



Renminbi Internationalization: Progress, Prospect and Comparison

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Abstract

Using principal component analyses, this paper constructs two internationalization indices for the renminbi (RMB) and 32 other major currencies. We find that the RMB's currency internationalization degree index (CIDI) is still low, and far behind the 4 most important international currencies. In 2009, it was ranked 18th among all important international currencies. However, in terms of the currency internationalization prospect index (CPII), the RMB has remained the world's fifth highest since 2006. Although it is still far behind the US dollar and the euro, surpassing the ranking of the yen and the pound is possible in the near future. The dramatic difference in the ranking between the CIDI and the CPII is a result of China's tight capital account control, the usage continuity of international currency due to network externalities, and the narrow foreign exchange and imperfect financial markets. Hence, to a large degree, the RMB's potential as an international currency depends on China's capital account liberalization.

Key words: currency internationalization, currency internationalization degree index, currency internationalization prospect index, principal component analysis, RMB
JEL codes: C1, F31, O24

I. Introduction

From 2007, to raise the status of the renminbi (RMB) in the international monetary system, the Chinese Government began issuing RMB-denominated notes, bonds and funds in Hong Kong. At home, the number of cities engaging in RMB settlement for trans-border trade increased from 5 in 2009 to 20 in 2010; by 2011, the RMB was being used throughout

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the country for trans-border trade. In addition, between December 2008 and April 2012, the Chinese Government signed currency exchange agreements with 17 countries and regions, with an accumulative amount of approximately RMB1.5tn (Xinhua Agency, 2012). With the acceleration of RMB internationalization, the question of whether the RMB will become another major international currency to challenge the international status of the US dollar has attracted increasing academic attention (Bergsten, 2009; Murphy and Yuan, 2009).

Although there is some academic literature concerning RMB internationalization, most related studies fall into the category of cost–benefit analysis. Such cost–benefit analyses emphasize that the internationalization of the RMB is a double-edged sword for Chinese economic development: the greater the economic benefits, the higher the added risk (Li, 2007). Cost–benefit analysis is not ideal for quantifying the economic benefits and risks brought by RMB internationalization (Gao and Yu, 2009).

RMB internationalization is not up to the Chinese Government alone. It is necessary to consider market factors, including the acceptance of the RMB by the global economic system and the economic viability of the RMB to become a major international currency (Genberg, 2009). As well as considering the benefits and the costs to the Chinese economy, it is important to measure the current status of RMB internationalization and to estimate the prospects for RMB internationalization in light of China's economic conditions and with regards to international monetary markets. Based on the progress of and the prospects for RMB internationalization, we discuss possible future for policy changes, such as the opening of the Chinese capital account.

The present paper measures the degree of and the prospects for RMB internationalization and compares the RMB with various currencies. The paper is structured as follows. Section II reviews the published literature providing definitions of international currency and discussing economic factors affecting currency internationalization, and assembles the relevant assessment indicators. Section III describes our research method. An empirical analysis of the degree of RMB internationalization and the prospects for RMB internationalization are conducted in Sections IV and V, respectively. Section VI concludes the paper.

II. Literature Review

This section reviews the published literature on the definition and measurement of international currency, economic factors affecting currency internationalization as well as the measurement of capital account control.

1. Definition and Measurement of International Currency

According to Cohen (1971), an “international currency” refers to a currency issued by a

Table 1. Functions of International Currency

Currency function	Government	Private sector
Unit of account	Pegging currency: The central bank pegs at one or several currencies to secure the local exchange rate.	Invoice currency: A currency for calculating the credit and debt among civilians.
Medium of exchange	Intervention currency: It is bought or sold by the central bank to maintain the local exchange rate.	Denominated currency: A currency for clearing the credit and debt among civilians.
Store of value	Reserve currency: International currencies and financial assets estimated with such currency held by the central bank.	Investment currency: International currencies and financial assets estimated with such currency held by civilians.

Source: Hartmann and Issing (2002).

country or region that circulates not only in the issuing country or region but also in other economies, where people use such currency as a unit of account, a medium of exchange and a store of value. Based on this definition, Hartmann and Issing (2002) further explain the functions of international currency (see Table 1).

Based on the definition of international currency, Taguchi (1994), Fratianni *et al.* (1998), Wyplosz (1999) and the European Central Bank (ECB, 2005–2010) use 9 indicators to assess the degree of internationalization of different currencies. Only 7 of the 9 indicators are used in our paper due to data availability: (i) reserve currency ratio (RCR); (ii) foreign exchange transaction currency ratio (FETCR); (iii) international bond investment currency ratio (IBICR); (iv) bank asset foreign currency ratio (BAFCR); (v) bank liability foreign currency ratio (BLFCR); (vi) pegging currency ratio (PCR); and (vii) trade invoicing currency ratio (TICR).

The first 5 indicators represent the ratio of a currency in the world's total amount. PCR refers to the ratio of a currency in all economies adopting a fixed foreign exchange rate. TICR refers to the amount of local currency invoiced in international trade divided by the total amount of this country's external trade.

No published study has analyzed all the aspects of the degree of RMB internationalization. Dobson and Masson (2009) and Wu *et al.* (2010) simply review the degree of RMB internationalization in terms of RCR. The RMB Internationalization Research Team (2006) estimates the degree of RMB internationalization based on 5 indicators: RCR, TICR, currency circulation abroad range (CCAR), currency circulation abroad amount (CCAA) and share of foreign direct investment denominated in local currency. However, they estimate CCAR and CCAA by themselves; no other study uses these two variables, and related international organizations did not provide pertinent data. In addition, “the share of foreign direct investment denominated in local currency” is obviously a very important indicator. However, because of the lack of data on foreign direct investment denominated in local currency, we omit this variable.

