

Research Article

A Study of RMB Internationalization Path Based on Border Area Perspective

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At present, the enhancement of China's comprehensive national strength, stable currency policy, and the new round of opening-up strategy layout have provided opportunities for the financial development in border areas, especially for the RMB internationalization advancement in border areas, while the lagging financial system construction in current border areas also challenges its RMB internationalization. Based on Friedman's monetary demand theory (1970), the thesis has combined the periodical characteristics and selected the representative Yunnan province in the border areas as the object, taking into overall consideration the two paths of geography and function for RMB internationalization in border areas, so as to build the two-dimensional path theory framework of RMB internationalization from a border area perspective. In view of the above, a panel econometric regression model is built to estimate the factors influencing RMB internationalization path in Yunnan province. The results show that the process of opening up to the outside world in Yunnan province is its major driving force for RMB internationalization, while the great fluctuation of price level tends to hinder the process advancement and such possible impact of overall revenue on RMB internationalization development as the regional disparity.

1. Introduction

The ever-increasing comprehensive national strength of China, gradual expansion of RMB circulation scale, and steady promotion of RMB international status have accelerated RMB internationalization. As of the end of June 2015, RMB cross-border trade settlement has reached the cumulative amount of 14.6 trillion and the direct investment of RMB has come to the cumulative amount of 2.2 trillion, with RMB exchange reaching 3.2 trillion and global market share of RMB international payment accounting for 2.18%, rising up to no. 5. In addition to the increasing RMB internationalization scale, with the deepening of the major strategy of "One Belt and One Road," the border areas (China's border areas include nine provinces as Yunnan, Guangxi, Tibet, Xinjiang, Gansu, Inner Mongolia, Liaoning,

Jilin, and Heilongjiang) of China have been transformed from the open "end" to open "front." Various policies, especially financial policies, such as financial comprehensive reform pilot area construction in Yunnan and Guangxi border areas, regional open financial system construction in three provinces in Northeast China, and regional financial innovation district construction in Xinjiang Horgos, have promoted the continuous acceleration of RMB regional internationalization in border areas. Relying on its regional, resource, and humanitarian advantages, Yunnan province has taken the lead in its distinctive RMB internationalization path as compared with other border provinces and regions. Yunnan province established "estuary mode" for border trade bank settlement as early as 1994 and set a precedent of China's RMB cash exit and entry dispatching business for border trade settlement in 2003; then in 2004, it received the

approval of enjoying tax refund policy in small-scale border trade RMB settlement with neighboring countries and tried out RMB settlement verification system for general trade in 2005, conducting pilot RMB settlement for goods trade with ASEAN in 2008. In 2010, Yunnan province launched pilot cross-border RMB settlement and obtained the approval of financial comprehensive reform pilot area construction in 2013. After over twenty years of development, the promotion of RMB internationalization development in Yunnan province has gradually converted from single drive by border trade to multicore drive by various cross-border businesses, with financial organization system construction expanded to multiple levels and financial infrastructure facilities constantly improved.

At present, China's border areas have become the meeting point of various policy plannings which is conducive to the promotion of RMB internationalization in border areas, while all provinces in border areas have lagged behind for a long time, whether in economic strength or social development, as compared with other provinces in China, and such gap exerts great influence in RMB internationalization process in the area. According to statistics, the cross-border RMB business settlement amount in China's border areas was lower than the national average level from 2011 to 2014, with the gap of about 2.54%; meanwhile, the growth rate of cross-border RMB business settlement in China's border areas also lagged behind the average level, with an annual 70.40% on average left behind. In further analysis, from 2011 to 2014, the cross-border RMB business settlement amount in Yunnan province had been growing at an average annual rate of 45.75%, ranking no. 5 in China's border areas, as one of the lowest-ranked locations.

Since RMB internationalization process in China's border areas lags behind the national average level in both scale and growth rate, during the important period of opportunities for openness in China's border areas currently, it is worth deeply discussing how to speed up the development process of RMB internationalization in border areas so as to promote the overall improvement of RMB internationalization level and the balanced development within the region. The thesis is firstly based on literature of RMB internationalization path and monetary demand theory and builds the theoretical framework of RMB internationalization analysis in border areas, then selects the representative Yunnan province for empirical analysis, and finally draws the conclusion and puts forward the RMB internationalization development path in border areas for reference.

2. Literature Review

2.1. Evolution Mode of RMB Internationalization Path

2.1.1. Monetary Function Path of RMB Internationalization. Monetary function path of RMB internationalization refers to the analysis of the phased evolution for such four functions of international currency as trade settlement, investment currency, credit financing, and reserve currency. As to trade settlement path of RMB internationalization,

some scholars at home and abroad think that the trade settlement scale determines RMB internationalization path at the present stage and RMB settlement scale for goods trade is higher than that for service trade and trade of other current accounts in terms of structure [1, 2]. As regards investment currency and credit financing paths for RMB internationalization, Frankel [3] considers that the realization of RMB internationalization investment and financing paths in China at present mainly rely on the offshore market for capital flow; in particular, Hong Kong offshore market plays an important role. Lyrtzakakis [4] offers an examination of the main economic and political determinants of Renminbi internationalization, both at the domestic and international levels. The analysis suggests that domestic economic determinants such as capital account openness, financial market development, and interest rate/exchange rate liberalization must be seen as necessary conditions for internationalization. Various domestic political actors determine the success of internationalization indirectly, by affecting the implementation of the necessary economic reforms and conditions. It is further argued that even though several domestic economic and political conditions are necessary for internationalization, they are not a priori sufficient, as international economic and political factors also play an important role in the internationalization process. Through this analysis, the paper ultimately illustrates that the issue of RMB internationalization needs to be understood and analyzed within a political economy context rather than within a purely economic one.

