Who cares about the Renminbi?

Vimal Balasubramaniam[1]
Shekhar Hari Kumar[2*]
Ila Patnaik[3]
Ajay Shah[4]

[1] Queen Mary University of London
[2] The Graduate Institute of International and Development Studies, Geneva,
[3] National Institute of Public Finance and Policy, New Delhi,
[4] Independent Researcher

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Abstract

Many researchers have examined the role of the Renminbi as an international currency, particularly after the Chinese authorities undertook policy initiatives for Renminbi internationalisation. We measure one aspect of Renminbi internationalisation: its role in de facto exchange rate arrangements as an anchor. We find that over 70 currencies have shown significant co-movements with the Renminbi over 2005-2017. Most of this global role is the response of some national currencies to unanticipated Renminbi depreciation. However, the contribution to explained variance by the Renminbi for detected currency-regime periods is very small, less than 2% on average, even in East Asian and Pacific-Rim countries who are known to closely track the Renminbi. This suggests that the Renminbi has thus far achieved a very small role in global exchange rate arrangements. Local currency co-movement with the Renminbi is strongest for countries with export exposure to China and Belt and Road initiative linkages. There is heterogeneity in this effect when conditioning on continent, exporter-type, net trade exposure and policy linkages like Belt and Road initiative suggesting multiple modes of future Renminbi internationalisation.

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*Corresponding author. Department of Economics, The Graduate Institute of International and Development Studies. Email: shekhar.hari@graduateinstitute.ch.
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1 Introduction

China's share in global output and its centrality in global trade lends credibility to the prospect of the Renminbi (RMB) as an international currency. Chinese authorities have made a concerted policy push to internationalise the RMB since 2009, via a large expansion of central bank linkages and RMB market development activities all over the world. This process has been a success as the RMB is now the most traded emerging market currency pair and part of the International Monetary Fund's Special Drawing Rights (SDR) basket. The RMB's jump in global foreign exchange market share has drawn comparisons with the ascent of the US Dollar (USD) as a global currency from a century ago, with commentators constantly speculating about *when* and not *if* the RMB will challenge the USD for dominant reserve currency status.

However, there is no consensus amongst economists regarding the role of the RMB in global exchange rate arrangements with two competing views. Tovar and Nor (2018) claim that the RMB is already the second most important anchor currency after the USD. This emerging *RMB bloc* view is disputed by Ilzetzki *et al.* (2019) who argue that the RMB is not flexible enough yet to be considered as an primary anchor currency. In this paper, we focus on the global role of the RMB as an anchor currency and reconcile some of this contradictory evidence. We answer *three inter-related questions* about the Renminbi's role in exchange rate arrangements.

First, we are interested in knowing whether the RMB is used as an anchor for exchange rate stabilisation as part of *de facto* currency baskets. We track currencies that significantly co-move with the RMB by using an augmented Frankel and Wei (1994) (FW) regression that estimates anchor currency basket-weights. Incorporating a novel structural breaks strategy, while allowing for both symmetric and asymmetric co-movements with the RMB across specifications, we find that *74 out of 135* currencies in our sample have at least one currency-regime period of statistically significant co-movement with the RMB between October 2005 and December 2017. In line with previous results, co-movement with the RMB is most pronounced for currencies in Asia-Pacific and Africa.

The count and geographic dispersion of currencies showing significant co-movement seems to suggest a large global role for the RMB. However, the co-movement is symmetric and stable for only a small minority of currencies with most RMB trackers showing greater sensitivity to RMB depreciations, implying a mercantilist motive to tracking the RMB. These aggregate results also hide the extent of time-variation in the co-movement. Less than a third of the currencies that co-move with the RMB, do so for more than half our sample-period. The majority of currencies display small transitory (6-24 months) periods of significant co-movement. This asymmetry and time-variation in RMB co-movements substantially weakens the case for the RMB being a primary currency anchor for these currencies.

Our main methodological contribution is in the inference of the relative importance of the RMB versus other anchor currencies in the augmented FW regression. We assess the economic significance of the RMB in local currency baskets by using squared standardised basket-weight coefficients ($\hat{\mathcal{B}}_t^2$) for relative importance inference. This allows us to re-express all the basket-weight coefficients in terms of their shares in explained variance of a detected currency-regime period. We find that while the size of the unstandardised RMB $\hat{\beta}$ coefficient is large, the contribution of the RMB in the explained variance for significant RMB co-movement periods is quite small ranging between 0-5%.

This enables us to answer our second question, *how important* is the RMB in the global monetary system compared with other reserve currencies, and how its global role has evolved over time.

Aggregating up to the global picture, we find that the RMB has a very small share, *less than 2% on average* as an additional anchor currency in the explained variance of the local currency basket-weight regression. This result holds even for currencies in Asia-Pacific and Africa, who have been known to closely track the RMB.[1] Most of the RMB's share in explained variance is due to periods of unanticipated RMB depreciation. There are *no curencies* that presently use the RMB as a primary anchor. This exercise conclusively shows that the RMB has thus far achieved a much smaller role in global exchange rate arrangements.

Lastly, we examine *why* countries co-move with the RMB to understand the fundamental drivers of potential RMB adoption. We investigate the role of trade, financial and policy linkages with China while controlling for country-characteristics and business cycle synchronisation. We find that trade linkages driven by export exposure to China and the policy linkages like the Belt and Road initiative (BRI) are the most robust fundamental determinants of RMB adoption and co-movement for our full sample. We find interesting variation in these fundamental determinants using sample-splits and interactions. Export exposure only becomes a significant predictor of RMB share in explained variance after announcement of RMB internationalisation policies in 2009. The full-sample effect of export exposure is driven primarily by Non-Asian economies, with its effect being strongest for African countries.

Through interactions, we find that the marginal effect of export exposure in predicting relative importance of the RMB are stronger for commodity exporters. An opposite effect is found for energy exporters. The marginal effect of export exposure also falls in import exposure, GDP size, exchange rate stability and capital account restrictions. This suggests that small open economies with trade and political linkages to China are the most likely to co-move with the RMB. There is variation in policy linkages effects across continents with local currency settlement facilities and ease of payments being important in Asia, BRI and policy affinity in Africa, bilateral swap lines in Europe and bilateral investment treaties in the Americas. This indicates multiple modes of RMB internationalisation at play, which could potentially scale up RMB use in the future. We can preliminarily conclude that co-movement with the RMB is strongest for small (commodity) exporter countries with relatively open capital accounts and flexible exchange rates.

We contribute to the literature on RMB internationalisation and anchor currency choice across various dimensions. We build upon existing methodologies and estimate the RMB basket-weight by embedding it in a structural breaks framework. This enables us to track time-variation in RMB co-movements. We further relax the assumption of symmetric co-movements, by using a linear spline and allowing the basket-weight of RMB appreciation and depreciation to differ. Via this approach, we are able to piece together a holistic view about *when*, *how* and *which* local currencies co-move with the RMB. Our primary contribution is in assessing the relative importance of the RMB. We differ from the extant literature by using RMB's share in explained variance rather than the relative size of the unstandardised RMB $\hat{\beta}$ to infer its role as an anchor (Kawai and Pontines, 2016; Tovar and Nor, 2018; Eichengreen and Lombardi, 2017).

We demonstrate that while the unstandardised RMB $\hat{\beta}$ is large in size, it is primarily because of the small idiosyncratic variance of the RMB. This implies that the RMB fix is usually predictable but *relatively large* however infrequent surprise RMB fluctuations drive large values of the co-movement coefficient. The low variability of the RMB translates into a very small share in explained local currency variance.[2] Studies that infer the relative importance of the RMB us-

[1]We compare the RMB's global average share in explained variance to shares of the Dollar and the Euro (EUR). We find that the USD is a true global currency with an average 60% share in explained currency variance, with the EUR being a distant second with around a 15% share.

[2]For example, If we set the top 1 percentile of RMB exchange rate depreciations to its sample median, we

ing unstandardised basket-weight coefficients are therefore likely to make erroneous conclusions.[3] Using anchor currency shares in explained variance make our results almost invariant to methodological issues like choice of numeraire.[4] These methodological contributions allow us to reconcile conflicting evidence regarding the role of the RMB in global exchange rate arrangements.

We are the first paper to our knowledge, which investigates the determinants of co-movement with the RMB at a global scale using a comprehensive set of economic and policy linkage covariates. Park and An (2020) utilise a similar empirical strategy in their paper, but they examine a much smaller set of currencies. Our results imply that co-movements with the RMB represent a mix of China exposure (including political affinity), exchange rate policy choices as well as common shocks which propagate via foreign exchange markets. For a managed currency like the Malaysian Ringgit, co-movement would be caused by a mix of all the three factors, whereas for a floating currency like the Australian Dollar it would be due to exposure to China and the presence of common shocks.

The rest of the paper is organised as follows. We start by providing context for our choice of research questions in Section 2. We tackle the question of which countries co-move with the RMB in Section 3. We first describe our estimation strategy as well as provide a worked example of our methodology in this section before presenting results for our sample of 135 national currencies. Aggregating the results from Section 3, we examine the importance of the RMB in global exchange rate arrangements in Section 4. We study the determinants of potential RMB anchoring in Section 5. Section 6 concludes with a short discussion of our main results and avenues for future research.

2 Motivations

The Renminbi has been attracting interest as an important regional currency in South-East Asia since the early 2000's. This was largely a consequence of China's increasing centrality in Asian trade networks, making it the second largest trading partner for most South-East Asian economies by the time of its WTO accession in 2001. During this period, the RMB had a hard peg to the USD and a strong system of capital controls limited access to onshore RMB markets. This implied that firms or investors with trade or financial exposure to China did not necessarily have to hedge their currency risk, as the People's Bank of China (PBoC) effectively hedged this risk for them by maintaining the fixed exchange rate system via reserve management.

In July 2005, the PBoC, under pressure from its global trading partners decided to abandon its fixed exchange rate to the Dollar and allow for greater onshore RMB flexibility (Hufbauer and Brunel, 2008). Ho *et al.* (2005) find evidence of statistically significant co-movements for most South-East Asian currencies in the pre-2005 period, which indicates a latent role for the RMB as an exchange rate anchor even before the onshore RMB exchange rate started demonstrating

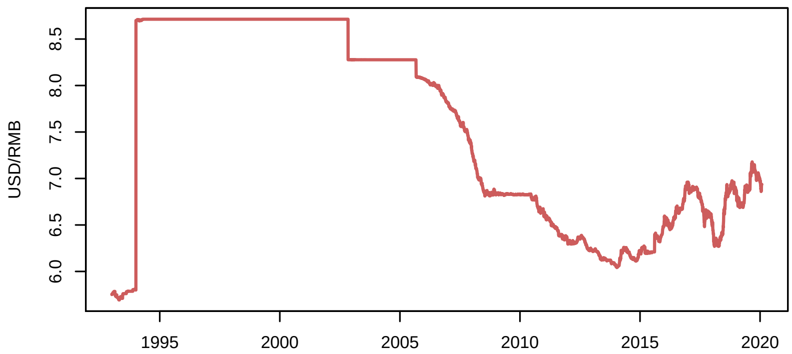
find that the size of RMB $\hat{\beta}$ shrinks substantially. Moreover LASSO estimations of the basket-weight regression almost always shrink the RMB $\hat{\beta}$ to zero, given its low incremental predictive power.

[3] Kawai and Pontines (2016) are the paper most closely related to ours and they reach similar conclusions regarding the role of the RMB as an anchor for Asian currencies. However, Tovar and Nor (2018) using the same methodology, but for a larger set of countries find evidence that points to the emergence of a large RMB bloc. We carefully replicate the methodology from Kawai and Pontines (2016) and show that their key assumption in estimating RMB $\hat{\beta}$ does not hold in the data. This is what inflates the estimated size of RMB $\hat{\beta}$ leading researchers to overstate the global role of the RMB.

[4] We demonstrate the robustness of our methodology by showing that switching numeraire does not qualitatively change our results in Appendix F.2

idiosyncratic variability.[5] Speculation regarding potential RMB appreciation, seems to have driven these statistically significant co-movements for South-East Asian currencies with (large) trade exposures to China. This suggests exchange rate management driven by effective exchange rate concerns for South-East Asian economies versus the Renminbi. Ho *et al.* (2005)'s results also implied a larger role as a regional anchor for a more informative and accessible Renminbi market following onshore market liberalisation.

Figure 1 USD/RMB exchange rate



Note: This figure shows USD/RMB exchange rate since 1993. While there have been many RMB exchange rate reforms during the early sample period, the RMB only starting exhibiting variability after October 2005

First phase of liberalisation: 2005-15

The first phase of liberalisation allowed researchers to examine the role of the RMB as an anchor currency using regression-based methods in the tradition of Frankel and Wei (1994). Regression-based methods of estimating basket-weights of national currencies provide insights into their *de facto* exchange rate regime arrangements. The evolution of the currency-basket composition allows researchers to track changes in exchange rate anchoring behaviour and make inferences about the relative importance of candidate anchor currencies. This approach involves regressing the change in log returns of a national currency versus a basket of anchor currencies, expressed in a common numeraire. The FW framework can be augmented with the RMB as an additional (regressor) anchor currency. The RMB $\hat{\beta}$, if estimated correctly, represents the de facto basket-weight of the national currency to the RMB.

Studies following onshore RMB's exchange rate liberalisation in July 2005 uptil the next major round of liberalisation in August 2015 are divided on the importance of the RMB in Asian/

[5] Ho *et al.* (2005) find significant RMB co-movements for the Korean Won, Indonesian Rupiah, Malaysian Ringgit, Thai Baht, Singapore Dollar, Hong Kong Dollar and New Taiwanese Dollar. They use the non-deliverable forward implied USD/RMB exchange rate as their explanatory variable as the onshore USD/RMB rate was fixed during this period.

global exchange rate arrangements. On balance, the evidence is skewed towards detecting the emergence of a *RMB bloc* in South-East Asian currencies.

The pre-liberalisation results of latent anchoring to the RMB are reiterated by Shu (2010); Ito (2010); Chen *et al.* (2013); Henning (2012); Subramanian and Kessler (2013) for the post-2005 period using variants of the FW methodology with the RMB as an additional regressor. These papers also broadly find positive correlations between trade, financial and business cycle exposure to China and local currency co-movements. In terms of symmetry of the co-movement, Pontines and Siregar (2012) find that the effect of the RMB on Asian currencies is asymmetric and time-varying. Asian currencies showed greater sensitivity to bilateral appreciation versus the RMB than the USD. These results provided the basis for researchers to argue that the RMB may be the *primary* currency anchor for South-East Asian currencies given strong mercantilist motive to prevent excessive bilateral appreciation versus the Yuan (Rajan, 2012). The *RMB bloc* view is corroborated by Fratzscher and Mehl (2014), who present alternative evidence that RMB may already be a major regional currency in an unequal tri-polar global monetary system with the Dollar and the Euro.[6]

However, Balasubramaniam *et al.* (2011), Chow (2014), Kawai and Pontines (2016) and Kim *et al.* (2018) using similar methodology find counter-evidence that suggests a small but increasing role for the RMB as a regional currency, but not as primary anchor. These papers conclude that the USD remains the primary anchor in Asia with a *limited but growing* role for the RMB. The divergence in inference regarding the relative importance of the RMB are caused by seemingly minor differences in methodological choices in the FW regression.[7] Kawai and Pontines (2016) show that the mixed evidence about the role of the RMB is due to econometric problems in precisely estimating the RMB $\hat{\beta}_t$ in the FW regression. Given the tight link between the USD and RMB, adding the RMB as an additional regressor in the FW regression without controlling for this link induces multicollinearity. Differences in dealing with multicollinearity in the FW regression leads to differences in estimated RMB coefficients as well as inference regarding its relative importance. There are three ways researchers have dealt with the multicollinearity problem.

Some researchers may choose to ignore the multicollinearity problem, by estimating the FW regression with the RMB only for periods where the RMB is not tightly pegged to the Dollar (Henning, 2012; Subramanian and Kessler, 2013; Eichengreen and Lombardi, 2017; Park and An, 2020). This methodological choice leads to inflated estimates for RMB basket-weight, which might lead to researchers to over-state the importance of the RMB. Alternatively, researchers may use a two-stage regression strategy, orthogonalising the RMB exchange rate versus the Dollar in the first stage. The residual from this first-stage regression is further used as an explanatory variable in the second-stage FW regression to estimate the RMB $\hat{\beta}$.

There are differences in the estimation of the RMB $\hat{\beta}$ in the second stage. Balasubramaniam *et al.* (2011) estimate the with RMB $\hat{\beta}$ without a parameter restriction on the coefficient. Kawai

[6]They study the effects of RMB exchange rate liberalisation announcements on Asian currencies and show that the announcement effects have grown in size as the RMB has become more flexible. They argue that the role of the RMB in Asian exchange rate arrangements is similar to the role played by the Deutsche Mark as a latent anchor currency in Europe during Exchange Rate Mechanism-I.

[7]More generally, as is the case with empirical research, there is also variation in results due to the choice of inputs in the FW regression. Researchers may use different RMB exchange rates as the dependent variable (onshore, offshore or non deliverable forward implied rate) or choose different numeraires for the basket-weight regression (Swiss Franc, New Zealand Dollar, Special Drawing Rights, U.S. Dollar). There are also differences in frequency of data used, data source and differences in treatment of currency-regime change making various estimates of the RMB $\hat{\beta}$ across studies difficult to compare and reconcile with each other.

and Pontines (2016); Ito (2017), on the other hand, choose to estimate the RMB $\hat{\beta}$ using a parameter restriction that limits the sum of the FW regression $\hat{\beta}$'s to 1.[8] While this two-stage method is more precise than previous methods that ignore the problem of multicollinearity, using a parameter restriction in estimating the RMB $\hat{\beta}$ creates its own set of issues in inference problems.[9] Unsurprisingly, papers with a formal correction of the multicollinearity problem, estimate smaller RMB coefficients and are more sceptical about the RMB's role as an anchor currency. In spite of methodological debates and mixed empirical evidence, researchers could not ignore the RMB's potential as a future reserve currency given the performance of the Chinese economy and policy moves to internationalise the RMB.

The post-financial crisis period was marked by a concerted policy effort to internationalise the RMB as a global Dollar alternative. This included capital market reforms to increase onshore market access, extension of swap lines, development of RMB settlement infrastructure and an expansion of cross-border RMB investments under the Belt and Road initiative (BRI).[10] The incentivisation of the RMB use as an invoicing and reserve currency through central bank to central bank linkages and financial market development activities all over the world is unprecedented in its pace, scale and scope. Moreover, RMB internationalisation (RMBI) policies are the only example of a mostly state-led internationalisation of a national currency which is not freely convertible.[11]

RMB as a global anchor currency? 2015-

Policy developments from the first phase contributed positively in increasing RMB's share in global foreign exchange market turnover from roughly 0% to 4% between 2007 and 2016 (Windsor and Halperin, 2018; BIS, 2016). The positioning of the RMB as an alternative global currency led to comparisons with the ascent of the Dollar as an international currency a century ago (Eichengreen, 2011). Scholars agreed that the RMB had potential to become a global currency but questioned the sequencing of reforms for achieving these objectives as the RMB remained partially convertible and heavily managed against the Dollar (Frankel, 2012; Lee, 2014).

Nevertheless, this post-financial crisis momentum in expanding global RMB use culminated in two key events in the second half of 2015. First, the RMB exchange rate was devalued in Aug 2015 and exchange rate fixing was further liberalised.[12] Second, the RMB was accepted into IMF's Special Drawing Rights (SDR) basket of currencies in acknowledgement of China's economic influence, as well as to continue incentivising the Chinese authorities to liberalise their exchange rate regime and capital markets (Bénassy-Quéré and Capelle, 2014; Eichengreen and Xia, 2019).[13]

Studies following this second wave of RMB exchange rate liberalisation and SDR accession

[8]The RMB $\hat{\beta}$ is estimated as $1 - (\beta_{USD} + \beta_{EUR} + \beta_{GBP} + \beta_{JPY})$.

[9]This has important implications for inference as the parameter restriction may not hold in the data and it over-weighs the RMB $\hat{\beta}$. We deal with issues regarding estimation of the RMB $\hat{\beta}$ in detail, in Section 3

[10]Researchers consider Xiaochuan (2009) as the public starting point of global RMB internationalisation policies.

[11]See Frankel (2012) for more detailed discussion.

[12]Das (2019) finds that the RMB exchange rate is more flexible versus the USD and is linked to the China Foreign Exchange Trade System (CFETS) basket of currencies. She also notes that the RMB is still carefully managed, with the onshore forex market depth and diversity being low compared to other countries with *de jure* floating currencies.

[13]An IMF (2015) survey before RMB's SDR inclusion reported *38 countries* holding RMB in their official foreign currency reserves as of 2014. The RMB might be a latent anchor currency for these countries if they have high economic exposure to China

continued finding evidence of increased currency anchoring behaviour to the RMB for Asia-Pacific currencies (Eichengreen and Lombardi, 2017; Ito, 2017). However, the nature of the co-movement versus the RMB, in spite of greater flexibility in the RMB exchange rate, did not change. It continued to be time-varying and asymmetric as before, mediated by broad Dollar strength, effective exchange rate considerations and predictability of the RMB fix (Marconi, 2018; Keddad, 2019; McCauley and Shu, 2019). This makes it difficult to consider the RMB as a primary anchor for these currencies or conclude that a "stable" *RMB bloc* has formed.