2. Economic Factors Affecting Currency Internationalization

Eichengreen and Mathieson (2000) and Chinn and Frankel (2008) find that factors affecting the degree of internationalization of global currencies can be categorized into four items:

large economic and trade size; well-developed financial system; network externalities; and confidence in the currency's value.

Based on the factors affecting the degree of currency internationalization, Taguchi (1994), Hartmann and Issing (2002) and Chinn and Frankel (2008) use 12 indicators for assessing the prospect of currency internationalization, including market capitalization ratio (MCR), domestic bond ratio (DBR), bank loan ratio (BLR), foreign exchange transaction ratio (FETR), GDP ratio (GDPR), trade ratio (TR), FDI ratio (FDIR), outward direct investment ratio (ODIR), inflation ratio (InflationR), exchange rate volatility (ERV), currency internationalization degree index in the previous period (currency internationalization degree index (CIDI) [–1]) and capital account opening index (CAOI).

The first 8 assessment indicators refer to the relevant data of the currency-issuing country divided by the total global amount. InflationR represents the annual growth ratio of the consumer price index of the currency-issuing economy. ERV refers to the standard deviation of the exchange rate for each currency against special drawing rights within 1 year. The CIDI [–1] is an alternative indicator of network externalities.

Among the three existing papers measuring the prospect of RMB internationalization, Liu and Li (2010) select the least indicators, only including GDPR, TR, InflationR and ERV. Wu *et al.* (2010) use 7 indicators, but “network externalities” is not included.

Chen and Peng (2010) select 7 indicators and include network externalities, and simply choose RCR (–1) as the alternative indicator for network externalities. RCR is merely one of a myriad of indicators measuring the degree of currency internationalization and should not be the indicator for measuring the network externalities. Therefore, we use the currency internationalization degree index to measure the network externalities. According to the literature, the definition of international currency, and considering data availability, we choose 12 indicators to measure the prospects for currency internationalization (see Table 2).

3. Capital Account Control

Previous studies only analyze the degree of internationalization of the US dollar, the euro

Table 2. Indicators for Measuring the Prospect of Currency Internationalization

Category	Our study	Liu and Li (2010)	Wu <i>et al.</i> (2010)	Chen and Peng (2010)
Market capitalization ratio (MCR)	P		P	P
Domestic bond ratio (DBR)	P			
Bank loan ratio (BLR)	P			
Foreign exchange transaction ratio (FETR)	P		P	
GDP ratio (GDPR)	P	P	P	P
Trade ratio (TR)	P	P	P	P
FDI ratio (FDIR)	P		P	
Outward direct investment ratio (ODIR)	P			
Inflation ratio (InflationR)	P	P	P	P
Exchange rate volatility (ERV)	P	P	P	P
Currency internationalization degree index in the previous period (CIDI [–1])	P			P
Capital account opening index (CAOI)	P			

and the yen. As these currencies are available for free exchange, capital account control is not considered in related literature (Taguchi, 1994; Hartmann and Issing, 2002; Chinn and Frankel, 2008). While capital account control is common in most developing countries, this may affect both the degree and the prospect of currency internationalization of these economies (Genberg, 2009). Therefore, it is necessary to review capital account controls in assessing RMB internationalization.

Three main methods are used to assess China's capital account control. First, Liu and Li (2010) and Chen and Peng (2010) adopt either the scenario simulation or the counterfactual model to estimate the degree of RMB internationalization in the absence of measuring capital account controls.

Second, using qualitative approaches, Dobson and Masson (2009) and Wu *et al.* (2010) review the *de jure* regulation of capital account control adopted by the Chinese Government and the *de facto* situation of trans-border capital flow. However, as the qualitative approach is generally applied to case studies, it is difficult to conduct an inter-country comparison (Chinn and Ito, 2008).

Third, Chinn and Ito (2008) use principle component analysis (PCA) to calculate the weights of 4 capital account indicators from the *Annual Report on Exchange Arrangements and Exchange Restrictions* (IMF, 2000–2011). Then, they construct the capital account openness (KAOPEN) index for 189 economies by timing the weights of the 4 indicators with the scores of each economy's indicators. These 4 indicators are: the presence of multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions and the requirement of the surrender of export proceeds. Every year, Chinn and Ito issue the KAOPEN index on their website. As a result, the present paper uses the KAOPEN index as the measurement index for the degree of capital account opening. In addition, Park (2010) applies the same quantitative approach in his study using the capital account liberalization index developed by the World Economic Forum (WEF, 2008) to review the capital account opening degree of China and members of the ASEAN.

In a nutshell, to the extent that capital account controls could affect a currency's international status, it is crucial to consider appropriate quantitative measures of such controls in computing currency internationalization indices.

III. Research Methods and Data

The present paper aims to develop indices for measuring the degree and the prospect of internationalization of 33 currencies, including the RMB between 1999 (when the euro was established) and 2009. We use SPSS19.0 to measure statistics packages. The assessment indicators and data sources, PCA and model testing methods will be delineated in this section.

1. Assessment Indicators and Data Sources

The data sources for the measurement indicators of the CIDI used by the present study come from the International Monetary Fund (IMF) and the Bank for International Settlements (BIS). The IMF conducts the RCR statistics only on the US dollar, the euro, the yen, the pound sterling and the Swiss franc, while the BIS produce the BAFCR and BLFCR statistics on these 5 currencies.

The RMB banking business started in Hong Kong in 2004, and we use the balance of RMB deposits and loans of the banks in Hong Kong and Macau as BLFCR and BAFCR for RMB. We collect news reports to estimate the RCR of the RMB. For example, according to the Belarusian Central Bank, they allocated a total of RMB20bn (approximately US\$3bn) to the foreign exchange reserves of Belarus in accordance with the currency exchange agreement signed between China and Belarus on 11 March 2009 (Xinhua Agency, 2010). With reference to Dobson and Masson (2009) and Wu *et al.* (2010), data for the 27 currencies that are not provided by the above international organizations are coded “0” in our paper.