2.1.2. Regional Evolution Path of RMB Internationalization.

Most scholars at home and abroad think that the regional evolution path of RMB internationalization should be as East Asianization and Southeast Asianization → Asianization → internationalization. As far as "East Asianization and Southeast Asianization" are concerned, Yang [5] carries out regression analysis in use of the currency data for the main countries in ASEAN and RMB data from 2000 to 2010 through establishing econometrics model and found that the status of dollar had gradually declined in "currency anchor" of main countries in ASEAN since the appreciation of RMB in 2005, with the position of RMB in ASEAN rising continuously and the "currency anchor" of main countries in ASEAN adjusted to RMB, Japanese Yen, and Euro. In terms of "Asianization," Peng et al. [6] apply SYRADF panel unit root test with Fourier transform to conduct empirical analysis of the economy convergence for the major 13 countries in Asia and further study the possibility for RMB to become the regional key currency. The results show that Japanese Yen remains the currency occupying an important position in Asia and RMB presents increasing impact in Asia region with great potential for becoming the regional key currency. According to Park [7], there are two options that could be taken in the following regional approach. One is creating an ASEAN + New 3 (the Chinese Mainland, Hong Kong, and Taiwan) RMB bloc, and the other is liberalizing China's financial industries and

internationalizing the RMB by playing a leading role in East Asia's economic integration within the framework of ASEAN + 3. This paper concludes that the latter is a more realistic and effective approach for China.

2.2. Research on RMB Internationalization in China's Border Areas. Tang et al. [8] conduct research on RMB regional internationalization path in Guangxi, propose cross-border settlement of RMB and mutual financial pilot points, and establish offshore RMB investment return project library and the development path for provincial RMB "asset pool." The research group of Xinjiang Financial Society [9] from the perspective of domestic and foreign regional layout puts forward the path in which Kazakhstan is chosen as the first country for promoting RMB regionalization beyond the border and Sino-Kazakhstan Economic and Trade Cooperation Center in Horgos is regarded as the pilot point for RMB regionalization in China at the same time. In view of such problems as lagged financial services in Inner Mongolia and Mongolia and lagged adjustment of dollar and RMB fund position in RMB account settlement, Wang [10] raises the path of expanding RMB settlement business in border trade and strengthening financial cooperation with surrounding countries.

At present, the literature about RMB regional internationalization in Yunnan province mainly includes the feasibility of implementation, obstacles, suggestions for development, and existing risks. Liu [11] considers that the feasibility of implementation for RMB regional internationalization in Yunnan includes the following: the first is the high degree of acceptance, large stock, and wide distribution in neighboring countries; the second is the early cross-border settlement, obvious geographic advantages, and numerous participating industries and countries; and the third is the early small currency conversion and distinctive characteristics. Sun [12] thinks that there still exist such problems in promoting RMB regional internationalization in Yunnan as impeded clearing system, unsound backflow channels, cumbersome process for case cross-border dispatching, and currency conversion to be further improved. Based on the above situation, he puts forward the suggestions of strengthening the financial cooperation with neighboring countries, researching and developing RMB cash backflow mechanism, and encouraging provincial financial institutions to go out. Ding et al. [13] conducts empirical analysis of the factors influencing RMB settlement in cross-border trade through establishing econometrics model, including such factors as local total output, local currency supply, and national identity of trade target country. The study by Wu and Tang [14] explores what factors influence RMB internationalization in the process of the Belt and Road. It firstly makes a summary of the important influencing factors, then sets up a semi-logarithmic model to quantitatively analyze these factors, and finally puts forward suggestions for the steady development of RMB internationalization. Through literature review, it is found that since the Belt and Road initiative was put forward, RMB has been used more extensively in the

surrounding countries and regions. Through quantitative research, it is found that with China's GDP as a share of world GDP, the scale of imports and exports of goods and services and economic freedom are all positively related to the internationalization of RMB; the inflation rate and the volatility of real effective exchange rate are negatively related to it.

2.3. Summary of Literature Review. The research on the theory of China's RMB internationalization path in existing literature can be divided into two angles: on one hand, RMB internationalization mainly concerns trade settlement, supplemented by offshore market, with currency swap as the complement; on the other hand, RMB internationalization follows "East Asianization and Southeast Asianization → Asianization" and provides reference for establishment of the theoretical framework for RMB internationalization path based on China's border area perspective in the thesis. In addition, research in the literature on the status quo of promoting RMB internationalization process in China's border area also lays a certain foundation for the research in the thesis. However, the existing literature presents mismatching of research situations between RMB internationalization path at national level and RMB internationalization path at border area level, with relative lagging of research for border areas. Therefore, it is in urgent need of building the analysis framework of RMB internationalization path in border area in combination with the practical conditions.

These new data sources are particularly relevant in the absence of reliable data on economic outcomes, such as tracking and setting poverty targets in developing countries [15]. Jean et al. [16] trained neural networks to predict local economic outcomes based on satellite data from five African countries. Machine learning can also draw economic forecasts from large-scale network data; for example, Blumenstock et al. [17] use mobile data to measure wealth, enabling them to quantify poverty in Rwanda at the individual level. Image recognition can certainly be used outside of satellite data, and localized predictions of economic outcomes are relevant outside developing countries.