This claim is disputed by Tovar and Nor (2018) and Ito and McCauley (2019) who quantify the degree of reserve currency diversification and classify national currencies to reserve currency blocs on the basis of the anchor currency with the largest (unstandardised) basket-weight. Tovar and Nor (2018) find that 29 currencies with a 15.6% share in global (nominal) GDP co-move with the RMB.[14] They conclude that average size of the RMB bloc measured by the relative influence of the reserve currency is estimated to fall somewhere between 27 and 32 percent of global GDP in terms of purchasing power parity over the 2011-15 period. Ito and McCauley (2019) also find similar results for the size of the RMB bloc. These results suggest that the RMB is already the *second-most important* anchor currency in the world, in an unequal tri-polar currency bloc configuration.

Table 1 Share of SDR currencies in allocated reserves

	USD	EUR	RMB	JPY	GBP	Others
2016Q4	65.36	19.13	1.07	3.96	4.34	6.13
2017Q1	64.68	19.28	1.07	4.54	4.27	6.16
2017Q2	63.83	19.95	1.07	4.63	4.41	6.09
2017Q3	63.52	20.06	1.12	4.52	4.49	6.27
2017Q4	62.72	20.16	1.23	4.90	4.53	6.45
2018Q1	62.79	20.36	1.40	4.59	4.67	6.20
2018Q2	62.40	20.25	1.83	4.86	4.47	6.19
2018Q3	61.93	20.47	1.80	4.97	4.49	6.33
2018Q4	61.74	20.67	1.89	5.20	4.42	6.08
2019Q1	61.86	20.23	1.95	5.25	4.54	6.17
2019Q2	61.63	20.35	1.97	5.41	4.43	6.20

Note: This table shows the currency composition of foreign exchange reserves as per IMF's COFER dataset. The dataset is left censored to account for the inclusion of the RMB in the SDR basket. The final column aggregates the shares of non-SDR reported currencies: The Australian Dollar, Canadian Dollar and Swiss Franc. Source: IMF e-library

This is in contrast with Ilzetzki *et al.* (2019) who argue that the RMB may not be flexible enough to be an individual anchor currency. The RMB's share in allocated foreign exchange reserves seems to corroborate this sceptical view (Table 1).[15] Some divergence of evidence between *de jure* and *de facto* use of the RMB is to be expected given its current stage of internationalisation. Given China's size, centrality and political influence, researchers tacitly expect a greater use of the RMB as an international currency.

There is broad consensus on the reasons *why* currencies may co-move and subsequently adopt the RMB as a reserve currency. Meissner and Oomes (2009) show that trade network externalities are the primary driver of anchor currency choice with a secondary role for output correlations and currency denomination of liabilities. However, merely having the largest trade network, as

[14] They characterise this grouping as a RMB bloc, consisting of the BRICS countries and commodity exporters. They caution that their results may represent an upper bound to the RMB's influence.

[15] We must note that the COFER measure of relative importance is a limited metric of *which* countries care about the RMB. The COFER dataset is voluntary and confidential and does not identify reporters. Its voluntary nature may create a reporting bias regarding towards new or small anchor currencies. It only measures use of the RMB by the official sector, it may understate the magnitude of the spillovers from China's exchange rate policies to other currencies.

China does now, may not be enough to get countries to switch their currency invoicing choice due to path-dependence given the presence of non-trivial switching costs (Dowd and Greenaway, 1993; Uribe, 1997).

We can broadly categorise the reasons for co-movement with the RMB into trade, financial, business cycle and policy linkages (McCauley and Shu, 2019). The first three set of linkages are well-understood as they are a consequence of a country's global output share. As expected, researchers have found a positive role for trade share with China, stock market and inflation correlations in driving currency co-movements (Subramanian and Kessler, 2013; Eichengreen and Lombardi, 2017). Recently, Park and An (2020) find that exchange rate flexibility and portfolio flow linkages in addition to trade share predict co-movements with the RMB. Increases in Chinese trade intensity and financial openness over the last 15 years suggest a role for both trade and financial linkages in determining the extent of the co-movement with the RMB. There is also reason to believe that the effects of RMB flexibility will differ based on broad exposure to the Chinese business cycle (demand shocks), given its out-sized role in some commodity/product markets (Baum *et al.*, 2015; Kim *et al.*, 2015; Stuermer, 2017).

In the RMB's case, bilateral political affinity and RMBI policies may be *as important* as traditional pecuniary (transaction cost) motives in determining which countries adopt it as a currency anchor. These linkages are critical for the specific case of the RMB as the currency is not freely convertible. To overcome this issue in scaling the RMB's use, the PBoC has used many instruments like local currency settlement (LCY) arrangements and bilateral currency swaps (BCS) with central banks.[16] RMB infrastructure may also be adopted by countries to gain a first mover advantage in a new asset class or be "bundled" along with other Chinese bilateral policy agreements.[17] Bahaj and Reis (2020) show that swap lines may enhance the use of a newly internationalising currency like the RMB. This is an important insight as getting countries to invoice trade in the RMB would be difficult without explicit policy support or freer convertibility or a combination of both.[18]

There is also evidence of reverse-causality between countries' political affinity to China and receiving/adopting RMB infrastructure given the state-led nature of RMBI. Liao and McDowell (2016) find that "policy affinity" to China as compared to the United States is the most robust predictor of RMB reserve adoption as compared to other more traditional motives of reserve portfolio diversification.[19] Chinese economic diplomacy and outreach is most effective with countries who already have strong international relations with China. This may be an important point to consider as China is the biggest bilateral aid donor in the world. Liu and Tang (2018) find that Chinese aid has a greater impact on bilateral trade with African nations as compared to US aid. Similarly, Zhang *et al.* (2017) find a positive effect on trade through signing a swap agreement, which increases in magnitude for BRI countries. This effect may extend to exchange rate co-movements as well as Zhou *et al.* (2020) show that BRI policies have increased the centrality of the RMB in driving exchange rate movements for BRI signatories. There seems to

[16] Song and Xia (2019) test the RMB infrastructure hypothesis for signing of BCS and find that they serve as a "confidence building" signal and significantly increase share of foreign currency trades with the RMB/LCY pair.

[17] Chey *et al.* (2016) also find that countries with a global financial centre, preferential trade agreements or bilateral investment treaties are most likely to adopt RMB infrastructure rather than trade linkages.

[18] The experience of the Japanese Yen as a global currency suggests that even the right market and policy environments may not be enough to overcome the path-dependence of switching invoicing currency, limiting the positive network externalities via the trade linkages channel (Goldberg and Tille, 2008; Ito and Chinn, 2014; Ito and Kawai, 2016). Sato and Shimizu (2018) and Lapukeni and Kiyotaka (2019) both find evidence to suggest that RMB's share in currency invoicing does not match its trade share.

[19] See Bailey *et al.* (2017) for more details of this measure of ideological similarity based on United Nations General Assembly voting records

be strong complementarities between political affinity, selection into policy linkages and related positive effects on trade and financial flows which may cause co-movements with the RMB.[20] This makes it critical to consider the role of both "policy affinity" and policy linkages along with standard optimal currency area variables for explaining *de facto* adoption of the RMB.

To quickly summarise, there is a great deal of disagreement regarding the role and importance of the RMB in global exchange rate arrangements. China is already the world's largest trader and second largest economy. Chinese authorities have made a fair deal of progress over the last decade in creating policy linkages to internationalise its currency. The RMB is a part of the SDR basket along with being one of the 10 most traded currency pairs in the world. Chinese macroeconomic news, which includes information about the RMB exchange rate, are known to generate spillovers on asset prices, especially for countries with trade exposure to China. On the flipside, the RMB exchange rate remains tightly managed and partially convertible. Co-movements versus the RMB are asymmetric and time-varying, suggesting the emergence of an unstable RMB bloc at best. In this paper, we sequentially address three inter-related questions regarding the RMB's global role:

1. In which countries does the RMB play an important role for the exchange rate regime? (*Who* cares about the RMB?)
2. Aggregating up to the global picture, how important is the RMB in the global monetary system?
3. What are the characteristics of the countries where the RMB is important?

This allows us to reconcile some of the contradictory evidence in the literature while providing sharper insights about current state of RMB internationalisation.

3 Who cares about the RMB?

In the benchmark FW model, the basket weights of a national currency are estimated by regressing it on major reserve currencies: US Dollar (USD), British Pound (GBP), Japanese Yen (JPY) and the Deutsche Mark/Euro (DEM/EUR) all expressed in log returns with a common numeraire. We augment this model with the RMB as an additional regressor. We choose the New Zealand Dollar (NZD) as our numeraire currency similar to Kawai and Pontines (2016) given that its a floating currency belonging to a small open economy.[21] We use foreign exchange rate returns at a weekly frequency (Friday to Friday returns) as compromise between using daily returns which tend to be noisy and have an overlapping returns problem in a global setting and monthly exchange rate returns, which have a much smaller T for estimating the model.

If one desired an estimation with the Malaysian Ringgit (MYR), the model estimated is:

[20] Chey and Hsu (2020) suggests that these effects may also be heterogeneous across different regions suggesting multi-modality in the effect of different policy instruments in incentivising RMB use.

[21] Researchers have used the Swiss Franc (CHF), Special drawing rights (SDR) and the New Zealand Dollar (NZD) as numeraires. The estimation of basket-weights using a common-numeraire approach has some shortcomings as changing the numeraire may change the basket-weight estimate. Additionally, the numeraire currency used may have large idiosyncratic shocks which may affect the basket-weight coefficient estimates. The original FW model used the Swiss Franc as a numeraire but we choose not to use it given heavy management of the Franc exchange rate versus the Euro post the global financial crisis which would bias the estimated Euro basket-weights. Given its large time series of being a floating exchange rate with an inflation targeting anchor, we use the NZD as a numeraire. We present a discussion on how numeraire choice may affect our results in Appendix F.

$$d\log\left(\frac{\text{MYR}}{\text{NZD}}\right) = \alpha + \beta_1 d\log\left(\frac{\text{USD}}{\text{NZD}}\right) + \beta_2 d\log\left(\frac{\text{GBP}}{\text{NZD}}\right) + \beta_3 d\log\left(\frac{\text{JPY}}{\text{NZD}}\right) + \beta_4 d\log\left(\frac{\text{EUR}}{\text{NZD}}\right) + \beta_5 d\log\left(\frac{\text{RMB}}{\text{NZD}}\right) + \epsilon \quad (1)$$

As shown by Balasubramaniam *et al.* (2011) and Kawai and Pontines (2016) the addition of $\frac{RMB}{NZD}$ to the Equation 1 without controlling for the relationship between the RMB and the other SDR-currencies creates a multicollinearity problem. The RMB has historically been pegged to the Dollar and gradually shifted to a more diversified basket since October 2005. To demonstrate the extent of the multicollinearity problem, we run the FW model for the RMB (equation 2) using the Zeileis *et al.* (2010) structural breaks framework with weekly exchange rate returns. Table 2 shows the results of the structural break estimation of the onshore Renminbi and Figure B.1 shows the time series of the USD/RMB exchange rate from 2005 to 2018 superposed with the break-dates. The structural breaks estimation picks up 3 statistical breaks which correspond well to large policy changes in RMB exchange rate management (Das, 2019).

$$d\log\left(\frac{\text{RMB}}{\text{NZD}}\right) = \gamma_1 + \gamma_2 d\log\left(\frac{\text{USD}}{\text{NZD}}\right) + \gamma_3 d\log\left(\frac{\text{GBP}}{\text{NZD}}\right) + \gamma_4 d\log\left(\frac{\text{JPY}}{\text{NZD}}\right) + \gamma_5 d\log\left(\frac{\text{EUR}}{\text{NZD}}\right) + \epsilon \quad (2)$$

Table 2 RMB exchange rate regime break dates

	Start Date	End Date	R^2	USD	EUR	GBP	JPY	Intercept	Variance
1	2005-10-07	2009-01-09	0.99	0.94***	0.05***	0.01	0.00	-0.10	0.04
				(61.4)	(3.21)	(0.38)	(-0.30)		
2	2009-01-23	2010-06-18	1.00	0.99***	0.01*	0.00	0.00	-0.00	0.00
				(211.66)	(1.87)	(0.27)	(0.29)		
3	2010-06-25	2015-08-07	0.98	0.93***	0.02	0.03*	0.00	-0.04	0.05
				(58.98)	(1.39)	(1.82)	(0.29)		
4	2015-08-14	2017-12-29	0.89	0.79***	0.02	0.05	0.07**	0.05	0.22
				(18.61)	(0.34)	(1.28)	(1.96)		

*p<0.1; **p<0.05; ***p<0.01

Note: This table shows the estimated coefficients and break dates for the RMB using the FW regression with weekly returns and a NZD numeraire.

Even in the most recent period between the exchange rate devaluation in August 2015 to the end of 2017, the USD $\hat{\beta}$ is 0.79. The R^2 for this period is also 0.89 indicating a de facto exchange rate arrangement which is at the higher end of currency management compared to managed floats. This shows the need to control for the effect of the other anchor currencies on the RMB in order to correct for multicollinearity in estimating equation 1. The residuals from the structural breaks estimation of equation 2 represent idiosyncratic movements in the RMB which are not explained by changes in the basket currencies. We estimate equation 2 with structural breaks and plug the regime period-wise residuals which we term as the orthogonalised RMB_o exchange rate in equation 1 to yield our workhorse model shown in equation 3.[22]

[22]Figure B.2 shows the piece-wise orthogonalised RMB_o based on structural break estimation of equation 1. It shows us that the RMB is gradually becoming more flexible and showing two-sided volatility.

$$d\log\left(\frac{\text{MYR}}{\text{NZD}}\right) = \alpha + \beta_1 d\log\left(\frac{\text{USD}}{\text{NZD}}\right) + \beta_2 d\log\left(\frac{\text{GBP}}{\text{NZD}}\right) + \beta_3 d\log\left(\frac{\text{JPY}}{\text{NZD}}\right)$$
$$+\beta_4 d\log\left(\frac{\text{EUR}}{\text{NZD}}\right) + \beta_5 d\log\left(\frac{\text{RMB}_o}{\text{NZD}}\right) + \epsilon \tag{3}$$

Note that if the parameters/break-dates of equation 2 change, as is the case with statistical structural break detection over time, it is trivial to re-estimate RMB_o.[23] Post-estimation, we are concerned only with the *positive values* of the RMB_o $\hat{\beta}$ coefficient from equation 3 as positive coefficients are predictors of anchoring behaviour.[24] Therefore, we use a one-tailed test at a 95% significance level for the RMB_o $\hat{\beta}$. This is a maximalist approach where we might have a data-mining bias (potential type-I error) with a weaker statistical test. This bias towards classifying currencies as RMB trackers is by design as our aim is to err on the side of over-classification and identify the full range of currencies that co-move with the RMB_o. Unlike other papers in this literature, we do not use unstandardised-coefficients from this estimation to infer the relative importance of the RMB_o in the national currency basket. Our bias only exists in classification of the currencies RMB co-movers/trackers.

Our first major innovation is in understanding the dynamics of the co-movement of national currencies with the RMB_o. We investigate one aspect of it, symmetry, by modifying equation 3 with a (linear spline) knot at $\frac{\text{RMB}_o}{\text{NZD}} = 0$ while retaining the structural breaks framework. We allow the the slope to differ for Renminbi appreciation $\text{RMB}_{o(A)}$ (positive $\hat{\beta}$ indicates that a currency appreciates when RMB appreciates) and depreciation $\text{RMB}_{o(D)}$ (positive $\hat{\beta}$ indicates that a currency depreciates when the RMB depreciates). As before, we are only interested in positive RMB_o $\hat{\beta}$ values using a one-tailed test. The choice of a weaker statistical test is by design so as to identify the full range of currencies who may *only* have a positive one-sided co-movement with the RMB_o.[25]

$$d\log\left(\frac{\text{MYR}}{\text{NZD}}\right) = \alpha + \beta_1 d\log\left(\frac{\text{USD}}{\text{NZD}}\right) + \beta_2 d\log\left(\frac{\text{GBP}}{\text{NZD}}\right) + \beta_3 d\log\left(\frac{\text{JPY}}{\text{NZD}}\right)$$
$$+\beta_4 d\log\left(\frac{\text{EUR}}{\text{NZD}}\right)$$
$$+\beta_{depreciation} d\log\left(\frac{\text{RMB}_o}{\text{NZD}}\right) * (D = 1| \frac{\text{RMB}_o}{\text{NZD}} > 0) + \tag{4}$$
$$\beta_{appreciation} d\log\left(\frac{\text{RMB}_o}{\text{NZD}}\right) * (D = 1| \frac{\text{RMB}_o}{\text{NZD}} < 0) + \epsilon$$

The difference between the $\text{RMB}_{o(D)}$ and $\text{RMB}_{o(A)}$ $\hat{\beta}_{c,t}$ enables us to make inferences about the symmetry of that national currency to RMB_o movements. This helps us gain insights about *when* and *how* currencies might co-move with the RMB. Comparing RMB_o $\hat{\beta}_{c,t}$, $\text{RMB}_{o(A)}$ $\hat{\beta}_{c,t}$ and $\text{RMB}_{o(D)}$ $\hat{\beta}_{c,t}$ estimates across equation 3 and equation 4 enables us to classify a currency

[23]Based on results from McCauley and Shu (2019) we know that the post Aug 2015 period may have had more sub-regimes of RMB management. They use daily data to detect changes in the currency regime. This does not show up as a significant change via our structural break algorithm with weekly data when compared to the events of Aug 2015.

[24]This is a standard practice in the literature, as negative coefficients are rare and are usually ignored as they indicate currency-basket diversification rather than primary anchoring (Ito and McCauley, 2019).

[25]We want to identify *as many currencies as possible* that co-move with the RMB to ensure that we can gauge the global footprint as well as future potential of a newly internationalising currency. In other words, we stack the decks, in favour of the RMB being an international currency.

(country) into categories of two-way/symmetric sensitivity (RMB$_o$ $\hat{\beta}_{c,t} > 0$), asymmetric depreciation sensitivity (RMB$_{o(D)}$ $\hat{\beta}_{c,t} > 0$) or asymmetric appreciation sensitivity (RMB$_{o(A)}$ $\hat{\beta}_{c,t} > 0$). A currency may have any combination of the 7 possible combinations for three coefficients at a given time in the sample, with all three coefficients being zero the excluded category.

The literature suggests that the most currencies that co-move with the RMB would have RMB$_o$ $\hat{\beta}_{c,t} > 0$ along with RMB$_{o(D)}$ $\hat{\beta}_{c,t} > 0$, which implies that most of the positive RMB$_o$ $\hat{\beta}_{c,t}$ from equation 3 is driven by unanticipated RMB$_o$ depreciation. This would be in line with a mercantilist/effective exchange rate management motive. This linear spline technique is general enough to be applied for the other reserve currencies, but in this paper, we restrict our attention to RMB$_o$.

Our main methodological contribution is in the inference of the relative importance of the RMB$_o$ versus other anchor currencies in the augmented FW regression. We argue that the correct way to interpret the basket-weights in the FW model augmented with RMB$_o$ is by utilising *standardised relative importance metrics* instead of unstandardised coefficients. The rationale is as follows: Given the negligible variance of the RMB$_o$ compared to the other floating reserve currencies, the RMB$_o$ $\hat{\beta}$ estimated by OLS tends to be large given the presence of high leverage observations (sudden large changes in the RMB fix), when a parameter restriction is not applied to Equation 3. The size of the unstandardised RMB$_o$ $\hat{\beta}$ may lead a researcher to erroneously infer the RMB$_o$ having the largest basket-weight on a currency.

