. China is a large trading country but it is not strongly competitiveness. Although there has been a rapid development of cross-border RMB settlement from 2009 to 2012, the market share of the RMB in the global monetary system is still relatively low, while the euro, US dollar, Japanese yen and sterling account for a high proportion. The RMB's market share is even smaller than the Thai baht, which fails to match China's position as a large trading country.

Secondly, uneven geographical distribution of RMB cross-border settlement. China's cross-border transactions are concentrated in Hong Kong, Singapore and neighboring countries, and Hong Kong accounts for 85 percent. Developed countries, such as the United States and Britain, the use of RMB settlement is less, accounting for only about 2 percent. Most developed countries' enterprises prefer to use the US dollar, the euro, the pound, and so on. Southeast Asia, where the economy is weaker, prefers to use the RMB as the settlement currency. This shows that the RMB has not yet being a common settlement currency and its recognition in international trade transactions is low. Without an overseas market of RMB, the RMB has not realized effective reflow, so it cannot be freely convertible. Not many foreign investors are willing to accept settlement in RMB.

Thirdly, the exchange rate fluctuates greatly, the foreign exchange market is in a stage of development .Since 2009, the value of the RMB has increased notably, people's purchasing power has gradually strengthened, and the demand for imported products has also increased. This has also increased the number of RMB transactions in international trade, and the exchange rate fluctuations of the RMB have gradually

increased. But the exchange rate fluctuation and the risk will increases at the same time, and the exchange rate fluctuation condition and the cross-border RMB settlement quantity have the negative correlation, once the exchange rate fluctuation becomes higher, the currency holder's risk will increases. We all know that people prefer to trade and invest in currencies with more stable exchange rates.

Fourthly, the currency settlement option of Enterprises is weak. According to the theory of currency selection in the world trade, the most fundamental factor of whether a currency can become international to settle is the position of the country in international trade, that is, the quantity of the country in international trade, the overall quality of its exports and its differential characteristics. China has a great advantage in trade quantity, but the amount of cross-border RMB settlement is far from the advantage of trade volume. This is because most of the products exported from China are goods with low value-added level, and the difference level is not up to the requirements of international settlement currency, so we are in a weak position in the choice of currency settlement.

IV. AN EMPIRICAL ANALYSIS OF CROSS-BORDER RMB SETTLEMENT

Hellerstein and Ryan (2009) studied the factors affecting cross-border flows of US dollars and found that international currency flow like international flow of general commodities and financial assets, can also be explained by gravity models[5].

In view of this and basing on the model setting method applied in He et al. (2016), the paper analyzes the impact of cross-border trade in RMB settlement factors[6]. Because the cross-border RMB settlement is related to not only the total economic volume, geographical distance, but also other factors, this paper adds other humanistic variables, such as bilateral trade volume, exchange rate to construct a new model.

A. Model setting

In this paper, we choose the gravity model to study the factors affecting cross-border RMB settlement, the original investment gravity model (Flandreau M. and Jobst C., 2009) is deformed to test the variables needed for the study[7], and the model is set as follows:

$$\ln settlement_{gt} = \omega_0 + \omega_1 \ln gdpc_t + \omega_2 \ln exchange_{g} + \omega_3 \ln btv_{g}$$
$$+ \omega_4 \ln dis\tan ce_{g} + \omega_5 \ln language_{g} + \omega_6 \ln border_{g} + \omega_7 \ln apec_{g} + \varepsilon_{gt}$$

In the above model, g stands for the sample countries t stands for the time, Settlement is the amount of RMB cross-border country receipts and payments; gdpc is the GDP of China, exchange represent the exchange rate of china to the sample country, btv indicates that the distance between china and the trading country's capital, ω_0 is a constant item and ε_{gt} is a residual item. According to the theoretical assumptions, the main control variables are: common language, border, apec member countries.