3. Theoretical Framework

3.1. Research Hypothesis of RMB Internationalization Path from the Border Area Perspective. Effectively, internationalization of yuan has been pursued along two interrelated tracks [18]. One track focuses on cultivating use of the currency in foreign trade. At the official level, swap agreements have been arranged with an increasing number of foreign central banks, facilitating expanded use of the RMB as a means of payment [19]. By mid-2016, some three dozen agreements had been signed totaling more than RMB 3.3 trillion (C\$480 billion). At the private level, regulations have been gradually eased to permit more import and export transactions to be settled in yuan, bypassing traditional invoicing currencies like the dollar. The second track focuses on use of the RMB in international finance as a store of value.

Currently, the research theory of evolution mode for RMB internationalization path mainly focuses on the national level and seldom establishes the research analysis framework for RMB internationalization path reflecting geographical features in terms of a certain region. For this reason, the thesis has integrated Figure 1 and proposed the research hypothesis of RMB internationalization path in conformity with the characteristics of border areas:

The first is the regional path hypothesis of RMB internationalization from the border area perspective. Learning from the regional evolution path theory of “surrounding usage → regionalization → internationalization” at the national level for RMB internationalization, in consideration of the differences between national path and border area path for RMB internationalization, it is proposed that the regional evolution path for border areas should follow the hypothesis of border-oriented first and then internationalization, so as to reflect the location characteristics of the border areas in connection with the surrounding countries.

The second is the functional path hypothesis of RMB internationalization from the border area perspective. Learning from the functional evolution path theory of “trade settlement → investment currency → credit financing → reserve currency” at the national level for RMB internationalization, in consideration of the differences between national path and border area path for RMB internationalization, the hypothesis mainly focusing on such three functions as trade settlement, investment currency, and credit financing has been put forward from the border area perspective.

3.2. Theoretical Model of RMB Internationalization Path from the Border Area Perspective. Friedman [20] presents money demand function from the perspective of a country’s monetary demand as follows:

$$\frac{M}{P} = f\left(y, w, r_m, r_b, r_e, \frac{1}{P} \frac{dP}{dt}; u\right). \quad (1)$$

In the function, y refers to actual income, w means the proportion of nonhuman wealth in total wealth (namely, the proportion of income from property in total income), r_m represents the expected nominal yield of currency, r_b means the expected nominal yield of term bond, r_e refers to the expected nominal yield of stock, $(1/P)(dP/dt)$ means the expected change rate of commodity price (namely, reflecting inflation), and u stands for non-revenue factor.

According to money demand function, the main ideas of Friedman’s monetary demand theory can be summarized as the following aspects: firstly, in the economic society, money is a kind of asset and a form of holding wealth by people; the second is about the total amount of wealth held by people in various forms, and the difference in individual total wealth tends to influence his/her demand for money; the third is about the anticipated returns of wealth in all forms. In the economic society, people hold the total wealth in different forms; fourthly, the function can not only indicate the monetary demand of the ultimate wealth owner, but also

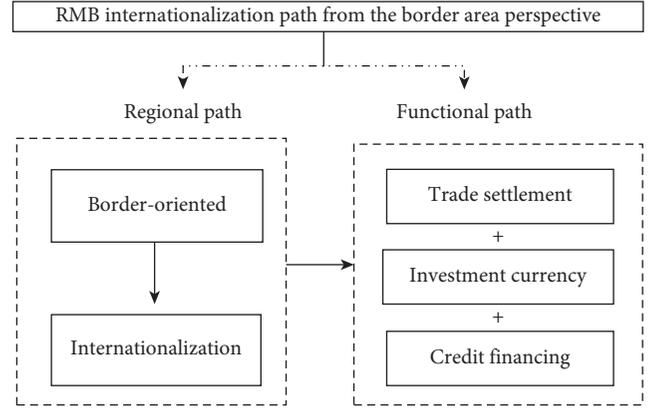


FIGURE 1: Two-dimensional research hypothesis of RMB internationalization path from the border area perspective.

represent the aggregate demand for a country’s money from the whole international community. Based on the above ideas, the thesis draws on the money demand function (formula (1)) established by Friedman [20], in comprehensive consideration of the two-dimensional hypotheses in accordance with regional and functional paths in border areas, and builds the following theoretical model of RMB internationalization path for border areas:

$$M_i = (y_i)^{\beta_1} \cdot (X_i)^{\beta_2} \cdot (R_i)^{\beta_3} \cdot \left(\frac{1}{P_i} \frac{dP_i}{dt}\right)^{\beta_4} \cdot u_i. \quad (2)$$

In the model, M_i refers to the RMB demand in the border country or border area i ; y_i means the overall revenue in the border area i ; X_i indicates the opening-up scale of the border area i , mainly reflecting the monetary function; R_i shows the wealth conditions in the border area i ; $(1/P_i)(dP_i/dt)$ represents the price change in the border area i ; u_i refers to the impact of other factors on the RMB demand in the border area i ; β_1 , β_2 , β_3 , and β_4 , respectively, represent the influence coefficient of various factors on the RMB demand in the border area i .

According to the above theoretical model, the main points of RMB internationalization path theory from the border area perspective proposed in the thesis include the following aspects: firstly, the demand for RMB in the border areas is affected by the opening-up scale of the region, namely, the functional path of foreign trade, investment currency, and credit financing; secondly, the demand for RMB in the border areas is influenced by the overall income, wealth of residents and enterprises, and price fluctuation in the region; thirdly, the regional characteristics of the border area and nonborder area are differentiated by the subscript i in the model.

