CHINESE RENMINBI
after 11 August 2015

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This study examines the effects of China's August 2015 improvement in its mechanism for setting the RMB central parity rate against the US dollar. In the ensuing period to July 2016, we find that there was increased volatility in both the CNY (RMB traded onshore) and CNH (RMB traded offshore) markets. We demonstrate a weakening in the causal relationship between the CNY and the CNH, which is likely due to official intervention. Consistent with the policy announced on 11 August 2015, we show that the previous day's closing price of the CNY plays a greater role in determining the RMB central parity rate. We also show that a currency basket (in the form of the CFETS Index) was used in exchange rate setting for only a short period after the announcement of this element of the reforms in December 2015. These developments reflect the growing power of participants in the Chinese RMB markets and the frequent interventions by Chinese authorities struggling to find a balance between implementing market-oriented reforms and stabilising financial markets.

On 11 August 2015, the People's Bank of China (PBC, China's central bank) announced an unexpected policy change designed to improve its mechanism for setting the official Renminbi (RMB) central parity rate against the US dollar, as well as devaluing the currency by 1.9 per cent. The daily fixing of the RMB was to occur with reference to the previous day's closing rate of the RMB, foreign exchange market demand and supply, and exchange rate movements in other currencies. This major policy change became known as '811'. Four months later, on 11 December 2015, the PBC announced that the RMB would be set according to a basket of currencies instead of the US dollar only.[1]

The timing of these initiatives was problematic as global investors were already facing considerable uncertainty stemming from the rising likelihood that the US Federal Reserve would finally begin to increase official US interest rates. Global capital markets were stunned by this largely unanticipated reform. Panicked investors thought China would join the 'currency war' and further depreciate the RMB to boost its exports.

Some investors viewed the RMB devaluation as a sign that China's real economy was much weaker than it appeared. The ensuing turmoil in both Chinese and global capital markets has thrown a spotlight on the RMB exchange rate.

In this paper, we address the following questions. What happened to the volatility of the RMB exchange rate in the wake of the 811 reforms — in its onshore (CNY) and offshore (CNH) markets? How did the linkage between the onshore and offshore markets evolve? Was the daily fixing of the RMB actually set with reference to the previous day's closing rate of the RMB, as set out by the PBC on 811? Did the PBC really set the RMB exchange rate with reference to a basket of currencies, as was promised on 811 and re-emphasised in the policy announcement four months later?

Recent developments in China's exchange rate policy

Since July 2005, when the Chinese authorities abandoned a longstanding dollar peg, the RMB has been allowed to trade within a defined band around the daily official fixing or central parity announced by the PBC. Initially, the daily trading band against the US dollar was set at ±0.3 per cent around the central parity. The PBC also announced the adoption of a managed and regulated floating exchange rate regime based on market demand and supply, and with reference to a basket of currencies.[2]

After the 2005 policy change, the RMB gradually appreciated against the US dollar until July 2008. Some studies (Frankel 2009; Sun 2010) describe this new regime as a basket peg including some weights on non-US dollar currencies. However, other studies (Ma and McCauley 2011; Yi 2013) argue that this kind of mechanism is similar to a crawling peg arrangement.

During the period from July 2008 to June 2010, the global financial crisis interrupted this experiment and the bilateral RMB/US dollar exchange rate was stabilised at 6.8, with the PBC effectively repegging the RMB to the US dollar.

In June 2010, PBC announced its intention to further reform the RMB exchange rate regime and enhance RMB exchange rate flexibility.[3] In essence, the PBC reintroduced the policies it announced in July 2005 — of managing the RMB against a basket of currencies. At the time, the global economy was gradually recovering, and China's economic recovery was also becoming more robust.

From June 2010, the RMB began to gradually appreciate. This trend attracted huge capital flows, with speculators betting on a one-way RMB appreciation. To further enhance RMB exchange rate flexibility, the PBC gradually widened the trading band around the daily US dollar fixing from an initial band of ±0.3 per cent to ±0.5 per cent on 21 May 2007 to ±1 per cent on 16 April 2012, and ±2 per cent on 17 March 2014. A wide band increases the probability of two-way fluctuations and hence reduces the likelihood that speculators will bet on RMB appreciation. (Indeed, when the trading band was widened in 2012 and 2014, the RMB experienced significant two-way volatility that deterred RMB appreciation betting positions.)

