



Article

Short-Term Capital Flows, Exchange Rate Expectation and Currency Internationalization: Evidence from China

Mingming Li ¹, Fengming Qin ^{2,*} and Zhaoyong Zhang ^{3,*} 

¹ School of Finance, Shandong University of Finance and Economics, Jinan 250014, China; tongmingyuyi@163.com

² School of Economics, Shandong University, Jinan 250100, China

³ School of Business & Law, Edith Cowan University, Perth, WA 6027, Australia

* Correspondence: fmqin@sdu.edu.cn (F.Q.); zhaoyong.zhang@ecu.edu.au (Z.Z.)

Abstract: This paper intended to employ a portfolio approach to assess the effect of exchange rate expectation on Chinese RMB internationalization and empirically test the interactive effects among short-term capital flows, RMB appreciation expectation and the internationalization process using a VAR model with monthly data ranging from February 2004 to December 2020. The results suggest that RMB exchange rate appreciation could lead to an increase in the foreign demand for RMB and RMB denominated assets, while RMB internationalization would attract more short-term capital inflow due to the reduced transaction costs. The empirical evidence from the VAR model estimation confirms the finding that expected RMB appreciation induces short-term capital inflow and promotes RMB internationalization. The robustness checks confirm the evidence. The results have important policy implication for RMB internationalization and for maintaining a sound and stable financial system.



Citation: Li, Mingming, Fengming Qin, and Zhaoyong Zhang. 2021. Short-Term Capital Flows, Exchange Rate Expectation and Currency Internationalization: Evidence from China. *Journal of Risk and Financial Management* 14: 223.

<https://doi.org/10.3390/jrfm14050223>

Academic Editor: Shigeyuki Hamori

Received: 5 March 2021

Accepted: 28 April 2021

Published: 17 May 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Keywords: RMB exchange rate expectation; RMB internationalization; short-term capital flow; interactive mechanism

1. Introduction

The global financial crisis (GFC) in 2008 has revealed the flaw of the existing international monetary system and created a greater awareness worldwide of the importance of establishing both a more resilient domestic economic and financial system and a better-functioning global financial system. Since the GFC, the Chinese government has adopted several measures to reform its exchange rate system and promote the RMB internationalization process. It has been documented that there are three major determinants for internationalizing a currency, i.e., the economic size of the country in terms of output or trade, the rate of return proxied by the domestic inflation or exchange rate, and the depth of financial markets in terms of foreign exchange market turnover (Krugman 1984; Eichengreen 2011). It remains an interesting question to ask whether or not China has fulfilled these criteria.

China began its economic reforms in the late 1970s, which have successfully transformed the country into an important trading nation and manufacturing center in the world over the past three decades. With its nearly double-digit growth rates for more than three decades from 1979 to 2014, China is now the world's second largest economy and largest economy in merchandise trade and foreign exchange reserves. Despite China's recent economic slowdown, the IMF forecasts that China will continue to be the largest contributor to global GDP growth. In addition, the rate of return for holding RMB over the past ten years has been one of the highest, which explains the strong portfolio capital inflows since 2004. Moreover, the domestic inflation rate has been well managed (Prasad and Wei 2005). Probably the only remaining issue is about China's capital control, especially over the flows of portfolio investment. However, it is still debatable whether a full capital account

convertibility is a prerequisite for achieving an international currency status when one reviews the internationalization process of the US dollar. As a matter of fact, when the IMF announced the inclusion of RMB into its Special Drawing Rights (SDR) reserve currency basket effective in October 2016, it officially recognizes that the RMB has met the criterion of being “freely usable”, reflecting China’s expanding role in global trade and the substantial increase in the international use and trading of the renminbi. This lends support to the view that full capital account liberalization is not a necessary condition for an international currency. Nevertheless, given China’s increasing importance as an economic power and major trading nation, the Chinese government has recently reaffirmed its determination to gradually liberalize its financial sector and move towards full capital account convertibility.

In recent years, the Chinese government has implemented measures for encouraging the use of the RMB in cross-border transactions and the creation of an RMB offshore market in Hong Kong, Singapore and other international financial centers to push the internationalization of the Chinese RMB. According to the People’s Bank of China, the share of China’s cross-border trade settled in Chinese RMB increased from almost zero in 2009 to about 17% by 2013 and the offshore RMB deposits amount to RMB 1987 billion. By the end of May 2015, the PBoC signed bilateral domestic currency swap agreements with 32 foreign central banks or monetary authorities of different countries or areas, with a total amount worth RMB3.1 trillion (Ho et al. 2017). The recent initiatives to liberalize the capital account and push RMB internationalization include the “Shanghai-Hong Kong Stock Connect” and “Shenzhen-Hong Kong Stock Connect”. According to the Bank for International Settlements (BIS), the RMB was the 8th most actively traded currency in the 2016 triennial survey of foreign exchange turnover, and became the second-most used currency in traditional trade finance and the number 5th payment currency of the world (The People’s Bank of China 2015).

More significantly, in 2004, banks in Hong Kong started to offer RMB retail banking services. The scope of the RMB business in Hong Kong has been expanded twice, in 2005 and in 2007, with Hong Kong now possessing a RMB bond market outside Mainland China. Till the end of 2019, the cross-border RMB settlement amounted to RMB 19.67 trillion, increasing by 24.1% on a yearly basis. The total receipts reached RMB 10.02 trillion, with a notable increase of 25.1% while the total payments were RMB 9.65 trillion, growing by 23% on a yearly basis. In September 2019, the restrictions for investment quotas as well as pilot countries or regions for the RMB Qualified Foreign Institutional Investors (QFII) were removed (PBoC 2020). The QFII program was launched by the Chinese government in 2002 to enable qualified foreign institutional investors to gain direct access to China’s capital markets. The program was administered by the China Securities Regulatory Commission (CSRC). The decision to remove QFII implies that the barriers on the use of the RMB abroad have been gradually reduced. The rising significance of the RMB is viewed as a natural response to the growing weight of China’s trade and investment flows in the world economy and also a result of its rapid economic and financial integration with the rest of the world.

Along with RMB exchange rate system reform and internationalization of the currency, another issue is about the short-term capital flows. Several existing studies have examined the factors that affect international short-term capital flows from different perspectives, such as interest rate spreads between home and abroad, exchange rate and its expectation, and assets price (Prasad and Wei 2005; Bouvatier 2010; Fang et al. 2012). Since 2005 when China switched its exchange rate system from the dollar-peg to a basket of currencies, the RMB has appreciated in nominal terms by over 34 percent against the US dollar and by 42 percent on a real (inflation-adjusted) basis between 2005 and 2013. According to the Bank for International Settlements (BIS), the RMB real effective exchange rate has appreciated by 8.2 percent from July 2008 to May 2010, and by 16.9 per cent between June 2010 and May 2013. Due to a strong market expectation of RMB appreciation, there were more short-term capital inflows to China in recent years. However, this expectation has

changed to RMB depreciation from the beginning of 2014, which has led to the short-term capital outflow since then.

Although exchange rate expectation is an important fact affecting the short-term capital flow, the relationship between exchange rate expectation and short-term capital flow is no longer straightforward when we incorporate RMB internationalization in our analysis. As aforementioned, China has implemented measures to promote the internationalization process of the Chinese currency, including encouraging the use of cross-border trade settlement in RMB since 2009, and outward direct investment and the development of the RMB offshore market. These measures have advanced the RMB internationalization process, which would bring more volatility and risks to China's financial system (Ho et al. 2017, 2018; Qin et al. 2018; Zhou et al. 2021). By the end of 2015, the RMB internationalization index, a comprehensive quantitative indicator of international acceptability, composed by the International Monetary Research Institute at Renmin University of China, reached 3.6 in the fourth quarter, rising from 0.02 in the first quarter of 2010.