3.3. Indicator System and Research Object

3.3.1. Indicator System and Research Hypothesis. In accordance with the selection of influencing factors for RMB internationalization path in border areas, the indicator system of influencing factors for RMB internationalization path in border areas has been established, as shown in Table 1.

TABLE 1: Indicator system of influencing factors for RMB internationalization path in border areas.

First class indicators		Second class indicators		Correlation	Variable type
Name	Code	Name	Code		
Demand for RMB	M	Cross-border RMB business settlement amount	kj	—	Explained variable
Overall revenue	Y	Local GDP	gdp	Positive correlation	
Opening-up scale	X	Total volume of foreign trade	trad	Positive correlation	Explanatory variable
		Foreign direct investment amount	fdi	Positive correlation	
Wealth conditions	R	Balance of deposits and loans in domestic and foreign currency for financial institutions	fina	Positive correlation	
Price change	$(1/P)(dP/dt)$	Consumer price index	cpi	Negative correlation	

The research hypotheses in five aspects have been put forward in view of the above indicator system:

H1: the local GDP in border areas presents the positive correlation with the demand for RMB in border areas

H2: the foreign trade volume in border areas presents the positive correlation with the demand for RMB in border areas

H3: the foreign investment amount in border areas presents the positive correlation with the demand for RMB in border areas

H4: the balance of deposits and loans in domestic and foreign currency for financial institutions in border areas presents the positive correlation with the demand for RMB in border areas

H5: consumer price index in border areas presents the negative correlation with the demand for RMB in border areas

3.3.2. Research Object. The research object of the thesis mainly refers to Yunnan province in China. Yunnan province covers a total area of about 390 thousand square kilometers and accounts for 4.11% of the country's territory, ranking no. 8 among the provincial administrative regions nationwide in terms of the area. The boundary line of Yunnan province is 4060 kilometers, bordering on such three countries as Burma, Laos and Vietnam. As to the concrete division, on one hand, Yunnan province was approved by China to carry out cross-border RMB settlement pilot work in 2011, and at the end of 2015, only the data for the past five years could be collected; for the econometric model with five explanatory variables, the regression results will be of significance with the minimum samples of freedom at 15. For this purpose, the thesis takes 16 cities and prefectures in Yunnan province into consideration from the cross-section angle to build the panel econometric model; in this way, the sample size increases to 80, meeting the requirements of regression. On the other hand, in order to show the innovativeness of the thesis and reveal the regional heterogeneity, Yunnan province is divided into such three regions as southern Yunnan, central Yunnan, and northern Yunnan, so as to reflect the differences of RMB internationalization path in different regions; see Table 2 for the detailed division.

3.4. Econometric Model and Data Specification

3.4.1. Econometric Model. Take the logarithm at both sides of the theoretical model (formula (2)) equation and establish the following four panel data econometric models of influencing factors for RMB internationalization in Yunnan province, in combination with the specific secondary indicator of the influencing factors for RMB internationalization path in the selected border area:

$$\ln kj_{it} = c + \alpha_1 \cdot \ln gdp_{it} + \alpha_2 \ln trad_{it} + \alpha_3 \ln fdi_{it} + \alpha_4 \ln fina_{it} + \alpha_5 \ln cpi_{it} + \mu_{it}, \quad (3)$$

$$\ln kj_{1t} = c_1 + \beta_1 \cdot \ln gdp_{1t} + \beta_2 \ln trad_{1t} + \beta_3 \ln fdi_{1t} + \beta_4 \ln fina_{1t} + \beta_5 \ln cpi_{1t} + \mu_{1t}, \quad (4)$$

$$\ln kj_{2t} = c_2 + \gamma_1 \cdot \ln gdp_{2t} + \gamma_2 \ln trad_{2t} + \gamma_3 \ln fdi_{2t} + \gamma_4 \ln fina_{2t} + \gamma_5 \ln cpi_{2t} + \mu_{2t}, \quad (5)$$

$$\ln kj_{3t} = c_3 + \delta_1 \cdot \ln gdp_{3t} + \delta_2 \ln trad_{3t} + \delta_3 \ln fdi_{3t} + \delta_4 \ln fina_{3t} + \delta_5 \ln cpi_{3t} + \mu_{3t}. \quad (6)$$

In the above four equations, equation (3) refers to the overall panel data econometric model for all the 16 cities and prefectures in Yunnan province; equations (4)–(6) indicate the panel data econometric models for the three regions of southern Yunnan, central Yunnan, and northern Yunnan in Yunnan province; c represents the constant term of the model; μ represents the random disturbance term of the model; α , β , γ , and σ show the estimated parameters before all explanatory variables.

3.4.2. Data Specification. Combine the specific indicator category in the above influencing factor indicator system for RMB internationalization path of Yunnan province and search the department concerned and relevant statistical yearbook, so as to collect and sort the panel data of influencing factor indicator from 2011 to 2015. The data for various indicators come from Kunming central subbranch of the People's Bank of China, statistical yearbook of Yunnan province, China's regional economic statistical yearbook, and Yunnan survey yearbook. On the basis of various indicator data collected and sorted, with the purpose of reducing the impact of absolute data dimension on regression results, as well as the fluctuation range of the data, take the

TABLE 2: Division of all regions in Yunnan province.