Kawai and Pontines (2016) try to solve this issue of large unstable RMB$_o$ $\hat{\beta}$'s by using a parameter restriction which restricts the sum of the augmented FW regression coefficients from equation 3 to add up to 1. They recover the RMB$_o$ $\hat{\beta}$ as $1 - (\beta_{USD} + \beta_{EUR} + \beta_{GBP} + \beta_{JPY})$. This parameter restriction creates it own set of inference problems. If the parameter restriction does not hold in the data, this technique over-assigns the remaining basket-weight to the RMB$_o$ $\hat{\beta}$. This over-assignment of RMB$_o$ basket-weight is particularly problematic for currencies with flexible exchange rates or diversified managed floaters with $\beta_{USD} + \beta_{EUR} + \beta_{GBP} + \beta_{JPY} < 0.6,\ where\ R^2 < 0.80$, who may be mis-classified as being part of a RMB bloc.[26]

We use a squared standardised coefficient to infer the economic significance of co-movements with the RMB$_o$. Equation 5 shows the calculation of the standardised coefficients. We re-express the $\hat{\beta}$'s from Equation 3 in terms of the standard deviation of the regressors and obtain the standardised coefficients $\hat{\mathcal{B}}$.

$$
\begin{aligned}
d\log\left(\frac{\text{MYR}}{\text{NZD}}\right) &= \alpha + \hat{\beta}_1 \frac{\hat{\sigma_1}\frac{\text{USD}}{\text{NZD}}}{\hat{\sigma_y}\frac{\text{MYR}}{\text{NZD}}} d\log\left(\frac{\text{USD}}{\text{NZD}}\right) + \hat{\beta}_2 \frac{\hat{\sigma_2}\frac{\text{GBP}}{\text{NZD}}}{\hat{\sigma_y}\frac{\text{MYR}}{\text{NZD}}} d\log\left(\frac{\text{GBP}}{\text{NZD}}\right) \\
+\hat{\beta}_3 \frac{\hat{\sigma_3}\frac{\text{JPY}}{\text{NZD}}}{\hat{\sigma_y}\frac{\text{MYR}}{\text{NZD}}} d\log\left(\frac{\text{JPY}}{\text{NZD}}\right) &+ \hat{\beta}_4 \frac{\hat{\sigma_4}\frac{\text{EUR}}{\text{NZD}}}{\hat{\sigma_y}\frac{\text{MYR}}{\text{NZD}}} d\log\left(\frac{\text{EUR}}{\text{NZD}}\right) + \hat{\beta}_5 \frac{\hat{\sigma_5}\frac{\text{RMB}_o}{\text{NZD}}}{\hat{\sigma_y}\frac{\text{MYR}}{\text{NZD}}} d\log\left(\frac{\text{RMB}_o}{\text{NZD}}\right) + \hat{\epsilon}
\end{aligned}
\tag{5}
$$

$$\Updownarrow$$

$$\hat{\mathcal{B}}_1\text{USD} + \hat{\mathcal{B}}_2\text{GBP} + \hat{\mathcal{B}}_3\text{JPY} + \hat{\mathcal{B}}_4\text{EUR} + \hat{\mathcal{B}}_5\text{RMB}_o + \hat{\epsilon}$$

[26] We must note here that this technique *may* work satisfactorily under some stringent conditions. This includes validity of the parameter restriction as well as the currency in question being being heavily managed with a high R^2 on the augmented FW regression. See Appendix F for a detailed discussion of our methodological choices for estimating the RMB$_o$ $\hat{\beta}$ in the literature. We show that our estimation strategy without any parameter restrictions would be more apt for estimating the RMB$_o$ $\hat{\beta}$.

We square the standardised $\hat{\mathcal{B}}$ coefficients from this calculation and this $\hat{\mathcal{B}}^2$ is our main metric of relative importance of anchor currencies. Under standard assumptions, individual $\hat{\mathcal{B}}^2$'s represents the relative contribution of the regressors to the explained variance in the model.[27] The value of $\hat{\mathcal{B}}^2$'s varies between 0 and 1, with higher values signifying a larger share in the explained variation. We only consider $\hat{\mathcal{B}}^2$ values for statistically significant $\hat{\beta}$ coefficients from our one-tailed test.

This re-expression makes our results almost entirely independent of the numeraire.[28] The scale-invariant $\hat{\mathcal{B}}^2$'s can now be compared to each other and we can accurately answer questions regarding the relative importance of the RMB in the exchange rate arrangement of a national currency. We follow the same procedure for our spline specification as well. The next section shows a worked example of our technique for a known RMB tracker: The Malaysian Ringgit.

3.1 Example: Malaysian Ringgit

Table 3 Malaysian Ringgit and the RMB

	Start Date	End Date	R^2	USD	EUR	GBP	JPY	RMB_o	Intercept	Variance
1	2005-10-14	2007-06-01	0.95	0.83^{***}	0.01	0.15^{**}	0.02	1.11^{***}	-0.05	0.13
				(18.88)	(0.14)	(2.41)	(0.37)	(2.83)		
2	2007-06-08	2015-07-31	0.74	0.70^{***}	0.09^{**}	0.07^{*}	-0.03	0.59^{***}	0.04	0.61
				(16.82)	(2.55)	(1.79)	(-1.14)	(3.32)		
3	2015-08-07	2016-12-16	0.40	0.68^{***}	0.14	-0.01	-0.18	1.01^{***}	0.12	2.24
				(4.2)	(0.59)	(-0.06)	(-1.37)	(2.58)		
4	2016-12-23	2017-12-29	0.88	0.70^{***}	0.14^{*}	0.08	0.03	0.12	-0.11	0.16
				(8.55)	(1.73)	(1.42)	(0.45)	(0.76)		

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$; One-tailed test for RMB_o, t-values in parentheses

Note: The MYR is one of the most integrated currencies with the RMB owing to deep global value chain linkages with China. This table shows the estimated coefficients and break dates for the augmented FW regression. One can clearly note that the USD is the only currency which loads significantly in every period

We illustrate our methodology by using the Malaysian Ringgit as an example currency. Bank Negara Malaysia was the first central bank which modified its currency basket in response to PBoC's announcement regarding the RMB in July 2005. Historically, the RMB has maintained a high weight in the Ringgit currency basket because of deep trade and financial linkages between the countries. Table 3 shows that the MYR had significant co-movement with the RMB, between 2005-2016 and that link seems to have been loosened in the most recent period since the end of 2016. There seems to be some switching behaviour in the MYR's co-movement with all the FW currencies except the USD.[29] This combination of active management and shocks are reflected in the large variation in the R^2 with the most recent period hinting towards a return to a Dollar-based managed float after a long phase of attempted basket-management.

[27] The $\hat{\mathcal{B}}^2$ measure ignores the covariance structure of the regressors. It should not matter for the RMB_o $\hat{\mathcal{B}}^2$ estimate as it is orthogonal to the other regressors.

[28] See Appendix F.2 for a discussion of how changing the numeraire from NZD to CHF has an effect on 10% of the detected currency-regime periods but has little effect on the estimated variance share of the RMB_o in explained variance of a currency.

[29] Yoshino *et al.* (2016) model the MYR reacting to the RMB's evolving currency basket in a DSGE setting (with US, China and Japan as the exogenous sources of shocks) and find that a switch from a USD peg to a basket peg with optimal weights is the optimal policy alternative for the MYR. This strategy is always preferred to sudden "surprise" responses to changes in RMB management. The detected changes in the MYR's basket weights may be explained by a similar calibration exercise along with responding to common global shocks.

Table 4 Variance decomposition for the Malaysian Ringgit

	Start Date	End Date	R^2	USD $\mathcal{B}^2$	EUR $\mathcal{B}^2$	GBP $\mathcal{B}^2$	JPY $\mathcal{B}^2$	RMB$_o\mathcal{B}^2$
1	2005-10-14	2007-06-01	0.95	0.67	0.00	0.02	0.00	0.01
2	2007-06-08	2015-07-31	0.74	0.59	0.01	0.01	0.00	0.01
3	2015-08-07	2016-12-16	0.40	0.36	0.01	0.00	0.03	0.06
4	2016-12-23	2017-12-29	0.88	0.55	0.02	0.01	0.00	0.00

Note: The RMB has maintained a high weight in the Malaysian Ringgit currency regime but this is not reflected in the variance decomposition. This table shows standardised $\mathcal{B}^2$ coefficients expressed as a share of the explained variance for each regressor. This is a crude metric for relative importance of the reserve currencies. The variance contribution of the RMB on the MYR is less than 1% of explained variance on average for the entire sample period and peaks at 6% during the RMB devaluation episode of 2015-16

Table 4 shows the standardised $\mathcal{B}^2$ coefficients for the regression in Table 3. Except for period 3 between 2015-08-07 to 2016-12-16, which includes a large RMB devaluation, the variance explained by the RMB$_o$ does not exceed 1% of the R^2. Even for period 3, where the share in explained variance of the RMB$_o$ is high, the USD share is 6 times larger and this regime-period sees a large fall in the R^2. This illustration shows the issues with unstandardised coefficient-based inference of the augmented FW regression when the underlying regressors have large differences in variance. Unstandardised coefficient-based inference would show the RMB$_o$ as the *primary* anchor currency for the MYR for 2 out of 4 identified periods.

The difference between the inference of relative importance using unstandardised and standardised coefficients also indirectly reflects the credibility of PBoC's RMB management. The week to week movements of the RMB are tightly managed allowing downstream currencies to ignore RMB$_o$ fluctuations as long as they might be in a de facto tolerance band. Moreover, the high USD $\hat{\beta}$ for the RMB and MYR reflects a complex multilateral currency management situation with versus the USD. Given the Ringgit's flexibility compared to the RMB, it allows Malaysian reserve managers to follow the moves of the PBoC in the foreign exchange markets when it aligns with their policy objectives.

The small share in explained variance also hints that RMB would not be the first choice as a vehicle currency for foreign exchange market intervention given its low predicted price impact, reducing its attractiveness as a asset for foreign exchange reserves. However, there might be occasional spurts of volatility driven by Chinese news, exchange rate policy change or common capital flows which causes high sensitivities reflected by the large (unrestricted) RMB$_o$ $\hat{\beta}$. Spillovers from the RMB exchange rate channel are important, but it is nowhere close to being a primary anchor currency. Our estimates indicate that the USD remains the dominant currency in terms of explained variance share in the MYR irrespective of period considered, with the RMB a being *distant second* at best.[30]

Table 5 shows the results of running the linear spline specification from Equation 4. This specification is aimed at understanding the difference in sensitivities for currencies co-moving with

[30] If a Kawai and Pontines (2016) style parameter restriction of was used to estimate the RMB$_o$ $\hat{\beta}$, they would correctly identify that the USD is the primary anchor currency for the Ringgit across all periods. The parameter restriction, in spite of its classification success creates some additional issues. As mentioned before, the parameter restriction of the augmented FW coefficients adding up to 1 does not hold in the data. Additionally, it would over-estimate the size of RMB$_o$ $\hat{\beta}$ for periods 2 and 3, making further standardised coefficient-based inference unreliable.

Table 5 Spline estimation: Malaysian Ringgit and the RMB

	Start Date	End Date	R^2	USD	EUR	GBP	JPY	$\text{RMB}_{o(A)}$	$\text{RMB}_{o(D)}$	Intercept	Variance
1	2005-10-14	2007-08-24	0.95	0.82***	0.02	0.21***	-0.03	-0.15	5.21***	-0.19	0.14
				(18.84)	(0.27)	(3.35)	(-0.54)	(-0.32)	(4.78)		
2	2007-08-31	2015-01-30	0.75	0.70***	0.10***	0.05	-0.03	0.82***	0.49	0.05	0.58
				(16.28)	(2.68)	(1.33)	(-1.19)	(2.8)	(1.55)		
3	2015-02-06	2016-12-16	0.45	0.72***	0.07	0.04	-0.12	-0.57	1.41***	-0.12	1.89
				(5.68)	(0.52)	(0.37)	(-1.12)	(-0.64)	(3.1)		
4	2016-12-23	2017-12-29	0.88	0.72***	0.12	0.10	0.01	-0.00	0.45	-0.17	0.16
				(8.54)	(1.45)	(1.64)	(0.18)	(-0.01)	(1.09)		

*p<0.1; **p<0.05; ***p<0.01; One-tailed test for RMB_o, t-values in parentheses

Note: This table shows the results for the MYR while running our linear spline specification. They suggest a time-varying sensitivity to RMB depreciation and appreciation. This suggests mercantilist motives to manage the MYR asymmetrically versus the RMB, with partial pass-through of appreciation and higher sensitivity to depreciation.

the RMB for periods of idiosyncratic appreciation versus depreciation. The results from this estimation provides important insights. First, there is a minor change in detected break periods with a small shift in regimes between period 2 and 3 by 6 months. This is interesting in itself as it suggests the MYR was sensitive to depreciation pressures on the RMB before the announcement of the exchange rate reform in Aug 2015. Second, the coefficients of RMB_o appreciation and depreciation are significantly different from each other for all periods, except the last one suggesting a time-varying asymmetry in movement versus the RMB.

In the first period and third period, the $\text{RMB}_{o(D)}$ coefficient is significantly different from 0 and much larger than the $\text{RMB}_{o(A)}$ coefficient. These are periods where the MYR depreciated when the RMB depreciated, potentially in a competitive manner or as a reflection of differences in country-risk. Period 2 has an interesting result where the MYR shows a sensitivity to the $\text{RMB}_{o(A)}$ coefficient but the magnitude of the coefficient is positive. This implies that the Malaysian authorities were happy to let the Ringgit partially appreciate when the RMB appreciated in the post-financial crisis regime-period via its strong USD peg. This time-varying asymmetry suggests a mix of mercantilist and exchange rate stability motives with selective pass-through of appreciation and higher sensitivity to depreciation. The last period of 2016-12 to 2017-12 doesn't have a positive coefficient for either $\text{RMB}_{o(D)}$ or $\text{RMB}_{o(A)}$, similar to general sensitivity results in Table 3. The Malaysian central bank, quite clearly cares about the bilateral RMB exchange rate and the Ringgit would be categorised as close RMB watcher with time-varying sensitivity and asymmetry to the RMB_o movements.

Table 6 Spline estimation: Variance decomposition for the Malaysian Ringgit

	Start Date	End Date	R^2	USD $\mathcal{B}^2$	EUR $\mathcal{B}^2$	GBP $\mathcal{B}^2$	JPY $\mathcal{B}^2$	$\text{RMB}_{o(A)}$ $\mathcal{B}^2$	$\text{RMB}_{o(D)}$ $\mathcal{B}^2$
1	2005-10-14	2007-08-24	0.95	0.64	0.00	0.04	0.00	0.00	0.02
2	2007-08-31	2015-01-30	0.75	0.60	0.01	0.00	0.00	0.01	0.00
3	2015-02-06	2016-12-16	0.45	0.41	0.00	0.00	0.01	0.00	0.07
4	2016-12-23	2017-12-29	0.88	0.57	0.02	0.01	0.00	0.00	0.00

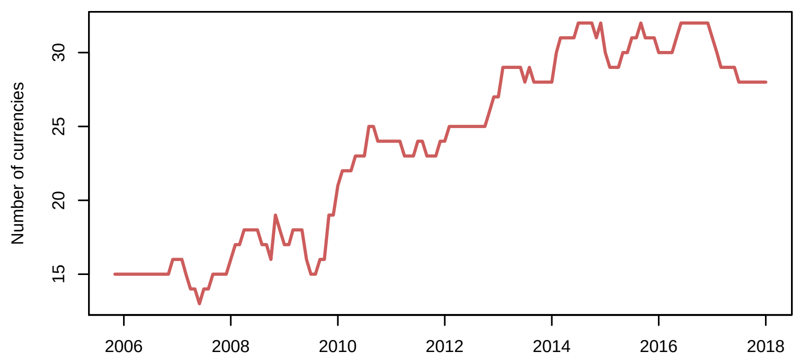
Note: MYR's asymmetric response to RMB_o depreciation is reflected in the explained variance as well with depreciation $\mathcal{B}^2$ accounting for a greater share of the explained variation, except for period 2 where the MYR showed a greater sensitivity to RMB appreciation

Table 6 shows the shows the standardised $\mathcal{B}^2$ coefficients for the regression in Table 5. Apart from period 2, the share in explained variance of RMB depreciation is larger than the contribution of RMB appreciation. This indicates that the MYR is more sensitive to periods of RMB depreciation. This may be driven by competitive considerations or variations in country-risk if a global shock is the source of the shared depreciation.

3.2 Results

We use the methodology illustrated in section 3.1 to look at the the co-movement of national (non-SDR) currencies with the RMB. We look at a set of 135 currencies from October 2005 to December 2017. The augmented FW regression with structural breaks is run on these currencies with the NZD as a numeraire for our baseline results using weekly data. The only *hyper-parameter* in our structural breaks estimation is the minimum duration of a exchange rate regime which is set at *26 weeks*. This parameter is chosen to reduce over-identification of short-lived exchange rate arrangements which may be caused by common global shocks or a temporary local crisis in an economy.

Figure 2 Currencies with a significant RMB_o co-movement coefficient



Note: This figure shows the count of currencies per month that have a significant RMB_o coefficient. The counts shows a pre-financial crisis peak, followed by a fall and then a steady rise as RMB internationalisation policies take effect

We identify 696 currency-regime periods for 135 currencies with a median of 4 breaks and 5 different periods per currency.[31] We find that there are *59 unique currencies* with 74 periods of significant co-movement with the RMB_o.[32] Figure 2 shows the count of currencies that have

[31]The density plot of regime duration is shown in Figure B.3. The median regime lasts around 77 weeks or approximately 1.5 years with the smallest regime spanning half a year and the longest one spanning the entire the sample period. The median RMB_o co-movement period lasts 142 weeks with the IQR ranging between 76 and 258 weeks; the size of a significant co-movement period with the RMB_o is slightly larger than the length of a median currency-regime without the RMB_o.

[32]There are 68 unique currencies, with 89 regime-periods, with at least one significant period of co-movement with the RMB_o. We remove spurious results by using an $R^2 = 1$ filter to control for hard pegs with the USD or EUR that show a statistical co-movement with the RMB_o. We report the currencies showing significant co-movement with the RMB_o in Appendix H. The full currency-regime results are available on request.

a significant co-movement with the RMB_o at a monthly frequency. The number of currencies showing significant co-movement with the RMB increases between 2005 till the global financial crisis. This number falls during the global financial crisis and rises after RMBI policies are announced, peaking in 2014, after which it falls again. The aggregate numbers ($\approx$ 20 median) per month hides the variation on the extensive margin of currencies/countries.

These *59 currencies* correspond to *71 countries* given the presence of shared currencies like the West African and Central African CFA Franc. The continental distribution of the currencies showing a significant co-movement with the RMB is as follows. Half of the currencies in Asia and Oceania, 26 out of 52 currencies demonstrate a significant co-movement with the RMB_o at some time in the sample. This is followed by Africa and the Americas which have 16 out of 37 and 10 out of 29 currencies showing a significant co-movement with the RMB_o respectively. There is a smaller presence in Europe with 7 out of 18 currencies showing significant co-movement with the RMB_o.[33]

There are 21 currencies/countries who have a statistically significant co-movement coefficient with the RMB_o for more than half the sample period (see Table B.1). We can observe that most of these countries are from Asia-Oceania (12) or Africa (6) with strong trade and financial links to China. The results for currencies with a long RMB sensitivity are qualitatively similar to results found by Tovar and Nor (2018) and Ito and McCauley (2019) who find $\approx$ 23-29 currencies co-moving with the RMB.[34] The time-variation in co-movements with the RMB makes it difficult to interpret the economic significance of these statistically significant co-movements. Only 5 currencies show a co-movement with the RMB through out the sample period.[35] We focus on the RMB_o's mean share in explained variance over the last three year period, 2015 to 2017.

Table 7 Currencies with highest mean share of RMB_o in explained variance

Currency	Mean share of RMB_o in explained variance (%): 2015-17
Sierra Leonese Leone	15.27
Malaysian Ringgit	2.82
Colombian Peso	2.69
Indian Rupee	1.76
Nepalese Rupee	1.64
Australian Dollar	1.50
Chilean Peso	1.40
Russian Rouble	1.36
Canadian Dollar	1.29
Korean Won	1.26

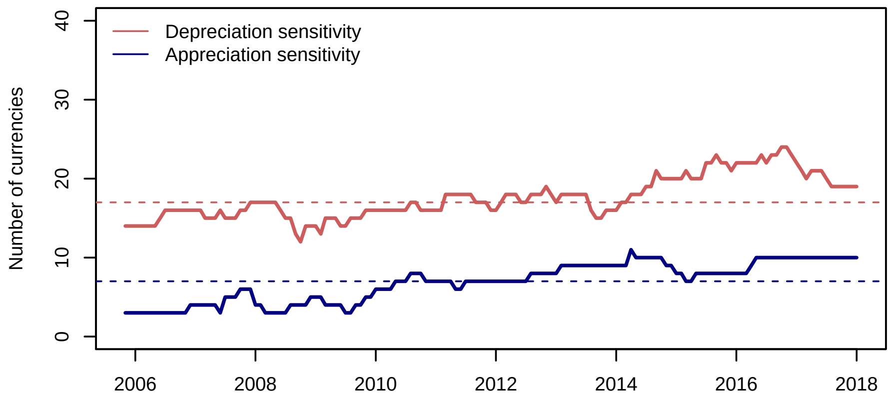
Table 7 shows the top 10 currencies with the highest mean RMB_o share in explained variance. None of the currencies has a RMB_o share of explained variance higher than 3%, except for Sierra Leonese Leone (SLL), which had a small free-falling period during the August 2015 RMB devaluation. The Malaysian Ringgit, Indian Rupee, Nepalese Rupee and Korean Won are the only Asian currencies with a non-zero RMB_o variance share greater than 1% for this period. The remaining non-Asian currencies may be described as commodity currencies with managed or free floats who share common demand shocks with China. This cross-section of results are a good

[33]Figure H.1 shows all the countries that have significantly co-moved with the RMB_o over the full sample period.

[34]There are some minor differences, for example we don't find the Mexican Peso and the Brazilian Real showing a significant co-movement with the RMB in our estimation using the NZD numeraire unlike Tovar and Nor (2018). See Appendix F.2 for more details.