The progress of RMB internationalization helps facilitate the short-term capital flows, and is believed to have new interactive effects on the exchange rate expectation and capital flows nexus. The purpose of this study is to assess from a portfolio approach perspective the effect of exchange rate expectation on Chinese RMB internationalization, and empirically test the interactive effects among short-term capital flows, RMB appreciation expectation and internationalization process. Our results show that RMB exchange rate appreciation could lead to an increase in the foreign demand for RMB and RMB denominated assets, while RMB internationalization would help attract more short-term capital inflow due to the reduced transaction costs. This study and the findings have important policy implications for the process of RMB internationalization and short-term capital flows, especially regarding how to manage the destabilizing effect of the short-term capital flows.

The remainder of this paper is organized as follows. Section 2 provides a brief literature review. Section 3 discusses the theoretical framework and the models used in this study. In Section 4 we discuss the data and the empirical results from our models. Section 5 concludes with some policy implications.

2. Literature Review

A large body of literature has discussed the relationship between exchange rate and short-term capital flow. Reinhart and Calvo (2000) showed that the changes of exchange rate expectation is the most important reason for international speculative capital flow compared to other factors. Of three types of motivations, currency arbitrage is a more active transaction than interest arbitrage and cross-rate arbitrage that led to international speculative capital flow (Chen and Yun 2009; Fang et al. 2012; Lv and Xu 2012). Some studies found that the most important factor that impacts short-term capital flow is the RMB appreciation expectation (Wang and He 2007; Zhang and Tan 2013; Prasad and Wei 2005). Both Bouvatier (2010) and Sun and Zhang (2006) reported that the RMB appreciation expectation, economic growth rates, interest rates spread and stock markets discrepancy are the main factors that affected cash flow between Hong Kong and the mainland of China from 1993 to 2004. On the other hand, short-term capital flows also influence the exchange rate level and changes. Combes et al. (2012) maintained that capital inflow causes appreciation of real effective exchange rate (REER) in the emerging markets. Golley and Tyers (2007) argued that financial capital flow is the main pushing factor for RMB exchange rate appreciation in the short run. Zhu and Liu (2010) examined the interactive relationship between exchange rate expectation and short-term capital flows, and found evidence that there exists a self-reinforcement cycle mechanism among the short-term capital inflow, RMB exchange rate appreciation and expectation, and financial assets price. Jiang et al. (2021) reported evidence suggesting that external policy uncertainty and political instability can also have spillover effects on international investors and hence on China's foreign exchange reserves hoarding and exchange rate expectation.

When a currency becomes an international currency, the relationship between exchange rate and short-term capital flow may change. First, exchange rate and currency internationalization will become interactive. Cohen (2012) stated that the key to the success of currency internationalization is the market confidence over the currency. Garber (2011) maintained that the strong market expectation about RMB exchange rate appreciation in the future is the main reason for the Hong Kong RMB offshore market boom. Jiang et al. (2012) argued that RMB exchange rate appreciation expectation may increase RMB deposits in Hong Kong by attracting overseas institutional investment in RMB assets or outbound importers converting foreign exchange into RMB in advance so as to increase the RMB deposits in Hong Kong. RMB exchange rate appreciation expectation enhances the RMB acceptance level by foreign investors. About the effect of currency internationalization on exchange rate, Maziad et al. (2011) and Frankel (2012) indicated that the currency will appreciate when it becomes internationalized, as investors will increase the demand for this currency or currency denominated assets. For instance, US dollar internationalization led to the dollar's appreciation (Wang et al. 2012). Lardy and Douglass (2011) found that RMB offshore holding increases RMB appreciation pressure. Recent empirical studies have documented the interaction effect between currency internationalization and exchange rate expectation, and concluded that promotion of RMB internationalization occupies a predominant role in raising RMB exchange rate expectation (Sha and Liu 2014).

Second, several recent studies have examined more closely the interactive relationship between currency internationalization and short-term capital flows. Wang (2011) discussed the dilemma of cross border capital flow management, and attributes the interest rate and exchange rate arbitrage problem to the home and abroad rates discrepancy. Xiang and Zhu (2013) reported that the cross-border trade RMB settlement aggravates the short-term capital flow fluctuation between the offshore market in Hong Kong and the onshore market in the mainland of China and increases economic uncertainty. The more fluctuation of short-term capital flow during the process of RMB internationalization causes currency and interest rate arbitrage, enlarges the risk in the short-term capital market and makes capital flow channels more diversified (Guo and Zhu 2012). It is also believed that the cross-border trade settlement in RMB and the RMB offshore market development in Hong Kong provide another channel for the short-term capital flows and reflect the relaxation of China's de facto capital control policy (Yu 2011; Zhang and Xu 2012).

There are some studies examining the effect of short-term capital flows on currency internationalization, but the results are mixed. From the perspective of currency competitiveness, financial transaction convertibility and short-term capital inflow may facilitate the development of domestic financial institutions and financial markets. On the other hand, a mature financial system seems to be the prerequisite for a currency internationalization as it will meet the demand of the international investors for currency diversification (Frankel 2012; Genberg 2009). Wang (2011) argued that it will not be sustainable to supply RMB in the offshore market via trade account only, and the cross-border capital flows in RMB would be another venue for RMB internationalization. Otherwise, the "Triffin Dilemma" will be inevitable again (Ma and Xu 2012). However, Hellmann et al. (1994) maintained that to liberalize the capital account would trigger domestic financial system risk when the country's economic or financial as well as regulation conditions are not mature enough. The fluctuations of cross-border short-term capital flows have a destabilizing effect on the domestic economy, which eventually affects the economic base of RMB internationalization (Yu 2012; Zhang 2012). Some studies on the Japanese Yen internationalization show that there is a reverse "U"-type relationship between cross-border short-term flow and international reserve status of the Yen. At the initial stage of Japan's capital account liberalization, the capital flows were stable, and the international status of the Japanese Yen was enhanced. However, in the late stage, the process of Japanese Yen internationalization appeared to be retrogressive, rather than progressive, when its rapid cross-border financial deregulation led to large and volatile short-term capital flows that could have a destabilizing impact (Jia 2014).

Yet, as far as we are aware, there is little or no evidence on the dynamic interaction effects among currency internationalization, short-term capital flows and exchange rate expectation. Therefore, this study intended to address this important issue and explore the interactive effects of these three elements which would allow us to draw some important policy implications for the RMB internationalization process and the regulation of the short-term capital flows.

3. Models and Theoretical Analysis

3.1. Interaction of RMB Exchange Rate Expectation and RMB Internationalization

By definition, the RMB internationalization refers to the process of taking the RMB outside of China as an international currency and allowing nonresidents to hold and use the RMB extensively overseas as a major pricing and settlement currency for trade, investments and reserves. In particular, in this study we simplified the RMB internationalization process by focusing on the analysis of the foreign demand for RMB and substitution effect of other currencies for RMB. The foreign demand for RMB can be divided into two components; one is for the cross-border trade settlement and outward direct investment in RMB, and another is for the speculative purpose by the foreign investors for the RMB denominated assets (Jiang et al. 2012).

We adopted the assets portfolio balance model to explore the effect of the expected change of RMB exchange rate on RMB internationalization and how the latter affects the short-term capital flows. The assets portfolio balance model was proposed by McKinnon and Oates (1966), Girton and Henderson (1976), and developed by Girton and Roper (1981), Cuddington (1983) and Zervoyianni (1993) to include currency substitution between foreign and domestic assets in the model. When the rate of asset return changes, the domestic investors will adjust their portfolio through substituting domestic assets for foreign exchange or foreign bonds, which will affect the demand for currencies.