Region	Include cities and prefectures	Division explanation
Southern Yunnan (8 cities and prefectures)	Baoshan city, Pu'er city, Lincang city, Honghe prefecture, Wenshan prefecture, Xishuangbanna prefecture, Dehong prefecture, Nujiang prefecture	All the cities and prefectures in this region directly neighbor the surrounding countries, as the border cities and prefectures
Central Yunnan (4 cities and prefectures)	Kunming city, Yuxi city, Qujing city, Dali prefecture	The cities and prefectures in this region have relatively developed economic and social status
Northern Yunnan (4 cities and prefectures)	Chuxiong prefecture, Lijiang city, Diqing prefecture, Zhaotong city	The cities and prefectures in this region are adjacent to other provinces in China

logarithm of the five absolute indicators, namely, cross-border RMB settlement, local GDP, total volume of foreign trade, foreign direct investment amount, and the balance of deposits and loans for financial institutions.

4. Empirical Analysis

The collected panel data of various regression variables are composed of five time dimensions and sixteen cross-section dimensions, namely, "short panel" data, with the sample size 80. See Table 3 for the detailed description of such statistical properties as the mean value, standard deviation, maximum, and minimum for all variable samples.

Applied to F -test and Hausman test for the panel data models established in the thesis and determine the form of the four panel data models as entity-fixed effect models. As to the entity effect models, considering that the cross section data of samples are more than the "short panel" traits of time series, it is advisable to adopt the generalized least squares (GLS) method to evaluate and obtain the estimated results of overall model and divisional models.

4.1. Significance of Coefficient for Overall and Divisional Models. The results of the overall model 3 processed with GLS estimation are shown in Table 4. The results show that the significant influencing factors for cross-border RMB settlement in Yunnan province are the total volume of foreign trade, foreign direct investment amount, and consumer price index. According to the concrete analysis, one percent point rise of the total volume of foreign trade in Yunnan province will make the cross-border RMB settlement scale in Yunnan province increase by 0.5514% on average; one percent point rise of foreign direct investment amount in Yunnan province will make the cross-border RMB settlement scale in Yunnan province increase by 0.2031% on average; one percent point rise of consumer price index in Yunnan province will make the cross-border RMB settlement scale in Yunnan province decline by 0.0507% on average, while such two factors as local GDP and the balance of deposits and loans in domestic and foreign currency for financial institutions in Yunnan province have not exerted remarkable influence on the cross-border RMB settlement in Yunnan province yet. From the analysis of statistical properties, adjusted R -squared (R^2) is relatively high, F statistical value is high, and DW statistics are close to 2, indicating the sound fitting degree of overall model,

significant overall coefficient, and no first-order autocorrelation for stochastic error term.

The results of the divisional model 4, 5, and 6 processed with GLS estimation are shown in Table 5. The results show that the factors influencing the regional RMB settlement vary for different regions. In southern Yunnan, the significant factors influencing cross-border RMB settlement scale are the total volume of foreign trade and foreign direct investment amount; to be more specific, one percent point rise of the total volume of foreign trade in southern Yunnan will make the cross-border RMB settlement scale increase by 1.5331% on average; one percent point rise of foreign direct investment amount in southern Yunnan will make the cross-border RMB settlement scale increase by 0.5748% on average. In central Yunnan, the significant factors influencing cross-border RMB settlement scale are the local GDP, total volume of foreign trade, foreign direct investment amount, and consumer price index; to be more specific, one percent point rise of the local GDP in central Yunnan will make the cross-border RMB settlement scale increase by 2.1006% on average; one percent point rise of the total volume of foreign trade in central Yunnan will make the cross-border RMB settlement scale increase by 0.2019% on average; one percent point rise of foreign direct investment amount in central Yunnan will make the cross-border RMB settlement scale increase by 0.2024% on average; one percent point rise of consumer price index in central Yunnan will make the cross-border RMB settlement scale decline by 0.0783% on average. As to northern Yunnan, the significant factors influencing cross-border RMB settlement scale are the total volume of foreign trade and consumer price index; to be more specific, one percent point rise of the total volume of foreign trade in northern Yunnan will make the cross-border RMB settlement scale increase by 2.7323% on average; one percent point rise of consumer price index in northern Yunnan will make the cross-border RMB settlement scale decline by 0.441% on average. Judging from the statistical properties of model 3.2 to 3.4, the adjusted R -squared (R^2) of the three models is relatively high, showing the sound fitting degree, and high F statistical value indicates the overall significance of all model coefficients, without first-order autocorrelation for stochastic error term of all models.

4.2. Deviation Degree of Intercept Term for Overall and Divisional Models. All the four panel models are entity effect models, mainly featuring the existence of individual influence

TABLE 3: Statistical representation of regression variable samples.

Variable	Mean value	Standard deviation	Minimum	Maximum	Sample size
ln kj	9.9674	1.4862	0.0000	15.7755	80
ln gdp	5.8895	0.0294	3.8720	8.1360	80
ln trad	9.7986	0.2055	5.5595	14.3401	80
ln fdi	7.6029	0.8676	0.0000	12.0996	80
ln fina	6.7282	0.0386	4.7449	9.8709	80
ln cpi	4.6534	0.0053	4.6269	4.7362	80

TABLE 4: Econometric regression results of overall model 3.

