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An empirical examination of factors driving the offshore renminbi market

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ABSTRACT

Following the 2010 establishment of the offshore renminbi market in Hong Kong, renminbi deposits there quickly rose above RMB 1 trillion. In this article, we examine fluctuations between the offshore value of the renminbi in Hong Kong and its onshore value in mainland China. The size of the spot market spread appears to be influenced by stock market sentiment as reflected in the spread between A-shares listed in Shanghai and H-shares listed in Hong Kong. There is also some evidence of a link between the spread and the pace of renminbi deposit growth in Hong Kong.

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> [T]he demand for the RMB in many countries has increased … In response, China began to facilitate the use of the RMB in cross-border trade and direct investment … These steps have not only supported the fast development of RMB internationalization, but also further strengthened RMB capital account convertibility.
>
> (Zhou 2015)

> [R]enminbi trade-settlement will exceed 50% of China's trade by 2020, thrusting the currency into the major leagues.
>
> (Qu and Mackel 2015)

Introduction

Although the renminbi did not become fully convertible even for current account transactions until 1996, recent liberalization moves have been accompanied by a growing role for China's currency in settling international transactions and increased renminbi circulation not only in Hong Kong but also in other Asian economies (cf. Burdekin 2014). Although a growing array of bilateral currency swaps and offshore renminbi centers have expanded renminbi usage as far as Europe, Africa and South America, the most long-established offshore renminbi market remains Hong Kong. In this article, we utilize monthly data to explore fluctuations in the spread between the onshore and offshore renminbi exchange rates and assess the role played by financial

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performance measures, renminbi deposit levels in Hong Kong, and internationalization and trade effects. The size of the spot market spread appears to be influenced by stock market sentiment as reflected in the spread between A-shares listed in Shanghai and H-shares listed in Hong Kong. There is also some evidence of effects on the spread associated with the pace of renminbi deposit growth in Hong Kong. Ordinary least squares (OLS) and causality testing results are supplemented by vector autoregressive (VAR) and impulse response analysis in our empirical examination of the onshore-offshore spread.

Renminbi circulation beyond mainland China

Although the use of the renminbi as a 'vehicle' currency for making transactions in cross-border trade was officially permitted as long ago as 1997, a key boost was provided by a 2010 program that expanded cross-border renminbi trade settlement to 20 provinces and cities (covering over 90% of total Chinese exports) and was open to trade with all countries.[1] The program was further expanded to cover the entirety of China in August 2011 and has been accompanied by an ongoing series of bilateral currency agreements abroad. Fully 28 bilateral currency swap arrangements were in place by 2015 (Zhou 2015), with Liao and McDowell (2015) finding the establishment of such swap arrangements to be correlated with trade interdependence and economic integration with mainland China. The overall proportion of international transactions settled in renminbi has itself been increasing sharply, and 22% of China's imports and exports were settled in renminbi at the end of 2013 compared to just 12% in 2012 (Qu and Mackel 2015).[2]

Speculation that the renminbi could have appeal not only as a vehicle currency but also as a potential challenger to the US dollar's role as international reserve currency (cf. Eichengreen and Kawai 2014) was seemingly validated by the International Monetary Fund (IMF)'s November 2015 decision to add the renminbi to its Special Drawing Rights (SDR) basket. The renminbi's initial basket weight of 11% put it ahead of the pound sterling and Japanese yen and behind only the euro and US dollar. Interestingly, this is very close to the 10% renminbi share in global currency reserves that Wang, Huang, and Fan (2015) find justified by economic fundamentals.[3] According to IMF managing director Christine Lagarde, this move represented 'recognition of the progress that the Chinese authorities have made in the past years in reforming China's monetary and financial systems' (see Bradsher 2015). Although it remains to be seen whether Bénassy-Quéré and Capelle (2014) will be correct in their assessment that renminbi inclusion could boost the SDR's attractiveness as a unit of account and store of value, it certainly represents a historic broadening of the basket. Renminbi usage as a reserve currency had, of course, been expanding well in advance of the SDR announcement. Notwithstanding mainland China's capital controls limiting access to the currency (cf. Liu and Moshirian 2014; Chinn 2015), as many as 35 central banks (along with the Hong Kong and Macau monetary authorities) held at least some renminbi reserves by 2014.[4]

The value of total renminbi turnover had already risen from just $34 billion in 2010 to $120 billion in 2013 (Bank for International Settlements 2013, 5). This made the renminbi the ninth most actively traded world currency during 2013, with an overall

2.2% share in worldwide foreign exchange volumes. It actually moved up further into fifth place in January 2015, displacing the Australian dollar and Canadian dollar (Bourse Consult 2015). Although the US dollar remained dominant with an overall 87% market share, the renminbi did gain ground on the euro as the euro's share of global foreign exchange trading fell from nearly 39% in 2010 to 33% in 2013 (Bank for International Settlements 2013, 4).[5]

Even though the renminbi's share in global spot market turnover remained below 2% in 2014 (Strauss 2014), offshore market currency and bond transactions have soared (see also Fung, Ko, and Yau 2014). Total renminbi-based bond issuance exceeded RMB 100 billion per year since 2011. During 2014, the issuance of renminbi bonds in Hong Kong accelerated by 69% and the total outstanding amount of renminbi bonds reached RMB 381 billion by the end of the year (Government of the Hong Kong Special Administrative Region 2015, 90). Some data on the new issuance of such 'dim sum' bonds in Hong Kong over the September 2011–February 2015 interval are provided in Table 1. Hong Kong is not the only offshore source of renminbi-denominated bonds, however. Such bonds are now issued in such other markets as Singapore, Taiwan and London. The Industrial and Commercial Bank of China sold London's first renminbi bond issue in November 2013 and this came amidst a series of steps designed to make London a major trading center for renminbi. Direct renminbi-sterling trading was established in October 2013 and London-based renminbi clearing followed in December 2013 (Davies 2013). A cooperation agreement between Britain and Singapore in February 2014 represented the first move towards formal linkages between renminbi centers outside China (Grant 2014).