Second, in the *Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity in April 2010* published by the BIS, only the transactions of global currencies on the foreign exchange market in 1998, 2001, 2004, 2007 and 2010 are included. Therefore, the linear estimates are obtained by means of interpolation as an alternative for the present paper, as in Chinn and Frankel (2008).

Third, we estimate the share of local currency invoiced in international trade (TICR) between 1999 and 2009 through linear trend at points based on the data of Kamps (2006). Kamps (2006) provides the most comprehensive data for TICR for 40 economies between 1992 and 2005.

Fourth, the major types of pegging currencies of economies throughout the world are divided into six types in the *Annual Report on Exchange Arrangements and Exchange Restrictions* published by the IMF.¹ As Fratianni *et al.* (1998), Wyplosz (1999) and ECB (2005–2010) only analyze economies pegging to 1 single currency, our paper will not include economies pegging to the whole basket of currencies.

Table 3 shows the shares of the world economy and the sources of data for the indicators for measuring the degree of currency internationalization.

The data sources for the measurement indicators of the currency internationalization prospect index (CIPI) used in our study come from the IMF (2012b), the BIS (2012), UNCTAD

¹ These six types of pegged exchange rate regimes include that flexibility is limited vis-à-vis the US dollar, flexibility is limited vis-à-vis the euro, flexibility is limited vis-à-vis another single currency, flexibility is limited vis-à-vis special drawing rights, and using the currency of another member as legal tender, and flexibility is limited vis-à-vis another basket of currencies.

Table 3. Indicators for Measuring the Degree of Currency Internationalization:
Share of World Economy and Source

Category	Share of world economy (%)	Source
Reserve currency ratio (RCR)	97.1	IMF (2012a)
Foreign exchange transaction currency ratio (FETCR)	98.19	BIS (2010)
International bond investment currency ratio (IBICR)	99.94	BIS (2012)
Bank asset foreign currency ratio (BAFCR)	96.96	BIS (2012)
Bank liability foreign currency ratio (BLFCR)	94.88	BIS (2012)
Pegging currency ratio (PCR)	99.10	IMF (2000–2011)
Trade invoicing currency ratio (TICR)	NA	Kamps (2006)

Notes: “Share” is the amount of currencies or related indicators included in this study divided by the amount of all currencies or related indicators in the world. PCR refers to the number of economies pegging to the currencies analyzed in this study divided by the number of economies pegging to any currency in the world. PCR does not reach 100 percent because Libyan Arab Jamahiriya and Syrian Arab Republic use special drawing rights as their currency anchor. TICR is the amount of local currency invoiced in international trade divided by the total amount of this country’s external trade. NA, not available.

(2011), Chinn and Ito (2010) and EC (2011). The total transaction amount on the foreign exchange market of currency issuing countries during 1998–2010 is obtained by means of interpolation.

We also conduct the following adjustments given that in published studies, the projected influence of assessment indicators is usually adjusted in a consistent direction when performing a PCA (Chen and Woo, 2010).

1 InflationR to price stability (PS): $1 - \text{Absolute InflationR}$.

2 ERV to exchange rate stability (ERS): $1 - \text{Absolute ERV}$.

Table 4 shows the shares and sources of data for the indicators for measuring the prospect of currency internationalization.

2. Principal Component Analysis

Previous studies review the assessment indicators individually (e.g. Taguchi, 1994; Fratianni *et al.*, 1998; Wyplosz, 1999; Hartmann and Issing, 2002; ECB, 2005–2010; Dobson and Masson, 2009; Wu *et al.*, 2010), and an overall assessment of the degree and prospect of currency internationalization is nearly impossible given that the results for different indicators vary. Therefore, the PCA is applied in the present paper to develop a single integrated index known as the CIDI, and a CIPI to assess the degree and prospect of RMB internationalization, respectively.

Principle component analysis is a statistical technique transforming various variables into several integrated indices whereby higher weight is assigned to major variables and lower weight to minor variables according to the maximum variable principle to reflect the meaning of the corresponding indices. The estimation is expressed as follows:

Table 4. Indicators for Measuring the Prospect of Currency Internationalization:
Share of World Economy and Source

Category	Share of world economy (%)	Source
Market capitalization ratio (MCR)	96.4	IMF (2012b)
GDP ratio (GDPR)	91.0	IMF (2012b)
Trade ratio (TR)	87.3	IMF (2012b)
Bank loan ratio (BLR)	96.3	BIS (2012)
Domestic bond ratio (DBR)	90.7	BIS (2012)
Foreign exchange transaction ratio (FETR)	99.3	BIS (2012)
FDI ratio (FDIR)	87.3	UNCTAD (2011)
Outward direct investment ratio (ODIR)	91.9	UNCTAD (2011)
Price stability (PS)	NA	IMF (2012b)
Exchange rate stability (ERS)	NA	IMF (2012b)
Capital account opening index (CAOI)	NA	Chinn and Ito (2010)
Currency internationalization degree index in the previous period (CIDI [-1])	NA	Our study

Notes: Share of world economy is the amount of currencies or related indicators included in this study divided by the amount of all currencies or related indicators in the world. PS equals $100 - \text{CPI growth rate}$. ERS is $100 - \text{foreign exchange rate volatility}$, where foreign exchange rate volatility is the standard deviation of the exchange rate for each currency against special drawing rights within 1 year. The data for the euro area is from EC (2011) and the data for other countries is from UNCTAD (2011). NA, not available.

$$PCA = \sum_{k=1}^Q W_k X_k, \quad W_k = \frac{I_k}{P}. \quad (1)$$

As shown in Equation (1), only a few variables (Q) are extracted from the principal components to substitute the original amount of variables (P), where X_k represents the value of the k th original variable, W_k represents the weight of the k th principal component and I_k refers to the eigenvalues of the k th principal component (Jolliffe, 2002).