Variable indicator and code	Variable parameter	Estimated value of variable parameter
Constant term	c	3.5741
Local GDP (ln gdp)	α_1	0.9607
Total volume of foreign trade (ln trad)	α_2	0.5514***
Foreign direct investment amount (ln fdi)	α_3	0.2031***
Balance of deposits and loans in domestic and foreign currency for financial institutions (ln fina)	α_4	-0.1319
Consumer price index (ln cpi)	α_5	-0.0507*
Adjusted R -squared, R^2		0.9737
F statistical value		147.3611
DW statistics		1.4161

* and *** represent the 10% and 1% significance levels for t statistics of all parameters, respectively.

TABLE 5: Econometric regression results of divisional model 4 to 6.

Variable indicator and code	Southern Yunnan (model 4)		Central Yunnan (model 5)		Northern Yunnan (model 6)	
	Variable parameter	Estimated value of variable parameter	Variable parameter	Estimated value of variable parameter	Variable parameter	Estimated value of variable parameter
Constant term	c_1	-5.1907	c_2	3.3347**	c_3	41.657**
Local GDP (ln gdp)	β_1	1.5843	γ_1	2.1006***	σ_1	-6.3848
Total volume of foreign trade (ln trad)	β_2	1.5331***	γ_2	0.2019***	σ_2	2.7323***
Foreign direct investment amount (ln fdi)	β_3	0.5748***	γ_3	0.2124**	σ_3	0.0099
Balance of deposits and loans in domestic and foreign currency for financial institutions (ln fina)	β_4	-2.4729	γ_4	0.2849	σ_4	3.9652
Consumer price index (ln cpi)	β_5	0.0275	γ_5	-0.0783***	σ_5	-0.441***
Adjusted R -squared, R^2		0.6828		0.998163		0.850353
F statistical value		17.78842		1291.449		14.49568
DW statistics		1.415892		2.20737		2.53379

** and *** represent the 5% and 1% significance levels for t statistics of all parameters, respectively.

among the 16 cities and prefectures in Yunnan province, without structural changes, and the individual influence is mainly embodied in the differences of intercept term of models for all cities and prefectures. It is noteworthy that the individual influence obtained by means of Eviews8.0 regression reflects the deviation of all cross section members from the overall average state. In other words, the differences of the intercept term for all cities and prefectures estimated from the overall and divisional models in the thesis are reflected in the deviation of the spontaneous cross-border RMB settlement (spontaneous cross-border RMB settlement refers to the existing cross-border RMB settlement value in all cities and prefectures when all the five factors influencing cross-border RMB settlement are zero at the same time; the

indicator can reflect the found) of all regions from the provincial average spontaneous cross-border RMB settlement. The estimated deviation value for all regions is shown in Tables 6 and 7. The analysis of the deviation degree of intercept term in different regions indicates that the following cities and prefectures have higher spontaneous cross-border RMB settlement scale than the provincial average spontaneous cross-border RMB settlement in terms of overall model: Dehong Prefecture, Honghe Prefecture, Lincang City, Xishuangbanna Prefecture, Pu'er City, Kunming City, Yuxi City, and Dali Prefecture, and the rest cities and prefectures have the spontaneous cross-border RMB settlement scale close to or smaller than the provincial average scale. As to divisional models, the regions with the spontaneous cross-

TABLE 6: Estimated results of spontaneous cross-border RMB settlement deviation (c_i^*) for all regions in overall model.

Region i		c_i^*
Dehong prefecture	DH	3.3764
Honghe prefecture	HH	1.1860
Lincang city	LC	1.1045
Xishuangbanna prefecture	BN	0.8273
Pu'er city	PE	0.6407
Kunming city	KM	0.5432
Yuxi city	YX	0.4631
Dali prefecture	DL	0.3214
Baoshan city	BS	0.0003
Lijiang city	LJ	-0.0503
Chuxiong prefecture	CX	-0.8801
Nujiang prefecture	NJ	-1.0530
Wenshan prefecture	WS	-1.0720
Zhaotong city	ZT	-1.6371
Diqing prefecture	DQ	-1.8310
Qujing city	QJ	-1.9394

TABLE 7: Estimated results of spontaneous cross-border RMB settlement deviation (c_i^*) for all regions in divisional models.

Region i		c_i^*
Southern Yunnan (model 4)		
Dehong prefecture	DH	0.1714
Honghe prefecture	HH	0.1720
Pu'er city	PE	0.0462
Xishuangbanna prefecture	BN	-0.2731
Lincang city	LC	0.1175
Baoshan city	BS	-0.1394
Wenshan prefecture	WS	-0.1522
Nujiang prefecture	NJ	0.0576
Central Yunnan (model 5)		
Kunming city	KM	1.1264
Yuxi city	YX	0.7139
Dali prefecture	DL	0.7090
Qujing city	QJ	-2.5493
Northern Yunnan (model 6)		
Chuxiong prefecture	CX	0.3814
Lijiang city	LJ	-3.6449
Diqing prefecture	DQ	-1.6196
Zhaotong city	ZT	4.8830

border RMB settlement scale higher than the provincial average spontaneous cross-border RMB settlement scale include Dehong Prefecture, Honghe Prefecture, Lincang City, and Pu'er City in southern Yunnan; Kunming City, Yuxi City, and Dali Prefecture in central Yunnan; and Zhaotong City and Chuxiong Prefecture in northern Yunnan.

4.3. Robustness Test of Overall and Divisional Models. The cointegration test of model 3 to 6 in Table 8 shows that the probability p value of ADF statistics for all models is less than 0.05; that is to say, at the significance level of 5%, all models refuse to accept the original hypothesis without cointegrated model, which indicates that all panel models are cointegrated, and all regression coefficients are effective, with explanatory power.

