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Geographic spread of currency trading:
The renminbi and other EM currencies

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ABSTRACT

We study the ongoing diffusion of renminbi trading across the globe, the first such research for an international currency. We analyse the distribution in offshore renminbi trading in 2013 and 2016, using comprehensive data from the central bank triennial survey of foreign exchange markets. In 2013, Asian centres favoured by the policy of renminbi internationalisation had big shares in global renminbi trading. In the following three years, renminbi trading seemed to converge to the spatial pattern of all currencies, with a half-life of 7-8 years. The previously most traded emerging market currency, the Mexican peso, shows a similar pattern, although it is converging to the global norm more slowly. Three other emerging market currencies show a qualitatively similar evolution in the geography of their offshore trading. Overall the renminbi's internationalisation is tracing an arc from the influence of administrative measures to the working of market forces.

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1.   Introduction

How does a currency grow from a largely national or regional role into a global role? One aspect of this is its trading geography. What is the path along which a currency's trading evolves from localised trading to global trading?

No doubt, the US dollar, the Deutsche mark and the Japanese yen in their turns all went through a process whereby their trading diffused across the globe. The end-result is evident in the 2016 Triennial Central Bank Survey of Foreign Exchange and Derivatives Turnover (henceforward the 2016 Triennial Survey). For example, the geographic distribution of US dollar trading and that of the Japanese yen resemble each other, despite the disparity of their respective international roles and the number of time zones that separate the two home countries.

However, the diffusion of these major currencies took place before reasonably comprehensive surveys of FX turnover began in 1989. These surveys nowadays span over 50 jurisdictions, albeit at only a triennial frequency. The short span of consistent, comprehensive data makes it impossible to document the geographic diffusion of trading of, say, the yen or Australian dollar.

The last two Triennial Surveys available make it possible to analyse the recent internationalization of emerging market currencies. In the 2013 Triennial Survey, a broad range of jurisdictions reported turnover in emerging market currencies. This marked a break from the 2010 survey in which only some reporting jurisdictions broke out such currencies. Therefore, our analysis of the internationalization of the renminbi and other emerging market currencies depends on two snapshots: 2013 and 2016.

Our hypothesis is that a currency undergoing internationalization experiences a characteristic evolution of its geographical distribution of trading outside its home

jurisdiction. In particular, it approaches the global geographical distribution of trading observed for the overall foreign exchange (FX) market. Given the vehicle role of the dollar in FX trading (Krugman, 1984), with it serving as one of the currencies in almost 90 percent of trades, the geographical distribution of dollar trading nearly matches that of overall trading. As other currencies become more broadly traded, they close the gap between their original geography of trading and the global distribution of FX trading by center.

In particular for the renminbi, Ehlers and Packer (2013) found that the renminbi's offshore trading was concentrated in Asia in 2013. Cheung and Yiu (2017) found that the distribution of renminbi trading was affected by the size of the financial markets in the host jurisdiction, as well as the bilateral foreign direct investment flow with China. Contrary to Cheung (2015), the role played by policy variables such as the People's Bank of China swap lines, emerged as modest. Whatever the factors that accounted for the 2013 distribution, our approach is to try to account for the change between the surveys of 2013 and 2016 of a given center's share of renminbi trading. We hypothesize that the distribution of renminbi trading worldwide is converging to that of all currencies.

To our knowledge, this conception of the geographical diffusion of an internationalizing currency is a novelty of this article. Like Griliches (1957), we describe a diffusion process with three parameters: the initial conditions, which we observe, the speed of diffusion, which we infer from the data, and the ultimate endpoint, which we posit.[1]

The closest work to ours is that of Eichengreen et al. (2016). They find that submarine fibre optic cables lead to a loss of market share of the home foreign exchange market and a gain of offshore centers. In light of these findings, Mehl (2017) interprets the euro area's loss of market share in trading the euro against other currencies and London's parallel gain as

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[1]   The analogy would be stronger if we were investigating the renminbi share of global trading, but instead we are investigating the distribution of renminbi trading, whatever its overall level.

reflecting "London's trading cables." We take the onshore-offshore split as given and model the change in the offshore distribution.