[35]Figure H.2 shows the countries with significant RMB_o co-movement in Dec 2007 and for Dec 2017. One can see that the South African Rand (and the Rand zone of currencies), Taiwanese Dollar, Philippine Peso and Cambodian Riel are the only currencies which show co-movement with the RMB through-out the sample period. All the other currencies with periods of co-movement with the RMB have entry and exit on the extensive margin, representing a mix of common shocks as well as policy choices.

Figure 3 Currencies with a significant asymmetric RMB co-movement



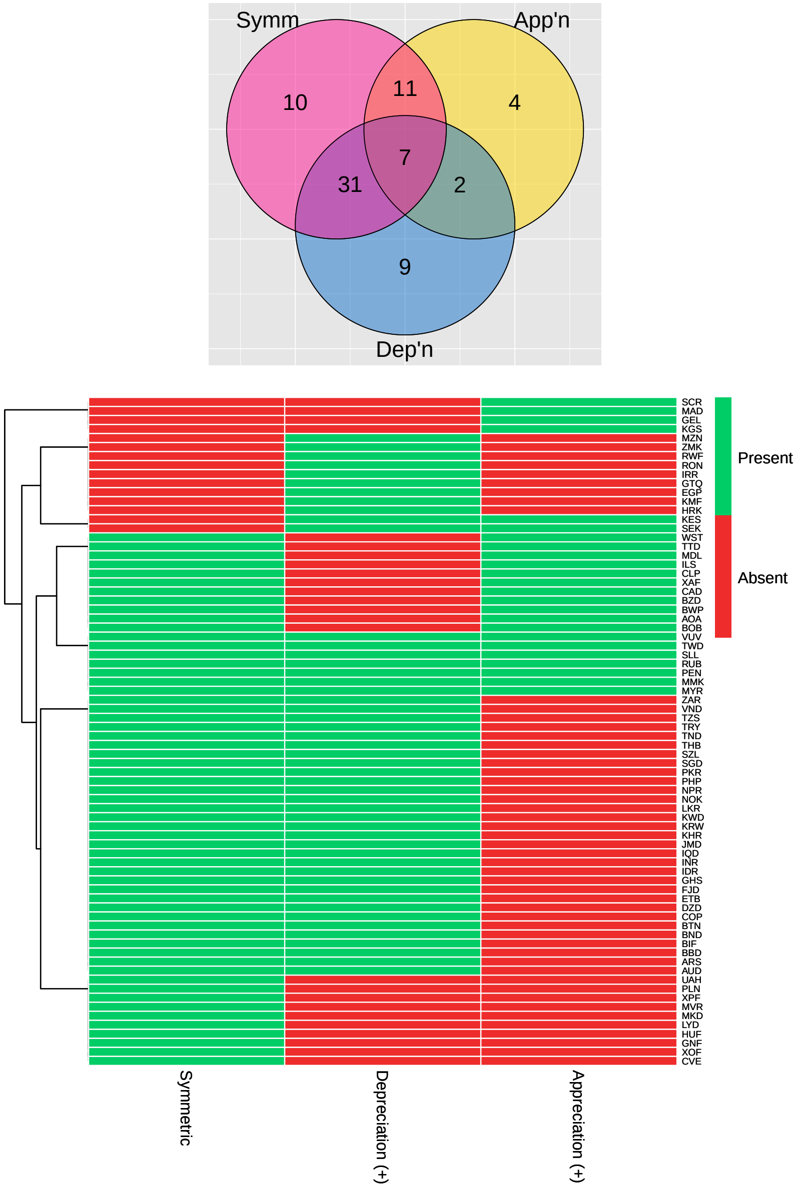
Note: This figure shows the count of currencies per month that have a statistically significant $\text{RMB}_o(D)$ and $\text{RMB}_o(A)$ coefficient. The dashed lines show the sample means for the number of countries showing a statistically significant $\text{RMB}_o(D)$ and $\text{RMB}_o(A)$ coefficient.

approximation of the full-sample results. The RMB_o share in explained variance for all the 59 currencies with a significant co-movement with the RMB_o is less than 10% for every detected regime-period. This suggests that these co-movements have a small share in explained variance, unlikely to imply anchoring to the RMB as a primary anchor.

We explore asymmetries and time variation in co-movement with the RMB within the FW framework by augmenting the regression with a knot at $\text{RMB}_o = 0$. We find that there are 49 currencies (with 61 regime-periods in all) that have at least one period of significant co-movement with $\text{RMB}_{o(D)}$. On the other hand, we find that there are only 25 currencies (with 25 regime-periods) who show significant co-movement with $\text{RMB}_{o(A)}$. Figure 3 shows the counts of currencies co-moving asymmetrically with the RMB at a monthly frequency. The number of currencies co-moving with RMB depreciation peaks in 2016, a year after the RMB devaluation in 2015. Co-movement with RMB appreciation seems to have no discernable trend after a brief increase in 2011. The counts indicate that currencies in our set are more sensitive to unanticipated RMB depreciation than appreciation. This is in line with our understanding of effective exchange rate concerns driving co-movements versus RMB depreciations (Pontines and Siregar, 2012; Rajan, 2012; Marconi, 2018; Keddad, 2019).

We classify currencies (countries) into combinations of two-way/symmetric sensitivity, asymmetric depreciation sensitivity and asymmetric appreciation sensitivity. A currency may have any combination of the 7 possible combinations for three coefficients at a given time in the sample. Figure 4 shows the Venn diagram of counts for currencies in different buckets. Some interesting patterns emerge from this exercise. Across the full sample, considering both specifications, there are a total of *74 currencies*, at different points in time that show a positive statistically significant RMB_o coefficient. This count may be considered may be considered an *upper bound* to RMB's global footprint as we are focusing on currencies with a statistically significant co-movement coefficient using an inclusive one-tailed test.

Figure 4 Asymmetry in global sensitivity to the RMB$_o$



Note: This figure shows counts and classification of currencies which have a linear sensitivity to the RMB$_o$ compared with countries who react asymmetrically to RMB$_0$ appreciation and RMB$_0$ depreciation for the full sample

Starting from the smallest set, there are 15 currencies who show a sensitivity to the RMB only in the spline specifications. This implies that there are some currencies who only show an asymmetric co-movement with the RMB and this cannot be observed *without* a spline specification. Out of these 15 currencies, 9 currencies show sensitivity to $\text{RMB}_{o(D)}$, and 4 currencies with a sensitivity to $\text{RMB}_{o(A)}$ and 2 currencies to both (at different times in the sample). These currencies are mostly pegs to their anchor currency and have (commodity) trade links with China.[36]

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Out of the 59 currencies that have a positive RMB_o coefficient from our estimation of Equation 5, there are only 10 currencies for whom the co-movement is symmetric across appreciation and depreciation. These are once again small countries with known primary currency anchors.[38] 31 currencies show greater sensitivity to $\text{RMB}_{o(D)}$. As expected, currencies with asymmetric sensitivity to $\text{RMB}_{o(D)}$ is the largest set of currencies. It includes most of the currencies belonging to countries that may be considered competitors to China like the Korean Won, Indian Rupee, Thai Baht, Vietnamese Dong and Indonesian Rupiah.

11 currencies show a greater sensitivity to $\text{RMB}_{o(A)}$. None of these currencies are from Asia-Oceania except for Samoan Tala. Moreover, these currencies may be classified as either commodity currencies or having an export exposure to China $\geq 10\%$ of total country exports barring the Botswanan Pula (part of the South African Rand zone) and Trinidad and Tobago Dollar. The remaining 7 currencies have the distinction of having asymmetric sensitivity to RMB appreciation and depreciation at different points in time, as well as having a statistically significant RMB_o coefficient. This set includes known RMB trackers like the Malaysian Ringgit, New Taiwanese Dollar, Russian Rouble and the Peruvian Sol along with small currencies like the Vanuatu Vatu, Sierra Leonese Leone and the Burmese Kyat, where economic linkages with China have increased over the past decade. We can conclude preliminarily, using raw counts that most currencies tend to show a greater sensitivity to RMB_o depreciation rather than appreciation.[39]

As before, we examine the economic significance of these statistically significant asymmetric co-movements by looking at their variance contributions. Table 8 shows the top 10 currencies with highest (time-series) mean $\hat{\mathcal{B}}^2$ by $\text{RMB}_{o(D)}$ and $\text{RMB}_{o(A)}$ for the 2015-17 period. We observe that the mean variance contribution of both $\text{RMB}_{o(D)}$ only exceeds 4% for the Zambian Kwacha and the Sierra Leonese Leone. We can see that the entire Indian Rupee zone is affected by idiosyncratic RMB depreciations. The mean $\text{RMB}_{o(A)}$ $\hat{\mathcal{B}}^2$ does not exceed 1% for any of the currencies that show a statistically significant co-movement with RMB appreciation for this period. The variance share of asymmetric RMB co-movements are in the similar 0-3% range we found in Table 7 for symmetric co-movements. This corroborates our preliminary inference

[36] All the currencies in this category are hard pegs to the Dollar except for the Swedish Krona, which may be classified as a managed float against the Euro

[37] All the currencies in this category are hard pegs to the Dollar except for the Swedish Krona, which may be classified as a managed float against the Euro

[38] This includes the Ukrainian Hryvnia, Maldivian Rufiyaa and Libyan Dinar with the USD as aprimary anchor. The EUR is the primary anchor for the West African CFA franc, Cape Verdean Escudo, Hungarian Forint, Polish Zloty, Guinean Franc and Macedonian Denar. The Australian Dollar is the primary anchor for the CFP Franc.

[39] We relax the assumptions of positive co-movements for $\text{RMB}_{o(A)}$ in Appendix D to see if there are any currencies that significantly depreciate when the RMB appreciates. We find that there are 22 such currencies who significantly depreciate when the RMB appreciates. This can also be seen as evidence of real exchange rate management versus trend appreciation of the RMB. We do not report these results in the main text of the paper as we are focused on only positive co-movements, as they are a better predictor of anchoring potential of a currency.

Table 8 Currencies with highest mean share of $\text{RMB}_{o(D)}$ and $\text{RMB}_{o(A)}$in explained variance between 2015-17

Currency	Mean share of $\text{RMB}_{o(D)}$ in explained variance (%)	Currency	Mean share of $\text{RMB}_{o(A)}$ in explained variance (%)
Sierra Leonese Leone	17.15	Rwandan Franc	0.64
Zambian Kwacha	4.17	Zambian Kwacha	0.50
Malaysian Ringgit	4.05	Australian Dollar	0.40
Indian Rupee	2.82	Sierra Leonese Leone	0.32
Nepalese Rupee	2.67	Algerian Dinar	0.18
Bhutanese Ngultrum	2.39	Bhutanese Ngultrum	0.17
Rwandan Franc	2.19	Malaysian Ringgit	0.17
Korean Won	1.31	Brunei Dollar	0.08
Turkish Lira	1.30	Pakistani Rupee	0.08
Algerian Dinar	1.14	Guatemalan Quetzal	0.08

regarding the greater relative importance of $\text{RMB}_{o(D)}$ explaining a greater share of currency co-movements.

4 How important is the RMB in global exchange rate arrangements?

We have illustrated the difference between unstandardised and standardised coefficient-based inference of relative importance in section 3.1. Switching to $\mathcal{B}^2$ coefficients in the augmented FW regression shows that even a well-known RMB tracker like the Ringgit has a very low share of variance explained by the RMB_o. This is an unsurprising result considering the dominance of the Dollar in the global financial system and small idiosyncratic variance of the RMB_o.[40] We utilise aggregates of standardised RMB_o $\hat{\mathcal{B}}^2$ for inferring the *economic significance* of statistical co-movements with the RMB_o at a global scale. We use two different approaches for measuring the aggregate importance of RMB co-movements.

Through our structural break estimation, we have a measure of RMB's influence on each currency (country) c and at every point in time t in the sample. We calculate the cross-sectional mean over all the RMB_o $\hat{\mathcal{B}}^2_{c,t}$'s. The cross-sectional mean is a backward-looking average global RMB_o share in explained currency variance. We utilise a non-parametric bootstrap to obtain 95% confidence intervals and we report this estimator as a continuous measure of average global variance contribution by the RMB_o in exchange rate baskets.[41]

$$\frac{\sum_{c=1}^{C} \text{RMB}_o\ \hat{\mathcal{B}}^2_{c,t}}{C} = \text{RMB}_o \mu_{\hat{\mathcal{B}}^2_t} \tag{6}$$

$$\sum_{c=1}^{C} \textit{Global GDP Share}_{c,t} * \text{RMB}_o\ \hat{\mathcal{B}}^2_{c,t} = \text{RMB}_o \mu_{\textit{weighted}\ \hat{\mathcal{B}}^2_t} \tag{7}$$

[40]Dollar dominance in Asian exchange rate arrangements is not a novel result. Ilzetzki *et al.* (2019) find that the Dollar is by far the largest global reserve currency. Boz *et al.* (2017) and Gopinath and Stein (2018) show a similar effect of the Dollar for trade and bank funding, whereas Avdjiev *et al.* (2019) demonstrate the role of the Dollar as a global risk factor for bank funding and real-investment.

[41]For completeness, we repeat this procedure for the unstandardised $\hat{\beta}_{c,t}$ as well to get a global time-series measure of sensitivity to the RMB_o. In the interests of brevity, we only show results for RMB_o $\hat{\mathcal{B}}^2_{c,t}$ in the main text of the paper. Results based on unstandardised RMB_o $\hat{\beta}_{c,t}$ in Appendix C.

We calculate an unweighted and a PPP-GDP weighted variant of this cross-sectional mean as shown in Equation 6 and Equation 7. The PPP-GDP weighted mean represents the RMB_o's average global (per cent) share in explained variance accounting for relative GDP shares of the anchoring economies. The PPP-GDP weighted $\mu_{\hat{\mathcal{B}}_t^2}$ allows us to gauge the share of global GDP affected by RMB_o movements.[42] We compare the contributions of RMB appreciation and depreciations in total RMB_o variance share. We also compare the importance of the RMB over time with the other reserve currencies using their respective $\hat{\mathcal{B}}_t^2$ shares in explained variance.

This further allows us to group currencies (countries) into reserve currency blocs on the basis of which of the five candidate anchor currencies from the augmented FW regression has the highest share in explained variance. For example, the MYR would be placed in the USD currency bloc as the USD explains ≈60% of the R^2 in the augmented FW regressions. For floating currencies and regional currency arrangements, we use an *indirect* approach to allocating currencies to reserve blocs. Every currency in our set should belong to the USD, EUR, JPY, GBP or RMB bloc. This implies is that we ignore floating currencies like the Australian Dollar or Turkish Lira. If the USD has the highest share in explained variance for these currencies they are allocated to the USD bloc. This indirect anchor allocation is applied to regional anchor currency arrangements.[43] This exercise allows us to build a comprehensive view about reserve currency blocs. It tells us which reserve currency a central bank treasury manager may look to target as an intervention vehicle. The reserve currency with the largest $\hat{\mathcal{B}}_t^2$ would deliver a larger and more predictable local currency impact of intervention.

4.1 Results

Figure 5 shows the average contribution of RMB_o to the model R^2 from our augmented FW regression for all 135 currencies. We can observe that the average contribution to the explained variance all currencies is less than 2% except for the 2015 RMB devaluation period.[44]

If we restrict the currency set to 59 currencies which have shown a statistically significant co-movement versus the RMB_o, we get insights into the within variation in share of explained variance for these *RMB trackers*. Panel (b) of Figure 5 shows the share in explained variance of the RMB_o for currencies who have at least one period of statistically significant co-movement. The average share in explained variance of the RMB_o for RMB trackers is very similar to the full currency sample average, except for the 2015 period of RMB devaluation. Nevertheless, the mid-point estimate of $\mu_{\hat{\mathcal{B}}_t^2} \leq 2\%$ *even for RMB trackers*, indicating a supporting/latent anchor role at most, for currency managers. For countries like Australia and Canada with floating

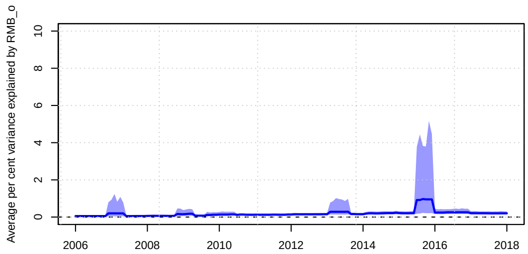
[42] We do not consider the GDP-weights of the SDR currencies while estimating Equation 7 or assign them to their own currency blocs like Tovar and Nor (2018). The rationale is as follows: The RMB itself has 80% USD weight in the FW regression. Attributing all of Chinese GDP to the RMB bloc is a large under-statement of the Dollar bloc's size. Ilzetzki *et al.* (2019) also note this to be problem in determining anchor currency area GDP. This exclusion of SDR-basket currency countries means that the total PPP-GDP contribution of non-SDR currencies for our sample period 2006-2017 covers between 35-45% of global PPP-GDP depending on the year in question.

[43] For example, if the EUR has the largest share in explained variance for the South African Rand, then most Rand zone currencies get assigned to the EUR bloc, due to their Rand peg.

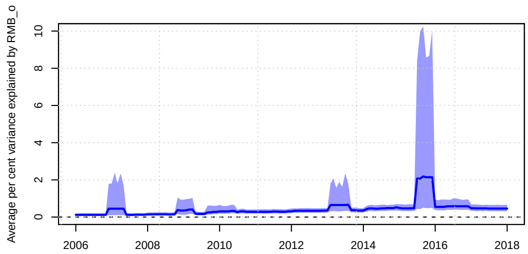
[44] This is in contrast to the results in Figure C.1 with $\mu_{\mathrm{RMB}_o \hat{\beta}_t}$, which seems to indicate a fairly high sensitivity to RMB_o movements. This divergence is because the variance of the RMB_o is much smaller in comparison to the other reserve currencies. Currencies have a high sensitivity to unanticipated RMB fluctuations but it is a small contributor to the explained variation over the time series because of the perceived "predictability" of RMB currency management versus the USD as shown by McCauley and Shu (2019).See Appendix C for a discussion of the aggregate results with unstandardised coefficients

exchange rates and credible nominal anchors, the RMB_o co-movements are unlikely to imply latent anchoring. For countries with market determined exchange rates, significant RMB_o co-movements are likely just statistical co-movements driven by common shocks.

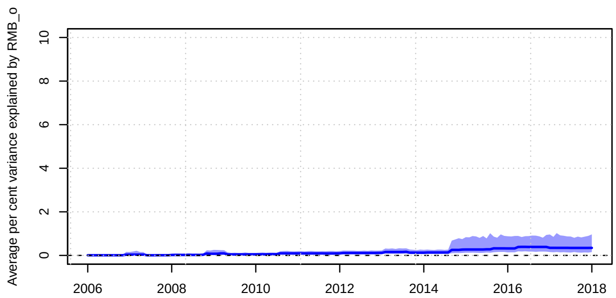
Figure 5 Unweighted mean and GDP-weighted RMB_o share in explained variance



a. Full sample



b. RMB trackers



c. GDP-weighted

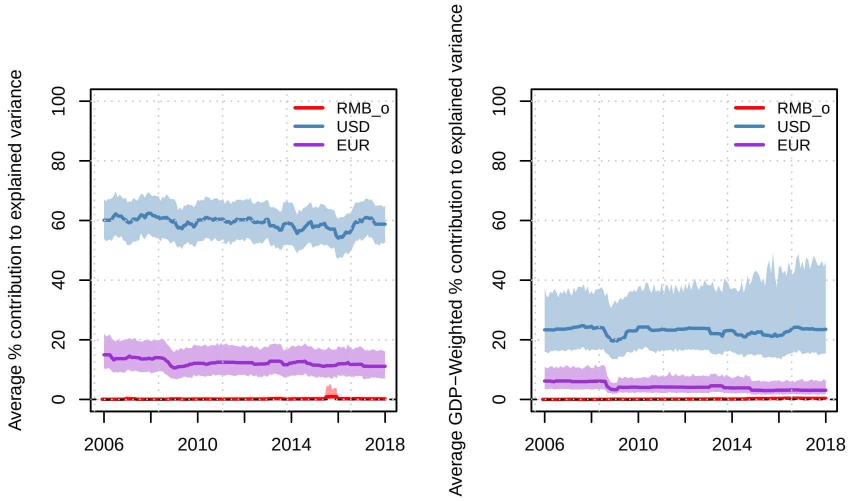
Note: This figure in the top-left panel shows the unweighted contributions of RMB_o in the augmented FW regression for 135 non-SDR currencies. This figure in the top-right panel shows the average variance contribution of RMB_o for the 59 currencies who track the RMB. The figure in the bottom panel shows the PPP GDP-weighted RMB_o variance share. As we set statistically insignificant $\hat{\mathcal{B}}^2$ to zero, the measure for GDP-weighted $\mu_{\hat{\mathcal{B}}_t^2}$ is identical for the full sample and RMB trackers.

