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The renminbi's status as a safe-haven currency

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Introduction

The *China Financial Stability Report* (Financial Stability Analysis Group of the People's Bank of China 2019) pointed out that the factors threatening global financial stability will likely persist into the future, especially as unilateralism and trade-protectionist sentiments have only intensified globally, while financial markets are highly sensitive to trade—all of which has led to growing uncertainty around the world. As such, global systemic risk prevention and control remain vital. Consequently, analysis of the demand for safe havens and the allocation of safe-haven assets appears extremely urgent. Traditionally, the main safe-haven currencies are the Swiss franc, the Japanese yen and the US dollar. However, these currencies do not exhibit the characteristics of a safe-haven asset all the time. Meanwhile, the large and concentrated demand for such assets is likely to lead to excessively high currency portfolio holding costs.

A highly topical research question is whether the renminbi (RMB) plays the role of a safe-haven currency. After two important reforms of the exchange rate system, the renminbi is striding towards greater marketisation. Currently, the value of the renminbi continues to be relatively stable, and the various monetary policies implemented and promoted by China's central bank are relatively independent and prudent. The renminbi has always maintained a stable position in the global monetary system. Since the renminbi is not yet fully convertible under the capital account, the onshore and offshore markets operate simultaneously and, compared with that onshore, the offshore renminbi market has a more flexible mechanism. After years of painstaking management and development, offshore renminbi market products have become more diversified. According to the *RMB Internationalisation*

Report 2020 issued by the People's Bank of China (PBC 2020), renminbi foreign exchange products in the offshore over-the-counter (OTC) market include spot, forward, swap, currency swap and option and a variety of renminbi-denominated investment products, such as renminbi currency futures, renminbi-traded open-end index funds (exchange-traded funds [ETF]) and renminbi real estate investment trusts (REITs). In addition, the implementation of financial innovation policies such as Shanghai–Hong Kong Stock Connect, Shenzhen–Hong Kong Stock Connect and Bond Connect has promoted the continuous expansion of the breadth and depth of the offshore renminbi market. To a certain extent, the renminbi already has the characteristics of a safe-haven currency.

Whether the renminbi—specifically, the offshore renminbi—has become a safe-haven currency has become a question among financial market observers and participants (Fatum et al. 2017). Habib and Stracca (2012) deemed the net foreign exchange asset position and the size of the stock market significant factors in measuring whether a country's currency can be regarded as a safe-haven currency. Currently, China holds the largest net foreign asset position in the world, reaching US$3.2 trillion, and its stock market is the second-largest in the world. Therefore, it is reasonable to include the renminbi when considering global safe-haven currencies. However, there is no consensus in the literature as to what constitutes a safe-haven currency or, for that matter, which currencies exhibit safe-haven features and when these emerge. Ranaldo and Söderlind (2010) found that, during episodes of elevated market uncertainty prior to the Global Financial Crisis (GFC), the Japanese yen, the Swiss franc, the euro and the British pound were all exhibiting safe-haven currency features. Coudert et al. (2014) offered a daily data analysis of the evolution of 26 currencies from both advanced and emerging economies. They found that only the Japanese yen and the US dollar exhibited safe-haven currency properties. Hossfeld and MacDonald (2015) defined a currency to be a safe-haven currency if its effective returns were significantly negatively related to global stock market returns in times of high financial stress. They hold the idea that the US dollar better qualifies as a safe-haven currency relative to the Swiss franc, but the euro and the yen are not safe-haven currencies. Grisse and Nitschka (2015) argue that a safe-haven currency is one that offers hedging value against global risk—on average and particularly during a crisis. They examined the hedging characteristics of the Swiss franc and found it exhibits safe-haven characteristics against most, but not all, other currencies. The results in Fatum and Yamamoto (2016) showed that, during the GFC, the Japanese yen appreciated significantly vis-a-vis all other possible safe-haven currencies, thereby implying that the yen was the 'safest' safe-haven currency during this recent period of extreme market turmoil. Moreover, the hedging characteristics of currencies are time-varying—that is, a currency may exhibit hedging characteristics only for a specific period.

It is worth noting that little scholarly attention has been given to whether the renminbi is a safe-haven currency, and what there has been has focused on the extent to which the renminbi has become the anchor of other local currencies. Currently, only Fatum et al. (2017) have discussed the risk aversion of the renminbi. They considered that, at the full sample level, the renminbi exhibited safe-haven asset characteristics against some currencies, including the pound and the euro, but not against other major currencies, such as the US dollar and the yen. Nevertheless, at the at the sub-sample level, the renminbi does not have risk-averse properties. Basically, the renminbi cannot yet be counted as a safe-haven currency, nor has it moved towards becoming one. Regarding the research into the renminbi's anchor-currency status, we list the following studies as representative examples. Ito (2010) quoted the method of studying currency anchors proposed by Frankel and Wei (1994) and found that the renminbi has played a de facto currency basket role in East Asian countries since China's implementation of a managed floating exchange rate system on 21 July 2005. Subramanian and Kessler (2013) believe the influence of the renminbi in East Asia has surpassed that of the dollar and the euro, and it is playing the role of an anchor currency. Ito (2017) pointed out that, in the post-GFC era, the weight of the renminbi in the recessive currency basket of Asian countries has surpassed that of the US dollar. The research of Pontines and Siregar (2012) and Shu et al. (2015) also supports the above conclusions. Chinese scholars have also carried out extensive research on this topic. Yang and Li (2017) consider that the renminbi has become an implicit currency anchor for most countries in the world, particularly those that have close economic and trade relations with China. Liu and Zhang (2018) point out that, with the advancement of the Belt and Road Initiative (BRI), the renminbi's anchor effect will gradually be amplified in inland regions such as Central Asia. Nevertheless, Jian and Zheng (2016) probed the dynamic spillover effects between the renminbi and East Asian currencies from the dual dimensions of space and time and found that the renminbi would not be able to shake the dominant position of the US dollar among East Asian currencies. Peng et al. (2015) also found that the renminbi is not currently the dominant currency in Asia. Although the renminbi may not have become the currency anchor in the region, this does not prevent it having increasing influence, especially the offshore renminbi (Yin and Wu 2017). Does this influence include the hedging properties of the renminbi—that is, in times of crisis, can the renminbi become a haven for various risk assets in the region? This point requires further investigation.

This raises some academic questions: Does the renminbi, especially the offshore renminbi, have the characteristics of a safe haven? Do these characteristics behave significantly differently due to the different monetary environment—that is, are there significant differences in the safe-haven characteristics of the offshore renminbi in different currency portfolios? Meanwhile, do these attributes have time-varying characteristics? In the context of renminbi internationalisation and the BRI, analysing these issues clearly assists us in exploring the hedging characteristics of the renminbi from a quantitative perspective and investigating the hedging value provided by the renminbi to investors when extreme events occur, which in turn provides support for renminbi internationalisation and the BRI. It also has critical reference value and practical significance for the security of the financial system and the reform of the exchange rate system under the 'New Normal'.