British interest in renminbi business was reflected in the Chancellor of the Exchequer, George Osborne, and the Mayor of London, Boris Johnson, both visiting China in the same week in October 2013 (Brown 2013). A major boost to London renminbi trading followed when China Construction Bank was ushered in as the official clearing bank in London under the new system launched on 29 July 2014. Daily renminbi trading volumes in London averaged $61.5 billion during 2014, up 143% from 2013, while total renminbi deposits stood at RMB 20 billion at year end 2014 after having previously hovered around RMB 14 billion since 2011 (Bourse Consult 2015). London is likely to face growing competition within Europe, however, with the Bank of China being named as the official clearing bank for Frankfurt in June 2014. Meanwhile, Luxembourg, benefiting from being the European headquarters of both the Bank of

Table 1. New renminbi bond issuance in Hong Kong, September 2011–February 2015.

Date	
28 February 2015	4.9
31 December 2013	116.6
30 September 2013	75.4
28 February 2013	12.9
31 December 2012	112.2
30 September 2012	93.8
30 September 2011	85.8

Note: Amounts are in billions of renminbi.
Source: Bloomberg.

China and China Construction Bank, has begun gaining even more listings of dim sum bonds than London (Strauss 2014).

The total number of offshore renminbi centers expanded to 14 by early 2015, with recent additions including Bangkok, Kuala Lumpur, Nairobi, Singapore, Taipei and Zurich. The 6 June 2012 free trade agreement between China and Singapore had included a provision for designating two Chinese banks to undertake renminbi clearing transactions in Singapore (Fung, Ko, and Yau 2014, 14). Renminbi futures trading was subsequently launched in Singapore on 21 October 2014 and overall daily turnover of renminbi foreign exchange transactions reached $31 billion in early 2015 (Romann 2015). Meanwhile, Taiwan first allowed domestic banks to undertake renminbi transactions in February 2013, and six companies had already issued RMB 3.9 billion in bonds by November 2013 (Song 2013). The share of renminbi settlement for the full set of offshore centers outside Hong Kong and Macau rose from 17% in February 2013 to 25% in February 2015 (Romann 2015).

The offshore renminbi market in Hong Kong

Although formal arrangements for an offshore renminbi currency market in Hong Kong were not established until 2010, as early as 1 November 2005 the People's Bank of China reported that 38 banks in Hong Kong – representing almost all banks offering retail services – provided personal renminbi business to their clients. Renminbi circulation was bolstered by the rising number of visitors traveling to Hong Kong from the mainland after individual visas were permitted in 2004. Many Hong Kong shops posted Chinese language signs explicitly welcoming renminbi and the larger RMB 50 and RMB 100 denominations became widely accepted for settling cash transactions throughout Hong Kong. Renminbi-based transactions in Hong Kong subsequently exploded after the offshore market was formally established in July 2010 and renminbi deposits exceeded 10% of total Hong Kong deposits in 2011. There was a five-fold increase in renminbi remittances for cross-border trade settlement with Hong Kong banks over the 2010–2014 period. This was followed by a 63% growth in renminbi trade settlement transactions handled by banks in Hong Kong during 2014 to reach over RMB 1.7 trillion at year end, accompanied by 63% growth in renminbi loans as well as 10% growth in total renminbi deposits that exceeded RMB 1.1 trillion at year end (Government of the Hong Kong Special Administrative Region 2015, 90–91).

An obvious advantage over Hong Kong holdings of dollars and euros is the scope for investing such offshore renminbi holdings back into the mainland (see also HSBC 2011). Such movement was aided by the November 2014 Hong Kong-Shanghai stock market link allowing funds to move much more freely between the two markets – with total turnover under this scheme reaching RMB 29.9 billion on 8 April 2015. Moreover, Hong Kong residents have an incentive to keep their funds in renminbi to benefit from renminbi appreciation against the US dollar to which the Hong Kong dollar is, of course, tied under its currency board arrangement. Low Hong Kong deposit rates only added to the incentive to seek returns from currency appreciation instead (Fung, Ko, and Yau 2014, 13). Despite the rapid growth of new offshore renminbi centers, Hong Kong was still handling approximately 70% of all renminbi transactions outside

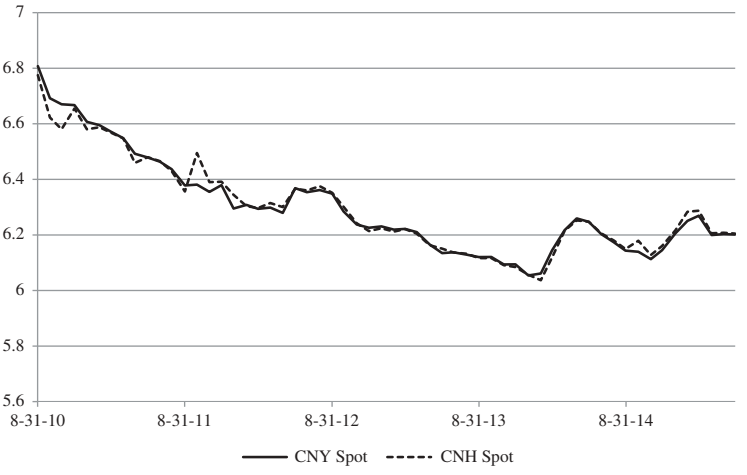

Figure 1. Onshore vs. offshore renminbi spot exchange rate against the US dollar.

mainland China in 2015 – and its real-time gross settlement system was moving approximately RMB 800 billion per day in May of that year (Romann 2015).

As shown in Figure 1, the offshore renminbi rate in Hong Kong essentially mirrored the steady appreciation of the onshore renminbi rate during 2010–2013 followed by a modest depreciation in 2014 and leveling off in early 2015. The forward rates for one-month, three-month, six-month and 12-month contracts on the offshore renminbi generally exhibit similar trends over the post-August 2010 period for which contract data are available (Figure 2). The spreads between the offshore and onshore rates are depicted in Figure 3. All four forward offshore rates traded predominantly at a premium but these premiums show a declining trend during 2011–2012 and discounts emerge for all but the longest duration 12-month contract before the end of 2012. The