In July 2010, the Hong Kong Monetary Authority and the PBC signed the Memorandum of Understanding on Renminbi Business Cooperation, which allows the trading of spot and forward RMB and RMB-linked structural products in Hong Kong.[4] Since then, RMB transactions in Hong Kong have essentially been conducted as though the RMB were a convertible currency. Market participants have labelled the RMB traded offshore as CNH, as opposed to CNY which is traded onshore. The Chinese authorities' main motivation was to increase the use of the RMB in cross-border trade settlements and thereby enhance the internationalisation of the RMB. The establishment of the offshore RMB market is part of China's plan to reform its currency system. The CNY and CNH markets are segmented because China has not yet fully opened its capital account; there are various forms of restrictions limiting investors from transferring RMB funds between the CNY and CNH markets.

Since the 11 August 2015 change in the RMB–US dollar central parity formation mechanism, the daily fixing has been set with reference to the previous day's closing rate of the RMB, foreign exchange market demand and supply, and exchange rate movements in other currencies. Previously, the central parity rate was based on a trimmed weighted-average of prices from designated liquidity providers, and the currency weights were set discretionally.

On 11 December 2015, the PBC announced that the RMB would be set according to a basket of currencies instead of the US dollar only.[5] The reference to a currency basket was openly announced back in 2005 and again in 2010. However, the currency basket now includes a RMB Index (China Foreign Exchange Trading System Index, or CFETS Index).

Accomplishing the convertibility of the RMB is key to China's ongoing reform and opening-up policies, and to the reform of its financial system. This policy direction was first announced in December 1993 when Chinese authorities stated that 'the long-term goal of China's foreign exchange reforms is to realise convertibility of the RMB' (Avery et al. 2011). This goal was repeated in the 13th five-year plan for 2016–20.[6] However, no official timetable was provided.

Both CNY and CNH markets have become more volatile

Let us now examine the volatility of RMB exchange rate before and after August 2015 (or '811'). Table 1 presents the standard deviation of the percentage change in the CNY and CNH. Both before and after 811, the CNH has been more volatile than the CNY. This observed volatility differential reflects a greater degree of exchange rate management of the CNY than the CNH; it is widely believed that before 811 there was essentially no intervention in the offshore market (Funke et al. 2015). It is clear that since the 811 reform, both the CNY and the CNH have become more volatile; they were particularly volatile during the period from 11 August 2015 to 29 February 2016. This partly reflects the fact that market participants have faced greater

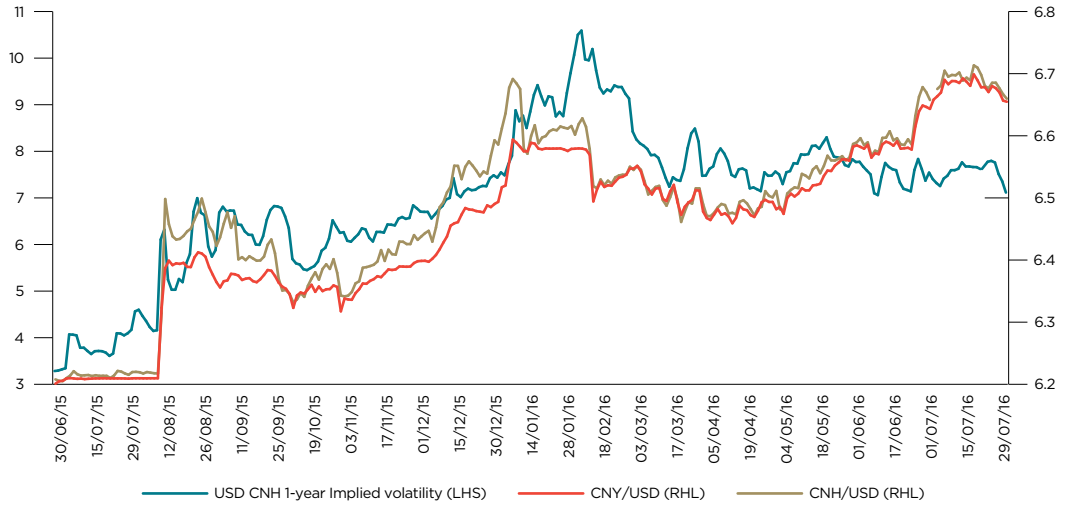
uncertainty since 811. However, the rise in RMB volatility, particularly for the CNH, is also likely due to intervention. The consequences of this intervention can be observed in Figure 1, which depicts the USD/CNH one-year, option-implied volatility (left-hand axis) and the levels of the CNY/USD and the CHN/USD (right-hand axis). A rise in the exchange rate indicates a depreciation of the RMB.