Based on the assets portfolio model of Cuddington (1983) and Adebisi (2005), we set up a foreign demand model for RMB. We assume that, (i) the domestic investors in a foreign country pursue to maximize their return from holding the RMB at a given level of risk; (ii) out of their total wealth, the domestic investors hold four different types of assets consisting of domestic assets, local bonds, foreign exchange (RMB) and RMB denominated assets; and (iii) investors can freely convert from one asset to another by changing the relative composition of the portfolios. In this assets portfolio balance model, the demand for assets is determined by the relative rate of return of the assets, income and total wealth. For domestic investors, the demand function for RMB is specified as follows:

$$M^d = a + a_1r + a_2er + a_3(er + r^*) + a_4Y + a_5W \quad (1)$$

where M^d denotes the logarithm of nominal demand for RMB, r is the yield for local bonds, er is the rate of expected RMB appreciation, r^* refers to the interest rate for RMB denominated bonds, Y refers to the logarithm of nominal income and W is the total wealth of the domestic investors. In this model, we set the nominal return of local currency as 0. For domestic investors, r , er and $(er + r^*)$ are respectively the nominal return of local bonds, RMB and RMB denominated bonds. When local bonds return r rises, the domestic investors increase their demand for local bonds and reduce their demand for RMB and RMB denominated assets, hence, $a_1 < 0$. When the rate of expected RMB appreciation er increases, the local price of RMB is expected to rise, which leads to an increase in demand for RMB by local investors, so $a_2 > 0$. When the return of RMB denominated bonds $(er + r^*)$ increases, the demand for RMB denominated bonds increases and demand for RMB decreases; thus, it is expected that $a_3 < 0$. RMB demand function also depends on foreign income Y and the total wealth W , with an expected positive sign, i.e., $a_4 > 0$, and $a_5 > 0$.

In a similar fashion, we specify the demand function for RMB denominated bonds as follows:

$$B^d = B^d(r, er, er + r^*, Y, W) \quad (2)$$

When both r and er decrease and $(er + r^*)$ increases, domestic investors' demand for RMB denominated bonds increase. Both Equations (1) and (2) suggest that RMB appreciation expectation will lead to an increase in demand for RMB and RMB denominated bonds. However, one may note that the expected change of RMB exchange rate can affect the demand for RMB and RMB denominated bonds both directly and indirectly, a_2 representing the direct effect of RMB appreciation expectation. When er increases, it will raise the domestic demand for the RMB and decrease the demand for RMB denominated bonds. However, the rise of er also affects the demand for RMB denominated bonds indirectly through its impact on the increase in $(er + r^*)$, which then leads to an increase in demand for RMB bonds and a decrease in demand for the RMB. Both direct and indirect effects affect the demand positively.

$$\frac{\partial M^d}{\partial er} = \frac{\partial M^d}{\partial r^*} \frac{\partial(er + r^*)}{\partial er} + \frac{\partial M^d}{\partial er} > 0 \tag{3}$$

$$\frac{\partial B^d}{\partial er} = \frac{\partial B^d}{\partial r^*} \frac{\partial(er + r^*)}{\partial er} + \frac{\partial B^d}{\partial er} > 0 \tag{4}$$

Now we turn to the impacts of RMB internationalization on RMB exchange rate expectation. As aforementioned, the process of RMB internationalization implies that the RMB is to be used worldwide by non-residents for payment and investment, suggesting that foreign demand for RMB will increase, which will lead to an increase in RMB appreciation expectation. On the other hand, currency internationalization could also be driven by market or government (Cohen 1971). When RMB internationalization is viewed as government driven, investors may not have full confidence about the RMB, which may lead to RMB depreciation expectation. Therefore, the effect of RMB internationalization on RMB exchange rate expectation is undetermined based on the above analysis.

3.2. Interaction of RMB Internationalization and Short-Term Capital Flows

We relate our model to the assets portfolio theory, currency crisis theory and the theory of interest rate parity (IRP). The short-term capital inflow to a country can be caused either by cross-border interest rate arbitraging activities or by currency arbitraging activities. Moreover, short-term capital inflow is also subject to the capital account regulation. The stricter the capital control, the higher the cost of capital flows. We specify the short-term capital flows function as follows:

$$\ln F = \ln A + a_1 \ln(e) + a_2 \ln(i - i^*) + a_3 \ln(er) + a_4 \ln(ar) + a_5 \ln c \tag{5}$$

where F denotes the short-term capital net inflow, e indicates the local currency exchange rate, i is domestic interest rate, i^* is foreign interest rate, er is the local currency expected appreciation rate, ar is the asset market return and c is the cost of capital flows. Equation (5) shows that short-term capital inflow is determined by the exchange rate level, the interest rate spread at home and abroad, the expected exchange rate changes, assets price and capital flow cost. The partial derivative of short-term capital flow to each variable is as follows:

$$\frac{\partial F}{\partial e} > 0 \quad \frac{\partial F}{\partial(i - i^*)} > 0 \quad \frac{\partial F}{\partial er} > 0 \quad \frac{\partial F}{\partial ar} > 0 \quad \frac{\partial F}{\partial c} < 0 \tag{6}$$

It shows that the short-term capital net inflow has a positive relationship with the local currency exchange rate, interest rate spread at home and abroad, domestic currency exchange rate appreciation expectation and assets market return rate, but is negatively related to capital flow cost. The RMB internationalization will help reduce the transaction costs of capital flows (Yu 2011; Zhang and Xu 2012) as,

$$c = c(s), \text{ and } \frac{\partial c(s)}{\partial s} < 0 \tag{7}$$

There are two channels through which the RMB internationalization process can reduce the transaction costs of capital flows. One is the cross-border RMB payment facility and another is the RMB offshore market, which facilitates interest rate and currency arbitraging activities. It is believed that the RMB offshore market is less regulated than the onshore market. Although the financial assets traded on both markets are essentially the same, the price deviations between the two markets can be viewed as different responses of the market players either to the different market conditions or even the same information but with different interpretation. These interest rate and currency arbitrage activities derived from both the RMB onshore and offshore markets are the important cause to the short-term capital flows, which provides the major sources of offshore RMB liquidity under the effective control of China's capital account. On the other hand, the RMB internationalization provides an additional source of liquidity to the offshore RMB market, in addition to the QFII program. The recent establishment of the Qianhai Shenzhen-Hong Kong Modern Service Industry Cooperation Zone aims to create a modern service industry zone, with a particular focus on the development of innovative financial instruments and financial products, while experimenting with the expansion of offshore RMB fund flow-back channels and the internationalization of Qianhai's financial market. Foreign investors may convert their foreign exchange into RMB on the offshore markets, then backflow into the onshore market. With the process of the RMB internationalization, the transaction costs of the capital flows have been reduced, defined as follows,

$$\frac{\partial F}{\partial s} = \frac{\partial F}{\partial c(s)} \frac{\partial c(s)}{\partial s} > 0 \quad (8)$$

With the rising short-term capital inflow, it will undoubtedly affect China's financial market and hence the RMB onshore market. It is arguable that the short-term capital inflow will not only contribute in terms of liquidity to the onshore financial markets, but also help promote the competitiveness and acceptance of the RMB in the global market. Moreover, the short-term capital inflow may expedite the development of the financial institutions and market in China, and help promote its currency internationalization (Genberg 2009; Frankel 2012). Finally, the short-term capital inflow may help raise the market expectation for RMB appreciation and accelerate the process of RMB internationalization.