TABLE 8: Kao test results of overall model and divisional models.

	Kao residual cointegration test		
	ADF	t statistic	Prob.
	Overall model (3)	Residual variance	-5.116029
	HAC variance	2.073562	—
	Kao residual cointegration test		
Southern Yunnan model (4)	ADF	t statistic	Prob.
	Residual variance	-2.452871	0.0071
	HAC variance	1.475345	—
	Kao residual cointegration test		
Central Yunnan model (5)	ADF	t statistic	Prob.
	Residual variance	-4.66203	0.0000
	HAC variance	0.036618	—
	Kao residual cointegration test		
Northern Yunnan model (6)	ADF	t statistic	Prob.
	Residual variance	-2.252246	0.0122
	HAC variance	3.807812	—
	Kao residual cointegration test		
	HAC variance	3.539807	—

5. Conclusions and Suggestions

The research features innovative research perspective on one hand, based on the regional heterogeneity analysis, combining the characteristics of cross-border RMB development at the local level and integrating the two paths of monetary function and regional evolution for RMB internationalization into one analysis framework according to the money demand function established by Friedman [20], so as to set up the theoretical model of RMB internationalization path in border areas; on the other hand, the research has the innovative research method, trying to find out the influencing factors for the regional internationalization of RMB in Yunnan province and the influencing degree from such aspects as demand for RMB, overall revenue, opening-up scale, wealth conditions, and price change according to the theoretical model of RMB internationalization path in border areas by establishing panel regression model, in order to provide the empirical support for the design of RMB internationalization path in border areas. On the basis of the analysis from theoretical and empirical levels, integrating the research hypotheses in five aspects, the research results of the thesis are drawn as follows:

- (1) Hypothesis H1: the local GDP in border areas presents the positive correlation with the demand for RMB in border areas. The analysis in the thesis indicates that the local GDP in Yunnan province presents no obvious correlation with the demand for RMB in Yunnan province from the 16 cities and prefectures in the province as a whole, while the local GDP of central Yunnan region presents positive correlation with the demand for RMB in the region

from the regional perspective, consistent with the hypothesis.

- (2) Hypothesis H2: the foreign trade volume in border areas presents the positive correlation with the demand for RMB in border areas. The analysis in the thesis shows that the foreign trade volume in Yunnan province presents obvious positive correlation with the demand for RMB in Yunnan province, either from the overall or regional perspective, consistent with the hypothesis.
- (3) Hypothesis H3: the foreign investment amount in border areas presents the positive correlation with the demand for RMB in border areas. The analysis in the thesis indicates that the foreign investment amount of Yunnan province presents obvious positive correlation with the demand for RMB in Yunnan province, from the 16 cities and prefectures in the province as a whole, consistent with the hypothesis; in terms of regional aspect, the conditions in southern Yunnan and central Yunnan are consistent with the hypothesis, while the conditions in northern Yunnan shows no significant correlation.
- (4) Hypothesis H4: the balance of deposits and loans in domestic and foreign currency for financial institutions in border areas presents the positive correlation with the demand for RMB in border areas. The analysis in the thesis shows that the balance of deposits and loans in domestic and foreign currency for financial institutions in Yunnan province presents no significant correlation with the demand for RMB in Yunnan province.
- (5) Hypothesis H5: consumer price index in border areas presents the negative correlation with the demand for RMB in border areas. The analysis in the thesis indicates that the consumer price index in Yunnan province presents obvious negative correlation with the demand for RMB in Yunnan province, from the 16 cities and prefectures in the province as a whole, consistent with the hypothesis; in terms of regional aspect, the conditions in central Yunnan and northern Yunnan are consistent with the hypothesis, while the conditions in southern Yunnan shows no significant correlation.

On the basis of the above research results, the research conclusions in the following aspects for the thesis can be drawn: firstly, the factor of opening-up scale is the main driving factor promoting RMB internationalization in Yunnan province; secondly, the factor of price change hinders RMB internationalization process in Yunnan province to a certain extent; thirdly, the factor of overall revenue promotes the development of RMB internationalization only in some regions of Yunnan province; fourthly, the factor of wealth conditions has not exerted or released its driving potential for RMB internationalization process in Yunnan province.

The following four aspects of policy suggestions are put forward based on the conclusions from the thesis.

The first is to accelerate the innovation of financial products and expand regionalization of cross-border RMB investment and financing. Efforts should be made to expand RMB capital export business; focus on promotion of cross-border two-way RMB capital pool business, cross-border RMB central collection business and cross-border RMB loan business under current account, cross-border RMB settlement and RMB international investment, and loan fund business under personal current account; rely on the major investment projects abroad; actively seek and expand market; and give play to other monetary functions of cross-border RMB other than the trade settlement of cross-border RMB; furthermore, it is suggested to speed up the innovation of RMB overseas investment products, increase the product categories for overseas RMB valuation, and expand regionalization of cross-border RMB investment and financing.

The second is to improve the foreign trade environment and stabilize the status of trade settlement for cross-border RMB; try to promote the industrial upgrading, adjust the trade structure, improve the trade conditions, and boost the currency options of import and export enterprises in trade; implement the differentiated encouraging policy for general trade and bulk commodity trade in use of RMB settlement; establish the trade cooperation platform and consolidate the trade and investment scale with the neighboring countries through such effective ways as simplifying customs clearance formalities for goods trade (especially in the less developed area on the border), accelerating approval and registration progress for cross-border investment and reducing trade and investment costs.