TABLE 1: Standard deviation of the percentage changes of CNY and CNH

Time period	CNY	CNH
Before 11 Aug 2015	0.10%	0.15%
After 11 Aug 2015 (until 29 July 2016)	0.22%	0.34%
From 11 Aug 11 2015 to 29 Feb 2016	0.25%	0.41%

Source: Wind.

FIGURE 1: USD/CNH one-year volatility vs USD/CNH & USD/CNY



Source: Bloomberg.

Figure 1 shows that from July to December 2015, the trend depreciation of the CNH was closely associated with USD/CNH implied volatility; i.e. CNH implied volatility rose as the RMB depreciated. From January 2016, the CNH depreciation momentum reversed as a result of intervention by the Chinese authorities — likely aimed at wrong-footing speculators with short CNH positions.

The linkage between the CNY and the CNH has become disconnected since 811

In this section, the Granger Causality test[7] is employed to illustrate the relationship between the CNY and CNH before and after the 811 reform. Table 2 shows the results of the *P*-value of the *F*-statistics for the Granger test. The results show that there was two-way causality before 811. However, from 811 to the end of 2015, the CNY Granger caused the CNH, but the reverse relationship — the CNH Granger causing the CNY — was much weaker (and not statistically significant at standard levels, p = 0.09). Since 1 January 2016, there has been no significance either way, suggesting that the relationship between the two markets has essentially broken down.

TABLE 2: Summary results of Granger causality test

	Time period	Granger Causality Test: CNH = *f(CNY) (lag=8)*	Granger Causality Test: CNY= *f(CNH) (lag=8)*
P-Value	Before 11 August 2015	0.000	0.016
	During 12 August 12 to 31 December 2015	0.001	0.088
	After 1 January 2016	0.126	0.722

Data Source: Wind.

The results shown in Table 2 are likely the result of intervention by the Chinese authorities. Before 811, the CNY and CNH affected each other's pricing. Clearly there were arbitrage activities between the CNY and CNH markets before 811 — despite the restrictions in place to limit this activity.

From 811 to the end of 2015, the Chinese authorities' aim was to peg the CNH to the CNY. To achieve this, the Chinese authorities (mainly the PBC, but also offshore branches of large Chinese state-owned banks and other Chinese government-linked entities) used large amounts of foreign reserves to reduce the downward momentum of the CNH. Declining foreign reserve holdings (data on reserves are published monthly by the PBC) led investors to doubt the Chinese authorities' ability to achieve a sustained stabilisation of the CNY and particularly the CNH markets.

In early 2016, the Chinese authorities adopted a new strategy to reduce speculative activity in the offshore RMB market and stabilise the currency: deliberately reducing CNH liquidity (as evidenced by declining RMB deposits in Hong Kong and rising Hong Kong interbank offer rates on borrowing RMB offshore). Not surprisingly, the costs associated with short sales have increased dramatically. These interventions have changed the fundamentals of the formerly market-driven CNH market. As a result, the CNH and CNY markets have become disconnected from each other.

Intervention in the RMB offshore market, which led to the disconnect between the CNY and the CNH, is likely to be seen as a 'multiple currency practice'. In this light, the PBC's interventions constitute a major setback to the RMB internationalisation process.

From 2014, the Chinese authorities launched a series of reform measures to enhance RMB internationalisation. One of China's successes has been the official inclusion of the RMB in the International Monetary Fund's (IMF) Special Drawing Rights basket, effective from 1 October 2016. According to the IMF's policy on multiple currency practices introduced on 20 March 1981, '(a) action by a member or its fiscal agencies that of itself gives rise to a spread of more than 2 per cent between buying and selling rates for spot exchange transactions between the member's currency and any other member's currency would be considered a multiple currency practice and would require the prior approval of the Fund.'