At present, PCA is widely applied to various performance rankings. For example, Chinn and Ito (2008) develop a KAOPEN index for 181 countries using PCA and Chen and Woo (2010) estimate the economic integration degree of 17 Asia-Pacific Economic Cooperation member economies using PCA.

It is noteworthy that more than one principal component can be extracted with PCA. Therefore, the final weight of individual indices in our paper is calculated according to Chen and Woo (2010). The estimation of final weight is expressed in the following equation:

$$Final\ Weight_k = \frac{\sum_{k=1}^p I_k a_k^i}{\sum_{k=1}^p I_k}. \quad (2)$$

Equation (2) shows how the final weights are constructed with the score of the i th index in the k th principal component (a_k^i). In the following two sections, the two equations are used to compute the CIDI and the CIPI of the RMB and other currencies.

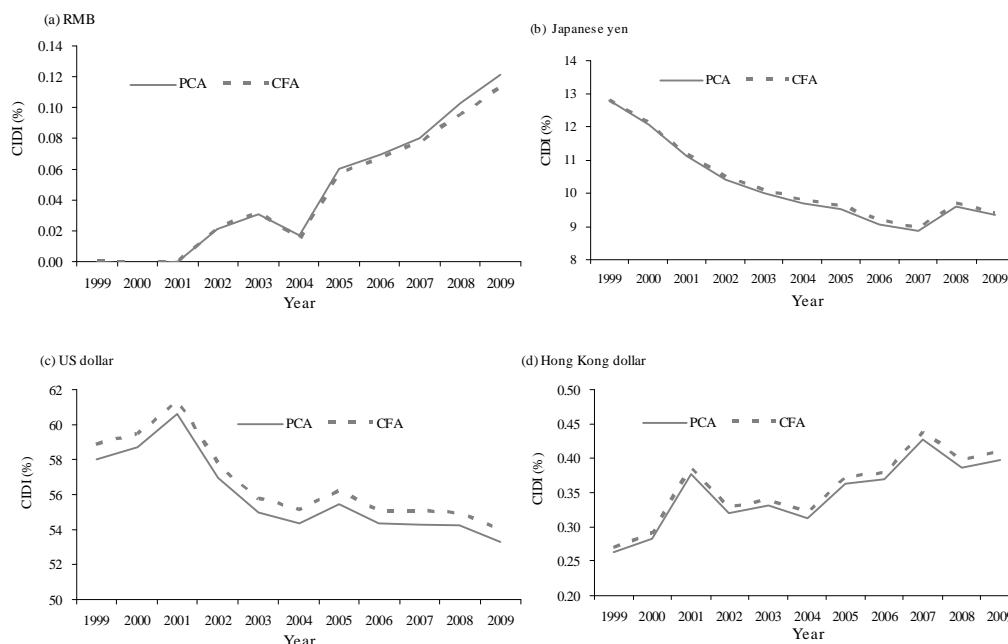
IV. Currency Internationalization Degree Index of the Renminbi

In the PCA sampling adequacy test, the Kaiser–Meyer–Olkin sampling adequacy quantity is 0.790 (Kaiser, 1974). In addition, the results of the Bartlett’s test of sphericity are significant at 1 percent (Bartlett, 1951). This suggests that the sampling for the currency internationalization degree PCA is adequate.

According to the model robustness test developed by Chen and Woo (2010), we compare the empirical results from PCA with those from common factor analysis (CFA). The result shows that the CIDI for 4 currencies, the RMB, the yen, the US dollar and the Hong Kong dollar calculated by PCA and CFA are very close and have very similar trends. Therefore, the weights computed by either PCA or CFA are stable in terms of time series (see Figure 1).

One point of particular interest to note is, according to Velicer and Jackson (1990), the empirical results of CFA and PCA will be highly similar only when the number of variables being used is greater than 40. However, we only use 7 variables in the present study and

Figure 1. Comparison of Currency Internationalization Degree Using Principal Component Analysis (PCA) and Common Factor Analysis (CFA) Models, 1999–2009: (a) RMB, (b) Japanese yen, (c) US dollar and (d) Hong Kong dollar



Source: Drawn by the authors.

Note: CIDI, currency internationalization degree index.

Table 5. Final Weight of Currency Internationalization Degree Index Indicators

Indicator	Eigenvector							Final weight
	PC1	PC2	PC3	PC4	PC5	PC6	PC7	
RCR	0.933	−0.342	−0.097	−0.015	−0.004	0.046	0.017	0.136
FETCR	0.952	−0.283	0.068	0.087	−0.037	−0.008	−0.010	0.141
PCR	0.961	−0.189	−0.193	−0.005	0.055	−0.035	−0.001	0.143
IBICR	0.988	0.105	−0.051	−0.063	−0.073	−0.014	−0.010	0.152
BAFCR	0.852	0.521	−0.011	0.034	−0.006	−0.006	0.029	0.139
BLFCR	0.924	0.377	−0.002	0.007	0.036	0.028	−0.028	0.147
TICR	0.947	−0.135	0.288	−0.039	0.031	−0.008	0.007	0.143
Eigenvalue	6.154	0.675	0.137	0.015	0.012	0.004	0.002	NA

Source: Calculated by the authors.

Notes: BAFCR, bank asset foreign currency ratio; BLFCR, bank liability foreign currency ratio; FETCR, foreign exchange transaction currency ratio; IBICR, international bond investment currency; PCR, pegging currency ratio; RCR, reserve currency ratio; TICR, trade invoicing currency ratio. PC, principal component. NA, not available.

produce similar results using both methods.

When no severe defect was found in the model tests, the final weight of CIDI indicators was further estimated. As shown in Table 5, when measuring the CIDI, the international capital market (international bonds and money market instruments) has a larger weight. This is consistent with the finding of Hartmann (1998), who asserts that the exponential growth of the international financial transaction in the early 1990s, such as the scale of bonds market, is the decisive factor for the currency internationalization degree.