To anticipate, we find that between 2013 and 2016 the renminbi's turnover diffused from Asia to the rest of the world. It did so in a manner consistent with convergence to the geographical distribution of global FX trading that has resulted from market forces. If policy had given the two Asian financial centers, Hong Kong SAR (henceforward Hong Kong) and Singapore, head starts, they both lost market share to London and New York – the world's two leading FX trading centers.

How fast might the convergence go? At the rate of 2013–2016, it would take 7–8 years. That translates to two to three Triennial Surveys.

A question immediately arises: is the renminbi convergence unique? To demonstrate that something different was happening with the renminbi, we follow Cheung and Yiu (2017) and repeat the exercise with the Mexican peso (MXN).[2] The Mexican peso is worthy of analysis because it was the most traded emerging market currency before the renminbi surpassed it in the 2016 Triennial Survey. We find that the Mexican peso is also diffusing from its regional base in the Americas, but at a slower rate.

We also repeat the analysis for all of the emerging market currencies with widely reported turnover. In this context, we follow Cheung and Yiu (2017) by adding controls for the change in trade and foreign direct investment relations between the currency's home country and that of the trading center, as well as for financial and real aspects of the center. We find that the trading of three other emerging market currencies is diffusing according to our hypothesis. And the renminbi and peso results are robust to the inclusion of the controls.

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[2] These currencies are the next ones on the emerging market currency hit parade from the Triennial, neglecting the Hong Kong and Singapore dollars, which, much like sterling, have an FX trading centre as home jurisdiction.

The rest of the paper is organised in five parts. The second section provides an overview of the geography of currency trading, which establishes a norm for a major currency. Section III briefly reviews renminbi internationalization, highlighting its transition from a heavily regional profile of trading. Section IV reports regression analysis that tests whether the pattern of trading the renminbi and the Mexican peso is converging to that of major currencies. The fifth section repeats the exercise for all of the well-reported emerging market currencies, adding controls to test the robustness of our results. The sixth section concludes.

2.   Overview of the geography of currency trading

Our starting point is the remarkable similarity of the trading of the dollar and yen across centers. Tokyo's FX market closes before New York opens and New York closes before Tokyo opens. The dollar was on one side of 88 percent of all FX trades in April 2016; the yen on only 22 percent. The dollar is used globally to denominate about half of trade; the yen is used to denominate only a fraction of Japan's trade. It is easy to imagine that the geographical distribution of trading in the dollar and yen must differ considerably.

They do not. In Figure 1, the distribution of trading of the dollar on the left shows more trading in New York than does trading in the yen. The yen shows more trading in Tokyo than does trading in the dollar. Fair enough: there is a bias to trading the home currency. But the distributions of trading in London, Singapore and Hong Kong are remarkably similar.

The geographic distribution of FX trading shows considerable stability. Looking across the eight Triennial Surveys from 1995 through 2016, London and New York have

remained no. 1 and no. 2 (Figure 2).[3] Among the Asian centers, Tokyo has lost share, while Singapore and Hong Kong have gained. The top 5 accounted for 77 percent of turnover (on a net-gross basis) in 2016. Despite the addition of new reporting countries, the top centers' joint share has risen over the years from about two-thirds. This reflects the rise in the offshore share of trading across currencies.[4]

Some readings of the 2016 Triennial Survey ascribed London's loss of market share to the growth of renminbi trading elsewhere. While Moore et al. (2016) gave no attention to the geography of trading, the press did, with a headline, "London's grip on global FX trading hit by Asia" (Martin, 2016). Hutton and Kent (2016) reported market intelligence that ascribed less trading in London to the growth in trading of emerging market currencies like the renminbi, the Mexican peso and the Korean won. However, they emphasized London's pre-eminence in renminbi trading outside of Asia and hinted at our hypothesis:

> Outside of the Asian centers of Hong Kong, China and Singapore, which naturally are the home to most of this activity [renminbi trading], the United Kingdom is now the largest center for RMB trading. Historically, London has been the major center for FX turnover, perhaps accounting for its standing within RMB turnover (Hutton and Kent, 2016).

3.   The diffusion of renminbi trading, 2013-16

This section describes the diffusion of the renminbi trading in the three years April 2013 to April 2016. The following section reports our regression analysis that points to convergence of the renminbi's trading to the geographical distribution of the trading of all currencies.