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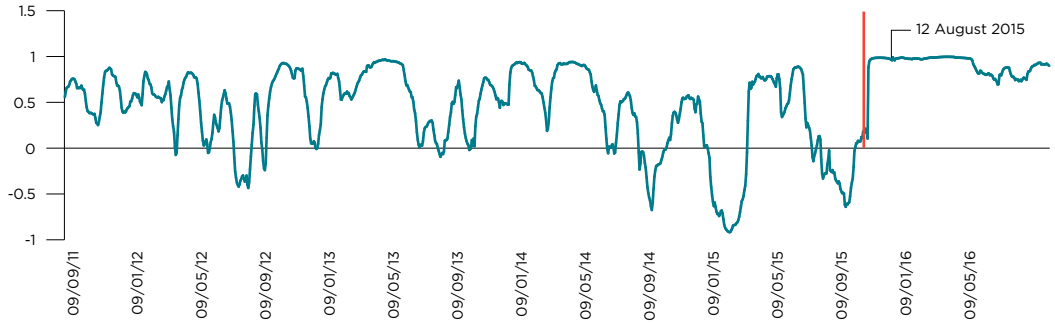
The previous day's closing price of the CNY has begun to play a greater role in setting the central parity rate since 811

As discussed earlier, under the new '811' mechanism the central parity is set with reference to the previous day's closing rate of the RMB, foreign exchange market demand and supply, and movements in other currencies. This section assesses whether the PBC is indeed doing what it said it would do. Is the central parity rate set with reference to the previous day's closing price of the RMB?

We first use a rolling correlation analysis to examine the changing nature of the relationship between the central parity and the previous day's closing price of the CNY, before and after the 811 reform. Figure 2 depicts 30-trading-day rolling correlations between these two variables. It shows that 12 August 2015 (the day after '811') is a clear turning point. Before this date, the relationship between the central parity and the previous day's closing price varied greatly. Since then, there has been a near-perfect positive correlation between the two, indicating that the central parity formation mechanism fundamentally changed following the 811 reform. Note that this correlation analysis is based on the past 30 days' trading data. The sudden change of the correlation coefficient from 0.10 to 0.88 on 12 August suggests that the PBC had, in fact, started this new pricing system 30 trading days earlier than the announcement date — on 2 July 2015.

FIGURE 2: Relationship between the central parity rate and the previous day's closing price of the CNY



Source: Wind.

Second, we run a series of univariate regressions. The specification is as follows:

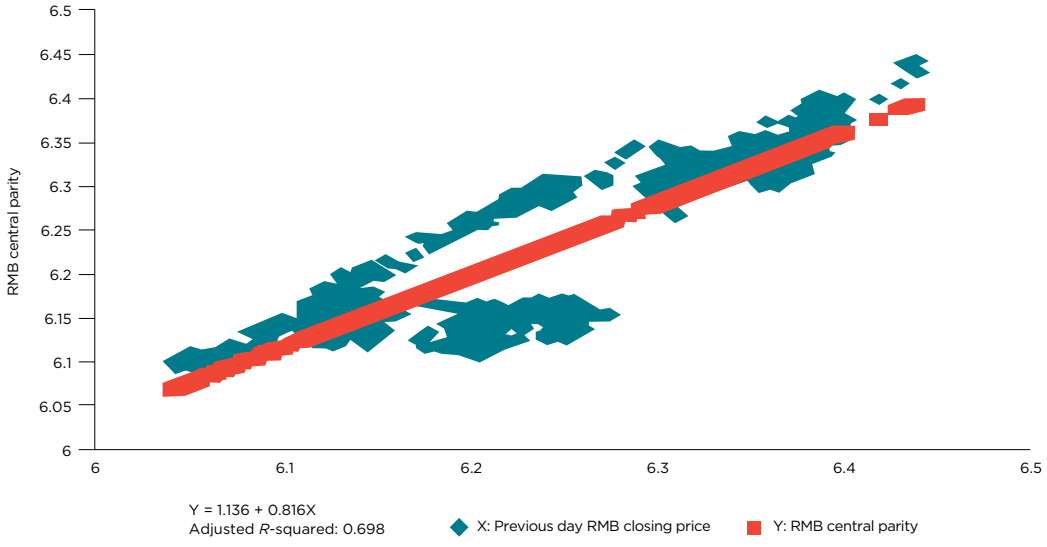
$$Yt = \alpha + \beta X_{t-1} + \varepsilon_t$$

where *Y* and *X* are the central parity rate and CNY rate, respectively.

Consistent with the findings of the rolling correlation analysis, the regression analysis demonstrates that the PBC does indeed refer to the previous day's closing price of CNY when setting the RMB central parity. At the very least, following 811 the previous day's CNY closing price began to play a much larger role in setting the RMB exchange rate than previously.