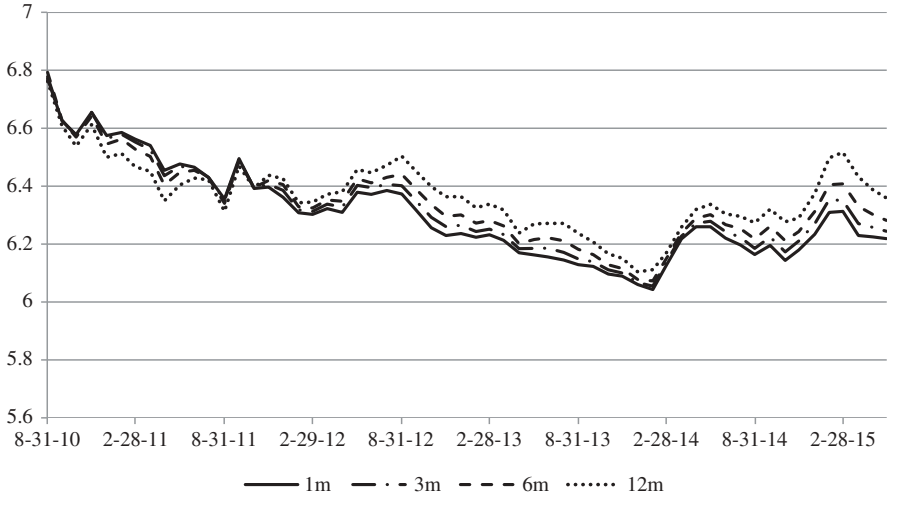

Figure 2. Offshore renminbi forward rates against the US dollar in Hong Kong.

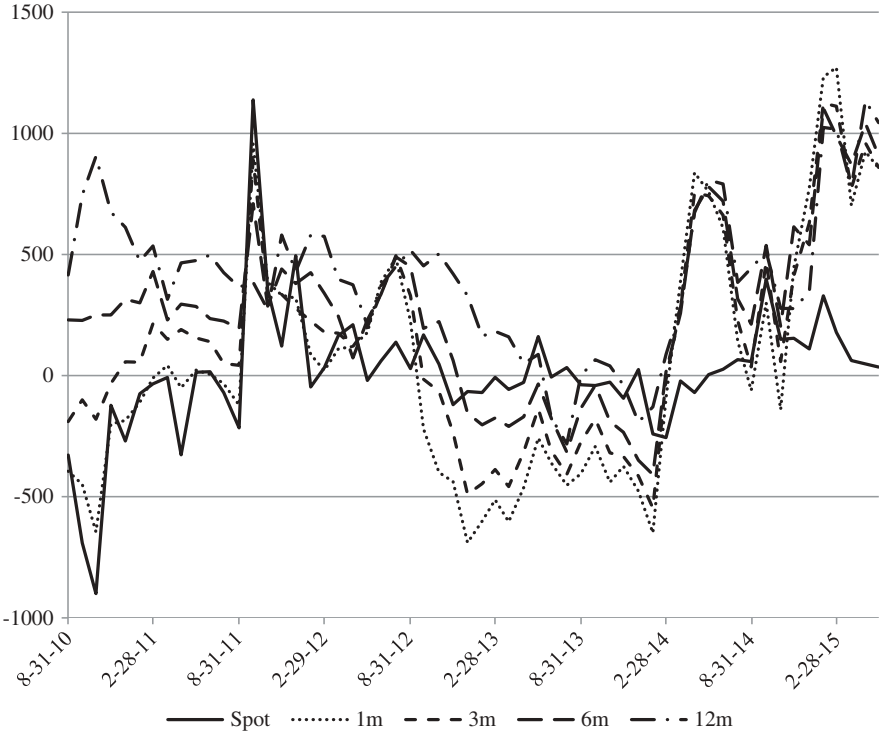

Figure 3. Spreads between the offshore and onshore renminbi exchange rate.
Note: Calculated from (CNH-CNY)*10,000.

emergence of relative discounts in 2012 coincides with a slowdown in renminbi deposits in Hong Kong's banking system relative to the rapid growth seen in the preceding year. Total deposits nearly doubled between 2010 and 2011, rising from RMB 314,938 million to RMB 588,529 million, but then increased only marginally during 2012 to reach RMB 602,996 million at the end figures 1,2, and 3 are provided (Fung, Ko, and Yau 2014, 13).

Interest in the offshore renminbi forward contracts certainly appears to have risen during the latter part of our sample, however, accompanied by a renewed upward surge in renminbi deposits in Hong Kong. These Hong Kong-based deposits reached RMB 0.8 trillion at the end of 2013 and just over RMB 1 trillion at the end of 2014 (Government of the Hong Kong Special Administrative Region 2015, 91). Although all four offshore forward rates remained at a discount to the onshore rate for most of 2013, this was followed by a strong move back to premiums in early 2014. A further surge to all-time high premiums of above 1000 basis points was seen around the end of 2014. This last, and largest, upward move occurred in conjunction with the launch of the Hong Kong-Shanghai stock market link on 17 November 2014. Interestingly, the premiums for offshore vs. onshore spot rates remained much more modest and fell back to only just above zero at the end of our sample in May 2015 – even as the premiums on all four forward rates remained close to 1000 basis points.[6]

Accounting for fluctuations in the offshore-onshore premium

The fluctuations in renminbi offshore spreads and in renminbi deposit growth in Hong Kong, in turn, reflect factors encouraging the transfer of funds between mainland China and Hong Kong. Although the November 2014 stock market link facilitated the movement of funds between the two markets, macroeconomic conditions and liquidity in mainland China would continue to affect the funds available – while relative sentiment levels would influence the flow of funds insofar as it captures the relative attractiveness of the two markets to investors. Using the more limited range of data available at a daily frequency, Craig et al. (2013) test for the divergence between onshore and offshore renminbi exchange rates being affected by shifts in investor sentiment, the level of liquidity in the offshore market, and limitations on arbitrage stemming from ongoing capital controls. While pointing to the importance of liberalization for both inflows and outflows, Craig et al.'s empirical work emphasizes the effects of new renminbi deposit growth in Hong Kong as well as the opening of new arbitrage channels for capital flows between mainland China and Hong Kong. Meanwhile, Funke et al.'s (2015) analysis of factors affecting daily volatility in the offshore spread allows for a richer analysis that suggests capital market liberalization and increased liquidity in the offshore market both act to reduce volatility levels. In this article, we stick with monthly data so as to be able to test for the effects of macroeconomic data not provided on a daily basis. We include the growth of Hong Kong renminbi deposits found to be significant by Craig et al. (2013) while also considering the effects of liquidity conditions in mainland China reflected in monetary and inflation data as well as possible trade-related effects on the spread.