Starting from the extended uncovered interest rate parity (UIP), this chapter selects the bilateral exchange rates of the offshore renminbi relative to major currencies and those of countries along the BRI as its research objects. By observing the changes in the offshore renminbi when global risks are rising, and combining its differential performance in different currency environments, we are able to explore the safe-haven characteristics of the offshore renminbi, while simultaneously assessing the time-varying effects of safe-haven characteristics. This study contributes to the literature by providing evidence that the offshore renminbi is a safe-haven currency. We argue that the offshore renminbi exhibits safe-haven asset characteristics against some of the major currencies and those of countries along the BRI. It provides technical support and a demonstration of feasibility for promoting the development of the renminbi as a carrier of cross-border trade payments and settlements in countries along the BRI, and even as a denominated and reserve currency. To a certain extent, the exploration of the safe-haven value is an important manifestation of the offshore renminbi market's ability to perform its functions, which opens up new directions for subsequent research on the renminbi and its offshore markets. Based on the time-varying safe-haven characteristics of the offshore renminbi, export-oriented enterprises can reasonably plan their asset-allocation strategies, and financial regulatory authorities can carry out appropriate policy coordination and institutional arrangements.

Theoretical background

This section aims to employ an asset-pricing framework to interpret the changes in exchange rates. It first presents some conceptual background and then introduces recent advances in the currency risk models that create the foundation for our empirical analysis.

UIP regressions

With the assumption of rational expectations and risk neutrality, UIP declares that the expected changes in exchange rates reflect the interest rate differential between the home country and the foreign country in previous periods—that is, Equation 9.1.

Equation 9.1

$$E_t(s^k_{t+1}) - s^k_t = i^k_t - i_t + \delta_{t+1}$$

In Equation 9.1, s_{t+1}^{k} is the log spot exchange rate of the home country relative to country k at time t+1 and E indicates the expectation operator; i_t and i_t^k reflect the interest rates of the home country and country k, respectively; δ_{t+1} is a risk premium. An increase in s indicates an appreciation of the home currency and depreciation of the foreign (country k) currency.

According to the study by Akram et al. (2008), interest rate differentials are approximately equal to forward discounts at least at the monthly frequency—namely, Equation 9.2.

Equation 9.2

$$i_t^k - i_t \approx f_t^k - s_t^k$$

In Equation 9.2, f_t^k denotes the log forward exchange rate of the home country relative to country k at time t. Under the rational expectation, Equation 9.3 holds.

Equation 9.3

$$E_t(s_{t+1}^k) = s_{t+1}^k + e_{t+1}^k$$

In Equation 9.3, the forecast error, e_{t+1}^k, is white noise. In particular, e_{t+1}^k is unrelated to any information that is available in period t. Substituting Equation 9.3 into Equation 9.1, we have Equation 9.4.

Equation 9.4

$$\Delta s_{t+1}^k = (f_t^k - s_t^k) + \delta_{t+1} - e_{t+1}^k$$

We can then give the transformation form of the standard UIP regression for the bilateral exchange rate with country k, Equation 9.5.

Equation 9.5

$$\Delta s_{t+1}^k = \alpha^k + \beta^k (f_t^k - s_t^k) + \lambda_{t+1}^k$$

According to the UIP condition, the regression coefficient, β, should be equal to 1 and the constant term, α, should be equal to zero. The error term, λ_{t+1}^k, reflects both forecast errors and the risk premium. In other words, the forward exchange rate should be equal to the future spot exchange rate. However, there is little literature to support the UIP condition. In fact, most of the literature points out that the UIP condition is idealised. One potential explanation is that market participants have a demand for risk premiums in foreign currency investments—that is, the assumption of risk neutrality is too rigorous (for example, Ranaldo and Söderlind 2010; Lustig et al. 2011; Jin and Chen 2012; Menkhoff et al. 2012; Farhi and Gabaix 2016; Xiao and Liu 2016; Verdelhan 2018). According to this research, the ex post deviation from the UIP condition may be attributed to covariation of exchange rate returns with contemporaneous currency risk factors (Grisse and Nitschka 2015).

However, many studies employ survey-based expectations of exchange rates to illustrate that the UIP is reasonable ex ante. Recent representative literature includes Bacchetta et al. (2009) and Grisse and Nitschka (2015). Grisse and Nitschka (2015) used survey expectations data on Swiss franc exchange rates and found that the UIP basically holds ex ante. Generally, the findings indicate that the asset-pricing viewpoint for currency returns may not be the best or only explanation for the ex post deviation from the UIP condition.

However, for the assessment of currency investment strategies and the safe-haven characteristics of exchange rates, the asset-pricing models for currency returns still have a strong appeal. This is because a safe-haven currency can help investors to acquire hedging value against global risk (Grisse and Nitschka 2015). Adopting this model to evaluate the safe-haven characteristics of the offshore renminbi relative to some of the major currencies and those of countries along the BRI will be the contribution of this chapter.

Theoretical background to exchange rate return pricing models

The asset-pricing models of exchange rate returns regard the UIP condition as an investment strategy with zero net value. At time t, this strategy first claims borrowing in the home country with interest rate i and then converting the home currency at the spot exchange rate into $1/S$ foreign currency units (FCUs). Holding FCUs can obtain a certain foreign interest rate, i^k. At time t+1, the investor converts the FCUs into the home currency at the spot exchange rate, S_{t+1} (Burnside et al. 2011; Grisse and Nitschka 2015). This investment strategy yields the following payoff, χ_{t+1}(Equation 9.6).

Equation 9.6

$$\chi_{t+1} = \frac{1}{S_t}(1+i_t^k)S_{t+1} - (1+i_t)$$

We then directly employ the following asset-pricing equation for excess returns based on the above interpretation of the UIP condition (Cochrane 2005), such that we get Equation 9.7, which should hold and in which w_{t+1} indicates the stochastic discount factor.

Equation 9.7

$$E_t\left[\left(\frac{1}{S_t}(1+i_t^k)S_{t+1} - (1+i_t)\right)w_{t+1}\right] = 0$$

We can generate the 'risk-adjusted' form of the UIP condition by dividing $E_t(w_{t+1})$ and rearranging—namely, Equation 9.8.

Equation 9.8

$$(1+i_t) = (1+i_t^k)\left[E_t\left(\frac{S_{t+1}}{S_t}\right) + \frac{\text{cov}[(S_{t+1}/S_t), w_{t+1}]}{E_t(w_{t+1})}\right]$$

Meanwhile, the covered interest rate parity (CIP) condition is listed as Equation 9.9.

Equation 9.9

$$(1+i_t) = \frac{1}{S_t}(1+i_t^k)F_t$$

In Equation 9.9, F_t denotes the forward exchange rate of the home currency relative to the foreign currency at time *t*.

Combining Equations 9.8 and 9.9, we further obtain the alternative form of the 'risk-adjusted' UIP condition that constitutes the basis of most empirical studies of the link between risk factors and exchange rate returns—namely, Equation 9.10.