Figure 3 shows where the renminbi traded over US$1bn or over US$10bn per day in 2013 and 2016. In 2013, only the Chinese Mainland, Hong Kong SAR, Singapore and

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[3]   Looking across lines of business, Cassis (2006) puts New York ahead of London. London's particular strength in foreign exchange can be ascribed to its time zone advantage.
[4]   Over time, the share of offshore trading in currencies has tended to rise; see McCauley and Scatigna (2011), Ehlers and Packer (2013), Eichengreen et al (2016) and Mehl (2017).

London traded over US$10bn per day, while Taipei, Paris and New York all traded in the US$1–US$10bn range. In 2016, turnover in New York had climbed to over US$10bn per day, while Tokyo, Seoul, Sydney and Frankfurt had joined the US$1–US$10bn club.

While this evidence shows diffusion, it does not necessarily support the hypothesis that the diffusion is taking renminbi trading towards a particular endpoint in terms of its geography of trading. Recall, we are not following Griliches (1957) in analyzing the rise of renminbi trading as a share of trading in all currencies; rather we are modelling the geographic distribution of renminbi trading. Moreover, the diffusion is also occurring within Asia and the Pacific.

Therefore, we consult the shares as we did with Figure 1, this time comparing renminbi turnover by center in 2013 and 2016 (Figure 4). Is renminbi turnover distributed more like that of the dollar or yen over time? So it seems: the major centers of London and New York gaining at the expense of the regional centers, Hong Kong and Singapore.

4.   Convergence of renminbi and Mexican peso trading

While figure 4 is consistent with our convergence story, the acid test is a cross-sectional analysis of the change in a center's share of renminbi trading between 2013 and 2016. Our "error-correction" hypothesis is that centers that have more (less) than their share of renminbi trading will lose (gain) share. The norm for the warranted share is simply the center's share of turnover for all currencies.

We estimate the following:

(1) $Y_{i,2016} - Y_{i,2013} = \alpha + \beta(Y_{i,2013} - X_{i,2013}) + \gamma(X_{i,2016} - X_{i,2013}) + \delta(Y_{i,2013}/X_{i,2013}) + \varepsilon_i,$

where $Y_{i,2016} - Y_{i,2013}$ is the change in centre i's share of offshore renminbi trading between 2013 and 2016; α is the constant; $Y_{i,2013} - X_{i,2013}$ is the gap between centre i's share of offshore renminbi trading and its share of all currency trading; $X_{i,2016} - X_{i,2013}$ is the change in

centre i's share of al currency trading; and $Y_{i,2013}/X_{i,2013}$ is centre i's renminbi trading as a share of its all-currency FX trading in 2013.

Our key finding is that the estimated coefficient on the gap between a centre's renminbi share and all-currency share is negative (Table 1). This finding points to convergence of the renminbi trading to the global norms dominated by the major currencies. When allowance is made for a given centre's gain or loss of global market share, the coefficient on the gap is larger in absolute value, suggesting faster convergence. The coefficient of -0.22 suggests a convergence process with a half-life of 7-8 years after controlling for the change in a centre's overall FX trading share in 2013-16. A centre's ratio of renminbi to all currency trading in 2013 does not play much role.

We repeat the analysis of the renminbi's diffusion for the Mexican peso, the second most traded emerging market currency (Table 2). We find that the peso is also going through a process of geographical diffusion. This finding is consistent with reports that the Bank of Mexico intervened in Asian hours in the peso/dollar rate in early 2017 (Yuk (2017)). This was reportedly a change from previous occasions when it intervened during New York/Chicago/Mexico City hours.[5]

That said, the process for the Mexican peso differs in important ways from that of the renminbi. The speed of the process is slower for the Mexican peso. Trading in the Mexican peso does respond to a centre's overall increase in share, as does the renminbi. And the variance of the changes in the location of Mexican peso trading that a simple diffusion process accounts for is much smaller. (As with the renminbi, the centre's 2013 share of Mexican peso trading in all trading is insignificant.) Overall, one is tempted to associate the more laissez-faire approach of the Mexican authorities to peso internationalisation—one

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[5] While there has been discussion of official Chinese intervention in the renminbi/dollar rate in Hong Kong, we are not aware of any reports of such intervention in London or New York.

recalls the European Central Bank policy of neither encouraging nor discouraging the euro's international use—with the leisurely pace of peso trading's geographic diffusion.