Even though Craig et al. (2013) did not find any significant role for investor sentiment differentials when this was proxied by the spread between the non-deliverable and deliverable forward rate for the renminbi, we consider an alternative measure based on the premium between A-shares traded in Shanghai and H-shares of the same companies traded in Hong Kong. Although those premiums seen in Shanghai are influenced by exchange rate expectations, cross-sectional variation in this premium has also been linked to market-specific and company-specific sentiment effects (cf. Arquette, Brown, and Burdekin 2008). The fluctuations in an index reflecting the average A-share vs. H-share premium are shown in Figure 4. The movements in this premium broadly mirror the declining trend in the forward rate spreads during 2012 and 2013 followed by a strong uptrend in 2014–2015. The premise of its being linked to sentiment is also supported by the apparent commonality between the A-share premium and Shanghai market performance. For example, the Shanghai composite skyrocketed after mid-2014 at the very time that the A-share vs. H-share premium spiked higher (Figure 5).[7]

As with Craig et al. (2013), we also consider the effect on the offshore premium arising from the growth in renminbi deposits in Hong Kong banks (Figure 6). *Ceteris paribus*, greater liquidity arising from more rapid build-up of Hong Kong renminbi deposits would tend to shrink the spread between the offshore and onshore rates. In common with Craig et al. (2013), the interpretation of rising renminbi deposits is complicated by the fact that they could reflect either increased supply or increased demand. Whereas greater supply would naturally tend to depress the offshore premium,

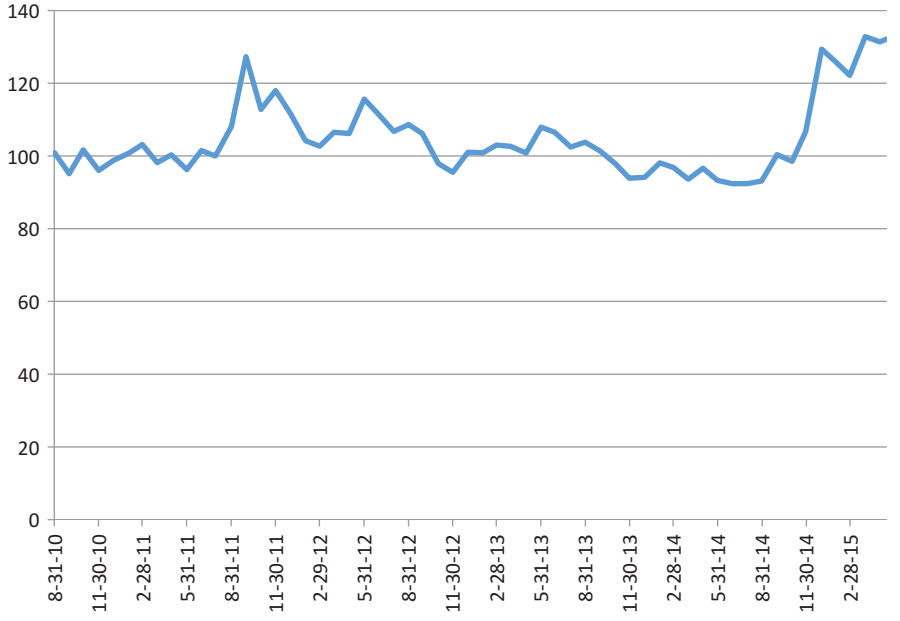

Figure 4. Premium/discount of Shanghai A-shares to Hong Kong H-shares.

insofar as higher renminbi deposits are driven by greater demand for the currency, this would be associated with upward pressure on the offshore rate. Therefore, the overall effect of renminbi deposit growth becomes an empirical issue as the overall effect will be dependent upon whether supply side or demand side effects dominate in practice.

Additional potential influences on the spread that we consider in this article are monetary conditions in mainland China (as reflected in base money growth, inflation and new loan issuance) and mainland China's international position as captured in net monthly foreign direct investment, export levels and the trade balance. Given that any empirical examination of the offshore premium is limited to a sample period beginning in August 2010, we did not consider series unavailable on even a monthly basis.[8] In line with Craig et al.'s (2013) emphasis on the importance of capital controls, we do, however, also allow for a shift in the behavior of the offshore premium following the launch of the Hong Kong-Shanghai stock market link via a dummy variable set equal to one from November 2014 onward. Summary statistics on each series are provided in Table 2, whereas Table 3 provides the correlation coefficients over our sample period. The start date is August 2010, when the offshore market in Hong Kong first opens, and extends to May 2015 where available. The series on M0, monthly new loans and new renminbi deposits were only available through March 2015, however, while the export and trade balance series extend only through April 2015 in our dataset. All these series were drawn from the Bloomberg terminal and included every data point available at the time of writing.

The summary statistics in Table 2 reveal that the average size of the premium progressively increases with the length of the contract, extending from an average of just 9.88 basis points for the spot rate to as much as 406 basis points for the 12-month spread. At the same time, Table 3 shows that, whereas the forward rates are