Equation 9.10

$$E_t\left(\frac{S_{t+1} - S_t}{S_t}\right) = \frac{F_t - S_t}{S_t} - \frac{\text{cov}[((S_{t+1} - S_t)/S_t), w_{t+1}]}{E_t(w_{t+1})}$$

According to Equation 9.10, expected exchange rate returns are influenced not only by the previous period's forward discount/interest rate differential but also by the stochastic discount factor. This rationale forms the backbone of asset-pricing models for exchange rate returns in recent studies. And we describe that in the next subsection, which guarantees follow-up empirical analysis work can be carried out smoothly.

Recent empirical advances in exchange rate return pricing models

The UIP regressions should be expanded by including currency risk factors in accordance with the asset-pricing viewpoint on exchange rate determination (Verdelhan 2018). The specific form is Equation 9.11.

Equation 9.11

$$\Delta s_{t+1}^k = \alpha^k + \beta_0^k(f_t^k - s_t^k) + \beta_1^k\theta_{t+1}^1 + \beta_2^k\theta_{t+1}^2 + \cdots + \beta_n^k\theta_{t+1}^n + \lambda_{t+1}^k$$

In Equation 9.11, *n* represents the number of risk factors in an augmented currency risk premium model, *k* denotes the currency and θ indicates a specific currency risk factor.

Note that Equation 9.11 additionally assumes that the investor's discount factor is a linear function of the risk factors, θ. The introduction of risk factors expands the UIP so as to be able to evaluate the impact of the risk factors on contemporaneous exchange rate returns. Therefore, it is crucial to explore favourable risk factors in empirical research.

Since traditional risk factors, such as those proposed by Fama and French (1993), fail to effectively depict exchange rate returns, we try to obtain information about currency risk factors directly from exchange rate data by following recent studies. By sorting currencies' forward discounts or interest rate differentials, Lustig et al. (2011) constructed two first-principle components in portfolios of foreign currency returns based on US investors' perspective, and they correspond to a country-specific and global risk factor of excess currency returns. The empirical results show that differences in the risk exposure to the global factor decide the average risk premium on the currency portfolios. Lustig et al. (2011) further pointed out that their empirical model embodied an extension of the two-country framework proposed by Backus et al. (2001) to a multi-country and even global context. In this model, the country-specific factors play no part in the determination of currency risk premiums.

Moreover, under the conditions of exchange rate changes and excess currency returns, Lustig et al. (2011) and Verdelhan (2018) show that the other risk factors that derive from portfolios of excess currency returns are also informative of both time-series and cross-sectional variations in terms of bilateral exchange rate changes as well as bilateral excess returns. Thus, we utilise this model as our benchmark to explore the specific characteristics of the offshore renminbi exchange rate returns in the following sections.

Data

In this chapter, we consider the offshore renminbi exchange rates relative to selected major currencies, as well as the currencies of countries along the BRI. Specifically, the major currencies selected are: the Australian dollar, the Canadian dollar, the Swiss franc, the euro, the British pound, the Japanese yen, the Norwegian krone, the New Zealand dollar, the Swedish krona, the Singaporean dollar, the US dollar and the South African rand. Most of these currencies are not only the main currencies in the foreign exchange market, but also maintain a high degree of correlation with the commodity market. Simultaneously, the selection of countries along the BRI is based mainly on the announcement of the 'Belt and Road Portal' at the end of August 2020. The sources of the spot exchange rate data and the one-month forward exchange rates are available from DataStream. Meanwhile, these are subject to daily data under the US dollar quotation. Considering the availability of data, 26 countries along the BRI were selected, as shown in the last two columns of Table 9.1. In the subsequent empirical analysis, this chapter will examine the safe-haven characteristics of the offshore renminbi relative to the major currencies and those of countries along the BRI to comparatively analyse whether the offshore renminbi possesses safe-haven properties.

Our sample period spans from 11 July 2011 to 31 August 2020—chosen because the forward exchange rate data for the offshore renminbi can only be traced back this far. It should also be noted that the data adopted in this chapter are all bilateral exchange rates on the offshore renminbi relative to other currencies, and we gain these rates from the cross-rates of US dollar exchange rates. For example, the bilateral exchange rate of the United Arab Emirates (UAE) dirham/offshore renminbi is obtained by cross calculation between the offshore renminbi/US dollar and UAE dirham/US dollar.

Last, this chapter employs changes in the VIX based on daily data as a proxy for global currency risk. The VIX denotes the Chicago Board Options Exchange (CBOE) option-implied volatility index of the S&P 500. The VIX is mainly used to indicate the turbulence of global financial markets and the risk aversion of investors. If the VIX rises, global financial market volatility and investor risk aversion will be exacerbated. The data for the VIX are acquired from the CBOE's website (www.cboe.com/). All the data mentioned above have been processed by logarithm.

Table 9.1 Currency names and their corresponding symbols

Currency name	Currency symbol
Australian dollar	AUD
Bahraini dinar	BHD
British pound	GBP
Bulgarian lev	BGN
Canadian dollar	CAD
Croatian kuna	HRK
Czech koruna	CZK
Egyptian pound	EGP
euro	EUR
Hungarian forint	HUF
Indonesian rupiah	IDR
Japanese yen	JPY
Kazakhstan tenge	KZT
Korean won	KRW

Currency name	Currency symbol
Kuwaiti dinar	KWD
Malaysian ringgit	MYR
Moroccan dirham	MAD
New Turkish lira	TRY
New Zealand dollar	NZD
Norwegian krone	NOK
Offshore renminbi	CNH
Omani rial	OMR
Pakistani rupee	PKR
Philippine peso	PHP
Polish zloty	PLN
Qatari rial	QAR
Romanian leu	RON
Russian rouble	RUB
Saudi riyal	SAR
Serbian dinar	RSD
Singaporean dollar	SGD
South African rand	ZAR
Sri Lankan rupee	LKR
Swedish krona	SEK
Swiss franc	CHF
Thai baht	THB
UAE dirham	AED
US dollar	USD
Vietnamese dong	VND

Empirical results and analysis

This chapter discusses the safe-haven properties of the offshore renminbi relative to some major currencies and those of countries along the BRI. First, it quantitatively analyses the safe-haven characteristics of the offshore renminbi in view of the UIP and augmented UIP regressions. Second, it adopts the rolling window regressions to obtain a comprehensive analysis of the offshore renminbi's safe-haven features and its time-varying state.

The analysis of UIP regressions

This subsection mainly elaborates whether the UIP is reasonable for explaining the bilateral exchange rate changes of the offshore renminbi relative to major currencies and those of countries along the BRI. The regression model is described by Equation 9.12.

Equation 9.12

$$\Delta s_{t+1}^{k} = \alpha^{k} + \beta_{0}^{k}(f_{t}^{k} - s_{t}^{k}) + \lambda_{t+1}^{k}$$

In Equation 9.12, k indicates one of the bilateral offshore renminbi exchange rates, and s and f are the changes in the log spot exchange rate and the one-month log forward exchange rate, respectively. If β_0 equals 1, it indicates that the UIP is applicable in explaining exchange rate changes. Otherwise, it is necessary to consider adding more risk factors to expand the regressions.