We further investigated the dynamic relationship among these variables by employing a VAR model. We constructed a 3-variable VAR model, including RMB exchange rate expectation, RMB internationalization and short-term capital flow. The empirical analysis is based on Stata 13 and we use monthly series of data spanning from February 2004 to December 2020.

4. Data Description

There are three methods to calculate short-term capital flow: direct, indirect way and mixed methods. In this study, we adopted the indirect way to estimate the short-term capital flows, which is proxied by the increases in foreign exchange reserve minus export surplus and foreign direct investment.

Exchange rate expectation can be proxied by the forward margin. In this study, we used the RMB non-deliverable forward exchange rate (NDF) to calculate the forward margin as follows,

$$Expect = \frac{\text{one year NDF exchange rate of RMB against USD}}{\text{spot exchange rate of RMB against USD}} - 1 \quad (9)$$

If Expect is larger than zero, it means that offshore market investors have appreciation expectation for RMB. Daily data for a one year NDF exchange rate of USD against RMB was obtained from Wind Database, which is used to derive the one year NDF monthly data. We also collected the spot exchange rate of USD against RMB from WIND Database.

There are several measures for RMB internationalization, as reported in Table 1. Although RMB settlement of cross-border trade and the Standard Chartered RMB global indicator RGI can meet the need of the empirical study, the time span is too short and only available for the recent years. We decided to follow the method in [Sha and Liu \(2014\)](#) and use the RMB offshore market deposits as the proxy for the RMB internationalization. Although there are several major RMB offshore markets including Hong Kong, London, Seoul, Frankfurt and Singapore, the Hong Kong market plays a dominant role and accounts for about 80% of the global RMB deposit business ([SWIFT 2012](#)). It also offers the longest and consistent time series as compared to other variables in our sample. Thus, it is reasonable to select the Hong Kong RMB offshore market deposits as the proxy. We collected the monthly RMB deposits data from the Monthly Statistical Bulletin of the Hong Kong Monetary Authority. In order to avoid the possible heteroscedasticity problems, we took natural logarithms for Hong Kong offshore market RMB deposits.

Table 1. RMB internationalization indicators.

Indicators Name	Sample Period	Time Frequency
RMB settlement of cross-border trade	2012.1–2020.12	Monthly
Standard Chartered RMB global indicator RGI	2012.9–2017.6	Monthly
Hong Kong offshore market RMB deposits	2004.2–2020.12	Monthly
China Bank offshore market index ORI	2011.4–2020.4	Quarterly
China Bank cross-border RMB index CRI	2011.4–2020.3	Quarterly
RMB settlement accumulation of cross-border trade	2009.4–2020.4	Quarterly

We have conducted the ADF tests to check the time-series properties of the endogenous variables and the results of unit-root test are reported in Table 2. We choose lag order p based on information criterion LR, FPE, AIC and SC, and the optimal lag order is 2. As it can be seen in Table 2, the results of unit root tests indicate that all the three variables are stationary in level though at slightly different significance levels. Given that all of the series are $I(0)$, we proceed to VAR estimation rather than conduct cointegration tests as by definition these stationary variables cannot be cointegrated (see, for instance, [Lütkepohl 2006](#); [Ito and Sato 2008](#); [Zhang and Sato 2012](#)).

Table 2. ADF test results for variables.

Variable	Test Type (c, t, n)	ADF Statistic	Critical Value	Significance Level	Conclusion
Shortcapital	(c, t, 0)	−14.369	−4.006	1%	Stationary
lnCurrency	(c, t, 0)	−3.975	−4.006	1%	Stationary
Expect	(c, t, 0)	−9.582	−4.006	1%	Stationary

Notes: c in Test type (c, t, n) means containing intercept term. t means containing trend term. n is the lag order of the variables.

Table 3 reports the basic summary statistics of the three main variables. As can be seen in table 3, the average value of RMB appreciation expectation (*Expect*) is 0.041 and the maximum value is 0.465. The average value of RMB internationalization, as proxied by *lnCurrency*, is 12.169, with a maximum value of 13.819. The average value of short-term capital flow (*Shortcapital*) is 0.014 and the maximum value equals 0.113.

Table 3. Statistical Results.

Variable	Obs	Mean	Std. Dev.	Min	Max
Expect	203	0.041	0.124	−0.227	0.465
lnCurrency	203	12.169	1.622	6.797	13.819
Shortcapital	203	0.014	0.038	−0.108	0.113

5. Empirical Results

5.1. Impulse Response Effect Analysis

We employed the impulse response analysis and variance decomposition method to examine the dynamic relationship between RMB exchange rate expectation, RMB internationalization and short-term capital flow. Figure 1 reports the results of impulse response of the short-term capital flow to the shocks of RMB exchange rate expectation and RMB internationalization. The left panel of Figure 1 shows that the short-term capital flows respond positively to the shock of RMB exchange rate expectation. However, the positive response is short-lived, lasting for only one horizon and then falling immediately back to a close to zero level, though it experiences a short rise again in the third horizon. The results indicate that RMB appreciation expectation can drive short-term capital inflow. The right panel indicates that short-term capital flow has a positive response to a one-standard-deviation structural shock of RMB internationalization. The positive shock impact lasts for four horizons before turning into negative. The results suggest that the RMB internationalization process could lead to an increase in the short-term capital inflow.

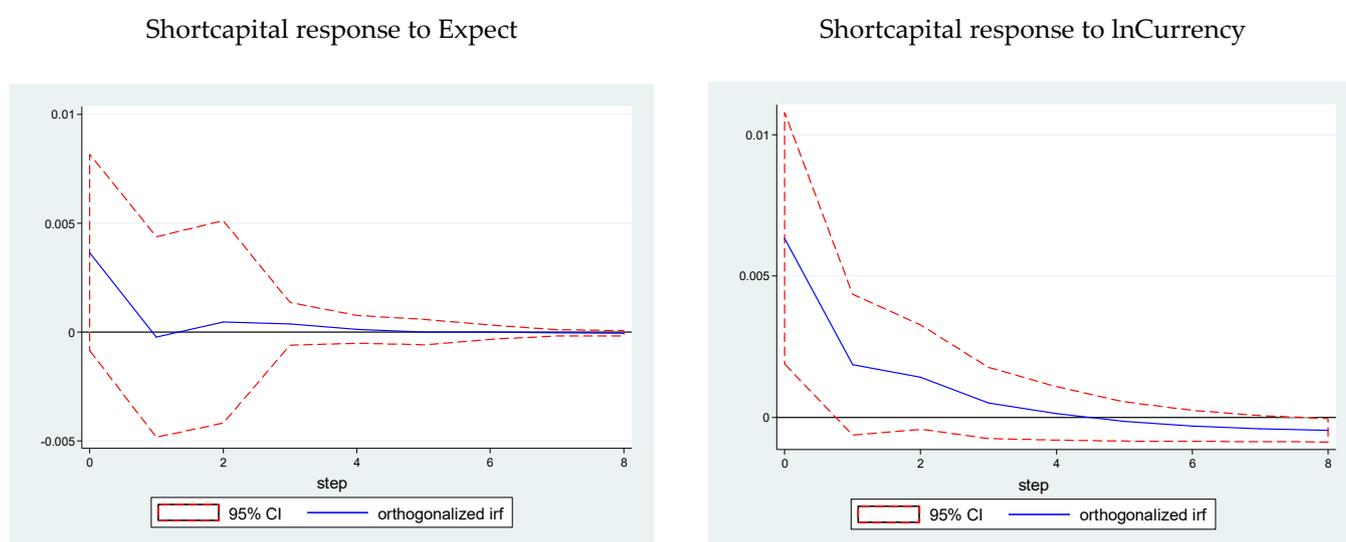


Figure 1. Impulse Response Function of Shortcapital to Expect and lnCurrency.