Table 6 shows the CIDI of the RMB using PCA. The CIDI of the RMB was 0 before 2001, increased to 0.02 percent in 2002 and decreased slightly to 0.02 percent in 2004. After 2005, the CIDI of the RMB shows a constant rising trend, increasing from 0.06 percent in 2005 to 0.10 percent in 2008 and further to 0.12 percent in 2009. Although making some progress, the CIDI of the RMB is still very low compared with the US dollar, the euro, the

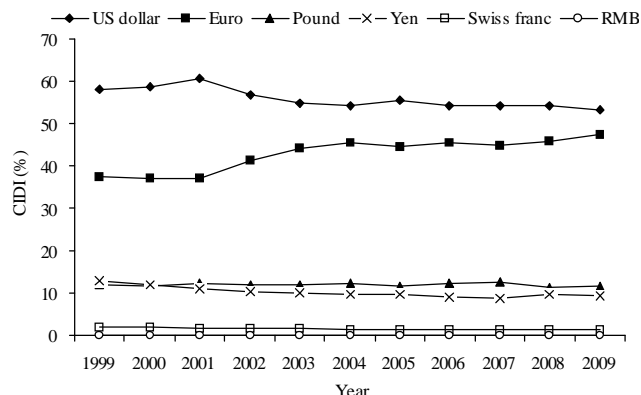
Table 6. Currency Internationalization Degree Index of RMB, 1999–2009 (Unit: Weight %)

Year	RCR	FETCR	PCR	IBICR	BAFCR	BLFCR	TICR	CIDI
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000	0.00	−0.01	0.00	0.00	0.00	0.00	0.00	0.00
2001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.02
2003	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.03
2004	0.00	0.10	0.00	0.00	0.00	0.02	0.00	0.02
2005	0.00	0.38	0.00	0.01	0.00	0.04	0.00	0.06
2006	0.00	0.45	0.00	0.01	0.00	0.03	0.00	0.07
2007	0.00	0.50	0.00	0.03	0.00	0.04	0.00	0.08
2008	0.00	0.61	0.00	0.05	0.00	0.07	0.00	0.10
2009	0.00	0.68	0.00	0.05	0.00	0.08	0.04	0.12
Weight	0.14	0.14	0.14	0.15	0.14	0.15	0.14	NA

Source: Calculated by the authors.

Notes: BAFCR, bank asset foreign currency ratio; BLFCR, bank liability foreign currency ratio; CIDI, currency internationalization degree index; FETCR, foreign exchange transaction currency ratio; IBICR, international bond investment currency ratio; PCR, pegging currency ratio; TICR, trade invoicing currency ratio; RCR, reserve currency ratio. NA, not available.

Figure 2. Currency Internationalization Degree Index (CIDI) Rankings of 6 Currencies, 1999–2009



Source: Drawn by the authors.

yen, the pound sterling and the Swiss franc.

When comparing with the 33 currencies, the CIDI ranking of the RMB rose from last in 1999 to 18th in 2009. The US dollar is still the most important international currency in the world, with the CIDI at 53.3 percent in 2009, despite the falling trend from 1999 to 2008, totaling 4.8 percent. In contrast, the CIDI of the euro has been rising steadily, reaching 47.4 percent in 2009. Before 2001, the CIDI of the yen was always in the top third of the world. However, its status was replaced by the pound sterling in 2002. By 2008, the CIDI of the yen and the pound sterling was 9.3 percent, thus ranking in the top third of the world. The Swiss franc held its rank as the world fifth highest, maintaining an average CIDI of 1.4 percent (see Figure 2).

During 1999–2009, the Canadian dollar, the Australian dollar, the Hong Kong dollar, the South African rand, the Indian rupee, the Singaporean dollar and the Swedish krona had risen to among the world's top 10 (see Table 7).

In terms of the greatest CIDI rises and falls between 1999 and 2009, the CIDI growth of the euro was the highest, with an increase of 9.97 percent. The Australian

Table 7. Currency Internationalization Degree Index Rankings of Top Ranking Currencies, 1999–2009

Item	1999	2003	2007	2009
Australian dollar	0.84 (6)	1.02 (6)	1.25 (6)	1.33 (6)
South African rand	0.79 (7)	0.65 (8)	0.61 (8)	0.41 (8)
Canadian dollar	0.70 (8)	0.71 (7)	0.79 (7)	0.87 (7)
Indian rupee	0.47 (9)	0.42 (9)	0.40 (11)	0.38 (11)
Singaporean dollar	0.38 (10)	0.36 (10)	0.34 (12)	0.32 (12)
Hong Kong dollar	0.26 (11)	0.33 (11)	0.43 (9)	0.40 (10)
Swedish krona	0.26 (11)	0.28 (12)	0.41 (10)	0.41 (8)

Source: Calculated by the authors.

Notes: World rankings are shown in parentheses. These 7 currencies were among the top 10 currencies during 1999–2009, while the US dollar, the euro, the Japanese yen, the British pound and the Swiss franc were always in the top 5.

Table 8. RMB and 6 Currencies with the Greatest Rise and Fall of Currency Internationalization Degree Index

Item	1999		2009		Growth	
	CIDI	Ranking	CIDI	Ranking	CIDI	Ranking
Euro	37.41	2	47.38	2	9.97	1
Australian dollar	0.84	6	1.33	6	0.49	2
Swedish krona	0.21	12	0.41	8	0.21	3
Chinese renminbi	0	29	0.12	18	0.12	9
Swiss franc	2.04	5	1.35	5	-0.70	31
Yen	12.78	3	9.32	4	-3.47	32
US dollar	58.05	1	53.25	1	-4.80	33

Source: Calculated by the authors.

Note: CIDI, currency internationalization degree index.