The results for the offshore renminbi relative to the major currencies and those of countries along the BRI under the UIP are summarised in Tables 9.2 and 9.3, respectively. We further report the Durbin–Watson (DW) statistic for checking the autocorrelation of the regression residuals. Combining the results in Tables 9.2 and 9.3, we find that: the UIP cannot well explain the exchange rate changes of the offshore renminbi. Depending on the estimation results of the coefficient β_0^k, we can test whether it rejects or accepts the null hypothesis that $\beta_0^k = 1$. Taking the offshore renminbi vis-à-vis the Australian dollar denoted by the AUD in Table 9.2 as an example, its estimation of β_0 is 0.061 with a standard error of 0.077. Then the corresponding t-statistic is (0.061-1)/0.077= –12.19, and its absolute value is obviously larger than the threshold of t-statistic at 95 per cent confidence level. Hence, the UIP is not applicable in the explanation of the exchange rate changes of the offshore renminbi relative to the Australian dollar. This conclusion generally reflects in the bilateral exchange rates of the offshore renminbi relative to major currencies and the currencies of countries along the BRI. It means that the lagged forward discounts factors do not play a certain role in explaining the exchange rate changes of these currencies.

Obviously, it is necessary to expand the UIP by considering currency risk factors to better discuss the issue of the bilateral exchange rate changes of the offshore renminbi relative to other currencies. Therefore, this chapter will conduct a new analysis of the issue based on an augmented UIP with currency risk factors.

Table 9.2 UIP regressions for the offshore renminbi against major currencies

	α^k	β_0^k	R^2	DW
AUD	–0.015	0.061	0.0002	1.939
	(0.015)	(0.077)		
CAD	–0.011	0.004	0.0000	1.918
	(0.017)	(0.073)		
CHF	0.013	–0.032	0.0000	1.931
	(0.036)	(0.100)		
EUR	–0.006	0.014	0.0000	1.927
	(0.025)	(0.075)		
GBP	0.024	–0.136	0.0009	1.868
	(0.025)	(0.094)		
JPY	–0.028	0.076	0.0002	1.911
	(0.031)	(0.098)		
NOK	–0.027	0.075	0.0001	1.918
	(0.023)	(0.102)		
NZD	–0.009	0.079	0.0002	1.945
	(0.016)	(0.101)		
SEK	–0.013	0.022	0.0000	1.939
	(0.022)	(0.071)		
SGD	–0.004	0.014	0.0000	1.934
	(0.013)	(0.056)		
USD	0.006	–0.013	0.0001	1.929
	(0.009)	(0.040)		
ZAR	0.010	0.162	0.0004	1.900
	(0.059)	(0.184)		

Note: Standard errors are in parentheses.

Source: Authors' calculations.

Table 9.3 UIP regressions for the offshore renminbi against the currencies of countries along the BRI

	α^k	β_0^k	R^2	DW
AED	0.006	–0.014	0.0001	1.929
	(0.009)	(0.040)		
BGN	–0.008	0.021	0.0000	1.928
	(0.024)	(0.078)		
BHD	0.001	0.017	0.0002	1.943
	(0.008)	(0.035)		

	α^k	β_0^k	R^2	DW
CZK	–0.020	0.057	0.0002	1.928
	(0.025)	(0.077)		
EGP	0.111***	0.080***	0.0223	1.990
	(0.036)	(0.011)		
HRK	–0.015	0.061	0.0003	1.928
	(0.019)	(0.066)		
HUF	–0.020	0.049	0.0002	1.923
	(0.020)	(0.069)		
IDR	–0.042**	–0.098	0.0011	1.919
	(0.020)	(0.068)		
KRW	–0.000	–0.018	0.0000	1.951
	(0.014)	(0.065)		
KWD	0.003	–0.028	0.0002	1.944
	(0.008)	(0.039)		
KZT	–0.004	0.045***	0.0034	1.945
	(0.023)	(0.015)		
LKR	–0.012	0.020	0.0002	1.926
	(0.015)	(0.035)		
MAD	0.002	0.023	0.0001	1.930
	(0.012)	(0.047)		
MYR	–0.013	0.081	0.0007	1.935
	(0.010)	(0.068)		
OMR	0.006	–0.015	0.0001	1.930
	(0.008)	(0.038)		
PHP	0.004	–0.092**	0.0019	1.926
	(0.008)	(0.044)		
PKR	–0.033**	–0.028	0.0007	1.931
	(0.015)	(0.034)		
PLN	–0.011	0.080	0.0004	1.920
	(0.018)	(0.083)		
QAR	0.006	–0.014	0.0001	1.930
	(0.009)	(0.044)		
RON	–0.007	0.005	0.0000	1.928
	(0.014)	(0.053)		
RSD	0.005	0.069	0.0011	1.917
	(0.016)	(0.042)		
RUB	–0.086*	–0.101	0.0006	1.939
	(0.048)	(0.092)		

	α^k	β_0^k	R^2	DW
SAR	0.006	–0.016	0.0002	1.931
	(0.009)	(0.042)		
THB	–0.000	0.065	0.0011	1.893
	(0.008)	(0.042)		
TRY	–0.072*	–0.007	0.0004	1.826
	(0.040)	(0.045)		
VND	0.001	0.020	0.0003	1.941
	(0.006)	(0.021)		

*** significant at the 1 per cent level

** significant at the 5 per cent level

* significant at the 10 per cent level

Note: Standard errors are in parentheses.

Source: Authors' calculations.

The analysis of augmented UIP regressions

In this subsection, we observe whether potential currency risk factors can help us better understand the exchange rate dynamics of the offshore renminbi. In the subsequent analysis, we apply the asset-pricing models as used in studies by Lustig et al. (2011), Grisse and Nitschka (2015) and Verdelhan (2018) to the offshore renminbi exchange rate context.

The currency-pricing model used in this chapter contains two risk factors. The first is currency-specific and is expressed by the average exchange rate change of the offshore renminbi. In other words, the average bilateral exchange rate changes of different currencies relative to the offshore renminbi are not completely consistent. According to Lustig et al. (2011), this factor interprets most of the time variation in excess currency returns. When we calculate the currency-specific factor, we must exclude the exchange rate itself, as recommended by Verdelhan (2018). For example, we use the arithmetical average of the exchange rate changes of 11 major currencies as the first risk factor when computing the average exchange rate changes of the offshore renminbi relative to the Australian dollar in the augmented UIP regressions.