Figure 2 presents the impulse response of RMB exchange rate expectation to RMB internationalization and short-term capital flow shocks. The left panel shows that RMB exchange rate expectation has a positive response to the shock of offshore market RMB deposits. A one-standard-deviation shock to RMB exchange rate expectation corresponds to a contemporaneous increase in the expectation of around 0.03 percentage points from the first horizon onwards. The shock impact is also quite persistent, with RMB exchange rate expectation on average about 0.04 percentage points higher from the first horizon onwards. This finding suggests that the increase of offshore market RMB deposits could lead to RMB appreciation expectation. The right panel shows that RMB exchange rate expectation decreases in response to the adverse shocks of short-term capital flows. A one-standard-deviation capital flows shock can cause exchange rate expectation contemporaneously to drop by as low as over 0.01 percentage points within the first month. The impact is reversed to become positive from the third horizon onwards though the magnitude remains small. The results imply that short-term capital inflow could lead to a short-lived RMB depreciation expectation.

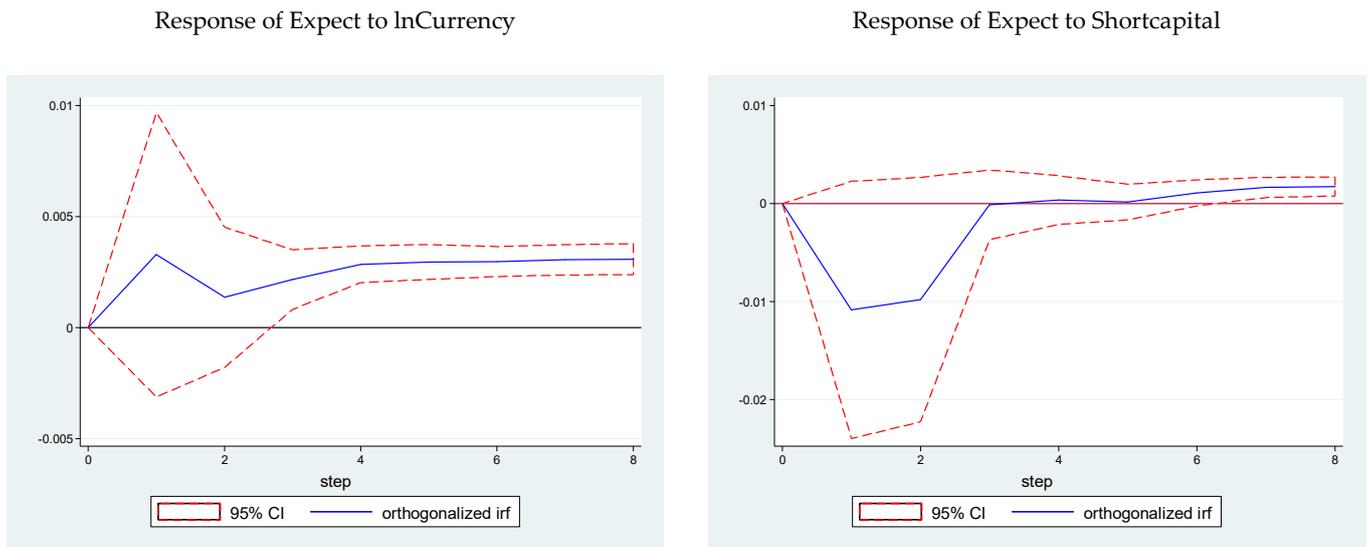


Figure 2. Impulse Response Function of Expect to LnCurrency and Shortcapital.

Figure 3 reports the impulse response of RMB internationalization to RMB exchange rate expectation shock and short-term capital flow shock. As can be seen from the left panel of Figure 3, the response of RMB internationalization to RMB exchange rate expectation shock is positive with an increasing trend over the horizons. The shock impact peaks at around 0.012 percentage points in the second horizon and is persistent at this level throughout the rest of the horizons. The results confirm that RMB appreciation expectation has a significant positive effect on RMB internationalization. The right panel of Figure 3 shows that, given a positive shock of short-term capital flow, offshore market RMB deposit responds positively, rising up to 0.04 percentage points in the fourth horizon and continuing to rise thereafter. Thus, short-term capital inflow could promote RMB internationalization and the positive shock impact is persistent.

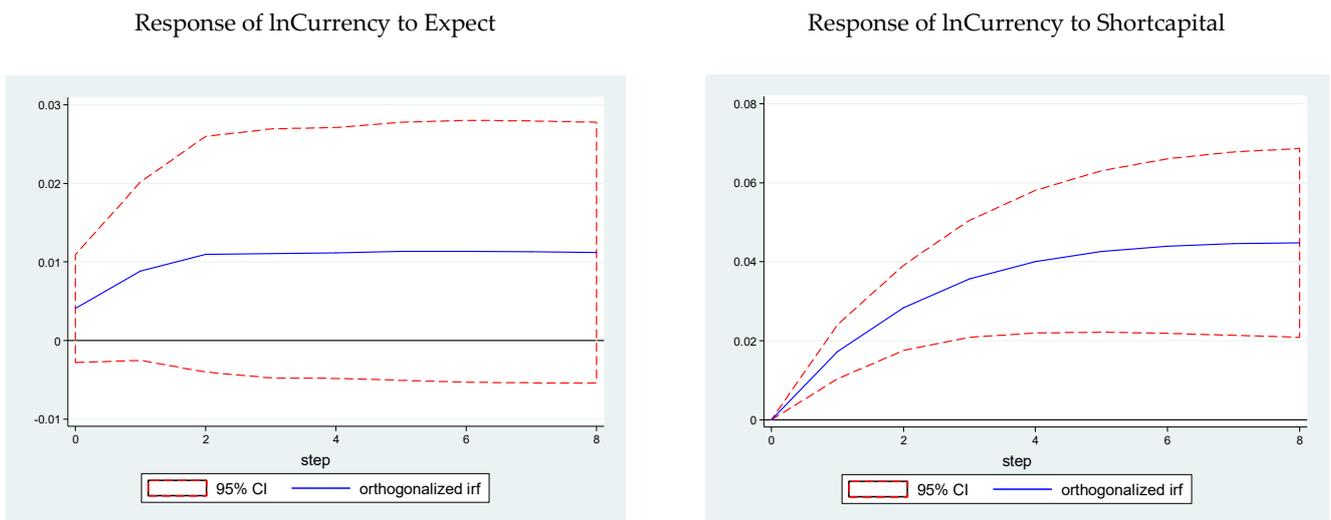


Figure 3. Impulse Response Function of LnCurrency to Expect and Shortcapital.

In sum, our results show that the RMB appreciation expectation could lead to short-term capital inflow through increasing RMB internationalization.

5.2. Variance Decomposition

The results for variance decomposition for RMB internationalization, exchange rate expectation and short-term capital flows are reported in Table 4. It can be seen in Table 4 that RMB exchange rate expectation can only explain 1.077% of the variation in short-term capital flows and 1.836% in RMB internationalization, while RMB internationalization accounts for 3.605% of the short-term capital flows variance and 0.497% of the change in RMB exchange rate expectation, respectively. On the other hand, short-term capital flows can explain over 21% of the variation in RMB internationalization. The findings confirm that RMB internalization is strongly associated with the short-term capital flow, while RMB internationalization has limited impact on RMB exchange rate expectation.

Table 4. Variance decomposition of three variables (in percentage).