Table 9. Currency Internationalization Degree Index of Major Currencies, 2010

Currencies	Unit: (%)				
	US dollar	Euro	Pound sterling	Yen	RMB
RCR	61.7	26.0	4.0	3.7	0.00
FETCR	84.9	39.1	12.9	19.0	0.90
PCR	54.3	37.9	0.0	0.0	0.00
IBICR	39.2	44.1	7.8	2.8	0.10
BAFCR	25.9	58.2	5.8	5.9	0.04
BLFCR	28.9	52.7	8.3	3.5	0.42
TICR	88.3	60.8	37.1	34.4	2.60
CIDI	54.5	45.7	10.9	9.8	0.58

Source: Calculated by the authors.

Notes: BAFCR, bank asset foreign currency ratio; BLFCR, bank liability; CIDI, currency internationalization degree index foreign currency ratio; FETCR, foreign exchange transaction currency ratio; IBICR, international bond investment currency ratio; PCR, pegging currency ratio; RCR, reserve currency ratio; TICR, trade invoicing currency ratio.

dollar came next, with an increase of 0.49 percent. The Swedish krona was the third, with an increase of 0.21 percent. The CIDI growth of the RMB was only 0.12 percent, so that it ranked 9th in the world. In contrast, the CIDI fall of the US dollar was the biggest, at 4.80 percent. The yen came next, with a CIDI fall of 3.47 percent, and the Swiss franc was third, with a CIDI fall of 0.70 percent (see Table 8).

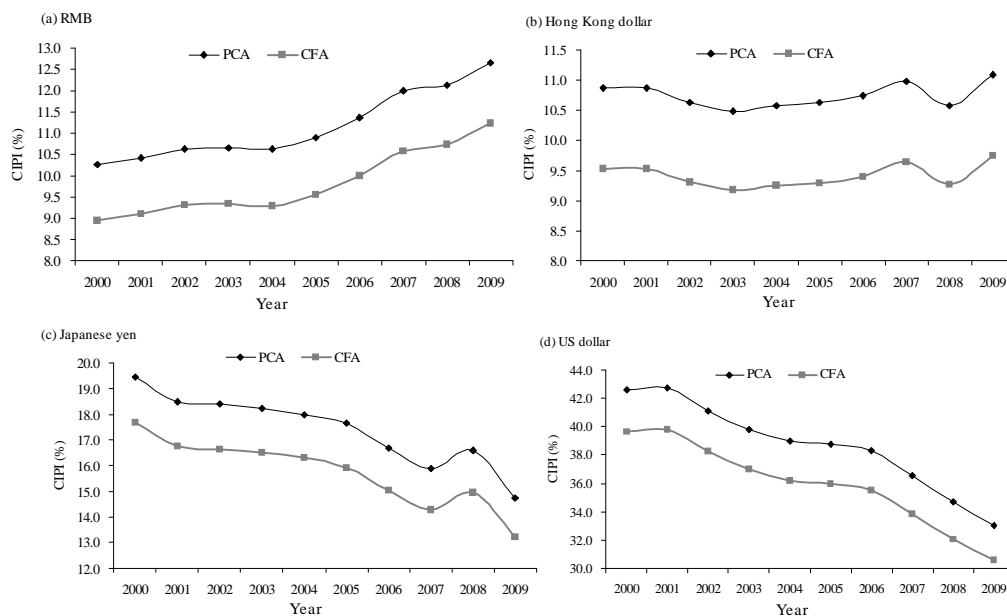
Finally, we estimate that the CIDI of the RMB was 0.58 percent in 2010, increasing by 0.46 percentage points from 2009, but still far behind the major international currencies. In 2010, the US dollar remained the most important international currency, with the CIDI at 54.5 percent; the second most important was the euro, with the CIDI at 45.7 percent; the third was the pound sterling, with a CIDI of 10.9 percent; the fourth most important was the yen, with the CIDI at 9.8 percent. This shows that there was still a huge gap in the internationalization degree between the RMB and the 4 other major international currencies (see Table 9).

V. Currency Internationalization Prospect Index of RMB

In the PCA sampling adequacy test, the Kaiser–Meyer–Olkin sampling adequacy quantity is

Figure 3. Comparison of Currency Internationalization Prospect Index (CIPI) Using Principal Component Analysis (PCA) and Common Factor Analysis (CFA) Models, 2000–2009:

(a) RMB, (b) Hong Kong dollar, (c) Japanese yen and (d) US dollar



Source: Drawn by the authors.

Note: We compare two models only from 2000 to 2009, instead of 1999–2009, because of a 1-year time lag for the CIDI (–1) variable.

0.812. In addition, the results of Bartlett's test of sphericity are significant at 1 percent. This suggests that the sampling for the currency internationalization prospect PCA is adequate.

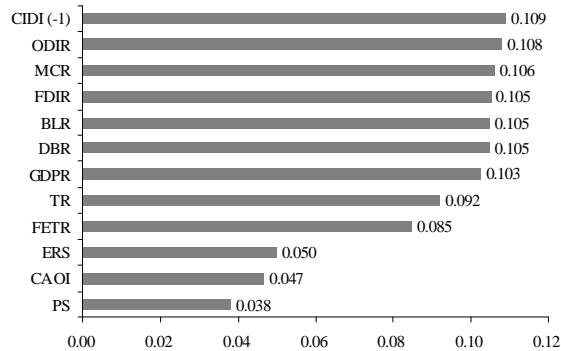
In addition, we compare the empirical results of the PCA with the CFA. The result shows that the CIPI for 4 currencies, the RMB, the yen, the US dollar and the Hong Kong dollar, have very similar trends when calculated using PCA and CFA. The weights computed by either PCA or CFA are stable in terms of time series (see Figure 3).

When no severe defect was found in the model tests, the final weight of the CIPI indicators was further estimated. Among all indicators, CIDI (–1), ODIR, MCR, FDIR, BLR, DBR and GDPR are the most important variables, while ERS, CAOI and PS are the least important variables (see Figure 4).