The second risk factor is the VIX, which is an effective measure of global risk on currency markets. Lustig et al. (2011) have shown that the empirical proxy of the global risk factors added to UIP regressions should be positively related to the volatility of global stock markets. Unlike Lustig et al. (2011), who adopted differences in the returns on high and low forward discount sorted currency baskets as the proxy for global risk factors, this chapter refers to the VIX proposed by Grisse and Nitschka (2015). The latter argue that VIX returns can be viewed as a significant measure of global equity market volatility and hence serve as an approximate proxy variable to estimate global risk factors in the model of Lustig et al. (2011). It should be pointed out that, although the VIX is derived from the US stock market, it maintains a highly positive correlation with the volatility indices of other equity markets. Thus, the employment of the VIX as a proxy of global risk factors is conducive to avoiding potential double counting in the augmented UIP regressions. Moreover, it will generate econometric issues by directly incorporating the global factor of Lustig et al. (2011) into a regression together with the forward discount rate of the bilateral exchange rate. The reason is that a particular currency pair or cross-rate is already contained in Lustig et al.'s (2011) global risk factor, which is derived from currency portfolios sorted on forward discounts/interest rate differentials. We thus tend to adopt a global risk factor proxy that is obtained neither from forward discounts/interest rate differentials nor from exchange rate data.

As Lustig et al. (2011) report, differences in the sensitivities of the returns to the global risk factor account to a large extent for the cross-sectional differences in foreign currency returns. Thus, exposures to global risk factors should reflect the safe-haven characteristics of a currency—namely, a safe-haven currency should have negative exposure to global risk factors. This means the safe-haven currency should gain in value when global risk materialises and thus provide a hedge for all investors (Grisse and Nitschka 2015).

The augmented UIP regressions then adopt the specification form of Equation 9.13.

Equation 9.13

$$\Delta s^k_{t+1} = \alpha^k + \beta^k_0 (f^k_t - s^k_t) + \beta^k_1 AFX_{t+1} + \beta^k_2 \Delta(VIX)_{t+1} + \lambda^k_{t+1}$$

In Equation 9.13, *AFX* refers to the average bilateral exchange rate changes of the offshore renminbi relative to all currencies excluding the currency of country *k*.

The results for the offshore renminbi relative to the major currencies and those of countries along the BRI under the augmented UIP regressions are summarised in Tables 9.4 and 9.5, respectively. A few observations are worth noting. First of all, the forward discount rate is still weak in explaining not only the bilateral exchange rate changes of offshore renminbi against major currencies, but also the exchange rate changes of countries along the BRI. Specifically, the situation where the coefficient, β^k_0, on the forward discount is significantly different from zero remains scarce. Second, the average exchange rate change of a specific currency has an extremely significant effect in explaining the bilateral exchange rate change of the offshore renminbi relative to the currency, and it is shown that the situation where the coefficient, β^k_1, on the AFX significantly differs from zero holds in all cases. In the analysis of the offshore renminbi relative to major currencies, the estimates of the coefficient, β^k_1, range from 0.072 for the US dollar to 1.264 for the Norwegian krone. One potential reason the coefficient of the offshore renminbi against the US dollar is smallest may be the fact that Chinese international trade is closely linked to the United States and hence the capital transactions behind it are relatively frequent. Although the bilateral trade volume between the European Union and China is higher, the former, as a common political economy, has a much larger membership than just those who use the euro. Third, in the analysis of the offshore renminbi relative to major currencies, the coefficients of β_2^k have distinct results. It should be noted that positive (or negative) coefficient estimates indicate that the offshore renminbi depreciates (or appreciates) against the respective currency when the VIX—that is, global risk—increases. On average, the Swiss franc, the euro, the yen and the US dollar provide a better safe haven against global risk than the offshore renminbi. In the context of increasing global risks, the risk hedging provided by these currencies is significantly better than that of the offshore renminbi. In fact, as the most vital currency in the world, the US dollar plays the role of the benchmark currency in international trade, financial markets and commodity markets, and its safe-haven properties are naturally stronger than those of the offshore renminbi. The Swiss franc, the euro and the yen are traditional safe-haven currencies. As for the other currencies, their safe-haven properties are notably weaker than the offshore renminbi's. Fourth, in the analysis of the offshore renminbi relative to the currencies of countries along the BRI, the coefficients of β_2^k also have distinct results and the proportions with positive coefficients are more than those with negative coefficients. Currently, a significant negative coefficient signal indicates the offshore renminbi appreciates against the respective currency when global risk increases. This is the case for the bilateral exchange rate changes of the offshore renminbi against the Czech koruna, Hungarian forint, South Korean won, Polish zloty, Russian rouble and New Turkish lira, which make the safe-haven features of the offshore renminbi more prominent. By contrast, the fact that half the coefficients of β_2^k appear to be significantly positive denotes the fact that the safe-haven features of the offshore renminbi are not yet prominent for the currencies of countries along the BRI. However, it is worth emphasising that the Korean won, the Russian rouble and the New Turkish lira are all regionally representative currencies, and the offshore renminbi has stronger hedging properties against global risk than these. To a certain extent, there may be a situation where the offshore renminbi has stronger safe-haven properties relative to the currencies of countries along the BRI than those revealed by the empirical results. In addition, insignificant coefficients of β_2^k demonstrate that the offshore renminbi relative to the Association of Southeast Asian Nations (ASEAN) currencies has not changed significantly under the rise in global risk factors. According to the thesis of Baur and Lucey (2010), this phenomenon to a certain extent reflects the fact that specific assets have safe-haven properties. Therefore, the offshore renminbi also has a safe-haven value relative to these currencies. In summary, the offshore renminbi holds safe-haven characteristics, which mostly exist for a few major currencies, while the safe-haven characteristics of the offshore renminbi relative to the currencies of countries along the BRI appear relatively weaker.

Table 9.4 Augmented UIP regressions for the offshore renminbi against major currencies

	α^k	β_0^k	β_1^k	β_2^k	R^2	DW
	(Constant)	$(f_t^k - s_t^k)$	(AFX_{t+1})	$(\Delta(VIX)_{t+1})$		
AUD	–0.003	0.005	1.109***	–0.604***	0.489	1.939
	(0.010)	(0.054)	(0.024)	(0.109)		
CAD	–0.000	–0.024	0.759***	–0.247***	0.390	1.906
	(0.013)	(0.057)	(0.020)	(0.093)		
CHF	0.028	–0.059	0.910***	1.082***	0.315	1.946
	(0.030)	(0.083)	(0.028)	(0.130)		
EUR	0.010	–0.015	0.998***	0.592***	0.546	1.942
	(0.017)	(0.051)	(0.019)	(0.087)		
GBP	0.039*	–0.172**	0.796***	–0.069	0.296	1.867
	(0.021)	(0.078)	(0.025)	(0.119)		
JPY	–0.026	0.078	0.485***	2.052***	0.161	1.916
	(0.028)	(0.087)	(0.029)	(0.140)		
NOK	–0.006	0.003	1.264***	–0.796***	0.490	1.939
	(0.016)	(0.070)	(0.027)	(0.123)		
NZD	0.006	–0.006	1.188***	–0.336***	0.445	1.962
	(0.012)	(0.072)	(0.027)	(0.126)		
SEK	0.006	–0.016	1.144***	–0.119	0.489	1.955
	(0.016)	(0.049)	(0.024)	(0.111)		
SGD	0.002	0.009	0.605***	–0.118**	0.582	1.942
	(0.008)	(0.035)	(0.011)	(0.051)		
USD	0.006	–0.011	0.072***	0.471***	0.036	1.930
	(0.009)	(0.039)	(0.012)	(0.061)		
ZAR	0.016	0.157	1.262***	–2.675***	0.290	1.903
	(0.050)	(0.158)	(0.045)	(0.203)		

*** significant at the 1 per cent level

** significant at the 5 per cent level

* significant at the 10 per cent level

Note: Standard errors are in parentheses.