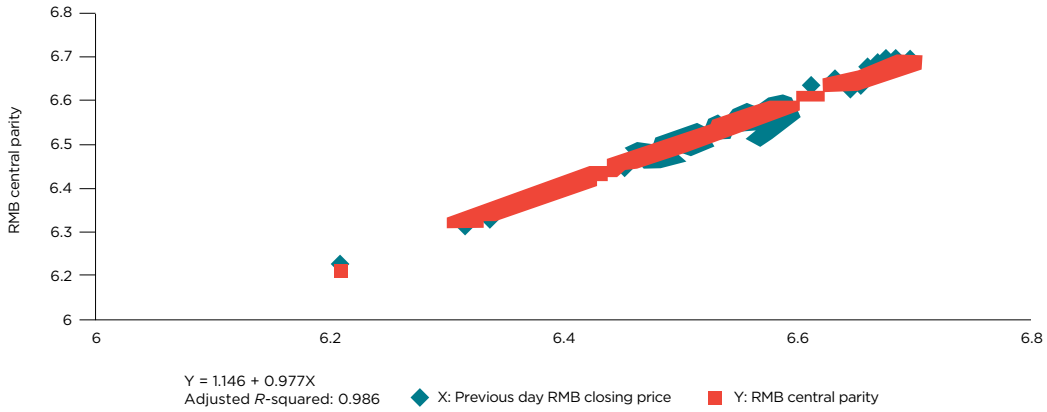
Figure 3 shows the relationship between the central parity rate and previous day's CNY closing price before 811. In this specification, the adjusted *R*-squared is 0.698. Figure 4 shows the relationship between the central parity rate and the previous day's closing price of the CNY after 811. As can be seen, the adjusted *R*-squared rises to 0.986. (The results shown in Figures 3 and 4 are significant at the 5 per cent level or better.) Consistent with the findings of the rolling correlation analysis, the regression analysis demonstrates that the PBC does indeed refer to the previous day's closing price of CNY when setting the RMB central parity. At the very least, following 811 the previous day's CNY closing price began to play a much larger role in setting the RMB exchange rate than previously.

FIGURE 3: Relationship between the central parity and previous day's closing price of the CNY before 811 (1 August 2011 to 10 August 2015)



Data source: Wind.

FIGURE 4: Relationship between the central parity and previous day's closing price of the CNY after 811 (11 August 2015 to 29 July 2016)



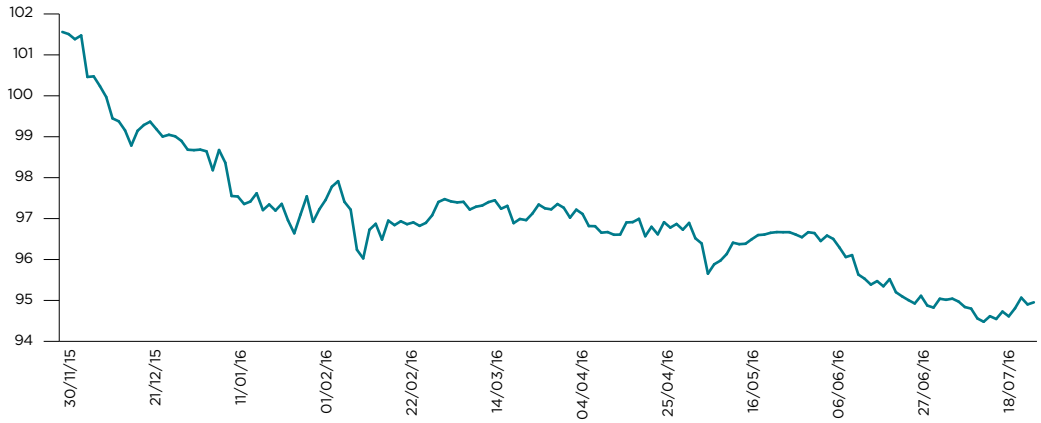
Data Source: Wind.

The CFETS RMB Index's role in setting central parity rate varies

In this section, we ask whether and to what extent the PBC, post-811, has used a currency basket in setting the RMB exchange rate. By referencing a basket of currencies, the RMB appreciates or depreciates against the US dollar depending on the performance of the component currencies, making the RMB flexible against the US dollar in both directions. The benefit of this approach is that a basket of currencies better captures the competitiveness of China's goods and services. Before 811, there had already been policy announcements indicating that the RMB should be set against a basket of currencies rather than against the US dollar only — specifically when the dollar peg was abandoned in 2005, and again in 2010. What was new in the announcement made on 11 December 2015 was an explicit reference to the RMB Index (CFETS Index).

Since the CFETS RMB Index is a weekly index, we need to transform it into a higher frequency data series. The sample currency weights are calculated by using international trade weights with adjustments for re-export trade factors; this information is disclosed by the PBC. Combining the daily exchange rate with information on these basket currencies, we can simulate the daily CFETS RMB Index (see Figure 5).