Period	lnCurrency		Shortcapital		Expct	
	Expect	Shortcapital	Expect	lnCurrency	lnCurrency	Shortcapital
1	0.668	0	1.249	3.750	0	0
2	1.362	4.272	1.145	3.720	0.108	1.181
3	1.719	8.777	1.092	3.652	0.121	2.047
4	1.799	12.627	1.085	3.614	0.165	2.038
5	1.817	15.621	1.080	3.593	0.243	2.035
6	1.829	17.922	1.078	3.588	0.325	2.033
7	1.835	19.685	1.077	3.593	0.409	2.043
8	1.836	21.049	1.077	3.605	0.497	2.067

5.3. Robustness Checks

We now turn to the robustness checks of these interactive relationship between the interested variables.

Firstly, we used global market share of RMB international payments as the proxy of RMB internationalization, and re-ran the VAR model. Figure 4 reports the results. The left panel of Figure 4 shows that RMB internationalization now responds positively to the RMB appreciation expectation shock. Similarly, as can be seen in the right panel of Figure 4, the RMB internationalization affects the short-term capital inflow positively, suggesting that the RMB internationalization may lead to an increase in the short-term capital inflow. This finding is consistent with that from our baseline model.

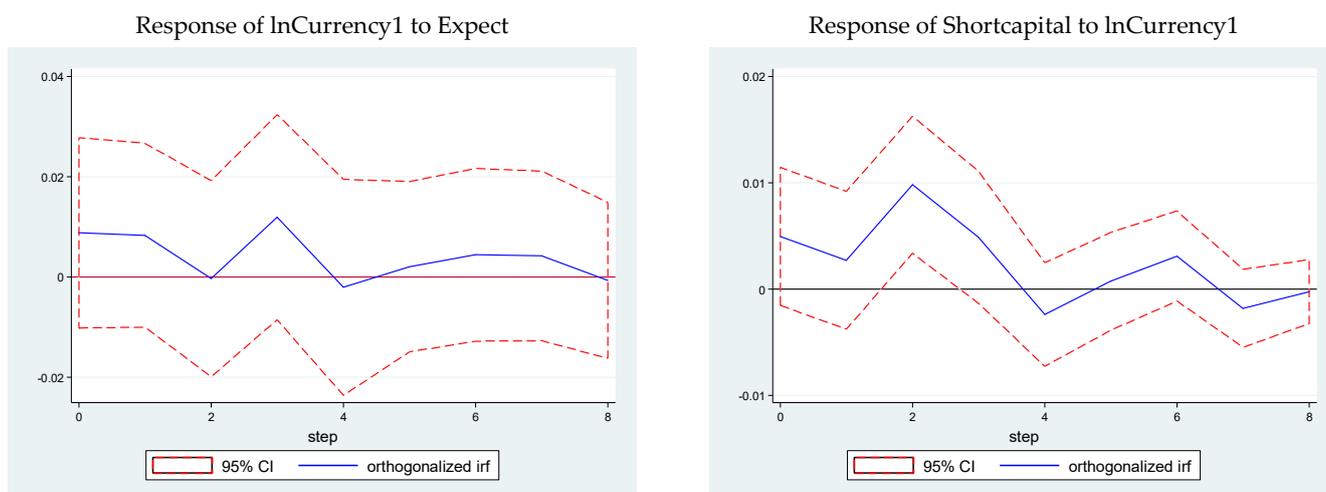


Figure 4. Impulse Response of lnCurrency1 to Expect and Shortcapital to lnCurrency1.

Secondly, we assessed the significance and sign of the estimates. Figure 5 reports the VAR model estimation results. As can be seen from Table 5, the coefficient of first-

order lag of lnCurrency is significantly positive at the 10% level. It indicates that RMB internationalization has a positive effect on RMB appreciation expectation. The coefficient of first-order lag of Shortcapital is significantly positive at the 1% level, implying that short-term capital flow has a positive effect on RMB internationalization.

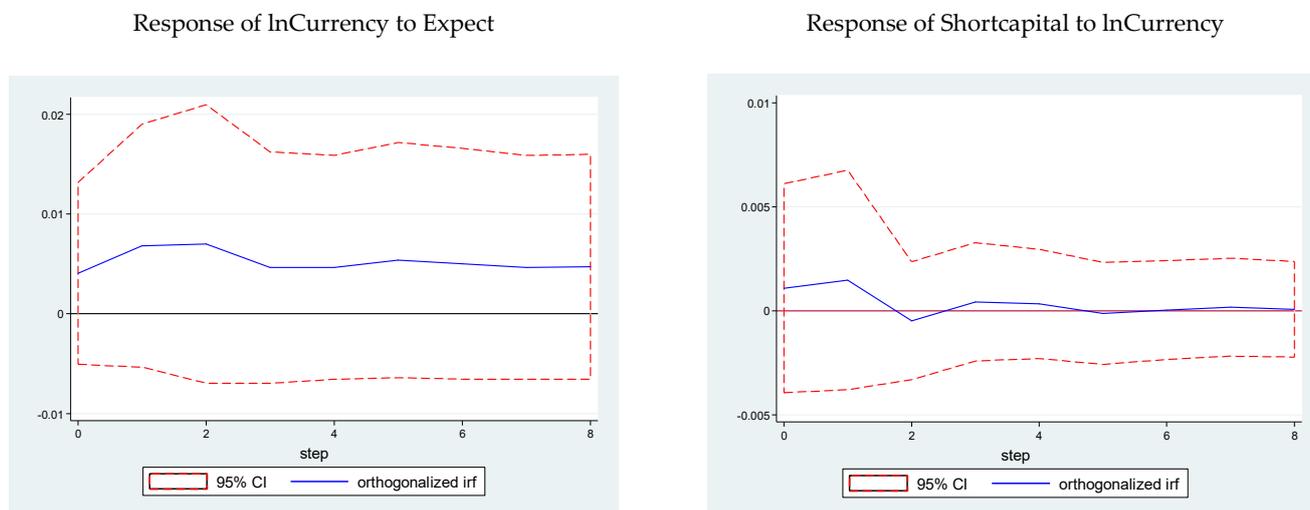


Figure 5. Impulse Response of lnCurrency to Expect and Shortcapital to lnCurrency.

Table 5. VAR model results.

	(1)	(2)	(3)
	Expect	lnCurrency	Shortcapital
L.Expect	−0.136 ** (0.0689)	0.0193 (0.0349)	−0.0139 (0.0230)
L2.Expect	−0.215 *** (0.0681)	0.0131 (0.0345)	−0.00269 (0.0227)
L.lnCurrency	0.110 * (0.0594)	1.220 *** (0.0301)	−0.00219 (0.0198)
L2.lnCurrency	−0.0529 (0.0575)	−0.225 *** (0.0292)	−0.00113 (0.0192)
L.Shortcapital	−0.340 (0.209)	0.540 *** (0.106)	0.311 *** (0.0698)
L2.Shortcapital	−0.307 (0.212)	0.0690 (0.108)	0.171 ** (0.0707)
Constant	−0.629 *** (0.0788)	0.0749 * (0.0399)	0.0484 * (0.0263)
Observations	201	201	201

Note: The values in parentheses are t. *, ** and *** represents significance at the 10% level, 5% level and 1% level, respectively.

Thirdly, RMB was included in the Special Drawing Rights (SDR) currency basket in October 2016. We re-estimate the model by using monthly data from October 2016 to December 2020. The results are reported Figure 5. The left panel of Figure 5 shows that RMB internationalization now responds positively to the RMB appreciation expectation shock. Similarly, as can be seen in the right panel of Figure 5, the RMB internationalization affects the short-term capital inflow positively, suggesting that the RMB internationalization may lead to an increase in the short-term capital inflow. This finding is consistent with the conclusion from our baseline model.