Source: Authors' calculations.

Table 9.5 Augmented UIP regressions for the offshore renminbi against the currencies of countries along the BRI

	α^k	β_0^k	β_1^k	β_2^k	R^2	DW
	(Constant)	$(f_t^k - s_t^k)$	(AFX_{t+1})	$(\Delta(VIX)_{t+1})$		
AED	0.009	0.003	0.484***	0.484***	0.304	1.935
	(0.008)	(0.033)	(0.016)	(0.052)		
BGN	0.014	–0.001	1.447***	0.326***	0.545	1.930
	(0.016)	(0.053)	(0.027)	(0.087)		
BHD	0.003	0.038	0.484***	0.519***	0.297	1.950
	(0.007)	(0.029)	(0.016)	(0.053)		
CZK	–0.005	0.068	1.615***	–0.207*	0.444	1.942
	(0.018)	(0.056)	(0.037)	(0.119)		
EGP	0.116***	0.081***	0.477***	0.212	0.038	1.994
	(0.036)	(0.011)	(0.078)	(0.254)		
HRK	0.010	0.017	1.438***	0.237**	0.506	1.928
	(0.013)	(0.047)	(0.029)	(0.094)		
HUF	0.002	0.028	1.768***	–0.887***	0.385	1.929
	(0.015)	(0.053)	(0.046)	(0.147)		
IDR	–0.033*	–0.088	0.597***	0.073	0.136	1.925
	(0.018)	(0.061)	(0.031)	(0.102)		
KRW	0.008	–0.026	0.606***	–0.218*	0.105	1.965
	(0.013)	(0.059)	(0.037)	(0.123)		
KWD	0.007	–0.008	0.619***	0.458***	0.456	1.958
	(0.006)	(0.028)	(0.014)	(0.047)		
KZT	0.001	0.044***	0.592***	0.303	0.037	1.950
	(0.022)	(0.015)	(0.065)	(0.218)		
LKR	–0.005	0.026	0.489***	0.495***	0.155	1.924
	(0.014)	(0.033)	(0.024)	(0.081)		
MAD	0.016**	0.023	1.213***	0.263***	0.630	1.932
	(0.007)	(0.029)	(0.019)	(0.062)		
MYR	–0.005	0.072	0.665***	–0.024	0.180	1.951
	(0.009)	(0.059)	(0.029)	(0.097)		
OMR	0.009	–0.001	0.483***	0.491***	0.302	1.937
	(0.007)	(0.032)	(0.016)	(0.052)		
PHP	0.010	–0.078**	0.598***	0.102	0.237	1.933
	(0.007)	(0.037)	(0.022)	(0.074)		
PKR	–0.026*	–0.021	0.514***	0.444***	0.118	1.929
	(0.014)	(0.033)	(0.030)	(0.098)		

	α^k	β_0^k	β_1^k	β_2^k	R^2	DW
	(Constant)	$(f_t^k - s_t^k)$	(AFX_{t+1})	$(\Delta(VIX)_{t+1})$		
PLN	0.011	0.054	1.750***	–0.833***	0.426	1.935
	(0.013)	(0.062)	(0.042)	(0.134)		
QAR	0.010	–0.004	0.483***	0.481***	0.298	1.936
	(0.008)	(0.037)	(0.016)	(0.053)		
RON	0.010	0.007	1.527***	0.064	0.505	1.934
	(0.010)	(0.038)	(0.031)	(0.099)		
RSD	0.014	0.032	1.450***	0.334***	0.456	1.927
	(0.011)	(0.031)	(0.033)	(0.104)		
RUB	–0.072	–0.092	0.847***	–3.152***	0.099	1.948
	(0.044)	(0.084)	(0.079)	(0.259)		
SAR	0.008	0.009	0.484***	0.484***	0.303	1.938
	(0.008)	(0.034)	(0.016)	(0.052)		
THB	0.008	0.048	0.655***	0.000	0.330	1.886
	(0.007)	(0.034)	(0.019)	(0.063)		
TRY	–0.053	0.008	0.996***	–1.456***	0.111	1.823
	(0.037)	(0.042)	(0.063)	(0.205)		
VND	0.005	0.009	0.481***	0.460***	0.270	1.947
	(0.005)	(0.018)	(0.017)	(0.056)		

*** significant at the 1 per cent level

** significant at the 5 per cent level

* significant at the 10 per cent level

Note: Standard errors are in parentheses.

Source: Authors' calculations.

The time-varying relationship between exchange rate changes and global risk factors

Considering that there may have been structural breaks in the course of our sample period, the corresponding research conclusions may have changed substantially. Meanwhile, within this period, several reforms of the renminbi exchange rate system have also been carried out, which may have had a profound impact on the relationship between the exchange rate changes of the offshore renminbi and global risk factors. Therefore, this subsection enriches this chapter's research conclusions by further exploring the time-varying relationships between the bilateral exchange rate changes of the offshore renminbi against the major currencies and those of countries along the BRI and global risk factors.

Figures 9.1 and 9.2 show the dynamic evolution paths of the relationships between the bilateral exchange rate changes of the offshore renminbi against major currencies and those of countries along the BRI, respectively, and global risk factors. According to Figure 9.1, several observations are remarkable. First, during the sample period, the time variation between the bilateral exchange rate change of the offshore renminbi against the Swiss franc and global risk factors was consistent with that of the Japanese yen. Specifically, with an increase in global risks, the Swiss franc and the Japanese yen maintained an appreciative trend relative to the offshore renminbi, and the safe-haven characteristics of the two currencies tended to strengthen, while the Japanese yen possessed better safe-haven characteristics than the offshore renminbi. This may be due to the geographical proximity of and close international trade between China and Japan. Therefore, compared with traditional safe-haven currencies, the safe-haven characteristics of the offshore renminbi do not exist. Second, compared with the Swiss franc and the Japanese yen, the time variation fluctuations in the bilateral exchange rate changes of the offshore renminbi against the euro and the US dollar and global risk factors were relatively weak. The reason the euro fluctuated sharply in the first half of 2016 may be attributed to the vote for Brexit, during which risk-averse sentiments surged and assets priced in the euro were able to attract some of the pound's safe-haven inflows, causing the time-varying relationship to reach a peak state—that is, the hedging value of the euro relative to the offshore renminbi increased. As for the US dollar, it maintained a moderate appreciation status relative to the offshore renminbi. On the whole, the US dollar's safe-haven feature is not salient. Especially in the second half of 2017, the offshore renminbi was better able to withstand global risk fluctuations than the US dollar. This may be because the US dollar was affected by the dual impacts of the international and domestic situations in 2017 and was unable to extricate itself from a sluggish market. Counterposed to this, the value of the renminbi continued to be firm, thereby satisfying investors' hedging demands to a certain extent. However, it is noticeable that the safe-haven characteristics of the US dollar relative to the offshore renminbi have become more obvious since the China–US trade friction began and continue to present a growing trend. This to some extent reflects the fact that the offshore renminbi is not yet fully equipped with safe-haven characteristics. Third, the time variation between the exchange rate changes and global risk factors tended to be consistent in terms of the offshore renminbi against the Australian, Canadian and New Zealand dollars. Among them, the main variation was in the first half of 2016, when the offshore renminbi had stronger safe-haven properties than these three currencies. A potential reason for this is that these are all commodity currencies and their values are profoundly affected by international commodity prices. From 2015 until the first half of 2016, commodity prices were in a sluggish state of decline, hence the corresponding commodity-currency values remained relatively weak. However, for the renminbi, its currency value was relatively stable and the steady demand for commodities in the Chinese market meant the hedging value of the offshore renminbi was greatly increased. Fourth, the offshore renminbi has more prominent safe-haven characteristics than the Norwegian krone, the Singaporean dollar and the South African rand—a fact that is especially obvious relative to the South African rand. Specifically, the time variation between the exchange rate changes of the offshore renminbi against these three currencies and global risk factors is generally negative, and the time variation for the South African rand tended to decline overall, especially between 2015 and the first half of 2016, such that this negative time-variation relationship continued to strengthen.