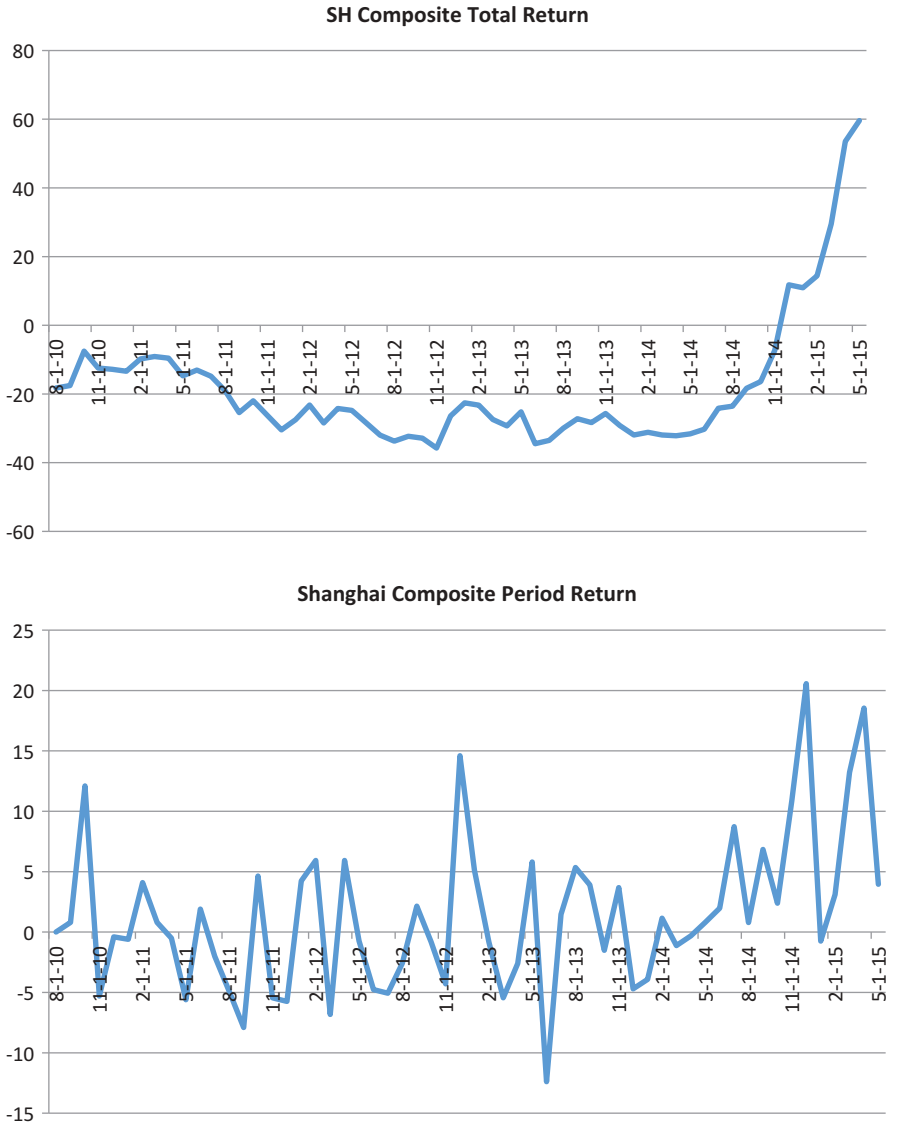

Figure 5. Total return on the Shanghai composite index.

quite highly correlated with each other, there is less correlation between the spot rate and the various forward rates. Indeed, there is even a negative correlation between the spot rate spread and the 12-month spread. All the respective spreads are positively correlated with the A-share vs. H-share premium, however, and the correlation coefficient is 0.45 or higher for all but the 12-month spread (for which it is 0.135). There are further positive correlations with the total return on the Shanghai market for all of the forward rates, ranging between 0.419 and 0.534. There is a negative correlation between the total return series and the spot rate spread, however. Otherwise, there is an initial indication of more rapid renminbi deposit growth in Hong Kong being associated with a smaller spread, with

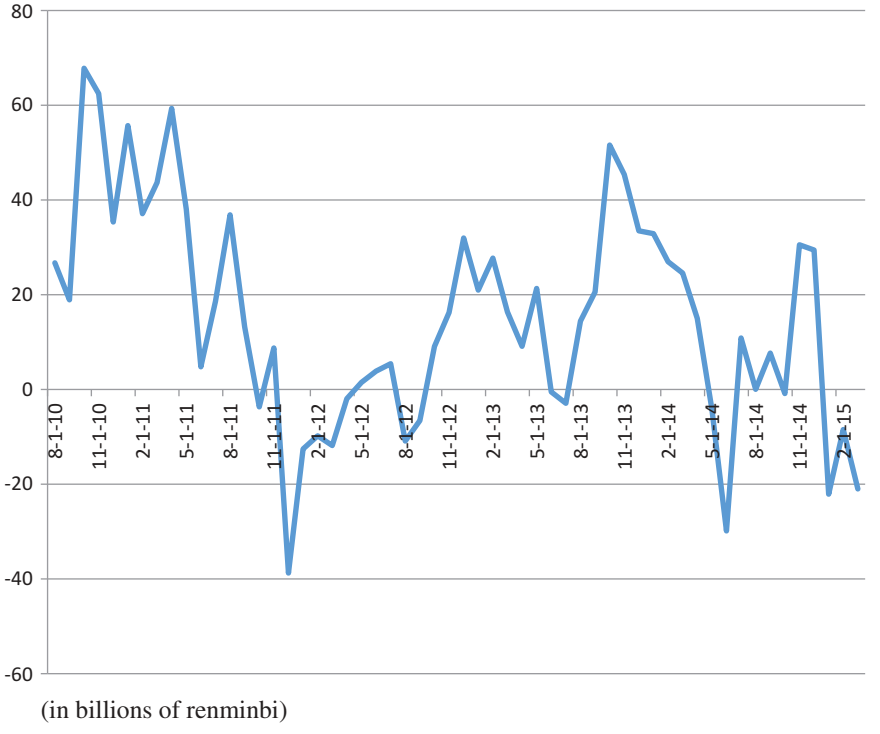

Figure 6. Monthly increase in new renminbi deposits in licensed Hong Kong banks.

Table 2. Summary statistics for renminbi currency spreads and related variables.

Variable Name	No. of obs	Mean	S.D.	Min	Max
CNH-CNY Spot Rate Spread	58	9.88	265.63	−900	1138
CNH-CNY 1-Month Forward Rate Spread	58	48.08	499.04	−690	1272
CNH-CNY 3-Month Forward Rate Spread	58	141.42	420.52	−547	1124
CNH-CNY 6-Month Forward Rate Spread	58	264.65	356.87	−408.5	1104
CNH-CNY 12-Month Forward Rate Spread	58	406.09	312.16	−282.5	1135
A-Share Premium Index	58	1.12	15.81	−19.08	41.92
Shanghai Composite Total Return	58	−18.29	19.29	−35.75	59.60
Monthly New RMB Deposits in HK	56	15.15	23.28	−38.77	67.80
M0 Annual Growth Rate	56	10.32	7.25	−17.60	42.49
Annualized Inflation Rate	56	3.16	1.49	0.80	6.50
Monthly New Loans	56	728.58	229.36	385.20	1470
Net Monthly FDI	56	452.54	878.48	−1230	2550
International Trade Balance (Index)	57	22.60	17.26	−31.99	60.62
Exports (Index)	57	11.73	12.77	−18.10	48.30

Note: CNH-CNY refers to the spread between the offshore renminbi rate in Hong Kong and the onshore rate in mainland China and the values are from (CNH-CNY) x 10,000.
The A-share premium index tracks the price premium (or discount) of A-shares to relative H-shares. The higher the index, the higher the premium of A-shares over H-shares, and vice versa (base = 100).
Monthly New RMB Deposits and Monthly New Loans are in billions of renminbi.
Net Monthly FDI is in billions of US dollars, and all other series represent index numbers or percentages.
All data are drawn from the Bloomberg terminal.

correlation coefficients ranging between −0.206 and −0.501. Otherwise, the correlations with the other variables are weaker and often more mixed but there does appear to be a tendency for more rapid new loan issuance in mainland China to be associated with larger spreads across the board.