Figure B.4 shows the share in explained variance of $\text{RMB}_{o(D)}$. Two things stand out when we consider the individual variance share of RMB_o depreciations. First, almost the entire explanatory power of RMB_o comes from $\text{RMB}_{o(D)}$. The share in explained variance for the $\text{RMB}_{o(D)}$ is greater than the RMB_o during periods of devaluations especially for currencies with a statistically significant $\text{RMB}_{o(D)}$ coefficient. This seems to suggest that unexpected RMB devaluations may have a strong effect on RMB trackers and countries with exposure to Chinese domestic demand. The share in explained variance of these surprise devaluations seems to be growing over time but this is partially backed up by the GDP-weighted $\mu_{\hat{\mathcal{B}}_t^2}$. Once again, the non-devaluation period mid-point estimates of $\mu_{\hat{\mathcal{B}}_t^2}$ is $\leq 2\%$ indicating a tertiary role for the RMB in exchange rate arrangements.[45]

[45]These results are reproduced for $\text{RMB}_{o(A)}$ in Figure B.5. In line with our priors, $\text{RMB}_{o(A)}$ has almost a zero

Figure 6 shows the share in explained variance for the USD, EUR and RMB_o over the sample period. We can see that the average share in explained variance for the USD and EUR is much larger than for the RMB_o. This reinforces the point that the while the RMB's importance and global influence are growing, its importance as an additional anchor of exchange rate policy is minuscule when compared to the USD and EUR.[46]

Figure 6 Comparing the average variance contribution of RMB_o, USD and the EUR



Note: This figure compares the variance contribution of RMB_o, USD and the EUR in the augmented FW regression for 135 non-SDR currencies. The left and right panels show the unweighted and GDP-weighted variance contributions respectively.

There are no large currencies for whom RMB_o's share in explained variance exceeds 10% for a currency regime-period. Most countries in our sample tend to fall clearly in the USD-EUR spheres of influence.[47] Armed with these results on reserve currency shares in explained variance, we can now allocate countries to reserve currency blocs using an indirect anchor approach. This exercise is a clean sweep for for the USD and the EUR with almost all non-SDR currencies being *de facto* anchored to the USD or the EUR. Figure 7 shows these results for the 3 year period 2015-2018.[48]

The USD is a true global currency whereas the EUR's influence is strongest in Europe and Africa. One could argue that the RMB has a global influence that is more similar to the USD than the EUR in its dispersion, given its role as the largest global trader. However, its a distant second (or third) most important currency as compared to the USD or EUR in these countries.[49] The

share in explained variance for our set of currencies.

[46]We visualise the full-sample median shares in explained variance for the USD, EUR and RMB_o for all currencies in a 3-D scatterplot in B.6 in Appendix B.

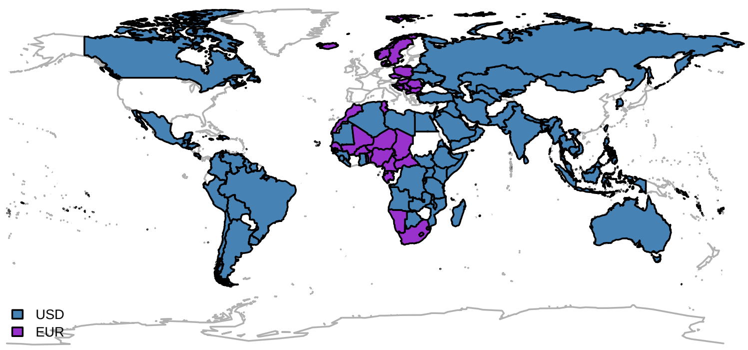
[47]See Figures B.7, B.8 and B.9 in Appendix B for a pair-wise comparison of full sample median shares in explained variance between the USD, EUR and RMB_o

[48]Full-sample estimates are almost identical for this sub-sample result presented here.

[49]Figure H.3 shows that the USD has a significant share in the explained variance. The Euro's global influence in terms of share in the explained variance can be seen in Figure H.4. These results seem to indicate that Euro has been unable to break out its geographical sphere of influence to become a "true" global currency. This is in

narratives surrounding the ascent of the RMB has to be put in perspective with the apparent struggles of the Euro to achieve greater international use. Maggiori *et al.* (2019) note that the EUR is a distant second to the USD in terms of a international currency. The inability of the Euro to widely adopted beyond its geographical sphere of influence seems to suggest that it may have fallen behind as compared to the RMB. Both the Eurozone and China have some similar structural issues preventing currency internationalisation, like current account surpluses and inadequate market depth for supplying safe reserve assets to the world. The EUR unlike the RMB is freely convertible and has many countries using the EUR as a primary anchor. This clearly implies that the EUR is more viable as an international currency than the RMB.

Figure 7 Anchor currency blocs: 2015-17



Note: This figure shows countries assigned to reserve currency blocs on the basis of the reserve currency which has the largest share in explained variance for the three year period 2015-2017. The USD is *clearly* the most important anchor currency followed by the EUR. We have not labelled reserve currency countries into belonging to their own currency zones as our focus is on non-reserve currencies.

Our results clearly show that the RMB is likely the *third most important global currency at best*, in spite of a large increase in it's global foreign exchange market share since the financial crisis.[50] These results demonstrate that we are much further away from a multi-polar global monetary system with the RMB playing a major role, as argued by Subramanian and Kessler (2013), Fratzscher and Mehl (2014) and Tovar and Nor (2018). Faster capital market reforms and moves towards full Renminbi convertibility may set the stage for the RMB to take on a larger global role in the future. But it does not seem to be case after a decade of RMB internationalisation policies.

line with research by Papadia and Efstathiou (2018) who find that the USD's use has grown relative to the EUR since the early 2000's.

[50] Figure H.5 shows that the share of the RMB_o in sample median explained variance is always less than 10%, similar to the GBP and JPY. Figure H.5 shows that the geographic spread of RMB's influence is more dispersed than the Euro and this might enable to diffuse faster as a global currency. Moreover, Figure H.6 shows that the RMB's share in explained variance has also increased in the last five years

5 Why do countries care about the RMB?

We examine the role of trade, financial linkages and policy linkages in predicting the co-movements of a local currency with the RMB_o while controlling for country characteristics. Unlike other studies in the literature, we focus on the determinants of the RMB_o's share in explained variance ($\text{RMB}_o\ \hat{\mathcal{B}^2_{c,t}}$) rather than the magnitude of the sensitivity of the co-movements ($\text{RMB}_o\ \hat{\beta_{c,t}}$). This allows us to understand the characteristics of countries where the RMB plays an important role in the exchange rate regime. Keeping these objectives, we estimate the following panel regression where c is the country index and t is the time index:

$$\begin{aligned}\text{RMB}_o\ \hat{\mathcal{B}^2_{c,t}} = \alpha_c + \gamma_t + \beta_1 Trade\ exposure_{c,t-1} + \beta_2 Financial\ linkages_{c,t-1} + \\ \beta_3 Policy\ linkages_{c,t-1} + \beta_4 X_{c,t-1} + \epsilon_{c,t}\end{aligned} \tag{8}$$

Our dependent variable is the $\text{RMB}_o\ \hat{\mathcal{B}^2_{c,t}}$ estimated for every currency from equation 3. We use the values from the structural break estimation of equation 5 for the end of every year to get a yearly value of the $\text{RMB}_o\ \hat{\mathcal{B}^2_{c,t}}$. In the spirit of the structural break estimation, the value of the $\text{RMB}_o\ \hat{\mathcal{B}^2_{c,t}}$ only changes for a particular currency only if there a regime break. The RMB_o $\hat{\mathcal{B}^2_{c,t}}$ which are not statistically significant are set as zero. In our benchmark specifications, we control for both country and year fixed effects in order to control for unobserved time-invariant country characteristics (culture, historical links, distance) as well as common global shocks over the sample time-period.[51]

Our covariates are divided into 4 categories. The first set of variables measure "trade exposure" to China as a per cent of a country's total trade using the IMF's Direction of Trade Statistics (DOTS) dataset. Trade exposure is measured as either imports from China, exports to China or total trade with China divided by the value of total imports, exports or total trade of that country respectively, expressed in percentages. All three variables of trade exposure have been shown to have a positive correlation with local currency co-movement with the RMB. The optimal currency area (OCA) literature suggests that trade exposure to a dominant trading partner may cause a trading country to adopt its partner's currency as an anchor to reduce transactions costs and minimise bilateral volatility.[52] This makes it important for countries to manage their co-movements versus the RMB if they are targeters of their exchange rate or current accounts. We also add dummy variables for exporter type, looking specifically at commodity and energy exporters given the demand linkages between China and these countries.[53] We additionally control for exporter complexity and diversification potential using the Economic Complexity Index and Complexity Outlook Index developed by Hidalgo and Hausmann (2009) to understand the role of value chain sophistication in determining the importance of the RMB in the exchange rate basket.

[51]Given our estimation strategy, we can specify the dependent variable in many ways. We can specify the LHS as a non-standardised $\hat{\beta}_{c,t}$ as has been done in the literature. This allows us test the robustness of our results and explore differences between $\text{RMB}_o\ \hat{\mathcal{B}}^2_{c,t}$ and $\text{RMB}_o\ \hat{\beta}_{c,t}$. We can also modify the dependent variable to study the determinants of effect-specific co-movements.

[52]There might be a strong mercantilist motive as well, Mattoo *et al.* (2017) find that there is a strong positive response of developing market exports to third country destinations following a real appreciation of the RMB.

[53]Sturmer (2017) have noted the importance of Chinese business news as well as portfolio allocation to commodity countries associated with Chinese demand.

The next set of variables measure financial linkages. These variables are measured as the level of investment "from China" and "to China" across various datasets and across different modes of investment. We use bilateral foreign direct investment statistics from UNCTAD, direct investment from IMF's Consolidated Direct Investment Survey (CDIS) and portfolio investment from IMF's Consolidated Portfolio Investment Survey (CPIS). We use the American Enterprise Institute (AEI) and Heritage Foundation's China Global Investment Tracker as an alternative project level dataset of Chinese investment. The financial linkages dataset is very unbalanced given data coverage and quality issues. Similar to the trade variables, we transform the financial linkages variable into a share variable dividing the reported foreign investment in that country from China by the relevant measure of total foreign investment in that year. This allows us to compare countries on the basis of their foreign investment dependence to China. There are some pitfalls to this approach due to under-reporting of FDI from China in the official FDI statistics especially for small countries. This causes our FDI dependence variable to take values greater than 100% when we use the AEI and CPIS dataset. We top code the investment dependence variable to take a maximum value of 250%.[54] We also control for country stock market correlations with the Shanghai stock exchange at one year and three year frequencies for 65 national currencies where the stock market data is available as our final variable of financial linkges as portfolio flows amongst developing countries tend to be correlated and this causes shared currency co-movement. Financial linkages have been seen to be important in predicting recent co-movements with the RMB and we expect these variables to be positively correlated to $\text{RMB}_o \ \hat{\mathcal{B}^2_{c,t}}$, especially for smaller open economies.[55]

We know that policy linkages and policy affinity play an important role in currencies co-moving with the RMB (Liao and McDowell, 2016; Chey *et al.*, 2016; Song and Xia, 2019; Bahaj and Reis, 2020; Zhou *et al.*, 2020; Liao and McDowell, 2016). The third set of variables look at policy linkages and include Preferential Trade Agreements (PTAs), Free Trade Agreements (FTAs) and Bilateral Investment Treaties (BITs) with China constructed from the WTO, China FTA tracker and UNCTAD datasets respectively. We further add information regarding RMB infrastructure adoption based on disclosures by the PBoC and State Administration of Foreign Exchange (SAFE) on Local Currency (LCYs) settlement facilities and Bilateral Currency Swaps (BCS). We also extend the dataset of RMB reserve adoption used by Liao and McDowell (2016) to include recent years. We also account for Belt and Road linkages using a mix of memorandum of understanding signing dates and investment flows. This set of variables are dummies and the dummy takes a value of 1 for the year a particular country and China entered into a policy arrangement. Finally, we also use the policy affinity dataset constructed by Bailey *et al.* (2017) as a measure of political alignment with China. This measure is constructed by aggregating at United Nations General Assembly voting records and tracks a particular country's voting agreement with China. We expect all these variables to have a positive effect in predicting the RMB's share in explained variance.

$X_{c,t-1}$ includes a vector of lagged country characteristics. We control for include GDP, CPI inflation and the trilemma configuration as measured via the Aizenman *et al.* (2010)'s trilemma indices. We use the Exchange Rate Stability (ERS) index as a continuous measure of exchange

[54]Constructing a bilateral financial linkages dataset to China would be a project in itself. The bilateral FDI set finishes in 2012, the CDIS set only starts in 2009 and the AEI tracker only covers large investment projects. The CPIS dataset only starts in 2015. This makes tracking the role of financial linkages difficult. We do not present results with financial linkages in our benchmark specification due to data coverage and quality issues and relegate it to Appendix E

[55]Ahmed and Huo (2019) show instantaneous co-movements between Chinese equity markets and Asia-Pacific stock markets. Park and An (2020) also find a strong role for portfolio linkages in explaining co-movements with the RMB.

rate regime.[56] Financial account openness is measured using the Chinn-Ito index coming from the trilemma indices as well.[57] We alternatively control for exchange rate regime and financial account openness using the Ilzetzki *et al.* (2019) classification and the Fernández *et al.* (2016) measure. We also control for inflation, foreign reserves correlations at yearly frequency, which roughly proxy business cycle synchronisation. We expect the the RMB's share in explained variance to fall for countries with a larger GDP but rise in output, inflation and foreign exchange reserve correlations. The role of the trilemma configuration is unclear, it is likely that effects of idiosyncratic RMB fluctuations are stronger for more open financial accounts and more flexible exchange rates.

These sets of controls are by definition incomplete and may be augmented to control for gravity variables or institutional quality variables. This parsimony in this regression strategy lends itself to many extensions based on the hypothesis that needs to be tested. We expect trade, financial and policy linkages to be positively related to share of variance explained by the RMB in a currency. Variable definitions and data sources used to construct the dataset can be found in Appendix A. In the interests of brevity, we only present benchmark results for RMB_o $\hat{\mathcal{B}^2_{c,t}}$ in Section 5.1 and present the supporting results along with robustness checks in Appendix E.

5.1 Benchmark results

Table 9 presents the results for the determinants of RMB_o $\hat{\mathcal{B}^2_{c,t}}$ across a variety of fixed effects specifications. We do not add financial linkages in our benchmark specifications due to missing data.[58] Model 1 with country and year fixed effects is our benchmark model as it controls for time-invariant country-specific unobservables as well as common global shocks. We find that the share in explained variance of the RMB_o in a currency is increasing in export exposure, BRI status and political affinity to China while its decreasing in import exposure and strictness of exchange rate management versus an anchor currency.

The coefficient sizes for the explanatory variables are small because the share of RMB_o in a currency's explained variance is small. A one standard deviation increase in export exposure to China (12.77% of total exports) increases the variance explained by the RMB_o in a currency by $\approx$2.5%. The export exposure result points to a trade and bargaining-power channel for currency co-movement with the RMB. There also seems to be a role for policy-linkages and policy affinity as indicated by the BRI and China affinity variable. Import exposure loads negatively, indicating a mitigating role for net trade exposure. This intuitively makes sense as it would be easier for Chinese companies to pay for exports in RMB whereas import payments would be foreign exchange earning activity in one of the more liquid and open global currencies. Lapukeni and Kiyotaka (2019) show this a limited setting where they look at invoicing choice for Malawian imports. Malawi imports more from China than it exports to China, with China being its second largest import partner. They find that while the Yen is used to invoice imports from Japan (a small trading partner), but that is not the case for imports from China.

Interestingly, we find that the variance contribution of the RMB in a currency is increasing in exchange rate flexibility. This implies that RMB foreign exchange market-based spillovers do affect currencies with more flexible exchange rate arrangements. Park and An (2020) also find

[56] Exchange rate stability is measured on a normalised scale between 0-1 where lower values represent higher exchange rate flexibility versus a currency anchor and higher values represents greater currency management.

[57] The index ranges between 0-1 where 0 represents a open economy and 1 a closed economy.

[58] Regressions controlling for financial linkages from China can be found in Table E.5 in Appendix E. None of the financial linkage variables are found to be significant.

Table 9 Benchmark results: Determinants of $\mathrm{RMB}_o\hat{\mathcal{B}^2_{c,t}}$

	Dependent variable:			
	$\mathrm{RMB}_o\ \hat{\mathcal{B}^2_{c,t}}$			
	(1)	(2)	(3)	(4)
Export exposure	0.003^{***}	0.001^{***}	0.001^{***}	0.003^{***}
	(0.0002)	(0.0001)	(0.0001)	(0.0002)
Import exposure	-0.001^{*}	-0.001^{***}	-0.001^{***}	-0.001^{*}
	(0.0004)	(0.0002)	(0.0002)	(0.0004)
Financial openness	0.001	−0.002	−0.001	0.001
	(0.015)	(0.003)	(0.003)	(0.014)
ERS index	-0.016^{**}	−0.003	−0.005	-0.016^{**}
	(0.006)	(0.003)	(0.003)	(0.006)
GDP	−0.004	0.0003	0.0001	−0.003
	(0.007)	(0.001)	(0.001)	(0.006)
Inflation correlation	0.00002	−0.001	−0.001	0.0002
	(0.001)	(0.001)	(0.001)	(0.001)
PTA	−0.005	0.004	0.003	−0.005
	(0.004)	(0.002)	(0.002)	(0.004)
BIT	0.005	−0.001	−0.002	0.005
	(0.007)	(0.002)	(0.002)	(0.006)
Reserve dummy	−0.006	−0.001	−0.001	−0.006
	(0.005)	(0.004)	(0.004)	(0.005)
Swap line	−0.003	−0.002	−0.003	−0.003
	(0.004)	(0.004)	(0.004)	(0.004)
LCY settlement	0.0001	0.006	0.007	0.00002
	(0.009)	(0.008)	(0.008)	(0.009)
BRI	0.013^{***}	0.010^{***}	0.010^{***}	0.013^{***}
	(0.004)	(0.004)	(0.004)	(0.003)
China affinity	0.047^{**}	0.023	0.018	0.027
	(0.022)	(0.016)	(0.014)	(0.020)
US affinity	0.018	0.026	0.022	0.015
	(0.025)	(0.018)	(0.017)	(0.023)
Fixed effects	Country & Year	Continent & Year	Year	Country & RMB regime
Observations	1,093	1,093	1,093	1,093
R^2	0.231	0.063	0.062	0.224
Adjusted R^2	0.124	0.039	0.041	0.123
Residual Std. Error	0.028 (df = 959)	0.029 (df = 1064)	0.029 (df = 1068)	0.028 (df = 967)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns.

a positive role for exchange rate flexibility in determining co-movements with the RMB. This can also be considered as soft evidence that financial linkages, especially via common "push" factor driven portfolio flows could be important in driving co-movements with the RMB for more flexible exchange rates (Koepke, 2018). Co-movement with the RMB could be driven by both policy linkages and market-based linkages, with policy linkages affecting mostly currency managers and market-based linkages that affect more floating exchange rates. Trade exposure remains the underlying driver of these secondary effects.

Model 2 and Model 3 are specified with continent and year fixed effects and year fixed effects respectively. The results across both the models are quite similar. The export exposure result is retained but the effect size is much smaller than our benchmark model 1. The import exposure variable grows in significance, indicating a greater role for net trade exposure in determining currency co-movement through the trade channel. The exchange rate stability index continues to load negatively. This implies that RMB fluctuations impact currencies with more flexible exchange rates. The BRI variable is always positive and significant implying a direct effect of Belt and Road linkages on co-movements with the RMB. Model 4 is specified with country and RMB currency regime break dates fixed effects based on regime periods identified for the RMB. These results are very similar to Model 1 except that policy affinity is no longer statistically significant.

Except for export exposure and BRI status, none of the other covariates show a robust effect across different fixed-effect specifications. This informs the next steps in our analysis. We explore heterogeneities in the nature of export exposure in determining RMB_o variance shares by looking at interaction effects across our major covariates and exporter type. These figures and tables are reported in Appendix E. The marginal effect of export exposure on determining RMB_o variance share *increases for commodity exporters* while it *decreases for energy exporters*. The marginal effect of export exposure is also decreasing in GDP size, import exposure, exchange rate stability, capital account restrictions and positive inflation correlations. For interactions with policy linkages we find that the marginal effect of export exposure in predicting RMB_o variance share is increasing in policy affinity to China, BRI status and BIT status.