According to Figure 9.2, we obtain several conclusions. First, the time variation between the bilateral exchange rate change of the offshore renminbi against the Hungarian forint and global risk factors is basically consistent with that of the Polish zloty. Although the time variation appears positive in some periods, its overall trend presented as dominantly negative. That is, the safe-haven properties of the offshore renminbi relative to these two currencies are persistent. However, it is worth noting that the safe-haven attributes after 2015 gradually weakened compared with their strength before 2015. It appears as a time-varying relationship that begins to wander up and down near zero. This may be due to the fact that global political and economic uncertainties have intensified, prompting investors to gradually focus on traditional safe-haven assets, and leading to the weakening of the offshore renminbi's safe-haven attributes. Second, the time variation between the bilateral exchange rate changes of the offshore renminbi against the Czech koruna and global risk factors is basically inverse to that of the Russian rouble. The safe-haven characteristics of the offshore renminbi relative to the Russian rouble persist, because the time variation between the bilateral exchange rate change of the offshore renminbi against the rouble and the global risk factors is below zero. In extreme cases, holding the offshore renminbi to hedge against exchange rate fluctuations in the rouble can yield higher returns. At the end of 2014, the rouble depreciated drastically due to the dual impacts of the plunge in oil prices and the crisis in Ukraine. At this time, the safe-haven value of the offshore renminbi was highlighted considerably. Under this circumstance, a 1 per cent increase in global risk factors, as measured by the VIX, will induce a 12 per cent appreciation of the offshore renminbi against the rouble—more than four times larger than the average effect. Obviously, to a certain extent, this reflects the fragility of Russia's economic and financial regime and the instability of the rouble. In bilateral trade with Russia or other international economic and financial activities, we must increase the awareness of risk aversion and make timely preparations to convert the rouble into the offshore renminbi or other safe-haven currencies. Currently, the safe-haven characteristics of the offshore renminbi relative to the Czech koruna are confused. In extreme cases, the time variation between the bilateral exchange rate change of the offshore renminbi against the Czech koruna and global risk factors has turned into a positive relationship. Third, the safe-haven characteristics of the offshore renminbi relative to the New Turkish lira persist and have become even more outstanding in extreme situations. From 2018 to 2019, affected by the political situation and uncertainty about monetary and fiscal policies, the New Turkish lira depreciated sharply and the safe-haven nature of the offshore renminbi was significantly enhanced. A 1 per cent increase in the VIX generated a 5 per cent appreciation in the offshore renminbi relative to the New Turkish lira. As for the hedging characteristic of the offshore renminbi relative to the Korean won, it is being strengthened. After 2016, the time variation between the bilateral exchange rate change of the offshore renminbi against the won and global risk factors has remained below zero. This may be because China and South Korea continuously carry out currency-swap mechanisms and actively promote economic and trade exchanges and financial market transactions, which have promoted the closer relationship between the renminbi and the won.

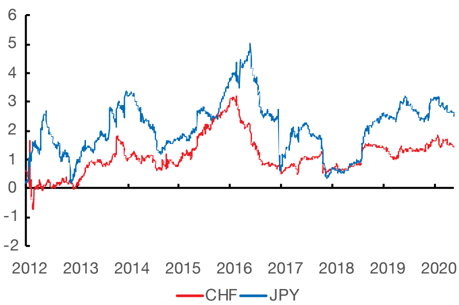

Figure 9.1a CHF and JPY

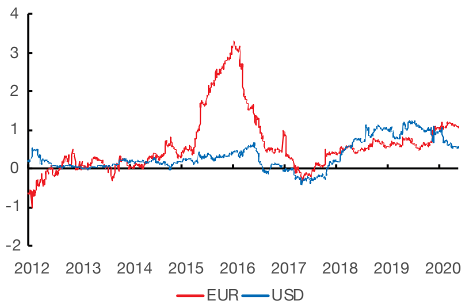

Figure 9.1b EUR and USD

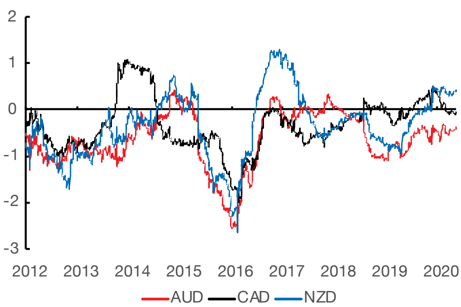

Figure 9.1c AUD, CAD and NZD

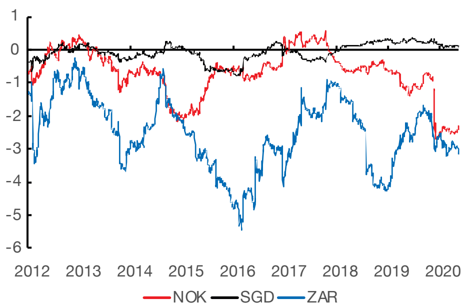

Figure 9.1d NOK, SGD and ZAR

Figure 9.1 The dynamic path of the relationship between the bilateral exchange rate changes of the offshore renminbi relative to major currencies and global risk factors

Source: Authors' calculations.