Table 3. Correlation coefficients for the currency spreads and related variables, August 2010–May 2015.

	Spot Spread	1M Spread	3M Spread	6M Spread	12M Spread
Spot Spread	1				
1M Spread	0.524	1			
3M Spread	0.446	0.980	1		
6M Spread	0.304	0.902	0.962	1	
12M Spread	−0.038	0.623	0.737	0.861	1
A-Share Premium Index	0.536	0.633	0.567	0.452	0.135
Shanghai Composite Total Return	−0.027	0.419	0.473	0.534	0.498
Monthly New RMB Deposits in HK	−0.501	−0.466	−0.434	−0.377	−0.206
M0 Annual Growth Rate	−0.236	−0.330	−0.297	−0.241	−0.059
Annualized Inflation Rate	−0.068	−0.130	−0.086	−0.057	0.061
Monthly New Loans	0.055	0.315	0.273	0.236	0.135
Net Monthly FDI	0.132	0.099	0.066	0.058	0.055
International Trade Balance (Index)	0.142	0.246	0.218	0.218	0.137
Exports (Index)	−0.152	−0.105	−0.052	0.032	0.243

Although any empirical work over such a limited sample can only be considered exploratory in nature, Table 4 reports the results of OLS regressions relating each of the currency spreads to the first lag of each of the explanatory variables laid out above plus a dummy for the November 2014 introduction of the Hong Kong-Shanghai market link, a lagged dependent variable and a simple time trend. All variables are differenced to assure stationarity. The maximum sample for which all variables were available, after allowance for the lagged terms, was October 2010 through March 2015. It was infeasible to consider higher lag orders given the already constrained degrees of freedom. We do, however, allow for four lags in additional bivariate Granger causality testing. In this case, the sample period begins in January 2011 owing to the additional lags.

The A-share vs. H-share premium is significant at the 95% confidence level and positive for the spot market spread in the OLS results in Table 4 but is not significant for the one-month through 12-month futures. There is weaker evidence of a significant effect on new deposit growth in Hong Kong on the spot market spread but no other variables are significant in this regression. The dummy entered for the dates following the November 2014 stock market link-up was itself always insignificant. Its effects may already be captured by the A-share premium, however, as the link-up was followed by a rapid expansion in the A-share premium that accompanied the skyrocketing offshore currency premium in late 2014 and early 2015. Meanwhile, the futures rate spreads are even less well explained than the spot spread as reflected both in the lower R-squareds and the fact that variable significance is limited to new renminbi deposit growth in Hong Kong (two cases out of four) and growth in foreign direct investment (also two cases out of four). Granger causality testing allowing for longer maximum lag lengths of four yielded similarly barren results for the futures rate spreads but were more positive for the spot rate spread.[9] It seems that support for significant effects of financial and macroeconomic variables on the spread is effectively limited to the spot market spread alone.

The Granger causality test results for the spot market spread depicted in Table 5 confirm the significant effects of the A-share premium seen in the preceding OLS results. There is also further evidence of a significant effect of new renminbi deposit

Table 4. OLS regressions for the currency spreads, September 2010–March 2015.

VARIABLES	(1) Spot Spread	(2) 1-Month Spread	(3) 3-Month Spread	(4) 6-Month Spread	(5) 12-Month Spread
A-Share Premium Index$_{t-1}$	21.55**	12.15	7.756	4.671	1.525
	(10.58)	(12.54)	(10.74)	(8.324)	(6.040)
Shanghai Total Returns $_{t-1}$	−18.27	−3.652	−0.0787	4.754	9.989
	(15.20)	(18.17)	(14.87)	(11.74)	(9.847)
New Renminbi Deposits $_{t-1}$	4.536*	3.912	1.852	−0.811	−2.236
	(2.413)	(3.008)	(2.633)	(2.072)	(1.748)
M0 $_{t-1}$	−8.724	−5.253	−1.859	3.751	3.488
	(6.270)	(7.883)	(6.322)	(4.832)	(4.119)
Inflation $_{t-1}$	52.53	12.65	1.584	−24.96	16.61
	(63.95)	(51.82)	(50.83)	(45.90)	(53.83)
New Loans $_{t-1}$	0.0908	0.306**	0.258**	0.103	0.0924
	(0.0962)	(0.138)	(0.116)	(0.103)	(0.0879)
FDI $_{t-1}$	−0.00309	−0.0569*	−0.0382	−0.0380*	−0.0327
	(0.0268)	(0.0296)	(0.0253)	(0.0213)	(0.0225)
Trade Balance $_{t-1}$	−3.537	−0.468	−0.292	0.715	0.532
	(2.282)	(3.367)	(2.843)	(2.519)	(1.843)
Exports $_{t-1}$	3.836	−0.311	0.497	−0.163	−1.038
	(3.761)	(4.071)	(3.125)	(2.382)	(2.533)
Capital Control Dummy	−72.93	26.30	−3.938	−7.804	−36.01
	(117.6)	(243.6)	(181.7)	(153.8)	(110.6)
Time Trend	0.264	0.329	0.896	0.967	1.375
	(2.791)	(2.916)	(2.653)	(2.323)	(2.195)
Spot Spread $_{t-1}$	−0.581***				
	(0.206)				
1-Month Spread $_{t-1}$		−0.0935			
		(0.270)			
3-Month Spread $_{t-1}$			−0.146		
			(0.243)		
6-Month Spread $_{t-1}$				−0.197	
				(0.220)	
12-Month Spread $_{t-1}$					−0.00603
					(0.129)
Constant	27.98	9.139	−10.00	−19.58	−41.36
	(96.88)	(80.72)	(68.79)	(55.08)	(60.39)
Observations	55	55	55	55	55
R-squared	0.432	0.235	0.160	0.145	0.151