FIGURE 5: Simulated daily CFETS RMB Index

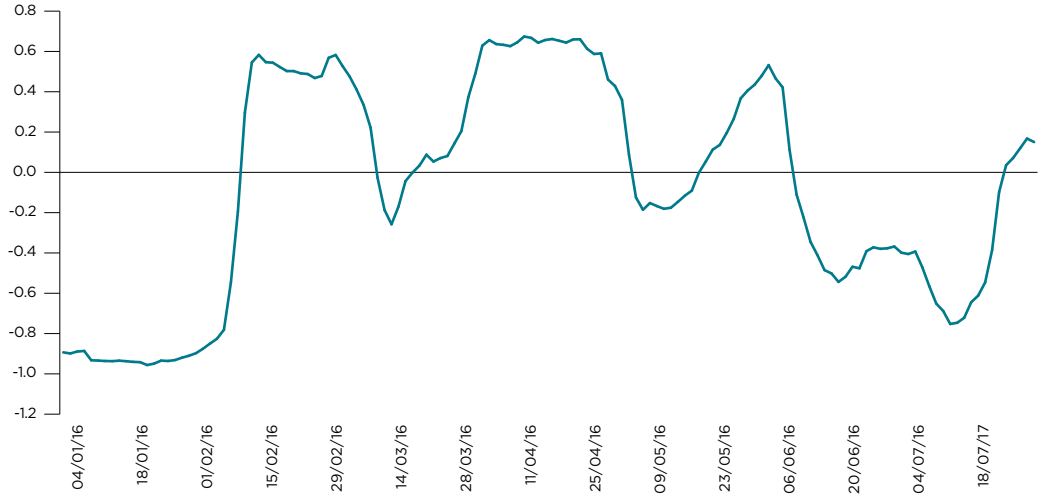


Source: Wind, Bloomberg.

As a higher CFETS RMB Index means a stronger RMB against a basket of currencies, the RMB central parity rate against the US dollar should be lower when the CFETS RMB Index is higher: that is, there is a negative correlation between them. We calculate a rolling thirty-day correlation between the RMB central parity rate and the CFETS RMB Index (see Figure 6).

Figure 6 shows that during the period from November 2015 to January 2016, the RMB central parity was almost perfectly negatively correlated with the CTETS RMB Index. However, since February 2016, the correlation between the RMB central parity and the CFETS RMB Index has varied widely — suggesting that after the first two or three months into the new regime, the PBC has not consistently referred to the full basket of currencies in its exchange rate setting.

FIGURE 6: Relationship between the RMB central parity rate and the CFETS RMB Index



Source: Wind.

We also conduct a series of univariate regressions to further explore the relationship between the RMB central parity rate and the CFETS RMB Index. Figures 7, 8, 9 and 10 show the results (regressions 7 and 10 are statistically significant at the 5 per cent level, while regressions 8 and 9 are insignificant).

Figure 7 shows that from 30 November 2015 to 29 January 2016, movements in the RMB central parity rate were closely associated with the CFETS RMB Index. The adjusted *R*-squared is 0.909, suggesting that the explanatory power of the CFETS RMB Index is very large. This is consistent with the rolling correlation analysis presented in Figure 6.

Figures 8 and 9 show that from February to May 2016, the causal relationship between the CFETS RMB Index and the RMB central parity rate broke down; that is, the correlation became statistically insignificant.

Figure 10 shows that from June 2016, the relationship became stronger but was still weak relative to the period from December 2015 to January 2016; the adjusted *R* square is just 0.116.

It is understandable, perhaps, that the PBC had changed its focus from the longer-term goal of internationalising the RMB — involving the freeing-up of capital controls and the reduction in exchange rate intervention — to other more urgent issues. This is consistent with China's gradual and trial-and-error approach to financial and economic reforms, placing an emphasis on stability.

The economic backdrop to this changing relationship between the RMB central parity and the CFETS RMB Index is that from January 2016, a series of economic data — including China's GDP growth rate in Q4 and for the whole year of 2015 — were below market expectations. Investors in China and in the rest of the world were worried about the possibility of further deterioration of the Chinese economy. The benchmark Shanghai Composite Index lost nearly 30 per cent in just one month. Capital outflows became stronger, and the Chinese authorities began to intervene in the CNH market, as well as implement a series of measures to curb these outflows.