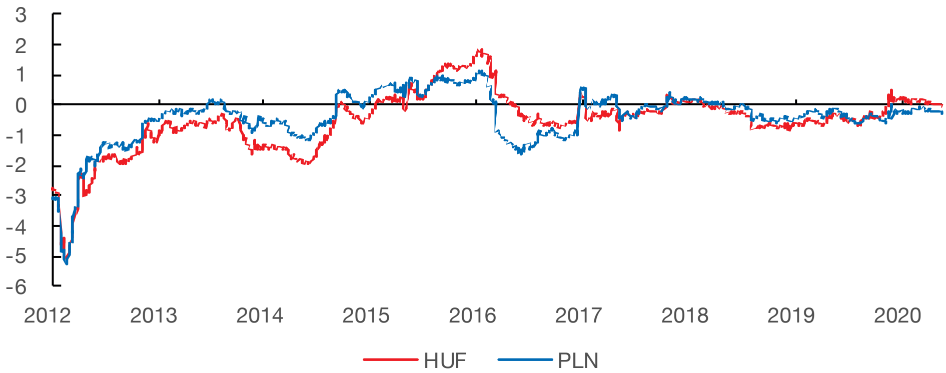

Figure 9.2a HUF and PLN

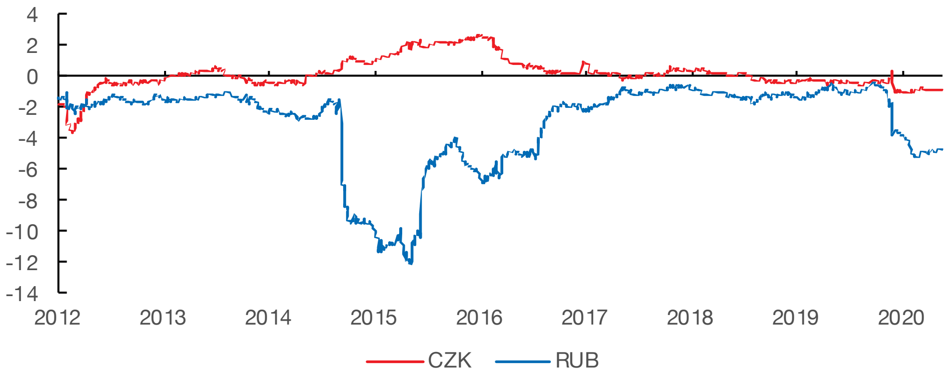

Figure 9.2b CZK and RUB

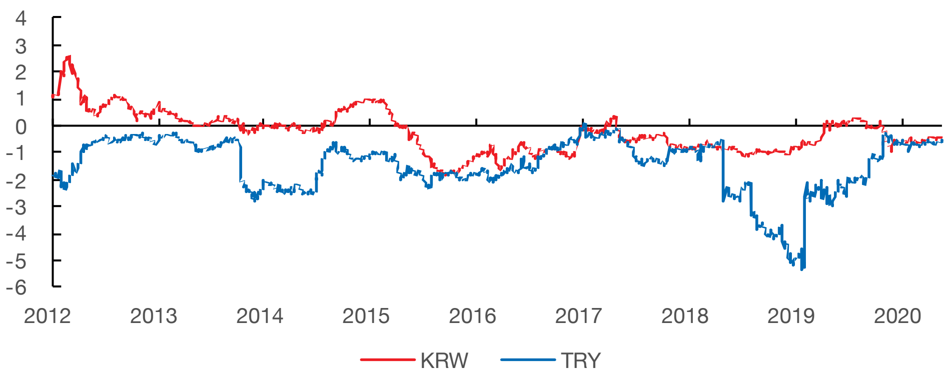

Figure 9.2c KRW and TRY

Figure 9.2 The dynamic path of the relationship between the bilateral exchange rate changes of the offshore renminbi relative to the currencies of the BRI countries and global risk factors

Source: Authors' calculations.

Conclusions and policy implications

Based on the classic asset-pricing framework, this chapter analyses the bilateral exchange rate changes of the offshore renminbi relative to some major currencies and those of countries along the BRI, before exploring whether the offshore renminbi possesses the characteristics of a safe-haven currency. Specifically, this chapter first introduces the augmented uncovered interest rate parity regressions including currency risk factors to obtain a basic understanding of the offshore renminbi's safe-haven characteristics. It then focuses on assessing the time variation between the bilateral exchange rate changes of the offshore renminbi relative to different currencies and global risk factors represented by the VIX to further examine the time-varying characteristics of the abovementioned safe-haven attributes.

This chapter draws some interesting conclusions. First, the offshore renminbi has safe-haven characteristics, which exist against some major currencies and some currencies along the BRI. Specifically, among major currencies, the offshore renminbi behaves like a safe-haven asset against partial currencies such as the Australian, Canadian, New Zealand and Singaporean dollars. Among the currencies of the countries along the BRI, the offshore renminbi also behaves like a safe-haven asset against partial currencies, including the Czech koruna, the Hungarian forint, the South Korean won, the Polish zloty, the Russian rouble and the New Turkish lira. Second, compared with major currencies, the safe-haven properties of the offshore renminbi are generally weaker in the currencies of the countries along the BRI. Taking into account the future growth trend of the Chinese economy, the continuous deepening of the renminbi's internationalisation and the advancement of the BRI, global recognition and acceptance of the renminbi will be greatly improved and the current status quo of weaker safe-haven properties for the offshore renminbi will also be ameliorated. Third, the traditional safe-haven currencies represented by the Swiss franc, the euro, the yen and the US dollar provided a better hedge against global risk than the offshore renminbi, and the hedging value of these currencies is significantly stronger than that of the offshore renminbi. In other words, the renminbi currently does not have enough power to compete with traditional safe-haven currencies in global financial markets and the rise of the renminbi has not completely subverted the global monetary system. Fourth, the safe-haven properties of the offshore renminbi possess time-varying characteristics. When extreme events occur, the hedging value of the offshore renminbi becomes more pronounced. For instance, during the financial crisis in Russia and the currency crisis in Turkey, the offshore renminbi's hedging performance against the rouble and the lira was outstanding. Obviously, to some extent this can provide new ideas for the arrangement of foreign exchange hedging strategies under situations of extreme risk.

In the process of advancing the internationalisation of the renminbi and the BRI, the renminbi's becoming a safe-haven currency is not among the primary strategic objectives, and yet it certainly remains a very important and meaningful attribute. On the one hand, it demonstrates the gradual formation of the renminbi's international status, while simultaneously guaranteeing the international community's recognition of China's identity as a responsible major country. On the other hand, it can help renminbi-denominated financial products gain wider market recognition in global foreign exchange asset allocations, especially when global markets are exposed to potential extreme risks.

To strengthen the renminbi's safe-haven characteristics, there are several areas in which China still needs to make significant progress. First, the reform of the renminbi exchange rate system should be steadily advanced to ensure that its flexibility better reflects market rules; second, the Hong Kong offshore renminbi market should be moved forward vigorously and given more scope for early and pilot implementation of financial innovation policies; third, the construction of renminbi internationalisation infrastructure should be promoted, and more useful attempts to support payment and settlement systems, accounting standards and rating systems should be made; fourth, economic and trade relations with countries along the BRI should continue to be strengthened and consideration should be given to placing the 'experimental field' of renminbi internationalisation in these countries.

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