The third is to promote cross-border financial cooperation and unbar the development channel of cross-border RMB business; concentrate efforts on promoting cross-border financial cooperation, deepening foreign exchange, strengthening the communication and cooperation with the central banks and commercial banks of neighboring countries, and set up the official communication and collaboration mechanism as soon as possible; further expand the cooperation with foreign institutions and improve the cross-border RMB clearing and settlement system with the surrounding countries and regions; expand the RMB backflow channels by means of overseas RMB loan, issuance of RMB bonds abroad, and permitting purchase of domestic enterprise equity by foreign legal persons and individuals.

The fourth is to promote financial infrastructure upgrades and optimize the support mechanism for cross-border RMB process; set up the research, development, and test center for financial engineering on the border and actively explore the construction of such financial infrastructures as financial private network, financial cloud computing center, integrated service platform with electronic payment, sharing platform for enterprise credit information, mobile financial public service platform, and financial information interaction platform; give great impetus to service facilitation, improve market participation, simplify formalities, reduce the examination and approval, lower the trade cost for enterprises, and enhance the service efficiency and optimize the construction of support mechanism for cross-border RMB process.

Data Availability

WIND database were used to support this study.

Conflicts of Interest

We declares that there is no conflict of interest regarding the publication of this paper.

References

- [1] B. Ermon, "China's challenge to the international monetary system: incremental steps and long-term prospects for internationalization of the renminbi," *Pacific Forum CSIS Issues and Insights*, vol. 9, no. 2, pp. 1–17, 2009.
- [2] F. Zhen, "The internationalization of renminbi: development, prospects and orientation," *Economic Theory and Business Management*, vol. 33, no. 5, pp. 22–31, 2014.
- [3] J. Frankel, "Internationalization of the RMB and historical precedents," *Journal of Economic Integration*, vol. 27, no. 3, pp. 329–365, 2012.
- [4] D. Lyrtzakakis, "The determinants of RMB internationalization: the political economy of a currency's rise," *American Journal of Chinese Studies*, vol. 21, no. 2, pp. 163–184, 2014.
- [5] R. H. Yang, "Effect of RMB circulation in surrounding countries and adjustment of currency anchor in ASEAN," *Journal of International Trade*, vol. 339, no. 3, pp. 61–68, 2011.
- [6] H. F. Peng, X. Y. Tan, W. B. Chen, and Y. L. Li, "Asian monetary cooperation and RMB regionalization process: an empirical research based on panel SURADF test with a fourier function," *World Economy Studies*, no. 1, pp. 36–47, 2015.
- [7] Y. C. Park, "RMB internationalization and its implications for financial and monetary cooperation in East Asia," *China & World Economy*, vol. 18, no. 2, pp. 1–21, 2010.
- [8] W. L. Tang, L. L. Qin, H. Sun, and L. Q. Huang, "The orientation of financial policy under the background of RMB regionalization in Guangxi," *Journal of Guangxi Financial Research*, no. 11, pp. 40–45, 2009.
- [9] Xinjiang Financial Society, "Research on the regionalization of RMB and the expansion of border trade settlement," *Xinjiang Finance*, vol. 29, no. 11, pp. 4–19, 2007.
- [10] X. Wang, "Local currency settlement of border trade and the development of RMB regionalization," *Heilongjiang Finance*, vol. 28, no. 10, pp. 29–30, 2007.
- [11] G. Liu, "A study of RMB internationalization," *Journal of the Party School of the Central Committee of the C.P.C.*, no. 6, pp. 55–59, 2012.
- [12] L. Sun, "Feasibility study on promoting RMB regionalization in Yunnan province," *Heilongjiang's Foreign Economic and Trade*, vol. 25, no. 8, pp. 63–66, 2011.
- [13] W. L. Ding, L. L. Yang, and F. J. Lin, "Research on the influencing factors of RMB settlement in cross-border trade: an analysis based on Yunnan data," *Guizhou Social Sciences*, vol. 296, no. 8, pp. 80–87, 2014.
- [14] T. T. Wu and R. Tang, "Research on the influencing factors of RMB internationalization in the process of the Belt and Road initiative," in *Proceedings of the 2018 2nd International Conference on Management, Education and Social Science (ICMESS 2018)*, Qingdao, China, June 2018.
- [15] J. E. Blumenstock, "Fighting poverty with data," *Science*, vol. 353, no. 6301, pp. 753–754, 2016.
- [16] N. Jean, M. Burke, M. Xie, W. M. Davis, D. B. Lobell, and S. Ermon, "Combining satellite imagery and machine learning to predict poverty," *Science*, vol. 353, no. 6301, pp. 790–794, 2016.
- [17] J. Blumenstock, G. Cadamuro, and R. On, "Predicting poverty and wealth from mobile phone metadata," *Science*, vol. 350, no. 6264, pp. 1073–1076, 2015.
- [18] P. Subacchi, *The People's Money: How China is Building a Global Currency*, Columbia University Press, New York, NY, USA, 2017.
- [19] S. Liao and D. McDowell, "No reservations: international order and demand for the renminbi as a reserve currency," *International Studies Quarterly*, vol. 60, no. 2, pp. 272–293, 2016.
- [20] M. Friedman, "A theoretical framework for monetary analysis," *Journal of Political Economy*, vol. 78, no. 2, pp. 193–238, 1970.