5.2 Sample-splits by time and geography

We explore the robustness of our results using sample-splits over time and continent in our benchmark specification. Table 10 shows the determinants of RMB_o $\hat{\mathcal{B}^2_{c,t}}$ pre and post RMB internationalisation (RMBI). We use 2009 as our cut-off year after which RMB internationalisation policies accelerated.[59] The difference between the pre-RMBI and post RMBI models is telling. The post-RMBI model is very similar to our benchmark full-sample model. However, the pre-RMBI model shows some salient differences in determinants of RMB_o variance contribution. In the pre-RMBI model, export exposure and GDP load negatively whereas there is a positive and significant effect of sharing common inflation shocks. The pre-RMBI period reflects a business cycle or monetary-policy related reasons for currencies co-moving with the RMB with a negative role for export exposure. This reversed for post-RMBI period with a greater role for export exposure possibly through China's increase in bargaining power after the financial crisis and policy linkages rather than synchronisation in monetary policy. This is an important result and reflects in some part the quick recovery China and similar emerging markets (commodity exporters) made after the financial crisis. This also suggests some limited success of the PBoC's

[59] We use the essay by on March 23rd 2009 by Zhou Xioachuan as the starting point of RMB internationalisation policies. See https://www.bis.org/review/r090402c.pdf for more details.

Table 10 Determinants of $\text{RMB}_o\ \hat{\mathcal{B}^2_{c,t}}$: Post and Pre-RMB internationalisation (RMBI)

	Dependent variable:	
	$RMB_o\ \hat{\mathcal{B}^2_{c,t}}$	
	Post RMBI (2010-16)	Pre RMBI (2006-2009)
Export exposure	0.004***	−0.001*
	(0.0004)	(0.0003)
Import exposure	−0.0003	0.0002
	(0.001)	(0.001)
Financial openness	0.016	−0.012
	(0.047)	(0.009)
ERS index	−0.028***	−0.011**
	(0.010)	(0.005)
GDP	0.016	−0.023***
	(0.013)	(0.007)
Inflation correlation	−0.002	0.004***
	(0.002)	(0.001)
PTA	0.0003	−0.005
	(0.008)	(0.009)
BIT	0.006	−0.001
	(0.016)	(0.005)
Reserve dummy	−0.008	
	(0.007)	
Swap line	−0.004	
	(0.007)	
LCY settlement	−0.002	
	(0.014)	
BRI	0.014***	
	(0.005)	
China affinity	0.085**	−0.001
	(0.036)	(0.016)
US affinity	0.008	−0.014
	(0.040)	(0.020)
Fixed effects	Country & Year	Country & Year
Observations	697	396
R^2	0.338	0.348
Adjusted R^2	0.189	0.070
Residual Std. Error	0.032 (df = 568)	0.011 (df = 277)
Note:		*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns. The pre-RMBI dataset covers 2006-2009, whereas the post-RMBI period covers 2010-2016 in our estimation internationalisation strategies. We further investigate how these results vary across different continents in 11. For ease of comparison, we group Asia and Oceania (roughly Asia-Pacific) into one continent and North and South America in one continent.

Table 11 Determinants of RMB$_o$ $\hat{\mathcal{B}^2_{c,t}}$: Heterogeneity across continents

	Dependent variable:			
	$RMB_o\ \hat{\mathcal{B}^2_{c,t}}$			
	Asia-Oceania	Africa	Europe	Americas
Export exposure	-0.0001	0.004^{***}	0.002^{*}	0.0004^{***}
	(0.0001)	(0.0005)	(0.001)	(0.0001)
Import exposure	-0.0002	-0.001	-0.0002	0.0001
	(0.0001)	(0.001)	(0.001)	(0.0001)
Financial openness	0.004	-0.091	0.001	0.005^{*}
	(0.006)	(0.084)	(0.008)	(0.003)
ERS index	-0.001	-0.040^{**}	-0.001	0.001
	(0.002)	(0.018)	(0.005)	(0.002)
GDP	-0.001	-0.004	0.002	-0.002
	(0.002)	(0.022)	(0.007)	(0.002)
Inflation correlation	0.001^{*}	-0.001	-0.0004	0.00002
	(0.0005)	(0.005)	(0.001)	(0.0004)
PTA	0.002	-0.019	0.0003	0.001
	(0.002)	(0.012)	(0.007)	(0.001)
BIT	-0.001	0.009	-0.0003	0.009^{***}
	(0.002)	(0.025)	(0.006)	(0.001)
Reserve dummy	0.001	-0.039^{**}	0.002	-0.0004
	(0.001)	(0.017)	(0.005)	(0.001)
Swap line	0.001		0.004	-0.004^{***}
	(0.001)		(0.003)	(0.001)
LCY settlement	0.006^{***}		-0.004	
	(0.002)		(0.007)	
BRI	0.0004	0.045^{***}	0.003	-0.00003
	(0.001)	(0.015)	(0.003)	(0.001)
China affinity	-0.012	0.130^{**}	0.051	0.004
	(0.008)	(0.059)	(0.047)	(0.007)
US affinity	0.008	0.064	0.021	0.025^{***}
	(0.010)	(0.075)	(0.035)	(0.006)
Fixed effects	Country & Year	Country & Year	Country & Year	Country & Year
Observations	383	317	151	242
R^2	0.438	0.340	0.245	0.660
Adjusted R^2	0.330	0.204	-0.002	0.580
Residual Std. Error	0.005 (df = 320)	0.048 (df = 262)	0.008 (df = 113)	0.003 (df = 195)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns. We group Asia and Oceania into one continent and North and South America in one continent.

We find that local currency settlement arrangements and inflation correlation with China load positively for Asia-Oceania. This grouping is our largest agglomeration of countries. The main export-exposure result does not hold for Asia-Oceania with the coefficient being negative and insignificant. This results holds if we replace the export and import exposure variables with a total trade exposure variable as well. These results indicate a positive role for RMB internationalisation policies directed at easing RMB payments for countries in China's geographic sphere of influence.[60]

Political affinity and RMBI policy linkages with China seems to be main driver of co-movements with the RMB in Africa. The export exposure, exchange rate stability, BRI and China affinity from the benchmark results are retained for African currencies.[61] European economies seem to be sensitive to trade exposure from China as well. The swap line coefficient is also positive and just insignificant for European economies. The swap line coefficient sign is reversed for currencies from the Americas with bilateral investment treaties being the policy linkage that predicts RMB_o share in explained variance. The US affinity variable is positive and significant for Western hemisphere economies indicating some complementarity between US affinity, dollarisation and co-movements with the Yuan.

These results seem to imply that there are multiple modes across countries and continents through which currencies get exposed to RMB fluctuations and start co-moving with it. This is similar to results found by Chey and Hsu (2020) who find multiple that different policy infrastructures across countries may be utilised in promoting RMB use. Export exposure and policy linkages seems to be the key drivers for non Asia-Oceania economies. Policy linkages seem to be the only significant variable for Asia-Oceania as trade exposures were already high at the beginning of our sample in 2006. The role of broader policy affinity also varies across continents which makes it difficult draw any robust conclusions about its role in predicting RMB_o variance shares. Additionally, we run a wide range of robustness checks in Appendix E. We control for neighbour effects to proxy for network externalities, trade linkages to the United States, and financial linkages to China. We also present results using RMB_o $\hat{\beta}_{c,t}$ and its effect-specific unstandardised coefficients. Across all these models, export exposure variable and BRI linkages are the only robust determinants of the size of the co-movement coefficients as well as variance share explained by the RMB. This suggests a dual channel for RMBI, driven by export linkages and economic diplomacy.

6 Conclusion

In this paper, we ask three inter-related questions about the role of the RMB in global exchange rate arrangements. First, we study which currencies co-move with the RMB in order to understand its potential use as an anchor for exchange rate stabilisation as part of *de facto* currency baskets. We do so by using a Frankel-Wei regression augmented with an orthogonalised RMB_o as an additional regressor within a structural breaks framework. We consider cases of both symmetric and asymmetric co-movements with the RMB_o across specifications and we find that 74

[60]These results for Asia-Oceania countries may be driven by omission of financial linkage variables. Adding FDI dependence variables or stock market correlations as well as sample splits in time do not alter the Asia-Oceania results, with trade exposure having a zero or negative effect of co-moving with the RMB. Tables available on request

[61]There's an odd result for reserve dummy, which indicates a negative effect of holding RMB reserves on currency co-movement share with the RMB. Only 5 African countries have claimed owning RMB foreign exchange reserves and this result could be driven by stabilisation of the bilateral exchange rate using those reserves.

out of 135 national currencies in our sample have at least one period of statistically significant co-movement between October 2005-December 2017. The network of currencies that co-move with the RMB are globally dispersed with more concentration in Asia-Pacific and Africa.

Our estimation strategy allows us to gauge symmetry, time-variation and persistence in co-movements with the RMB. For a majority of our currencies, we find that co-movement with the RMB_o is asymmetric, with greater sensitivity to RMB_o depreciation. Moreover, most small transitory periods of significant co-movement with only 21 currencies showing significant co-movements for greater than half the sample. These transitory but significant co-movements with RMB_o for these currencies could indicate a mix of policy choices, common shocks or business cycle integration. We assess the relative importance of the RMB_o in local currency baskets as an anchor by using squared standardised $\hat{\mathcal{B}}^2_{c,t}$ coefficients. We find that while the size of the unstandardised RMB_o $\hat{\beta}_{c,t}$ coefficients are large, the contribution of the RMB_o in the explained variance for significant RMB_o co-movement periods is almost negligible.

Second, we want to understand the role of the RMB in the global monetary system compared with other reserve currencies, and how its global role has evolved over time. Our structural breaks methodology allows us to track the relative importance of the RMB over time and aggregate RMB_o $\hat{\mathcal{B}}^2_{c,t}$ coefficients across currencies to get a continuous measure of the RMB's global influence. We find that the RMB has a very small share, less than 2% on average as an additional anchor currency in the explained variance of the local currency basket-weight regression. These results hold even for currencies who have been known to closely track the RMB with a majority of the RMB_o's share in explained variance is due to periods of unanticipated RMB_o depreciation. The USD and EUR, on the other hand have a 60% and 15% average share in explained currency variance. We allocate national currencies into reserve currency blocs based on RMB_o, USD and EUR $\hat{\mathcal{B}}^2_{c,t}$ shares. This exercise is a sweep for the USD and EUR. All currencies are found to be anchored to either the USD or EUR as a direct or indirect anchor.

The EUR and RMB look similar in their global GDP-weighted average share in explained variance after 2015. Moreover, the EUR is geographically constrained in its influence unlike the RMB, which has a more geographically dispersed global influence. This makes it seem as if the RMB may be on the verge of over-taking the EUR as an international currency. This is misleading, as it hides the fact that central banks use the EUR as a primary anchor in the Eurozone periphery and Africa. The RMB has a more geographically dispersed global influence, but its economic significance is very limited as there are *no currencies* that use it as a primary anchor. This exercise conclusively shows that the RMB has thus far achieved a tertiary role in global exchange rate arrangements, as suggested by its current global share of the RMB in allocated foreign exchange reserves.

Lastly, we study the country-level determinants of the variance share explained by the RMB_o in a currency after controlling for a standard set of covariates of optimal currency choice including trade, financial, policy linkages and business cycle synchronisation. We find that export exposure to China is the primary determinant of RMB_o $\hat{\mathcal{B}}^2_{c,t}$, with a role for policy linkages like the BRI (and broad policy affinity to China). Co-movement with the RMB_o is strongest for small (commodity) exporter countries with relatively open capital accounts and flexible exchange rates. China's special relationship with Africa is reflected by the fact that African currencies display co-movement with the RMB due to export exposure as well as bilateral policy affinity. There seems to heterogeneity in modes of internationalisation across continents with local currency settlement facilities being important in Asia, BRI in Africa, swap lines in Europe and BITs in the Americas. China has had great success exporting RMB internationalisation related infrastructure, which increases the likelihood that a country may start adopting RMB for invoicing and trade credit. This variation in policy-linkage coefficients indicates multimodality in RMB internationalisation, which might help scale its future adoption.

Our results are robust to choice of numeraire used in estimating the augmented Frankel-Wei regression as well as modelling choices in recovering the RMB_o $\hat{\beta}_{c,t}$ to account for multicollinearity. This implies that the narratives regarding the ascent of the RMB as global anchor currency are exaggerated and the future of RMB internationalisation remains uncertain, given trade tensions with the United States.[62] Even though we do not expect global value chains to move out of China given escalating trade and political tensions, the threat of relocation of supply chains may cause a reduction in countries' direct export exposure to China, which could reduce their incentives to use the RMB.

China's financial account openness and the low flexibility of the RMB remain stumbling blocks, preventing it from leveraging its influence in global trade to scale RMB adoption without resorting to unconventional internationalisation policies. Allowing for greater RMB flexibility as well as increasing RMB convertibility are the surest ways to enhance RMB's global role. Measures like the recent introduction of a blockchain-based Digital Yuan might provide an alternate way to internationalise its currency. However, unconventional and state-directed internationalisation policies are unlikely to allow for network effects that generate positive non-linearities in the rise of an international currency.

China's economic gravity ensures that RMB cannot be ignored as a potential international currency, but it is likely that with its current policy-mix, it will take a much longer time achieving that status.

[62]We utilise the methodology developed in this paper to repeat our analysis for the period between Aug 2015 and Jan 2020. This period includes the most recent RMB fixing reforms as well as the US-China trade-war up til agreement of the Phase-I trade deal. These results are presented in Appendix G. The results for this period are almost identical to our full-sample results. The global average RMB_o share does not exceed 2%, even for known RMB trackers. Full results for the trade-war period are available on request

Appendices

A Data

A.1 Currency data

Table A.1 Currency list

Currency	Country	Region	Currency	Country	Region
AOA	Angola	Africa	XCD	Antigua & Barbuda	Americas
BIF	Burundi	Africa	ARS	Argentina	Americas
BWP	Botswana	Africa	AWG	Aruba	Americas
CDF	Congo	Africa	BBD	Barbados	Americas
XAF	Central African Republic	Africa	BMD	Bermuda	Americas
XOF	CÃťte dâĂŹIvoire	Africa	BOB	Bolivia	Americas
CVE	Cape Verde	Africa	BRL	Brazil	Americas
DJF	Djibouti	Africa	BSD	Bahamas	Americas
DZD	Algeria	Africa	BZD	Belize	Americas
EGP	Egypt	Africa	CAD	Canada	Americas
ERN	Eritrea	Africa	CLP	Chile	Americas
ETB	Ethiopia	Africa	COP	Colombia	Americas
GHS	Ghana	Africa	CRC	Costa Rica	Americas
GMD	Gambia	Africa	CUP	Cuba	Americas
GNF	Guinea	Africa	DOP	Dominican Republic	Americas
KES	Kenya	Africa	GTQ	Guatemala	Americas
KMF	Comoros	Africa	GYD	Guyana	Americas
LRD	Liberia	Africa	HNL	Honduras	Americas
LYD	Libya	Africa	HTG	Haiti	Americas
MAD	Morocco	Africa	JMD	Jamaica	Americas
MGA	Madagascar	Africa	KYD	Cayman Islands	Americas
MRO	Mauritania	Africa	MXN	Mexico	Americas
MUR	Mauritius	Africa	PEN	Peru	Americas
MWK	Malawi	Africa	SRD	Suriname	Americas
MZN	Mozambique	Africa	SVC	El Salvador	Americas
RWF	Rwanda	Africa	ANG	Sint Maarten	Americas
SCR	Seychelles	Africa	TTD	Trinidad & Tobago	Americas
SLL	Sierra Leone	Africa	UYI	Uruguay	Americas
SOS	Somalia	Africa	VEF	Venezuela	Americas
SDG	South Sudan	Africa	AED	United Arab Emirates	Asia
STD	Sao Tome & PrÃŋncipe	Africa	AMD	Armenia	Asia
SZL	Swaziland	Africa	AZN	Azerbaijan	Asia
TND	Tunisia	Africa	BDT	Bangladesh	Asia
TZS	Tanzania	Africa	BHD	Bahrain	Asia
UGX	Uganda	Africa	BND	Brunei	Asia
ZAR	South Africa	Africa	BTN	Bhutan	Asia
ZMK	Zambia	Africa	GEL	Georgia	Asia
Currency	Country	Region	Currency	Country	Region
HKD	Hong Kong SAR China	Asia	BGN	Bulgaria	Europe
IDR	Indonesia	Asia	BYR	Belarus	Europe
ILS	Israel	Asia	CZK	Czechia	Europe
INR	India	Asia	DKK	Denmark	Europe
IQD	Iraq	Asia	GIP	Gibraltar	Europe
IRR	Iran	Asia	HRK	Croatia	Europe
JOD	Jordan	Asia	HUF	Hungary	Europe
KGS	Kyrgyzstan	Asia	ISK	Iceland	Europe
KHR	Cambodia	Asia	MDL	Moldova	Europe
KRW	South Korea	Asia	MKD	Macedonia	Europe
KWD	Kuwait	Asia	NOK	Norway	Europe
KZT	Kazakhstan	Asia	PLN	Poland	Europe
LAK	Laos	Asia	RON	Romania	Europe
LBP	Lebanon	Asia	RSD	Serbia	Europe
LKR	Sri Lanka	Asia	RUB	Russia	Europe
MMK	Myanmar (Burma)	Asia	SEK	Sweden	Europe
MNT	Mongolia	Asia	UAH	Ukraine	Europe
MOP	Macau SAR China	Asia	AUD	Australia	Oceania
MVR	Maldives	Asia	FJD	Fiji	Oceania
MYR	Malaysia	Asia	NZD	New Zealand	Oceania
NPR	Nepal	Asia	XPF	French Polynesia	Oceania
OMR	Oman	Asia	SBD	Solomon Islands	Oceania
PHP	Philippines	Asia	TOP	Tonga	Oceania
PKR	Pakistan	Asia	VUV	Vanuatu	Oceania
QAR	Qatar	Asia	WST	Samoa	Oceania
SAR	Saudi Arabia	Asia			
SGD	Singapore	Asia			
SYP	Syria	Asia			
THB	Thailand	Asia			
TJS	Tajikistan	Asia			
TMM	Turkmenistan	Asia			
TRY	Turkey	Asia			
TWD	Taiwan	Asia			
UZS	Uzbekistan	Asia			
VND	Vietnam	Asia			
YER	Yemen	Asia			
BAM	Bosnia & Herzegovina	Europe			

A.2 Dataset for panel regressions

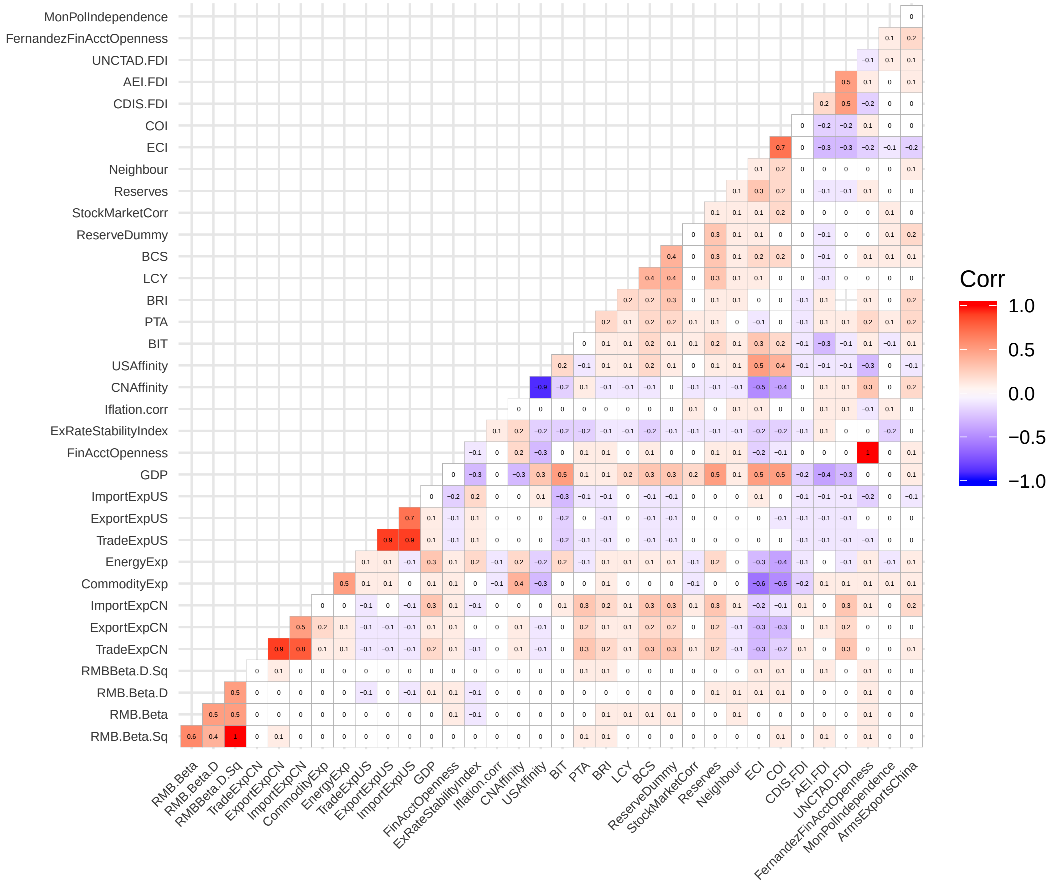
Table A.2 Dataset list

Variable	Source	Coverage
Currency closing price	Datastream	
Export exposure	IMF-DOTS	2005-2017
Import exposure	IMF-DOTS	2005-2017
Total trade exposure	IMF-DOTS	2005-2017
FDI dependence	UNCTAD	2005-2013
FDI dependence	IMF-CDIS	2015-.
Portfolio flows dependence	IMF-CPIS	2015-.
FDI dependence	AEI-Heritage Foundation	2009-.
CPI inflation	IMF-IFS	
Foreign exchange reserves	IMF-IFS	
GDP	IMF-IFS	
Country benchmark stock exchanges	Datastream	
PTA list	UNCTAD	
BIT list	UNCTAD	
FTA list	UNCTAD	
LCY list	SAFE	
BCS list	SAFE and PboC	
BRI list	AEI-Heritage Foundation	
Reserve dummy	Liao and McDowell (2016) and Author's calculations	
Idealpoint distance and affinity scores	Bailey *et al.* (2017)	
Trilemma indices	Aizenman *et al.* (2010)	
Exchange rate classification	Ilzetzki *et al.* (2019)	
Commodity dummy	UNCTAD	
Oil exporter dummy	UNCTAD	
Capital account openness	Fernández *et al.* (2016)	
Economic complexity indices	Hidalgo and Hausmann (2009)	
Chinese Arms Exports	SIPRI	