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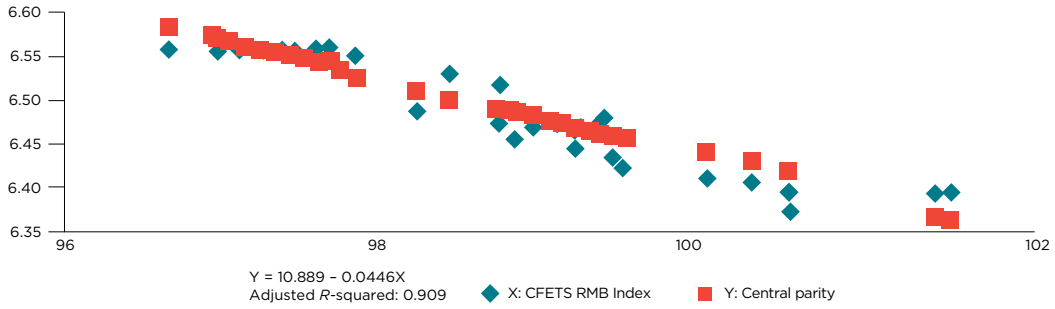
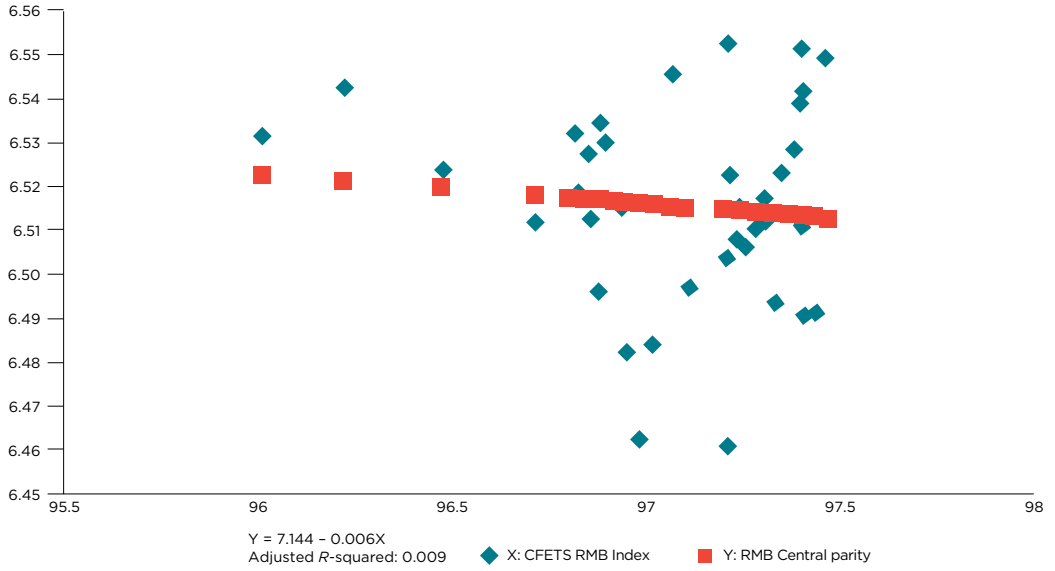
FIGURE 7: Relationship between the RMB central parity rate and the CFETS RMB Index (30 November 2015 to 29 January 2016)



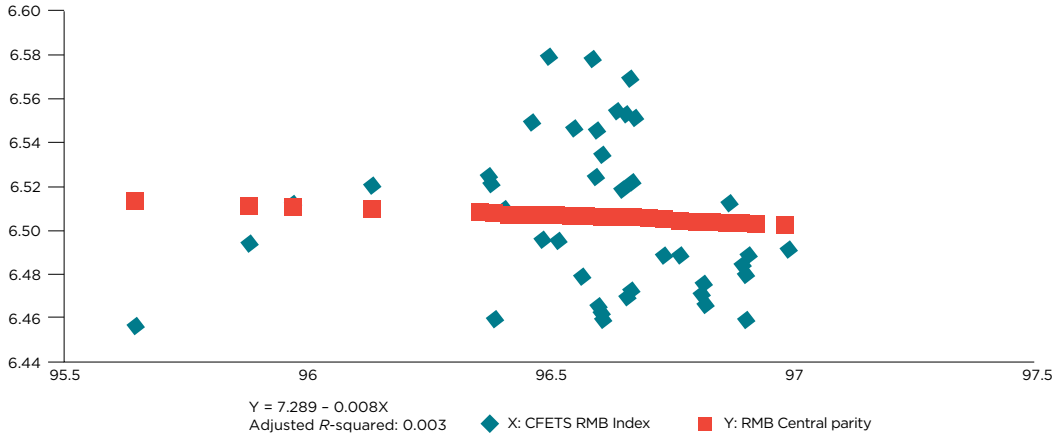
Source: Wind, Bloomberg.