B. Variables description

Analysis above indicates that we already knew the current situation of cross-border RMB, as for problems, we need to analyze its influencing factors. This paper will select GDP,

bilateral trade volume, the real exchange rate of RMB, the distance between countries and other factors for empirical analysis. (See table III).

TABLE III. DESCRIPTIVE STATISTICS OF VARIABLES

	Vars	Description	Average	Standard deviation	Min	Max
1	settlement	The amount of RMB received and paid across the border	7424.3	14791.23	51.8	64031.1
2	GDP	China's gross domestic product	657031.5	74434.7	540367	744127.2
	exchange	China's exchange rate with sample countries	149.3	414.3	0.06	1460.5
	btv	Bilateral Trade between China and sample countries	196.8	154.4	3.3	558.7
	distance	The distance between China and sample countries	5280.6	3637.5	962	10993.7
3	language	Whether or not to use Chinese as a common language	0.37	0.49	0	1
	border	a border with China or not	0.28	0.45	0	1
	apec	apec member countries or not	0.66	0.48	0	1

Note: 1,2,3 denote dependent variable, independent variable and control variable respectively.

C. Data sources and descriptions

This paper selects 11 countries and regions which have used RMB cross-border payment in the financial statements for 4 =years in a row, such as the United Kingdom, the United States, Japan, Germany, Australia, South Korea, Vietnam, Hong Kong, Macao, Singapore and Taiwan. Due to the availability of data sources, the selected period is from 2013 to 2016. Since the RMB internationalization report has only three years of data , the amount of cross-border RMB receipts and payments is based on data from Hong Kong, Singapore, Taiwan and its trend compared with 2014, and was then calculated using the econometric margin method.

Regard to the source of original data, the amount of RMB cross-border country-specific receipts and payments comes from the RMB internationalization report, China's GDP comes from China's National Bureau of Statistics, and China's exchange rate for the sample countries is from the Oanda Foreign Exchange official website. The bilateral trade volume between China and the sample countries comes from the un Comtrade official website, and the geographical distance between China and the sample country comes from the Google Geographic distance Calculator and the information of APEC member countries from the APEC official website.

GDP is chosen as an explanatory variable because it is often considered to be a core indicator of the economic situation of a country. (or region) Because most cross-border RMB transactions between China and sample countries occur in the field of trade, the bilateral trade volume is chosen as one of the explanatory variables. Usually, the closer the distance is, the more frequent the trade between countries is, and the more the trade volume is. The real exchange rate of RMB reflects the international competitiveness of domestic goods and is an important factor in international trade. Whether the common language is the currency in which Chinese influences trade to some extent, because culture influences the economy to some extent. The study of the border between China and the country can also affect the choice of currency. The reason for choosing the APEC member countries is that they belong to the same economic organization and have a certain degree of acceptance of the member countries' currencies.

D. Regression results and analysis

In order to check whether the test results are robust, this paper controls three control variables, namely, lan (language), border (borderland) and apec (apec members) respectively. The confidence level after adding the lan variable is not significant, which indicates that there is no significant relationship between the amount of RMB cross-border settlement amount and the use of Chinese as a common language. After joining the border variable, the confidence level is significant positive at 1%, indicating that countries bordering China are more inclined to use RMB as the settlement currency. The coefficient after joining apec dummy variable is not significant, which also indicates that whether the sample countries use RMB as settlement currency has no significant relationship with their joining in APEC.

TABLE IV. EMPIRICAL ANALYSIS RESULTS

	Equation 1	Equation 2	Equation 3
lngdpc	4.13*** (4.06)	4.14*** (4.28)	4.13*** (4.0)
lnexch	-0.268** (-2.31)	-0.49*** (-6.94)	-0.39*** (-5.55)
lnbtv	0.708*** (3.33)	0.348 (0.127)	0.701** (3.25)
lndis	-0.638 (-1.56)	-1.588*** (-4.28)	-0.91*** (-2.77)
lnlan	0.711 (1.12)		
lnborder		1.34*** (3.0)	
lnapec			0.188 (0.6)

Note: the values in brackets are Z values, and represents significant confidence levels at 1%, 5% and 10%, respectively. Equation 1 indicates that the control language is the control variable, equation 2 denotes the control boundary as the control variable, and equation 3 indicates that weather is a member of apec is the control variable.