Table A.3 Summary statistics

	Variable	Complete Rate	Mean	SD	p0	p25	p50	p75	p100
1	RMB$_o$ $\hat{\mathcal{B}}^2$	0.99	0.00	0.03	0.00	0.00	0.00	0.00	0.94
2	RMB$_o$ $\hat{\beta}_{c,t}$	1.00	0.11	0.44	0.00	0.00	0.00	0.00	7.57
3	RMB$_{o(D)}$ $\hat{\beta}_{c,t}$	1.00	0.17	0.65	0.00	0.00	0.00	0.00	12.17
4	RMB$_{o(D)}$ $\hat{\mathcal{B}}^2$	0.99	0.00	0.03	0.00	0.00	0.00	0.00	1.00
5	Trade exposure (China)	0.92	8.81	8.84	0.01	3.43	6.18	10.65	61.96
6	Export exposure (China)	0.94	7.10	12.77	0.00	0.63	1.99	8.16	88.13
7	Import exposure (China)	0.96	9.58	7.23	0.01	4.86	7.95	12.37	47.82
8	Commodity Exporter dummy	1.00	0.45	0.50	0.00	0.00	0.00	1.00	1.00
9	Energy Exporter dummy	1.00	0.17	0.37	0.00	0.00	0.00	0.00	1.00
10	Trade Exposure (US)	0.81	9.73	12.71	0.14	2.01	4.75	11.34	72.85
11	Export Exposure (US)	0.81	11.43	16.24	0.00	1.83	4.36	13.16	102.70
12	Import Exposure (US)	0.81	8.28	11.79	0.00	1.42	3.82	8.66	79.67
13	ln(GDP in Billions)	0.97	3.41	2.11	-2.25	1.98	3.44	5.14	7.87
14	FAO index	1.00	0.44	0.33	0.00	0.13	0.33	0.73	1.00
15	ERS index	0.93	0.58	0.31	0.00	0.31	0.50	1.00	1.00
16	Inflation correlation	0.87	0.31	0.69	-1.00	-0.26	0.61	0.90	1.00
17	China Affinity	1.00	0.77	0.15	0.11	0.74	0.83	0.88	1.00
18	US Affinity	1.00	0.19	0.13	0.00	0.10	0.16	0.22	0.92
19	BIT	1.00	0.55	0.50	0.00	0.00	1.00	1.00	1.00
20	PTA	1.00	0.23	0.42	0.00	0.00	0.00	0.00	1.00
21	BRI	1.00	0.10	0.30	0.00	0.00	0.00	0.00	1.00
22	LCY	1.00	0.01	0.12	0.00	0.00	0.00	0.00	1.00
23	BCS	1.00	0.08	0.28	0.00	0.00	0.00	0.00	1.00
24	Reserve Dummy	1.00	0.08	0.28	0.00	0.00	0.00	0.00	1.00
25	Stock Market Correlation	0.48	0.29	0.61	-1.00	-0.19	0.48	0.85	1.00
26	FX Reserves	0.88	33410.32	76458.15	0.00	724.86	4942.66	29145.73	721417.00
27	Neighbour dummy	1.00	0.45	0.50	0.00	0.00	0.00	1.00	1.00
28	ECI	0.66	-0.11	0.87	-2.79	-0.74	-0.15	0.47	2.06
29	COI	0.66	0.05	0.96	-1.35	-0.89	0.05	0.77	2.96
30	FDI dependence (CDIS)	0.55	8.28	36.00	-0.07	0.03	0.12	0.64	250.00
31	FDI dependence (AEI)	0.34	12.26	30.33	0.02	0.90	2.86	9.32	250.00
32	FDI dependence (UNCTAD)	0.52	2.93	8.08	0.00	0.09	0.53	1.99	101.56
33	FKRSU financial account openness	0.57	0.44	0.34	0.00	0.10	0.35	0.75	1.00
34	Monetary policy independence	0.85	0.46	0.18	0.00	0.35	0.49	0.59	0.96
35	Arms exports from China (dummy)	0.92	0.13	0.33	0.00	0.00	0.00	0.00	1.00

Figure A.1 Heatmap of regression covariates



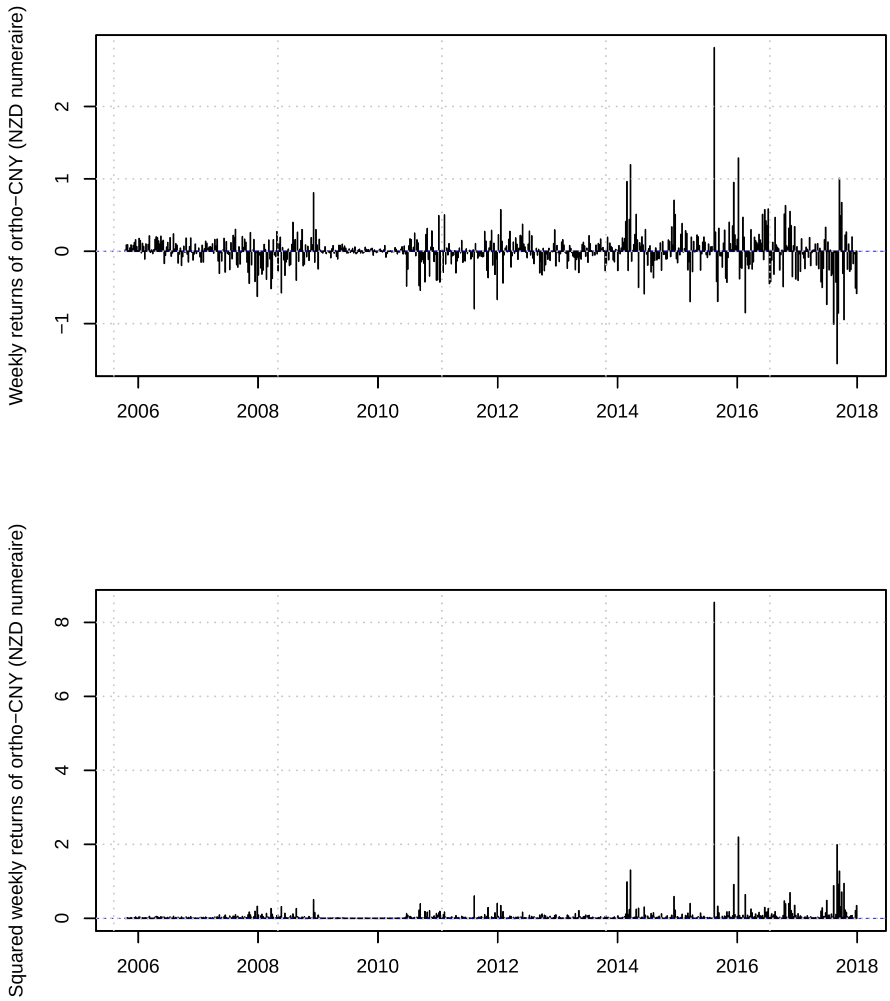
Note: This heatmap shows the correlation structure of all the variables utilised in our regression estimations. Significant correlations are shaded using the blue to red (negative to positive correlation) scale

B Additional results

Figure B.1 Chinese exchange rate regime changes

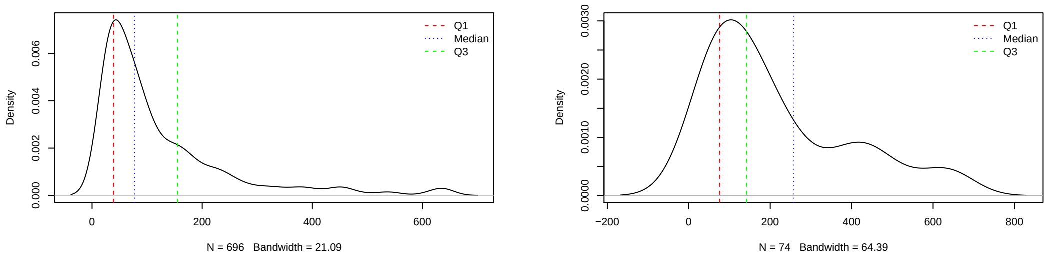
Note: This figure shows the evolution of Chinese exchange rate regime since 2005. The structural break estimation of equation 2 at weekly frequency recovers 3 break-periods.

Figure B.2 Orthogonalised Renminbi



Note: The top panel shows the weekly orthogonalised RMB returns after purging the effects of the FW currencies whereas the bottom panel shows squared-weekly orthogonalised RMB_o returns

Figure B.3 Duration of regime-periods



a. All detected regime-periods

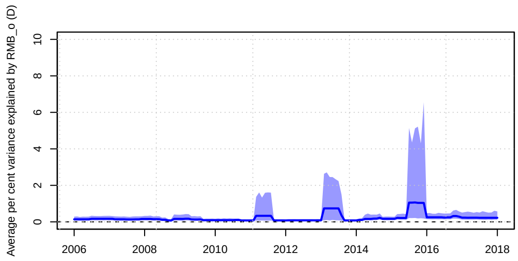
b. RMB$_o$ regime-periods

Note: This figure shows the density plot of regime duration in weeks for all estimated regime-periods in the sample in the left panel. This visualisation is repeated for currencies with regime-periods of significant RMB$_o$ co-movement in the right panel

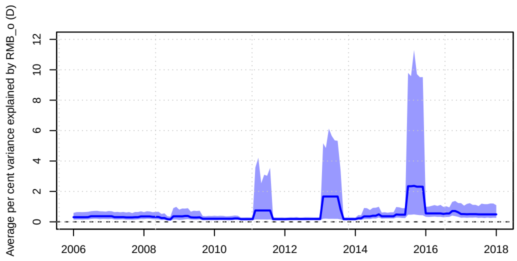
Table B.1 Countries with longest RMB$_o$ co-movement

	Country	Per cent of sample with a significant RMB$_o$ $\hat{\beta}$
1	Canada	60.67
2	South Korea	60.99
3	Botswana	61.61
4	Libya	61.61
4	Algeria	62.24
6	Chile	63.18
7	Vanuatu	64.12
8	Tunisia	67.26
9	Turkey	71.33
10	Brunei	72.27
11	Australia	72.43
12	Norway	75.10
13	Samoa	75.25
14	Thailand	80.11
15	Singapore	84.50
16	Malaysia	91.09
17	Cambodia	100
18	Philippines	100
19	Swaziland	100
20	Taiwan, Province of China	100
21	South Africa	100

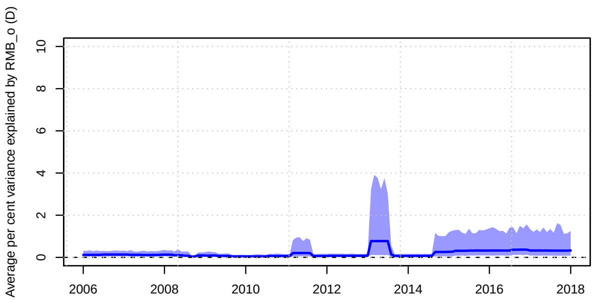
Figure B.4 Unweighted mean and GDP weighted $\text{RMB}_{o(D)}$ share in explained variance



a. Full sample



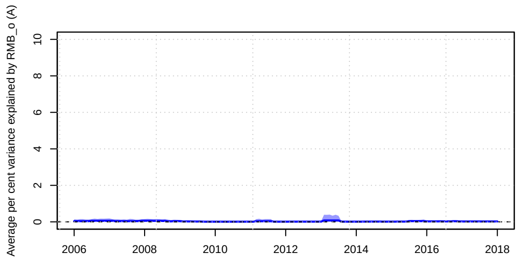
b. $\text{RMB}_{o(D)}$ trackers



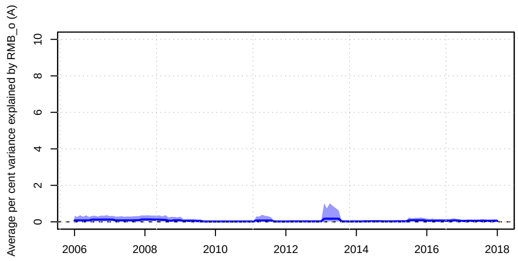
c. GDP-weighted

Note: This figure in the top-left panel shows the unweighted contributions of $\text{RMB}_{o(D)}$ in the spline version of the augmented FW regression for 135 national currencies. This figure in the top-right panel shows the average variance contribution of $\text{RMB}_{o(D)}$ for the 49 currencies who have a statistically significant $\text{RMB}_{o(D)}$ coefficient. The figure in the bottom panel shows the PPP GDP-weighted RMB_o variance share. As we set statistically insignificant $\hat{\mathcal{B}}^2$ to zero, the measure for GDP-weighted $\mu_{\hat{\mathcal{B}}_t^2}$ is identical for the full sample and RMB trackers

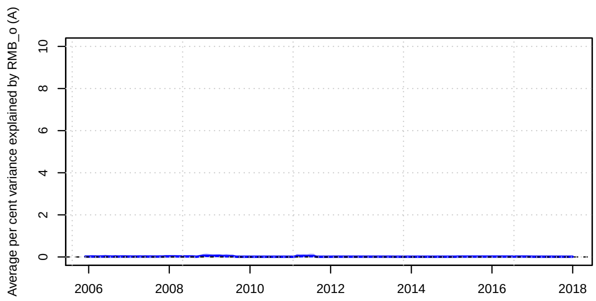
Figure B.5 Unweighted mean and GDP weighted $\mathrm{RMB}_{o(A)}$ share in explained variance



a. Full sample



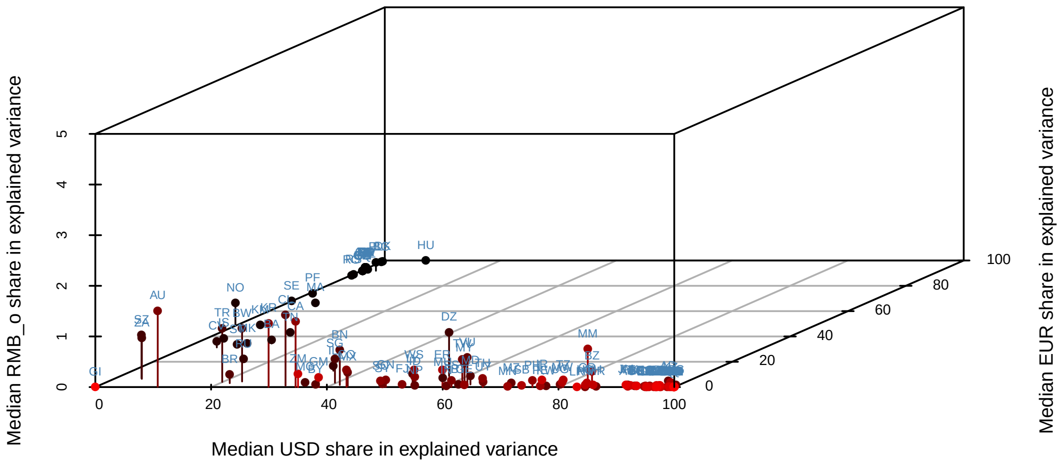
b. $\mathrm{RMB}_{o(A)}$ trackers



c. GDP-weighted

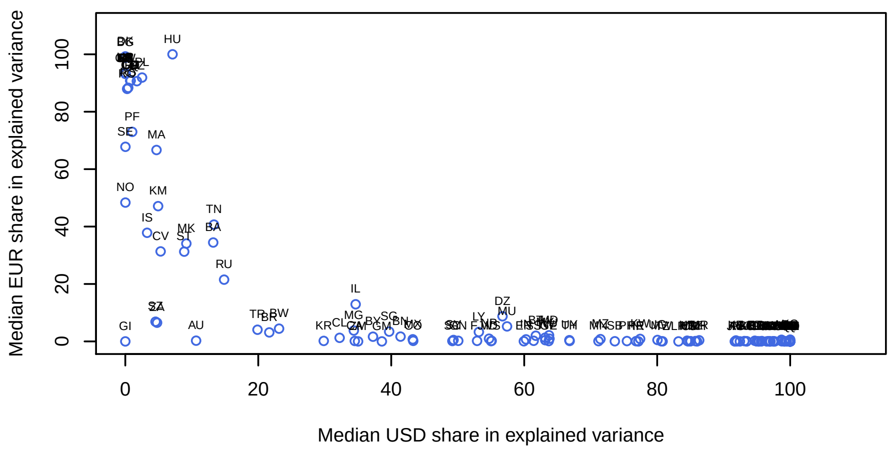
Note: This figure in the top-left panel shows the unweighted contributions of $\mathrm{RMB}_{o(A)}$ in the spline version of the augmented FW regression for 135 national currencies. This figure in the top-right panel shows the average variance contribution of $\mathrm{RMB}_{o(A)}$ for the 24 currencies who have a statistically significant $\mathrm{RMB}_{o(A)}$ coefficient. The figure in the bottom panel shows the PPP GDP-weighted RMB_o variance share. As we set statistically insignificant $\hat{\mathcal{B}}^2$ to zero, the measure for GDP-weighted $\mu_{\hat{\mathcal{B}}_t^2}$ is identical for the full sample and RMB trackers

Figure B.6 Comparing the average variance contribution of RMB$_o$, USD and the EUR



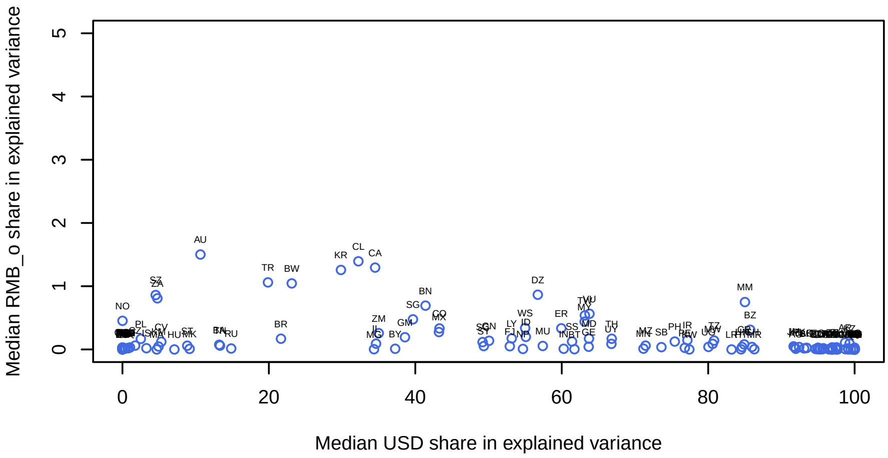
Note: This figure compares the variance contribution of RMB$_o$, USD and the EUR in the augmented FW regression for 135 national currencies using a 3-D scatter-plot. The currency in the left corner is the Gibraltar Pound which is pegged to the GBP, clearly showing the utility of our method.