Note: All variables have been differenced to assure stationarity; robust standard errors are in parentheses; *** denotes $p < 0.01$, ** denotes $p < 0.05$, and * denotes $p < 0.1$

growth in Hong Kong on the stock market spread. The indicated effect is positive, in line with the positive coefficient on the first lag seen in the OLS results. As noted earlier, whereas greater availability of renminbi in Hong Kong would be expected to reduce the offshore spread, greater demand for the renminbi would be expected to increase it. Meanwhile, the findings for the A-share premium have the offshore premium rising when stock market sentiment increases in Shanghai relative to Hong Kong. Insofar as more positive Shanghai market sentiment encourages funds to stay in the Shanghai market, this would be likely to reduce demand for the renminbi in Hong Kong.[10]

The relationship between the A-share premium, new renminbi deposits and the spot spread is further examined in a multivariate VAR framework. These three variables were incorporated so as to further explore the relationships identified as being significant in the preceding OLS and causality testing analysis. A VAR of order q has the following general form:

Table 5. Granger causality tests for the offshore-onshore spot market spread.

Causal Relationship	Coefficient Sum	Chi-Squared Statistic	Number of Lags	Confidence Level
Spot Spread → A-Share Premium Index	**−0.005**	**8.379**	**1**	**99.6%**
A-Share Premium Index → Spot Spread	**15.676**	**3.123**	**1**	**92.3%**
Spot Spread → Shanghai Total Return	0.001	0.005	1	5.3%
Shanghai Total Return → Spot Spread	−0.404	0.240	1	37.6%
Spot Spread → New RMB Deposits in HK	**−0.021**	**3.998**	**1**	**95.4%**
New RMB Deposits in HK → Spot Spread	**3.635**	**5.842**	**1**	**98.4%**
Spot Spread → M0	0.006	1.007	2	68.4%
M0 → Spot Spread	7.820	1.418	2	76.6%
Spot Spread → Inflation	0.000	0.0454	1	16.9%
Inflation → Spot Spread	−14.653	0.582	1	55.5%
Spot Spread → Monthly New Loans	−0.018	0.006	1	6.1%
Monthly New Loans → Spot Spread	0.009	0.030	1	13.8%
Spot Spread → FDI	−0.557	2.262	2	86.7%
FDI → Spot Spread	−0.077	0.045	2	16.8%
Spot Spread → Trade Balance	0.012	0.741	1	61.1%
Trade Balance → Spot Spread	**−1.702**	**2.729**	**1**	**90.1%**
Spot Spread → Exports	0.003	0.737	2	61%
Exports → Spot Spread	3.605	0.210	2	35.4%

Note: All variables are in first difference form.

$$y_t = \emptyset_1 y_{t-1} + \emptyset_2 y_{t-2} + \ldots + \emptyset_q y_{t-q} + u_t \tag{1}$$

where y_t is a $(k \times 1)$ vector of variables in the VAR system, $\emptyset_i$ is a $(k \times k)$ matrix of the estimated coefficients. To simulate the process of dynamic responses of variables to a shock, it is generally assumed that the shocks should be orthogonal (uncorrelated). The relationship between the reduced-form error terms, u_t, and the fundamental or structural shocks, ε_t, is assumed to be given by $u_t = \bar{A}\varepsilon_t$, where $\bar{A}$ is a $(k \times k)$ matrix of coefficients and ε_t is a $(k \times 1)$ vector of fundamental uncorrelated shocks, each with a unit standard deviation. This yields:

$$E\left[u_t u_t^{'}\right] = (\bar{A})\varepsilon_t \varepsilon_t^{'}((\bar{A})^{'} = \bar{A}\bar{A}^{'}E\left[\varepsilon_t \varepsilon_t^{'}\right] = I_n \tag{2}$$

Using the Cholesky decomposition, the structural residuals can be identified through the matrix A by decomposing the covariance matrix of the residuals. $\bar{A}$ should have a lower-triangular structure. Under this approach, the innovations in each variable produce changes in all the preceding variables in the order that they are entered into this recursive model.[11]

The results for our three variable VAR are presented in Table 6 with the lag order set at one as selected by both the AIC and BIC criteria.[12] Consistent with the OLS results, the A-share premium is seen to significantly affect the spot spread. There is also evidence of a significant effect of the A-share premium on new renminbi deposits. The A-share premium does not respond to any of the variables, however, and the new renminbi deposits variable is no longer significant. This suggests that it is not simply a deposit-driven story for the spot spread. Impulse response functions (Figure 7) also confirm a significant impact of the A-share premium on the spot spread but no significant response for new renminbi deposits, for which the 95% confidence band includes zero throughout. These impulse response functions were derived from the VAR specification and the significant

Table 6. Multivariate VAR results for the spot spread, AH premium and new RMB deposits.

VARIABLES	*Spot Spread*	*AH Premium*	*New RMB Deposit*
Lagged Spot Spread	**−0.483*** **	−0.00385	−0.0124
	(0.121)	(0.00302)	(0.00862)
Lagged A-Share Premium	**15.33*** **	−0.124	**−1.074*** **
	(5.665)	(0.141)	**(0.402)**
Lagged New RMB Deposits	2.593	0.0614	**−0.274** **
	(1.749)	(0.0435)	**(0.124)**
Constant	14.12	0.823	−0.378
	(32.36)	(0.804)	(2.297)
R^2	0.332	0.110	0.261
Chi^2	26.831***	6.685	19.021***

Note: One lag on each right-hand-side variable was selected by both the AIC and BIC criteria. All variables are in first differences. Standard errors are in parentheses, and ***, **, and * denote significance at the 99%, 95%, and 90% confidence levels, respectively.
Number of observation = 54.

impact of the A-share premium and insignificance of new renminbi deposits is seen even for an ordering under which we have the spot spread first, new renminbi deposits second, and the A-share premium third. The solid lines depict the estimated size of the impact and the dashed lines above and below show the range over which we can be at least 95% confident that the 'true' effect lies.