V. IMPLICATION OF PROMOTING RMB SETTLEMENT

A. Improving the overall national strength and developing the productive forces

To optimize the economic structure, we must first eliminate the unreasonable factors in the economic system, develop high-tech industries and improve the quality and added value of our products on this basis. At the same time, we should ensure fair competition in the industry, reduce

monopoly degree, respect the law of market development, provide certain policy support to small and medium-sized enterprises, enhance the competitiveness of Chinese enterprises from many aspects, and promote the comprehensive national strength of our country.

B. Perfecting the formation mechanism of RMB exchange rate and speeding up the construction and opening RMB offshore financial market

The offshore financial market is an important channel to develop domestic and overseas economy, and it is also a channel to stabilize the RMB exchange rate. Without the offshore financial market, it is very difficult for the RMB to be freely convertible and further develop the cross-border RMB. The establishment of RMB offshore financial market will attract a lot of foreign businessmen to invest and trade at home, which is conducive to the development and construction of domestic economy and further promote the internationalization of RMB. The opening of the financial market means more free flow of capital .On the basis of opening up, enterprises and individuals have a greater platform and scope of choice for the use of capital, which will further promote the development of cross-border RMB settlement. To open up the financial market, we should deepen the reform of the capital account management methods and means, sorting out and deleting the original unsuitable laws and regulations, and simplifying the complicated procedures.

C. Strengthening the discourse of enterprise's choice

To improve the competitiveness of international trade, China's enterprises must first improve the quality of products and services, create their own brand, and increase the level of differentiation, so China has a certain right to negotiate. Secondly, enterprises should increase R & D investment, because science and technology is the core competitiveness. They also should establish brand management, pay attention to after-sales service, increase the added value of products, and achieve the integration of goods and services. Enterprises should also pay attention to the perfection of supply chain. Enterprises should help each other, compete and develop each other. Finally, importing and exporting enterprises should have a corresponding understanding of the overall international situation and have a comprehensive knowledge of international trade and relevant laws and regulations, so that they can keep up with the international pace and have a certain position in the choice of settlement currencies to help further development of the cross-border RMB settlement.

D. Strengthening the trade with neighboring countries

China-ASEAN Free Trade area (CAFTA) was formally established in 2010, and the trade between China and ASEAN is ranked secondly to the United States and the European Union. Because of superior currencies and other factors, it is difficult to change the settlement currencies of European and American countries in a short period of time. However, due to their close ties with ASEAN countries, China has a stronger strength in trade, and ASEAN countries generally have lower bargaining power. The use of developing country's currencies also needs to be reconverted, so RMB in this case is more attractive. China can take a gradual approach to promote the process of RMB internationalization. It can firstly establish trade settlement relations with neighboring countries, and further negotiate with developed countries such as Europe and the United States to use RMB, and gradually promote the process of cross-border RMB internationalization.

VI. CONCLUSION

Based on the theory of currency internationalization and the background of China's development, this paper analyzes the current situation, problems, influencing factors and suggestions of cross-border RMB settlement. Cross-border RMB settlement has developed rapidly since the establishment of the pilot projects in 2009, and gradually emerged on the international stage. Judging from the development situation in the past few years, other countries and regions have gradually increased their recognition of RMB and are willing to use RMB for trade settlement and investment. To a certain extent, this indicates that RMB internationalization has made the initial success and has great potential for development in the future.

But this does not mean that the process of development is smooth, there are still some problems. China's GDP, exchange rate fluctuations, bilateral trade and other factors directly affect the development of cross-border RMB settlement. The problems in this process need to be solved by combining macro and micro measures, and the government and enterprises should work together to promote the process of cross-border settlement of RMB.

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