5.   Extension: other EM currencies and controls

This section extends the analysis of the renminbi and MXN to other Emerging Market currencies and follows Cheung and Yiu (2017) in introducing controls. These include changes in centers' economic relationship with China and its own characteristics.

We find that the renminbi's convergence to the geographical distribution of all currencies' trading is the fastest among those showing statistical significance (Figure 5). In addition to the renminbi and Mexican peso, the Hong Kong dollar, Indian rupee and Korean won show statistically significant convergence. It is worth noting that the diffusion of Indian rupee and Korean won trading is occurring largely through trading of the non-deliverable forward (McCauley and Shu, 2016). Only the Singapore dollar gives weak evidence for divergence.

Table 3 shows the results including five controls adapted from Cheung and Yiu (2017). In addition to the variable specified in equation 1 above, which are shown in the first two columns, the third column shows the coefficient on the growth of FX turnover in the centre as a share of the centre's GDP. Then follow the change in GDP growth rate in the centre, and the change the ratio of private credit to GDP for the centre. Then follow the bilateral relationship variables: the change in the share of foreign direct investment between the centre and the currency's home country and the change in the share of bilateral trade between the centre and the currency's home country.

The major take-away is that the convergence parameter for the renminbi and the MXN are robust to the inclusion of the controls. The convergence coefficient for the MXN increases in absolute value, although the significantly negative coefficients on the bilateral

direct investment and trade variables are anomalous. (That the change in the centre's overall share loses significance in the presence of the growth of FX turnover relative to GDP is more understandable.)

6.   Conclusions

In this paper we demonstrate that the location of trading of the renminbi diffused in 2013–2016 from Asian centers to which policy had given first mover advantages. Trading seems to be converging to the geographical pattern of all currencies. While another widely traded emerging market currency, the Mexican peso, shows a similar pattern, its speed of convergence is slower. Other emerging market currencies, notably the Hong Kong dollar, the Indian rupee and the Korean won show a qualitatively similar pattern of geographical diffusion in their offshore trading.

Overall, our results support the view of Kindleberger (1974), writing on the question of what financial center would prevail in Europe with a single question of eerie relevance today, as Brexit is debated. He wrote: "Government policy can accelerate or slow down the emergence of a given city as the primary financial center, but it can probably not change the outcome." We paraphrase: while the strategy of renminbi internationalization may have given a head start to Hong Kong and other Asian trading centers, if the renminbi becomes a key international currency, market forces, not policy, will determine where it is traded.

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Table 1 Convergence of renminbi trading (Dependent variable is change in centre's share of renminbi trading, 2013-16)

	(1)	(2)	(3)
Gap between centre's RMB and all currency share	-0.088**	-0.221***	-0.221***
	(0.042)	(0.023)	(0.037)
Change in centre's all currency share 2013-16		1.523***	1.525***
		(0.222)	(0.247)
Centre's RMB share of all currency trading 2013			0.002
			(0.039)
Constant	0.000	0.000	-0.002
	(0.110)	(0.051)	(0.045)
Adjusted R2	0.351	0.858	0.855
No. of obs.	51	51	51

Sources: BIS (2013, 2016); authors' calculations.

Note: ***, ** indicate significance at the 1 and 5 percent, respectively.

Table 2 Convergence of Mexican peso trading (Dependent variable is change in centre's share of MXP trading, 2013-16)			
	(1)	(2)	(3)
Gap between centre's MXP and all currency share	-0.076**	-0.065***	-0.066***
	(0.03)	(0.02)	(0.02)
Change in centre's all currency share 2013-16		-0.206	-0.204
		(0.156)	(0.155)
Centre's MXP share of all currency trading 2013			0.00000
			(0.00001)
Constant	0.044	0.049	0.043
	(0.052)	(0.05)	(0.047)
Adjusted R2	0.412	0.486	0.478
No. of obs.	51	51	51

Sources: BIS (2013, 2016); authors' calculations.