Finally, we considered other factors that may affect RMB internationalization, such as international trade. We constructed a four-variables VAR model, including RMB appreciation expectation, RMB internationalization, short-term capital flow and trade. The

proxy of international trade is the growth rate of total imports and exports. The results are reported in Figure 6. The left panel of Figure 6 shows that RMB internationalization responds positively to the RMB appreciation expectation shock. Similarly, as can be seen in the right panel of Figure 6, the RMB internationalization affects the short-term capital inflow positively, suggesting that the RMB internationalization may lead to an increase in the short-term capital inflow. This finding is consistent with the basic conclusion in the above analysis.

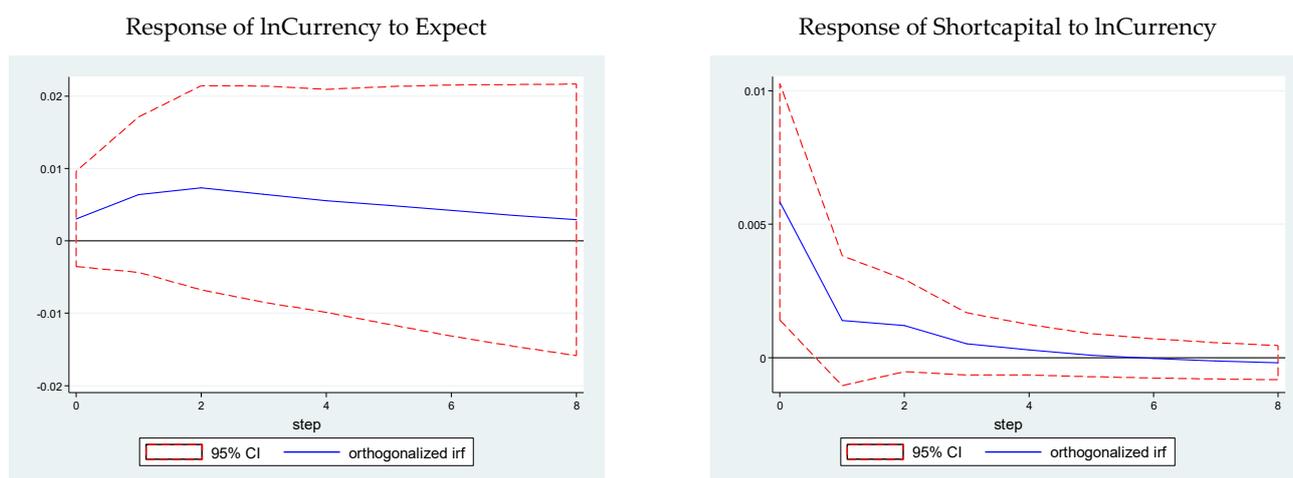


Figure 6. Impulse Response of lnCurrency to Expect and Shortcapital to lnCurrency.

6. Conclusions

In this paper, we have empirically examined the contemporaneous relationships among the RMB exchange rate expectation, currency internationalization and short-term capital flows. Using the assets portfolio balance model, we found strong evidence that RMB appreciation will lead to an increase in foreign demand for RMB and RMB denominated assets. With the short-term capital flow determination model, we also found some evidence that the degree of RMB internationalization may lead to an increase in the short-term capital inflow to China due to the reduction in transaction costs. The results from our VAR model show that RMB appreciation expectation will promote the RMB internationalization process, which in turn increases the short-term capital inflow. It was also found that RMB internationalization may lead to currency appreciation expectation. This is consistent with the conclusion of Frankel (2012), Lardy and Douglass (2011), Sha and Liu (2014). Our findings also suggest that, with the process of RMB internationalization, the relationship between exchange rate expectation and short-term capital flows has become no longer straightforward and it needs to be assessed in the context of RMB internationalization.

Our findings have some important policy implications. First, with a higher level of RMB internationalization, it becomes more important for the PBoC to pay close attention to the short-term capital flows, as high volatility in short-term capital flows has a destabilizing effect on the economy. This requires the central bank to conduct appropriate prudential financial regulations during the process of currency internationalization to cope with such a destabilizing effect. Second, although the government plays an important role in promoting the internationalization of RMB, the process essentially has to be market driven and to reflect China's rising importance in the global economy and financial system. The challenges for the monetary authority are essentially how to conduct the monetary and exchange rate policies in the process of internationalizing RMB, and how to inform the financial market of the policy changes with minimal "shocking" effects on both the RMB onshore and offshore markets.

Author Contributions: Conceptualization, M.L., F.Q. and Z.Z.; methodology, F.Q. and Z.Z.; software, M.L.; formal analysis and investigation, M.L., F.Q. and Z.Z.; writing, M.L., F.Q. and Z.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: An early version of this paper was presented at the 22nd International Congress on Modelling and Simulation. The authors wish to thank Michael McAleer, Chia-Lin Chang, three anonymous referees, and the conference participants for helpful comments and suggestions which have greatly improved the quality of the paper.

Conflicts of Interest: The authors declare no conflict of interest.

References

- Adebiyi, Adebayo Michael. 2005. Broad Money Demand, Financial Liberalization and Currency Substitution. Paper presented at 8th Capital Markets Conference, Indian Institute of Capital Markets Paper, Paris, France, July 8–13.
- Bouvatier, Vincent. 2010. Hot Money Inflows and Monetary Stability in China: How the People's Bank of China Took up the Challenge. *Applied Economics* 42: 1533–48. [\[CrossRef\]](#)
- Chen, Lang Nan, and Chen Yun. 2009. RMB Nominal Exchange Rate, Asset Price and Short-term International Capital Flows. *Journal of Economic Management* 1: 1–6.
- Cohen, Benjamin J. 1971. *The Future of Sterling as an International Currency*. London: Macmillan.
- Cohen, Benjamin J. 2012. The Yuan Tomorrow? Evaluating China's Currency Internationalization Strategy. *New Political Economy* 17: 361–71. [\[CrossRef\]](#)
- Combes, Jean-Louis, Tidiane Kinda, and Patrick Plane. 2012. Capital Flows, Exchange Rate Flexibility, and the Real Exchange Rate. *Journal of Macroeconomics* 34: 1034–43. [\[CrossRef\]](#)
- Cuddington, John T. 1983. Currency Substitution, Capital Mobility and Money Demand. *Journal of International Money and Finance* 2: 111–33. [\[CrossRef\]](#)
- Eichengreen, Barry. 2011. The renminbi as an international currency. *Journal of Policy Modeling* 33: 723–30. [\[CrossRef\]](#)
- Fang, Xianming, Ping Pei, and Yihao Zhang. 2012. Motivation and Effects of International Speculative Capital Inflow: Empirical Tests Based on Sample Data from 1999 to 2011. *Journal of Financial Research* 1: 65–77.
- Frankel, Jeffrey. 2012. Internationalization of the RMB and Historical Precedents. *Journal of Economic Integration* 3: 329–65. [\[CrossRef\]](#)
- Garber, Peter. 2011. *What Drives CNH Market Equilibrium*. Beijing: China Development Research Foundation.
- Genberg, Hans. 2009. *Currency Internationalization: Analytical and Policy Issues*. Hong Kong: Hong Kong Institute for Monetary Research Working Paper No. 31.
- Girton, Lance, and Dale W. Henderson. 1976. *Central Bank Operations in Foreign and Domestic Assets under Fixed and Flexible Exchange Rates*. Washington, DC: Board of Governors of the Federal Reserve System.
- Girton, Lance, and Don Roper. 1981. Theory and Implications of Currency Substitution. *Journal of Money, Credit and Banking* 13: 12–30. [\[CrossRef\]](#)
- Guo, Lianqiang, and Guoping Zhu. 2012. New Characteristics and Risk Aversion of Short-term Capital Flow in the Process of RMB Internationalization. *Social Science Front* 12: 47–50.
- Golley, Jane, and Rod Tyers. 2007. *China's Real Exchange Rate Puzzle*. College of Business and Economics. Working Paper No. 479. Canberra: Australian National University.
- Hellmann, Thomas F., Kevin C. Murdock, and Joseph E. Stiglitz. 1994. Addressing Moral Hazard in Banking: Deposit Rate Controls vs. Capital Requirements. Working Paper No. 12. Unpublished manuscript.
- Ho, Kin-Yip, Yanlin Shi, and Zhaoyong Zhang. 2017. Does news matter in China's foreign exchange market? Chinese RMB volatility and public information arrivals. *International Review of Economics & Finance* 52: 302–21.
- Ho, Kin-Yip, Yanlin Shi, and Zhaoyong Zhang. 2018. Public Information Arrival, Price Discovery and Dynamic Correlations in the Chinese Renminbi Markets. *The North American Journal of Economics and Finance* 46: 168–86. [\[CrossRef\]](#)
- Ito, Takatoshi, and Kiyotaka Sato. 2008. Exchange Rate Changes and Inflation in Post-Crisis Asian Economies: Vector Autoregression Analysis of the Exchange Rate Pass-Through. *Journal of Money, Credit and Banking* 40: 1407–38. [\[CrossRef\]](#)
- Jia, Xianjun. 2014. Cross-border Flows of Financial Capital and Reserve Currency Position: Based on Experience of Japanese Yuan. *Study of International Finance* 8: 35–43.
- Jiang, Xianling, Wei Liu, and Ye Bingnan. 2012. The Effect of Exchange Rate Expectation on Offshore Market RMB Demand. *Study of International Finance* 10: 68–75.