Figure 5 shows the result of the CIPI of the RMB using PCA. The CIPI of the RMB steadily increased from 10.3 percent in 2000 to 10.7 percent in 2003. Although the CIPI of the RMB declined slightly to 10.6 percent in 2004, it increased very rapidly afterward. The CIPI of the RMB increased to 12.7 percent in 2009.

The continuous rise of the CIPI of the RMB is attributed to the rapid growth of GDP in

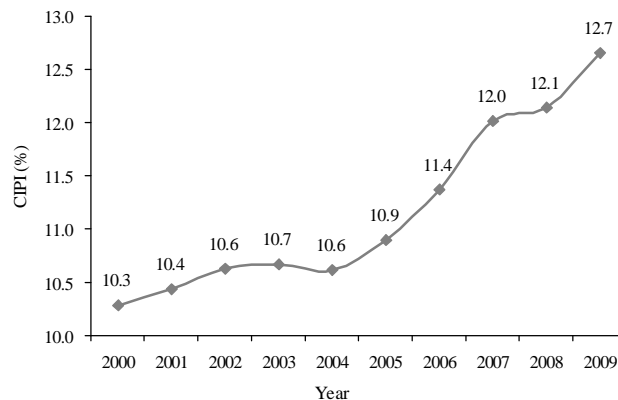
Figure 4. Final Weight of Currency Internationalization Prospect Index Indicators



Source: Drawn by the authors.

Notes: BLR, bank loan ratio; CAOI, capital account opening index; CIDI, currency internationalization degree index; DBR, domestic bond ratio; ERS, exchange rate stability; FDIR, foreign direct investment ratio; FETR, foreign exchange transaction ratio; GDPR, GDP ratio; MCR, market capitalization ratio; ODIR, outward direct investment ratio; PS, price stability; TR, trade ratio.

Figure 5. Currency Internationalization Prospect Index (CIPI) of RMB, 2000–2009



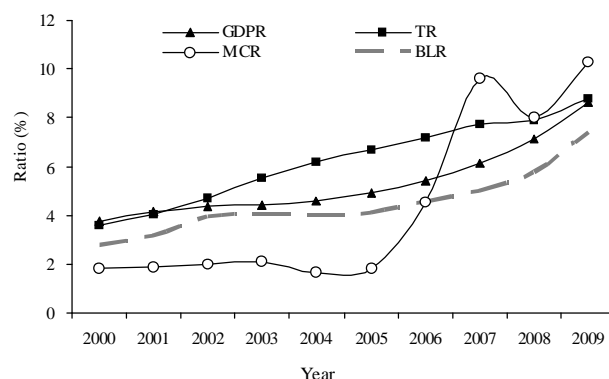
Source: Drawn by the authors.

China. The Chinese GDP ratio increased from 3.7 percent in 2000 to 8.6 percent in 2009. In addition, the expansion of the international trade and securities market in China is also contributing to the internationalization of the RMB. From 2000 to 2009, the TR and the MCR increased by 5.2 and 8.5 percent, respectively, as shown in Figure 6.

Among the 33 currencies we studied, the CIPI ranking of the RMB climbed higher from 8th place in 2000 to 5th in 2006 and stayed in the world's top five, next to the euro, the US dollar, the pound sterling and the yen. It is noteworthy that in 2009, the CIPI of the euro increased to 33.5 percent, surpassing the US dollar (33.1 percent) for the first time, and became a promising international currency (see Figure 7).

In addition, other currencies that rose among the world's top 10 during 2000–2009

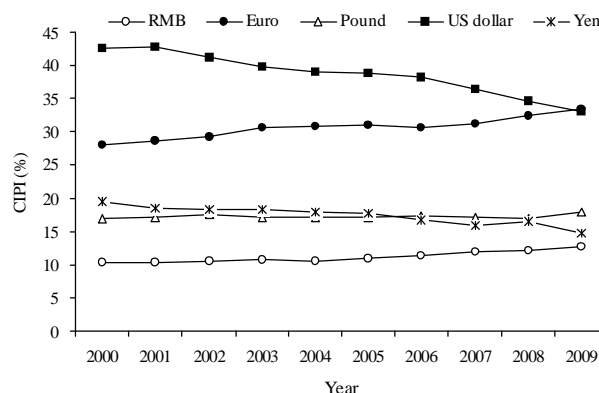
Figure 6. Indicators Affecting the Currency Internationalization Prospect Index Growth of RMB, 2000–2009



Source: Drawn by the authors.

Notes: BLR, bank loan ratio; GDPR, GDP ratio; MCR, market capitalization ratio; TR, trade ratio.

Figure 7. Currency Internationalization Prospect Index (CIP) Ranking of 5 Major Currencies, 2000–2009



Source: Drawn by the authors.

included the Canadian dollar, the Hong Kong dollar, the Swiss franc, the Singaporean dollar and the Australian dollar.

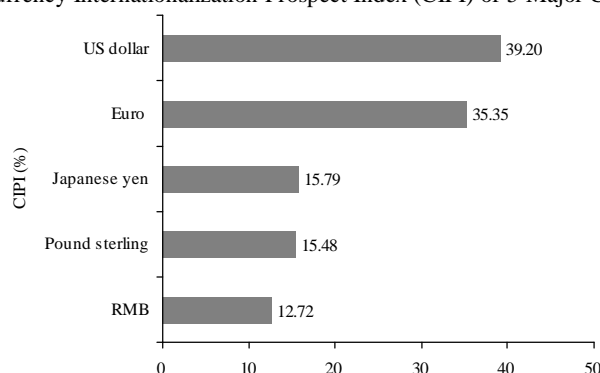
In terms of the highest rises and falls, the euro has the largest CIP growth at 5.48 percent. The RMB came second at 2.38 percent. The Turkish new lira ranked third at 2.02 percent. The rapid growth of the Turkish new lira is attributed to the following two factors. First, the CIP of the Turkish new lira was extremely low, and it was last among the 33 currencies in 2000. Therefore, there was much space for improvement from the bottom. Second, improvement in price stability in Turkey is another factor contributing for the 2.02 percent of the PCA score of the CIP for the Turkish new lira. However, by the end of 2009, the Turkish new lira still was ranked 26th in the CIP ranking of the 33 currencies. In contrast,