Note: ***, ** indicate significance at the 1 and 5 percent, respectively. MXN, Mexican peso.
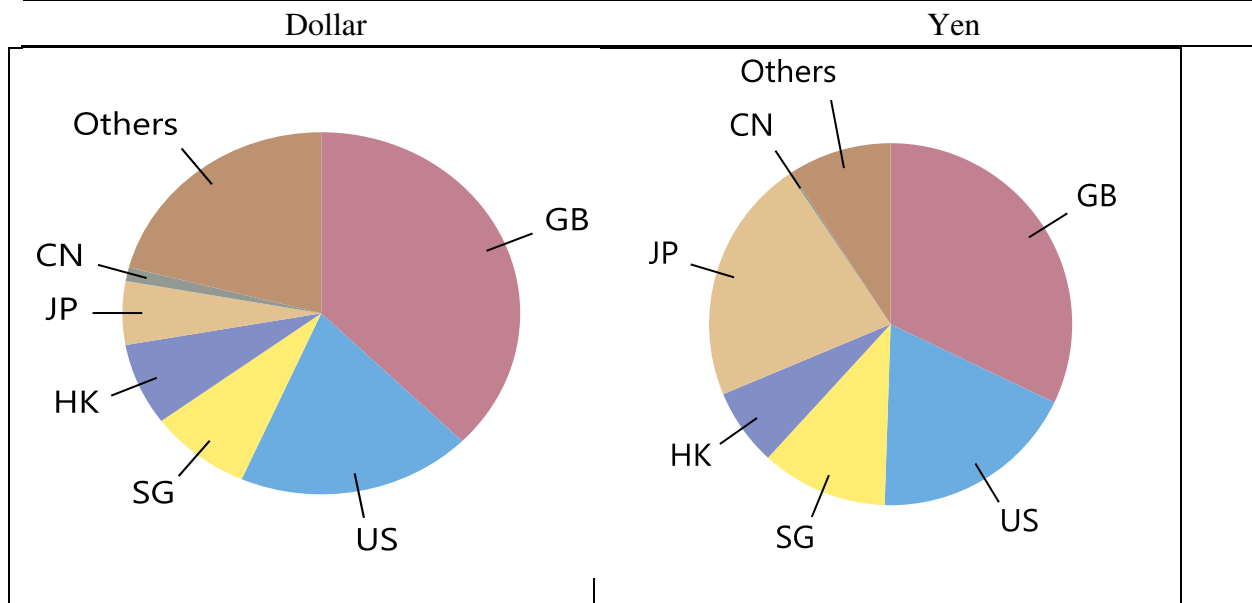
Table 3 Convergence of Emerging Market currency trading to all-currency distribution (Dependent variable is change in centre's share of trading of respective EM currency, 2013-16)

| | 2013 gap: centre's share of trading of currency – all currencies | Change in centre's all-currency share | FX market growth | Macro controls: change | | | | Constant | R2 | # obs. |
				GDP growth	Priv credit	Bilateral FDI	Bilateral trade			
RMB	-0.249	1.622	0	0.006	0.001	-0.002	0.051	-0.025	0.900	41
	(-13.009)**	(11.523)**	(-0.041)	(0.881)	(0.233)	(-0.426)	(1.669)	(-0.203)		
BRL	0.091	0.504	0.04	0.05	-0.005	-0.166	1.976	0.813	0.842	31
	(1.729)	(1.430)	(3.512)**	(1.819)	(-0.425)	(-1.152)	(2.374)*	(2.083)*		
HKD	-0.184	1.291	-0.013	-0.023	-0.015	0.3	1.788	-0.383	0.495	35
	(-2.749)*	(3.586)**	(-1.075)	(-1.545)	(-2.118)*	(0.729)	(3.180)**	(-1.598)		
INR	-0.162	1.338	-0.013	0.013	0.008	-0.089	-0.254	0.065	0.849	34
	(-8.356)**	(8.329)**	(-2.327)*	(1.072)	(1.441)	(-0.649)	(-1.203)	(0.342)		
KRW	-0.076	0.282	0.005	0.001	0.003	-0.187	0.234	-0.108	0.784	33
	(-2.959)**	(1.355)	(1.152)	(0.178)	(0.758)	(-1.843)	(1.676)	(-0.948)		
MXN	-0.139	0.064	0.011	0.004	-0.001	-0.261	-1.482	0.031	0.917	31
	(-10.991)**	(0.552)	(2.881)**	(0.476)	(-0.157)	(-6.435)**	(-3.138)**	(0.284)		
PLN	-0.424	0.577	0.03	0.014	0.001	-0.14	0.176	0.336	0.38	32
	(-1.994)	(1.036)	(1.996)	(0.385)	(0.043)	(-0.610)	(0.543)	(0.656)		
RUB	-0.195	-0.274	0.007	0.028	-0.007	-0.011	0.462	0.456	0.376	29
	(-0.932)	(-0.265)	(0.518)	(1.083)	(-0.555)	(-0.113)	(1.546)	(1.171)		
SGD	0.174	1.78	-0.061	-0.063	-0.003	-1.007	-0.267	-1.122	0.899	35
	(2.147)*	(6.316)**	(-4.660)**	(-3.104)**	(-0.331)	(-6.022)**	(-0.689)	(-3.735)**		
TRY	-0.06	0.888	0.002	0.015	-0.003	0.017	0.097	0.269	0.835	31
	(-1.002)	(2.644)*	(0.365)	(0.989)	(-0.394)	(0.279)	(0.489)	(1.186)		
TWD	0.153	0.702	-0.037	-0.013	-0.038	-0.229	-1.914	-0.109	0.62	33
	(0.953)	(0.611)	(-1.731)	(-0.329)	(-1.616)	(-0.490)	(-1.895)	(-0.176)		