- Jiang, Xiandeng, Yanlin Shi, and Zhaoyong Zhang. 2021. Does US Partisan Conflict Affect China's Foreign Exchange Reserves? *International Review of Economics & Finance* 75: 21–33. [\[CrossRef\]](#)
- Krugman, Paul Robin. 1984. *The International Role of the Dollar: Theory and Prospect//Exchange Rate Theory and Practice*. Chicago: University of Chicago Press, pp. 261–78.
- Lardy, Nicholas, and Patrick Douglass. 2011. *Capital Account Liberalization and the Role of the Renminbi*. Peterson Institute for International Economics, Working Paper. Washington, DC: Peterson Institute for International Economics.
- Lütkepohl, Helmut. 2006. *New Introduction to Multiple Time Series Analysis*. Berlin and Heidelberg: Springer.
- Lv, Guangming, and Man Xu. 2012. Short-term Capital Flow in China: Analysis of Three Motivations Base on Monthly VAR model. *Study of International Finance* 4: 61–68.
- Ma, Jun, and Jianguang Xu. 2012. *Road of RMB Going Abroad*. Beijing: China Economic Publishing Company, pp. 70–75.
- Maziad, Samar, Pascal Farahmand, Shengzu Wang, Stephanie Segal, and Faisal Ahmed. 2011. *Internationalization of Emerging Market Currencies: A Balance between Risks and Rewards*. IMF Staff Discussion Note. Washington, DC: International Monetary Fund.
- McKinnon, Ronald I., and Wallace Oates. 1966. *The Implications of International Economic Integration for Monetary, Fiscal and Exchange Rate Policies*. Princeton Studies in International Finance No. 16. Princeton: Princeton University.
- Prasad, Eswar, and Shang-Jin Wei. 2005. *The Chinese Approach to Capital Inflows: Patterns and Possible Explanations*. NBER Working Paper No.11306. Cambridge: NBER.
- PBoC. 2020. *2020 RMB Internationalization Report*. Beijing: The People's Bank of China.
- Qin, Fengming, Junru Zhang, and Zhaoyong Zhang. 2018. RMB Exchange Rates and Volatility Spillover across Financial Markets in China and Japan. *Risks* 6: 120. [\[CrossRef\]](#)
- Reinhart, Carmen, and Guillermo Calvo. 2000. *When Capital Inflows come to a Sudden Stop: Consequences and Policy Options*. Germany: University Library of Munich.
- Sha, Wenbing, and Hongzhong Liu. 2014. RMB Internationalization, Exchange Rate Volatility and Exchange Rate Expectation. *Study of International Finance* 8: 10–18.
- Sun, Tao, and Xiaojing Zhang. 2006. Empirical Analysis of Cross-border Capital Flow: A Case Study of Hongkong Route. *Journal of Financial Research* 8: 111–21.
- SWIFT. 2012. *RMB Internationalisation: Perspectives on the Future of RMB Clearing*. La Hulpe City: SWIFT.
- The People's Bank of China. 2015. *2015 Annual Report of Renminbi Internationalization*. Beijing: The People's Bank of China.
- Wang, Shihua, and Fan He. 2007. Short-term Capital Flow in China: Current Situation, Path and Factors. *Journal of World Economy*, 12–19.
- Wang, Xiaoyan, Qinli Lei, and Meizhou Li. 2012. The Effect of Currency Internationalization on Macro-economy in China. *Statistical Research* 5: 23–33.
- Wang, Xin. 2011. Study of Costs and Benefits in the Process of RMB internationalization. *International Trade* 8: 51–55.
- Wang, Yong. 2011. Cross-border Capital Flow Management Dilemma and Policy Proposal in the Process of RMB Internationalization. *International Trade* 9: 53–59.
- Xiang, Yu, and Haibo Zhu. 2013. Effect of Hongkong RMB Offshore Market on Short-term Capital Flow Volatility: Based on Analysis of Cross-border RMB Trade Settlement. *Inner Mongolia Social Sciences* 6: 90–94.
- Yu, Yongding. 2011. Some Thoughts on Renminbi Internationalization. *International Economic Review* 5: 7–13.
- Yu, Yongding. 2012. The Current RMB Exchange Rate Volatility and RMB Internationalization. *International Economic Review* 1: 18–26.
- Zhang, Bin, and Qiyuan Xu. 2012. RMB's Internationalization under the System of Limited Exchange Rate and Capital Account Control. *International Economic Review* 4: 63–74.
- Zhang, Ming. 2012. Capital Account Liberalization should Progress Gradually in China. *International Finance* 7: 3–6.
- Zhang, Ming, and Xiaofen Tan. 2013. Main Motivation Factors of Short-term Capital Flow in China: Data of 2000 to 2012. *Journal of World Economy* 11: 93–116.
- Zervoyianni, Athina. 1993. International Macroeconomic Interdependence, Currency Substitution, and Price Stickiness. *Journal of Macroeconomics* 14: 59–86. [\[CrossRef\]](#)
- Zhang, Zhaoyong, and Kiyotaka Sato. 2012. Should Chinese Renminbi Be Blamed for Its Trade Surplus: An VAR Approach. *The World Economy* 35: 632–50. [\[CrossRef\]](#)
- Zhou, Xinmiao, Junru Zhang, and Zhaoyong Zhang. 2021. How does news flow affect cross-market volatility spillovers? Evidence from China's stock index futures and spot markets. *International Review of Economics & Finance* 73: 196–213.
- Zhu, Mengnan, and Lin Liu. 2010. Short-run International Capital Flows, Exchange Rate and Asset Prices—An Empirical Study Based on Data after Exchange Rate Reform Since 2005. *Finance & Trade Economics* 5: 5–13.