Table 10. Six Currencies with the Highest Rise and Fall of the Currency Internationalization Prospect Index (CIPI)

Item	1999		2009		Growth range	
	CIPI	Ranking	CIPI	Ranking	CIPI	Ranking
Euro	28.03	2	33.51	1	5.48	1
RMB	10.28	8	12.65	5	2.38	2
Turkish new lira	6.86	33	8.88	26	2.02	3
Icelandic krona	8.61	28	8.12	33	-0.50	31
Yen	19.46	3	14.74	4	-4.73	32
US dollar	42.61	1	33.06	2	-9.56	33

Source: Calculated by the authors.

Figure 8. Currency Internationalization Prospect Index (CIPI) of 5 Major Currencies, 2010



Source: Drawn by the authors.

the US dollar had the biggest CIPI fall, at 9.56 percent, the yen is the second biggest at 4.73 percent, and the Icelandic krona is third at 0.50 percent, as shown in Table 10.

The CIPI of the RMB in 2010 was 12.72 percent, with an increase of 0.07 percentage points from 2009. Although it was the highest in the history of the RMB since 2000, when compared with major international currencies, the CIPI ranking of the RMB was only in the world's top five. The CIPI difference between the RMB and the pound sterling has reduced from 6.71 percent in 2000 to 2.76 percent in 2010. This suggests that the CIPI of the RMB is likely to surpass that of the pound sterling and the yen in the near future. However, it will still be difficult for the RMB to catch up with US dollar and the euro in the near future (see Figure 8).

VI. Conclusions

The present paper constructed the CIDI and the CIPI for the RMB using PCA and compared the CIDI and the CIPI of the RMB with 32 other major international currencies. The present paper contributes to the published literature in four respects: (i) by assembling various indicators suitable for estimating the CIDI and the CIPI; (ii) by selecting related data for the

CIDI and the CIPI indicators based on a wide range of data from the BIS, the IMF, the EC, the ECB and UNCTAD; (iii) by attempting to construct an integrated single index for the degree and prospect of currency internationalization (CIDI and CIPI) using PCA; and (iv) by reviewing the CIDI and the CIPI of the 33 currencies. Based on our analysis, our findings are as follows.

First, RMB internationalization is still nascent (ranking 18th of 33 currencies in 2009). In terms of the CIDI, there is a huge gap between the RMB and major international currencies.

Second, in terms of major components of the CIDI, bonds are the most important factor. Since 2007, the Chinese Government has been aggressively issuing bonds denominated in RMB in Hong Kong. As a result, the CIDI of the RMB is expected to rise constantly in the future.

Third, in terms of CIPI ranking, the RMB rose from 8th place in 2000 to 5th place in 2006 and remained steady afterward. This shows that China can continue to promote the international status of the RMB through increasing economic scale and trade expansion. Nevertheless, the biggest challenges for RMB internationalization stem from usage continuity of international currency due to network externalities, and China's narrow foreign exchange and imperfect financial markets.

Finally, other potential currencies whose CIDI and CIPI have both been promoted among the world's top 10 include the Canadian dollar, the Hong Kong dollar, the Singaporean dollar and the Australian dollar. However, the CIDI and the CIPI of these currencies are still far from those of the world's top 4 international currencies.

It is noteworthy that by the end of 2009, the CIDI of the RMB was 0.12 percent, ranking in the world's top 18. In contrast, the CIPI of the RMB was 12.65 percent, ranking it in the world's top 5. The difference between both indices is large. This may be the result of the capital account control by the Chinese Government. Currently, although the RMB has great potential for internationalization, the CIDI of the RMB is highly restricted by the capital account control. According to Eichengreen and Mathieson (2000), Genberg (2009), Frankel (2011) and Prasad and Ye (2012), the convertibility of currency is a decisive factor affecting the CIDI. In addition, the loosening of capital account control will raise other CIPI indicators, such as MCR and FETR.

Although CAOI was considered in our study, it does not precisely reflect the status of country-specific capital account control after averaging the virtual capital account control variables (Chinn and Ito method). The present paper also compared another generally accepted CAOI estimation method, that is, the simple averaging of the response to 142 questionnaire items (Johnston method). Results show that the Chinn and Ito method does not reflect micro changes: for example, the USA, the UK and New Zealand have a CAOI of 2.46 in 1996 according to the Chinn and Ito method; when estimated with the Johnston

Table 11. Comparison of Two Capital Account Opening Index Calculation Methods

Item	Chinn and Ito (2008)	Johnston (1999)
USA	2.46	0.87
UK	2.46	0.93
New Zealand	2.46	0.99

Source: Calculated by the authors.

method, there is a difference of 0.12 among these countries (see Table 11). Obviously, these two methods reach different results for capital account opening index for these three countries.

Looking into the future, the Chinese Government may loosen capital account control as the progress of the RMB internationalization accelerates. Apart from affecting the CIDI of the RMB, this will directly enhance the CIPI of the RMB. Therefore, future studies could pay more attention to the measurement of the CAOI using the Johnston method and capture the detailed interactions between the loosening of capital account controls of the Chinese Government and the CIDI of the RMB using panel data model.

Finally, as it is necessary to make the projected influence of all estimation indicators consistent before conducting a PCA, it is difficult to observe how InflationR, ERV and CAOI adversely affect RMB internationalization and how great the effect is. Therefore, future studies should use a panel data model to examine the causal relationship between the CIDI or the CIPI and factors affecting these indices.

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