Sources: See Cheung and Yiu (2017); BIS for private credit variable; authors' calculations.

Notes: t statistics in parenthesis. BRL, Brazilian real; HKD, Hong Kong dollar; KRW, Korean won; INR, Indian rupee; PLN, Polish zloty; RUB, Russian rouble; SGD, Singapore dollar; TRY, Turkish lira; TWD, Taiwan dollar; ZAR, South African rand.
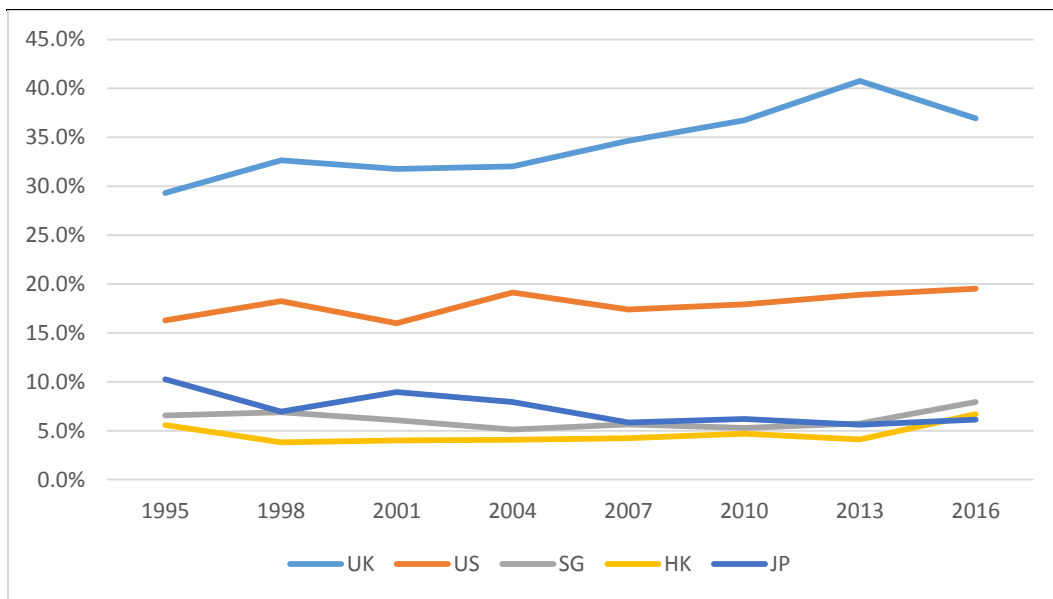
Figure 1. Turnover by Center for the Dollar and Yen, 2016
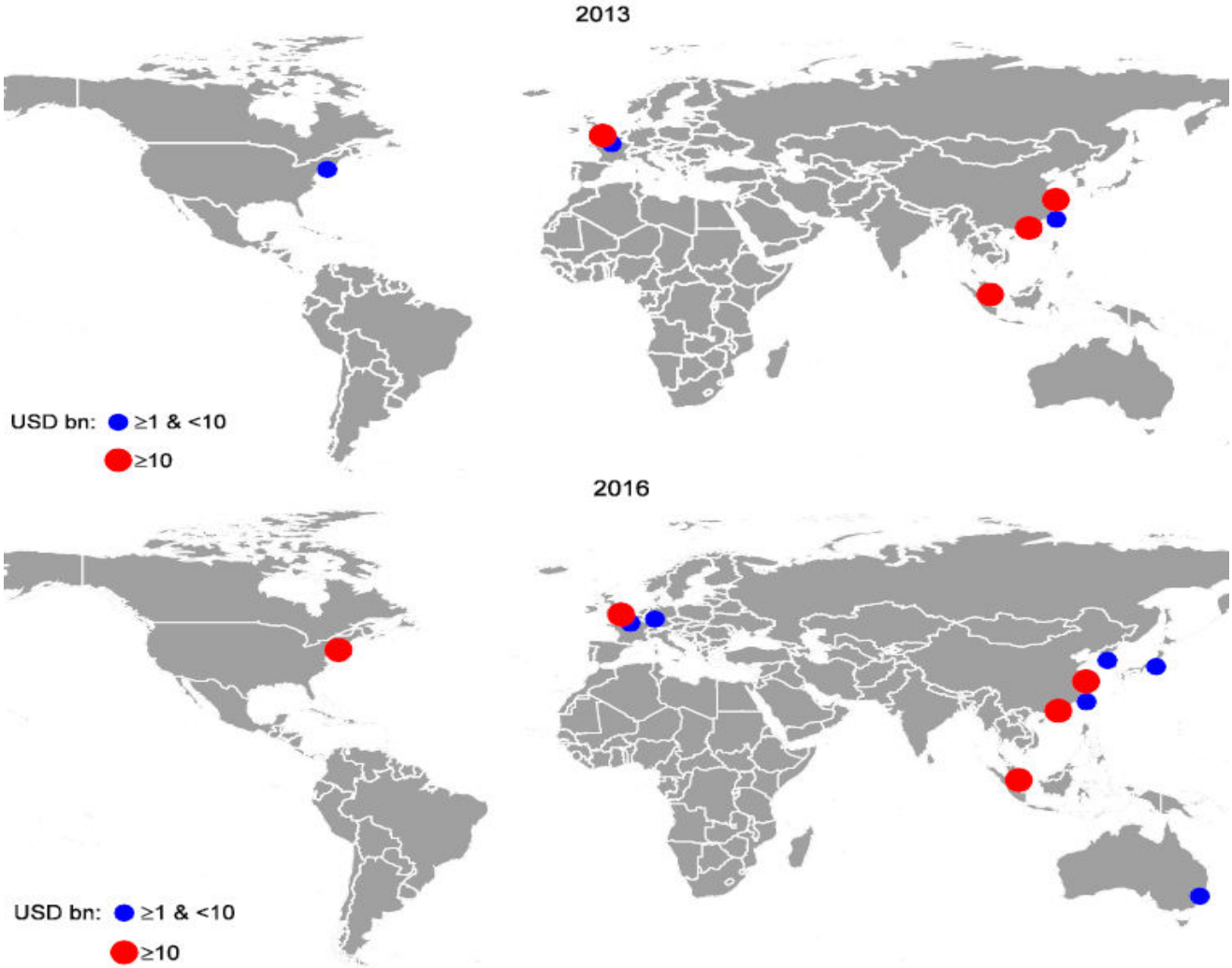
Dollar	Yen

Source: BIS (2016).