Conclusions

Growing global interest in the renminbi has been accompanied by continued deepening of the renminbi market in Hong Kong. Consistent with Craig et al. (2013), a significant role for new renminbi deposit growth in Hong Kong points to the ongoing importance of liquidity effects on the spread. The most consistent relationship evident across the OLS, causality testing and VAR analysis, however, is the effect of the A-share premium on the spread between the offshore and onshore spot rates. The use of this A-share premium as a proxy for relative stock market sentiment contrasts with Craig et al.'s (2013) reliance on the spread between the non-deliverable and deliverable renminbi forward rates. The impact of the A-share premium does not appear to extend to the futures rates, however. Although the dummy entered for the dates following the November 2014 stock market link-up was itself always insignificant, the fact that this link-up was followed by rapid expansion in the A-share premium implies that it may still, via this channel, have helped drive the surging offshore currency premium in late 2014 and early 2015.

The expanding international role for the renminbi has been reflected not only in its initial inroads into serving as a reserve currency held by foreign central banks but in its acceptance into the IMF's SDR system. This establishes the renminbi as a major world currency standing alongside only the dollar, euro, pound sterling and Japanese yen in the SDR basket. More complete removal of the nation's capital controls may still be required to achieve the inclusion of China's financial markets in regional and global benchmark indices, however – and the MSCI repeatedly deferred China's inclusion in its Emerging Market Index owing to concerns about market access before eventually approving it in June 2017. At the same time,

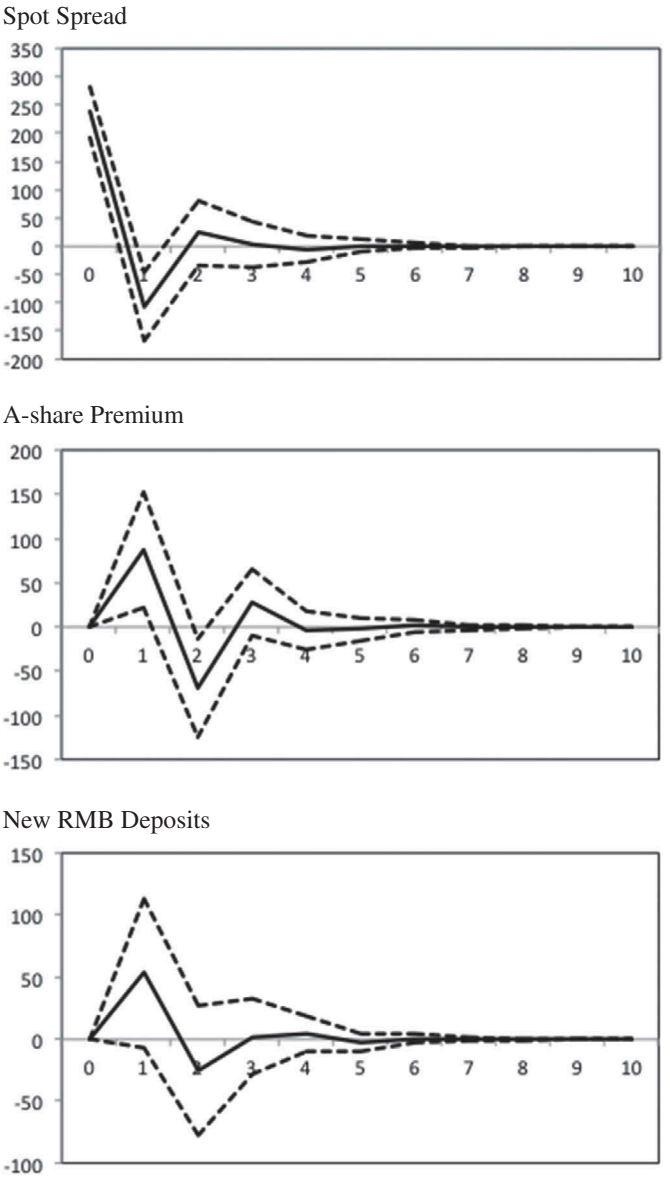

Figure 7. Impulse response function for the spot spread.

Note: The above plots depict the response of the spot spread to Cholesky one standard deviation innovations in itself and the other two variables with 95% confidence level bands; the horizontal axis is calibrated in number of months.

financial and equity market concerns remain only part of the impetus for further progress. Some of the more overriding factors are, as set out by Horesh (2014, 237), "the overall geostrategic posture that China opts to embrace vis-à-vis the IMF, the World Bank and the G20; by the development model it promotes and the shade of hegemony it chooses to exercise, as a resurgent superpower."

Notes

1. The State Council's initial pilot program launched in July 2009 had been limited to seven provinces with renminbi trade settlement permitted only with Hong Kong, Macao and the 10 members of the Association of Southeast Asian Nations (ASEAN).
2. The earlier October 2013 figure was 8.7% according to McCarthy (2014).
3. Wang, Huang, and Fan (2015) emphasize, however, that realizing such a 10% share in practice would almost certainly require improved institutional factors relating to such key issues as capital account liberalization and economic freedom.
4. Although Liao and McDowell (2016) suggest that a state preference for moving away from a US-centric system has contributed to this trend, the array of central banks with renminbi reserves is extremely diverse. More recent participants include European nations such as France, Switzerland and the United Kingdom, for example, whereas earlier movers were predominantly emerging market economies such as Chile, Malaysia, Nigeria, Russia and Venezuela.
5. With each transaction involving two currencies, the percentage shares of the individual currencies sum to 200% rather than 100%.
6. Spreckelsen et al. (2014) confirm high conformity between offshore and onshore spot rates over the earlier January 2011–March 2013 period and it does indeed seem that much more variation is evident in the forward rate spreads that we examine empirically in the section below.
7. The accompanying fluctuations in the monthly period-to-period returns are shown below the total return chart.
8. We also focus solely upon the movements in the spread rather than the dynamics by which the offshore rate may impact the onshore rate (Cheung and Rime 2014).
9. The actual lag length was determined by applying the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). In cases where the criteria selected different maximum lags, the more parsimonious of the two was employed in the causality testing.
10. The Granger causality tests also suggest causal effects of the trade balance on the spot market spread – but the indicated effect is significant only at the 90% confidence level and not confirmed in the OLS estimation results.
11. For additional discussion concerning the application to monetary policy shocks, see, for example, Christiano, Eichenbaum, and Evans (1999).
12. All variables were first differenced to ensure stationarity.

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