FIGURE 8: Relationship between the RMB central parity rate and the CFETS RMB Index (1 February 2015 to 31 March 2016)



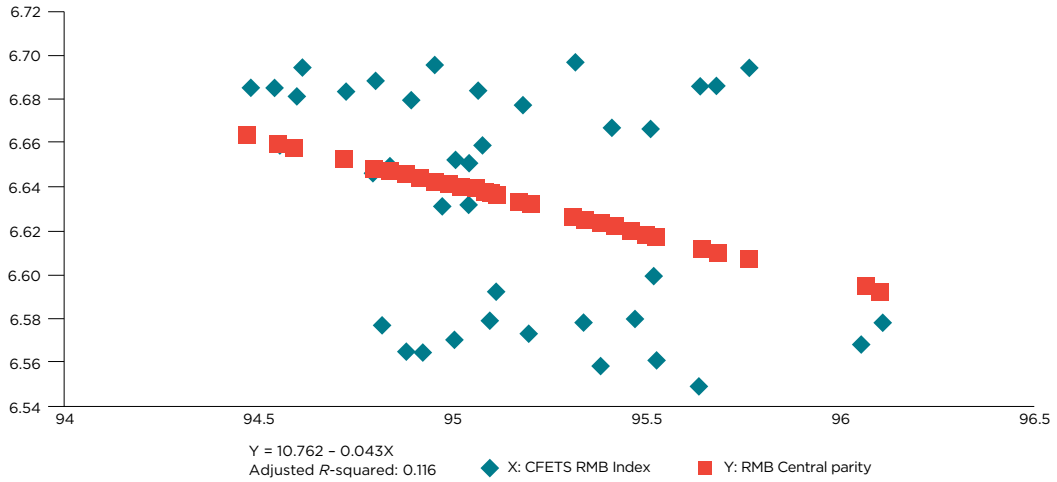
Source: Wind, Bloomberg.

FIGURE 9: Relationship between the RMB central parity rate and the CFETS RMB Index (1 April 2015 to 31 May 2016)



Source: Wind, Bloomberg.

FIGURE 10: Relationship between the RMB central parity rate and the CFETS RMB Index (1 June 2015 to 29 July 2016)



Source: Wind, Bloomberg.

Conclusion

The PBC's policy announcement on 11 August 2015 has had profound effects on the RMB markets. Since then, both the CNY and CNH have become more volatile. The causal relationship between the CNY and the CNH has weakened and disappeared since July 2016. The previous day's closing price of the CNY now plays a greater role in determining the RMB central parity rate. The renewed emphasis on using a basket of currencies in exchange rate setting — involving the introduction of the RMB Index — appears to have lasted for only a couple of months (December 2015 to January 2016). These developments reflect the increasing power of participants in Chinese RMB markets and the response by the Chinese authorities — who are struggling to find a balance between the long-term goal of implementing market-oriented reforms to further internationalise RMB and the short-term objective of stabilising financial markets in order to protect economic growth.

Acknowledgement

The author would like to thank an anonymous referee and Managing Editor Kevin Davis for very valuable comments.

Notes

1. See The People's Bank of China, 'The Launch of RMB Index Helps to Guide Public View of RMB Exchange Rate', 11 December 2015.
2. See The People's Bank of China, 'Public Announcement of the People's Bank of China on Reforming the RMB Exchange Rate Regime', media release, 21 July 2005.
3. See The People's Bank of China, 'Further Reform the RMB Exchange Rate Regime and Enhance the RMB Exchange Rate Flexibility', 19 June 2010.
4. See Hong Kong Monetary Authority, 'Signing of Memorandum of Co-operation on Renminbi Business', media release, 19 July 2010.
5. See The People's Bank of China, 'The Launch of RMB Index Helps to Guide Public View of RMB Exchange Rate', 11 December 2015.
6. See State Council People's Republlic of China, 'China to realize RMB convertibility on capital account', 5 March 2016.
7. The Granger Causality test is a statistical hypothesis test for determining whether one time-series *X* is useful in forecasting *Y* through a series of *t*-tests and *F*-tests on lagged values of *X* (including lagged values of *Y*).

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