Notes: CN, China; HK, Hong Kong; JP, Japan; SG, Singapore; UK, United Kingdom; US, United States.
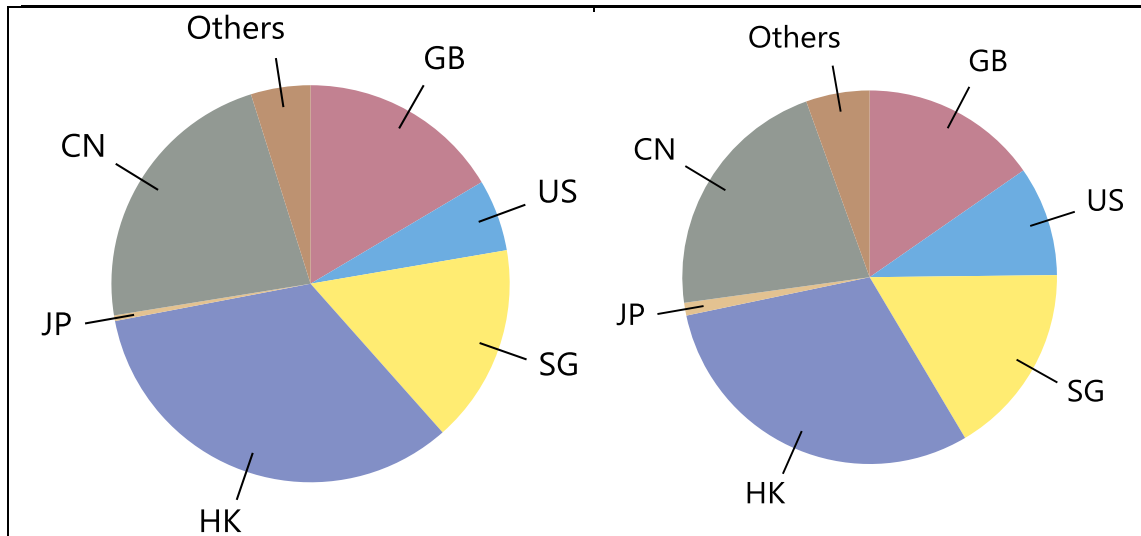
Figure 2: FX turnover shares of top 5 centres

Source: BIS (2016).

Figure 3: Renminbi turnover spreads from Asia between 2013 and 2016

Source: McCauley and Shu (2016).

Figure 4. Turnover of the Renminbi by Location, 2013 and 2016
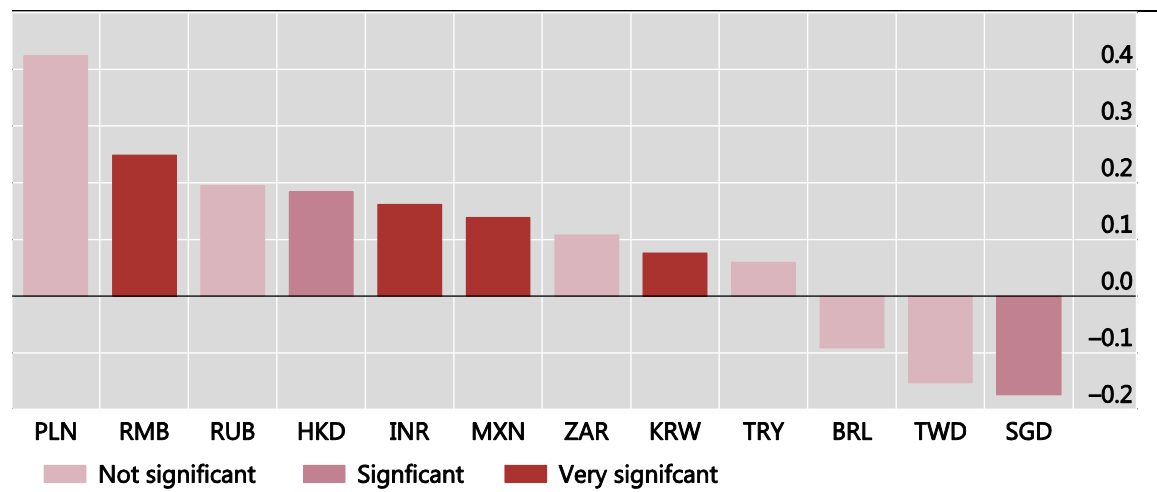

Source: BIS (2016).

Notes: CN, China; HK, Hong Kong; JP, Japan; SG, Singapore; UK, United Kingdom; US, United States.

Figure 5. Renminbi Diffusing Most Quickly

(Coefficient on Gap between Center's Share Trading of Respective Currency and Its Share of All Currencies)

Source: Table 3, negative of gap coefficient in first column.
Notes: BRL, Brazilian real; HK, Hong Kong dollar; KRW, Korean won; INR, Indian rupee; PLN, Polish zloty; RUB, Russian rouble; SGD, Singapore dollar; TRY, Turkish lira; TWD, Taiwan dollar; ZAR, South African rand.