Figure B.7 USD-EUR Dominance



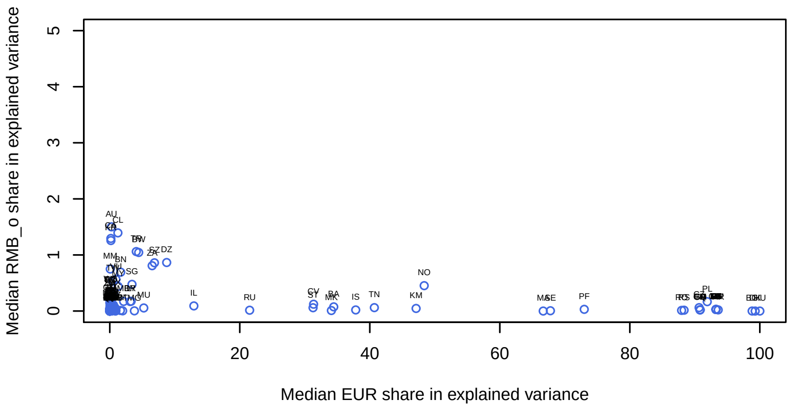
Note: This figure shows the scatter plots of the USD and EUR share of explained variance for the full sample period

Figure B.8 USD-RMB share



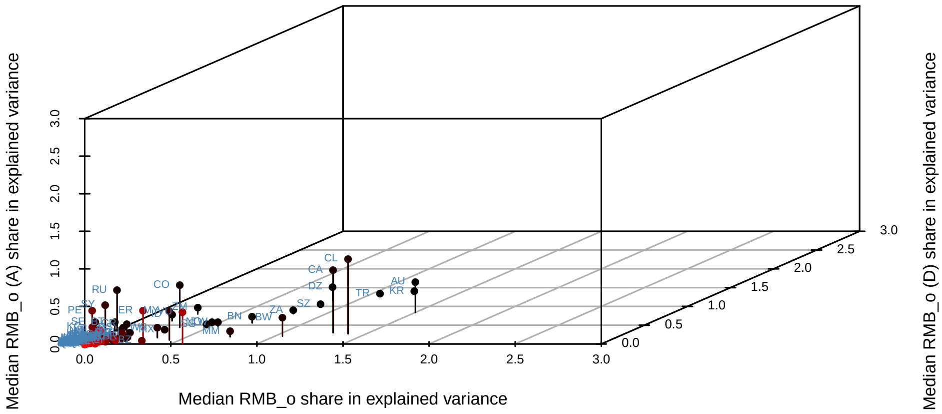
Note: This figure shows the scatter plots of the USD and RMB share of explained variance for for the full sample period

Figure B.9 EUR-RMB share



Note: This figure shows the scatter plots of the EUR and RMB share of explained variance for the full sample period

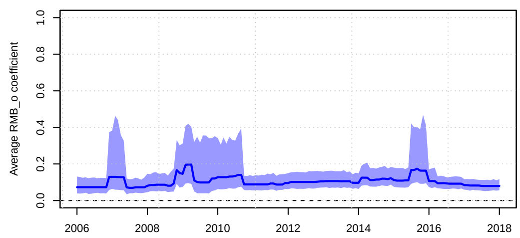
Figure B.10 RMB$_o$-RMB$_{o(A)}$-RMB$_{o(D)}$ share



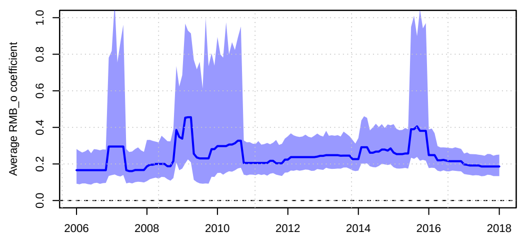
Note: This figure shows the 3D scatter plots of the median RMB$_o$, RMB$_{o(A)}$ and RMB$_{o(D)}$ share of explained variance for national currencies for the full sample period

C Results with unstandardised coefficients

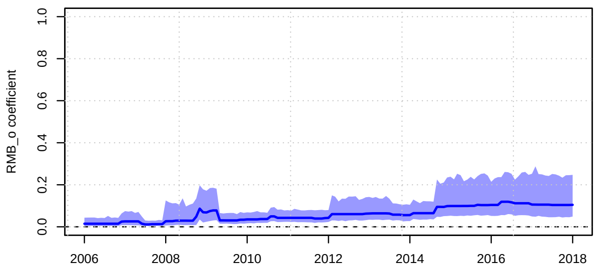
Figure C.1 Unweighted mean and GDP weighted mean RMB$_o$ $\hat{\beta}_t$



a. Full sample



b. RMB$_o$ trackers



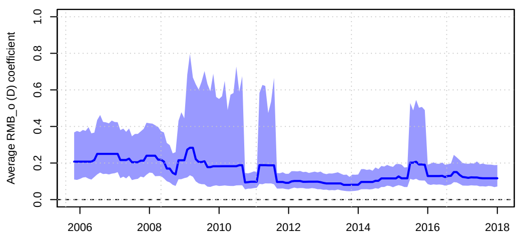
c. GDP-weighted

Note: This figure in the top-left panel shows the average RMB$_o$ $\hat{\beta}_t$ for 135 national currencies. This figure in the top-right panel shows the average RMB$_o$ $\hat{\beta}_t$ for the 59 currencies who have a statistically significant RMB$_o$ coefficient. The figure in the bottom panel shows the PPP GDP-weighted average RMB$_o$ $\hat{\beta}_t$. Three free-falling periods for Iranian Rial, Iraqi Dinar and the Barbados Dollar respectively have been set to zero for calculating the average, given very large RMB$_o$ $\hat{\beta}$'s that affect the interpretation of the time series average.

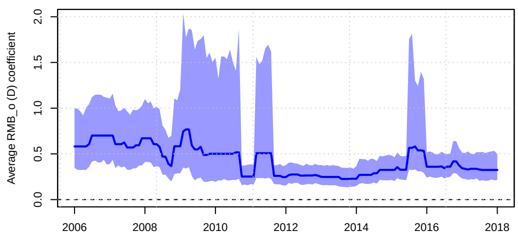
Figure C.1 shows the the global evolution of unweighted and GDP-weighted, RMB$_o$ $\mu_{\hat{\beta}_t}$ for our set of national currencies. We can see that the midpoint estimate of the unweighted RMB$_o$ $\mu_{\hat{\beta}_t}$ ranges between 0.07 to 0.20 with a time-series median of 0.10. This implies that a 1% depreciation of the RMB$_o$ would lead to average depreciation of 7 to 20 basis points (bps) for a national currency. This average point estimate twice as big higher for currencies with at least one period of statistically significant co-movement with the RMB$_o$, ranging between 20-50 bps. There are spikes in the size of the RMB$_o$ $\mu_{\hat{\beta}_t}$ for periods of RMB structural change but no discernable trend otherwise. This is not the case for the GDP weighted-mean coefficient estimate which is growing over time unlike the unweighted mean. This implies that relatively larger countries have become sensitive to RMB$_o$ fluctuations towards end of the sample period.

However, we must note that a depreciation of the RMB$_o$ $\geq 1\%$ happens only for 6 weeks over our entire sample period which is *less than 1%* of our observations. This clearly shows the dual problems of estimating the RMB_o $\hat{\beta}$ using OLS and using unstandardised coefficient based inference. While we don't directly deal with the problem of outliers generating large (and unstable) OLS coefficients, standardising the coefficients provide a workaround in inferring relative importance within the OLS framework, without resorting to ad hoc parameter restrictions or winsorisation of the data. Nevertheless, we provide aggregate estimates using unstandardised coefficients for the sake of comparability with other studies in the literature.

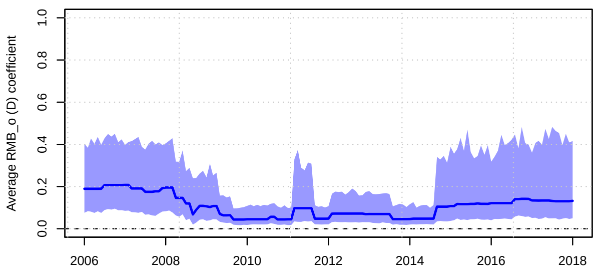
Figure C.2 Unweighted mean and GDP weighted mean $\text{RMB}_{o(D)}$ $\hat{\beta}_t$



a. Full sample



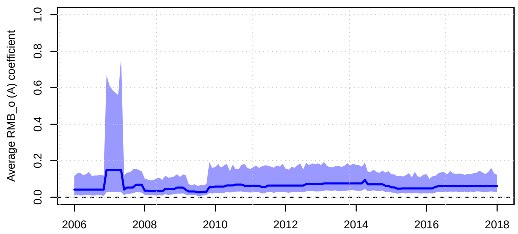
b. $\text{RMB}_{o(D)}$ trackers



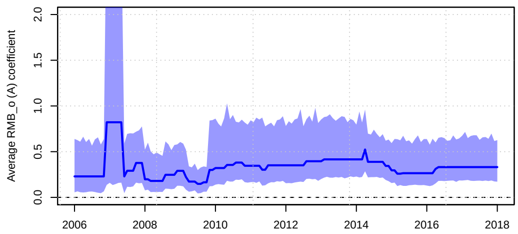
c. GDP-weighted

Note: This figure in the top-left panel shows the average $\text{RMB}_{o(D)}$ $\hat{\beta}_t$ for 135 national currencies. This figure in the top-right panel shows the average $\text{RMB}_{o(D)}$ $\hat{\beta}_t$ for the 49 currencies who have a statistically significant $\text{RMB}_{o(D)}$ coefficient. The figure in the bottom panel shows the PPP GDP-weighted average $\text{RMB}_{o(D)}$ $\hat{\beta}_t$. Some free-falling periods have been set to zero for calculating the average, given very large $\text{RMB}_{o(D)}$ $\hat{\beta}$'s that affect the interpretation of the time series average.

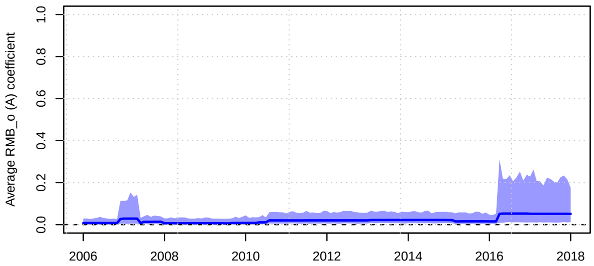
Figure C.3 Unweighted mean and GDP weighted mean $\text{RMB}_{o(A)}$ $\hat{\beta}_t$



a. Full sample



b. $\text{RMB}_{o(A)}$ trackers



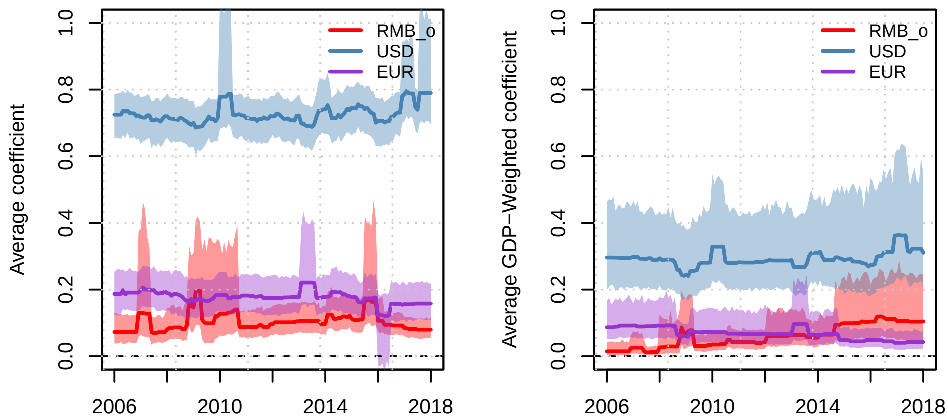
c. GDP-weighted

Note: This figure in the top-left panel shows the average $\text{RMB}_{o(A)}$ $\hat{\beta}_t$ for 135 national currencies. This figure in the top-right panel shows the average $\text{RMB}_{o(A)}$ $\hat{\beta}_t$ for the 24 currencies who have a statistically significant $\text{RMB}_{o(A)}$ coefficient. The figure in the bottom panel shows the PPP GDP-weighted average $\text{RMB}_{o(D)}$ $\hat{\beta}_t$.

Figure C.2 and Figure C.3 show the results for RMB_o depreciation and appreciation respectively. The midpoint estimate for $\text{RMB}_{o(D)}$ $\mu_{\hat{\beta}_t}$ is twice as large as the one for $\text{RMB}_{o(A)}$ for all three variants of our aggregate $\mu_{\hat{\beta}_t}$. This is in line with our expectations that currencies are more sensitive to unanticipated RMB depreciations than appreciations. This is caveated once again by reiterating that a 1% move in the RMB_o occurs less than 1% of the time in our sample. This is more indicative of countries' mercantilist motives versus RMB pricing of exports rather than primary anchoring behaviour.

Figure C.4 shows the similar averages for the USD and EUR along with a comparison with RMB_o. We can see that the midpoint estimate of the unweighted USD $\mu_{\hat{\beta}_t}$ ranges between 0.68 to 0.80 with a median of 0.71. This implies that a 1% depreciation of the USD would lead to average depreciation of 68 to 80 bps for a non-SDR currency. The same midpoint estimate for the EUR ranges between 0.12 to 0.22 with a median of 0.17. The average effect of the EUR and RMB_o start to look similar in magnitude towards the end of the sample period after the RMB devaluation.

Figure C.4 Comparing the USD, EUR and RMB_o



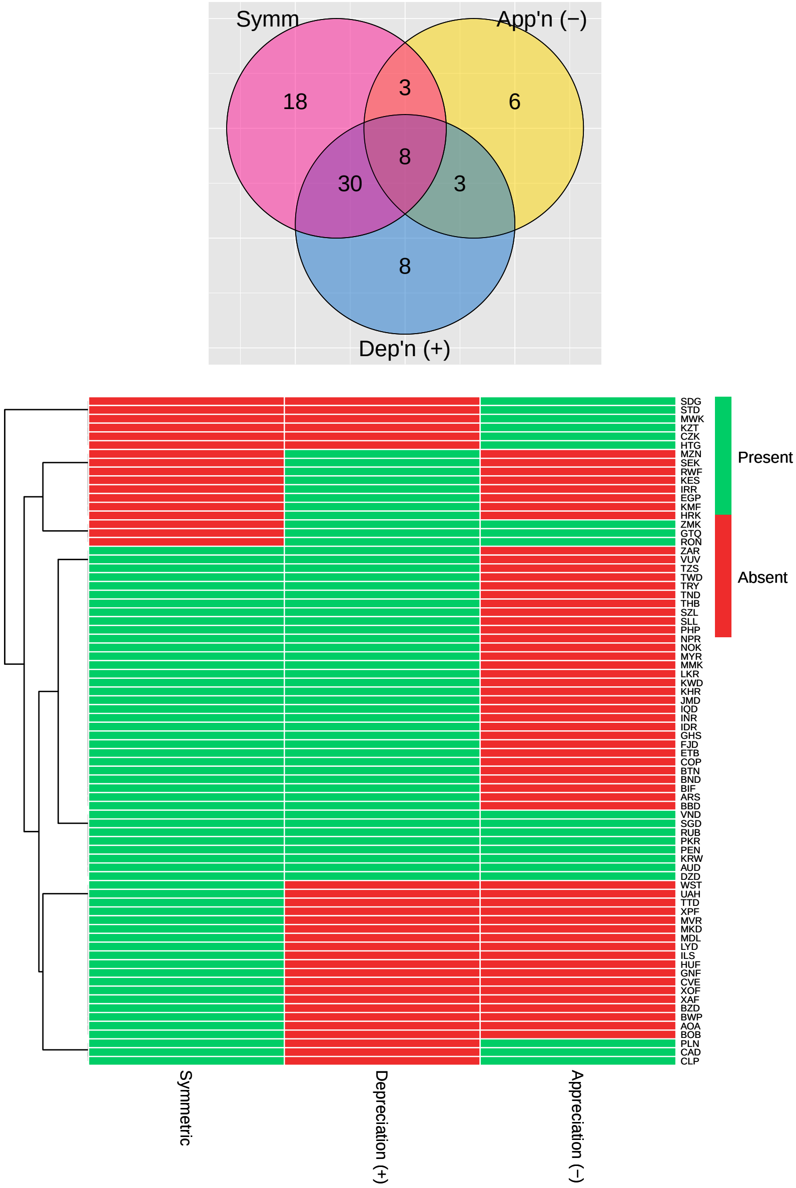
Note: This figure shows the unweighted and GDP-weighted USD $\hat{\beta}_t$, EUR $\hat{\beta}_t$ and RMB_o $\hat{\beta}_t$ means for non-SDR currencies

The weighted $\mu_{\hat{\beta}_t}$ show that RMB_o started having a larger impact on global (Excluding Euro area) GDP after 2015 compared to the EUR. Moreover, the lower end of USD and RMB_o $\mu_{\hat{\beta}_t}$ confidence intervals started overlapping for the post-2015 period. This would erroneously imply that the RMB is *already* the second most important reserve currency and is starting to look comparable to the USD in terms of its impact on national currencies.

D Allowing for negative co-movements

In In the main body of the paper, we have only focused on positive coefficients in our estimations as positive coefficients are a better predictor of anchoring behaviour and we believe that national currencies have no economic reason to appreciate in response to RMB_o depreciation. However, in the spline specification we can relax this assumption for $\text{RMB}_o(A)$. Negative coefficients for $\text{RMB}_o(A)$ would imply that there are some currencies that significantly depreciate following a RMB appreciation. This would be evidence of counter-cyclical management or a strong negative pass-through via markets to idiosyncratic RMB appreciation. We test for negative $\text{RMB}_o(A)$ coefficients with a one-tailed test, as we have done before. There are 22 currencies which show a negative $\text{RMB}_o(A)$. This is a diverse set including floaters like the Australian Dollar and Canadian Dollar as well as known China watchers like Vietnamese Dong, Pakistani Rupee and the Korean Won. This suggests mercantilist motives in allowing the bilateral exchange rate versus the RMB to weaken, when the RMB appreciates.

Figure D.1 Asymmetry in global sensitivity to the RMB$_o$



Note: This figure shows counts and classification of currencies which have a linear sensitivity to the RMB$_o$ compared with countries who react depreciate when the RMB$_o$ appreciates while also depreciating when the RMB$_o$ depreciates for the full sample

E Exploring heterogeneity in determinants of RMB co-movement

In this Appendix, we explore the heterogeneity in country-characteristics that predicts the RMB_o share in explained variance for a currency. We examine the marginal effects of export exposure interacted with some of our country covariates to get a sense of how export exposure may mediate the RMB_o share in explained variance for particular groups of countries in appendix E.1. We present robustness checks with variables that may have been omitted in the baseline specification in appendix E.2. We also study the predictors of $\text{RMB}_{o(D)}$ $\hat{\mathcal{B}^2_{c,t}}$ and $\text{RMB}_o\hat{\beta}_{c,t}$ to ensure robustness of our conclusions. Across specifications, export exposure to China is the only robust predictor of RMB_o $\hat{\mathcal{B}^2_{c,t}}$ (and $\text{RMB}_o\hat{\beta}_{c,t}$). There is secondary role for BRI linkages and policy affinity but this is more important for African nations than other geographies.

E.1 Interaction effects

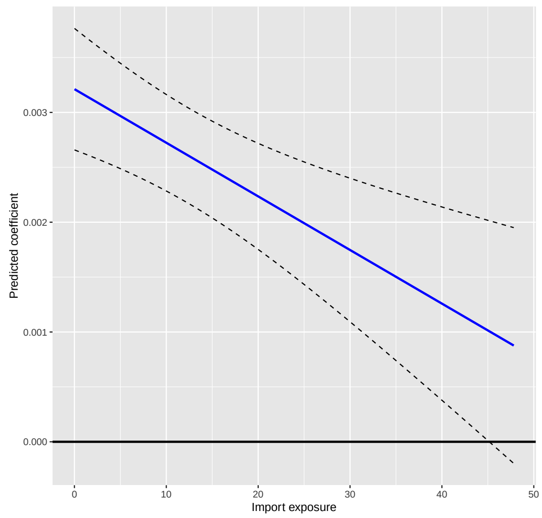
We start by looking at the effect of export exposure interacted with a commodity exporter dummy. Commodity exporter is a dummy variable which takes a value of 1 if over 20% of goods exports are primary commodities. 54 countries in our sample meet this criteria. Out of these countries, 24/54 countries have at least one period with significant co-movement with the RMB. Baum *et al.* (2015), Forbes *et al.* (2016), Stuermer (2017) have all noted the importance of Chinese business news as well as portfolio allocation to commodity countries associated with Chinese demand. We find that the effect of export exposure to China is *much stronger* for commodity exporters rather than commodity non-exporters fitting with the *dragon play* hypothesis posited by Forbes *et al.* (2016). Countries that share common demand shocks with China are more likely to have local currencies that co-move with the RMB. However, there is some heterogeneity in this effect as well, the commodity exporter results only hold for countries who export non-oil and gas related commodities.

We also examine the effect of a country's export complexity and export diversification potential using the economic complexity index and complexity outlook index developed by Hidalgo and Hausmann (2009). We interact these two variables with export exposure to China to understand the role complexity and diversification potential of exports may play in predicting importance of the RMB. We find that the marginal effect of increasing export complexity and diversification potential have no effect on the variance explained by the RMB in a currency. These four exporter-characteristics interactions can be found in Figure E.2. These results indicate that there is a high amount of exporter-specific variation in determining how important the RMB is for a local currency.

We repeat this exercise for our major covariates and interact them with export exposure in a sequential manner. Figure E.3 shows the interactions of export exposure with ERS index, financial account openness, inflation correlation with China and country size. The interaction plots suggest that the effect of export exposure is decreasing in all these covariates. The same effect can be seen for export exposure interacted with import exposure. This might suggest some kind of RMB sensitivity mitigation mechanism running through Chinese exporters preferring to accept payment in Dollars rather than RMB whereas RMB importers are likelier to pay for exports in RMB. Figure E.1 shows the interactions of export exposure with import exposure, and we find that the marginal effect of export exposure is falling in import exposure. This is potentially because of the preference of Chinese firms to invoice exports to other countries in Dollars.

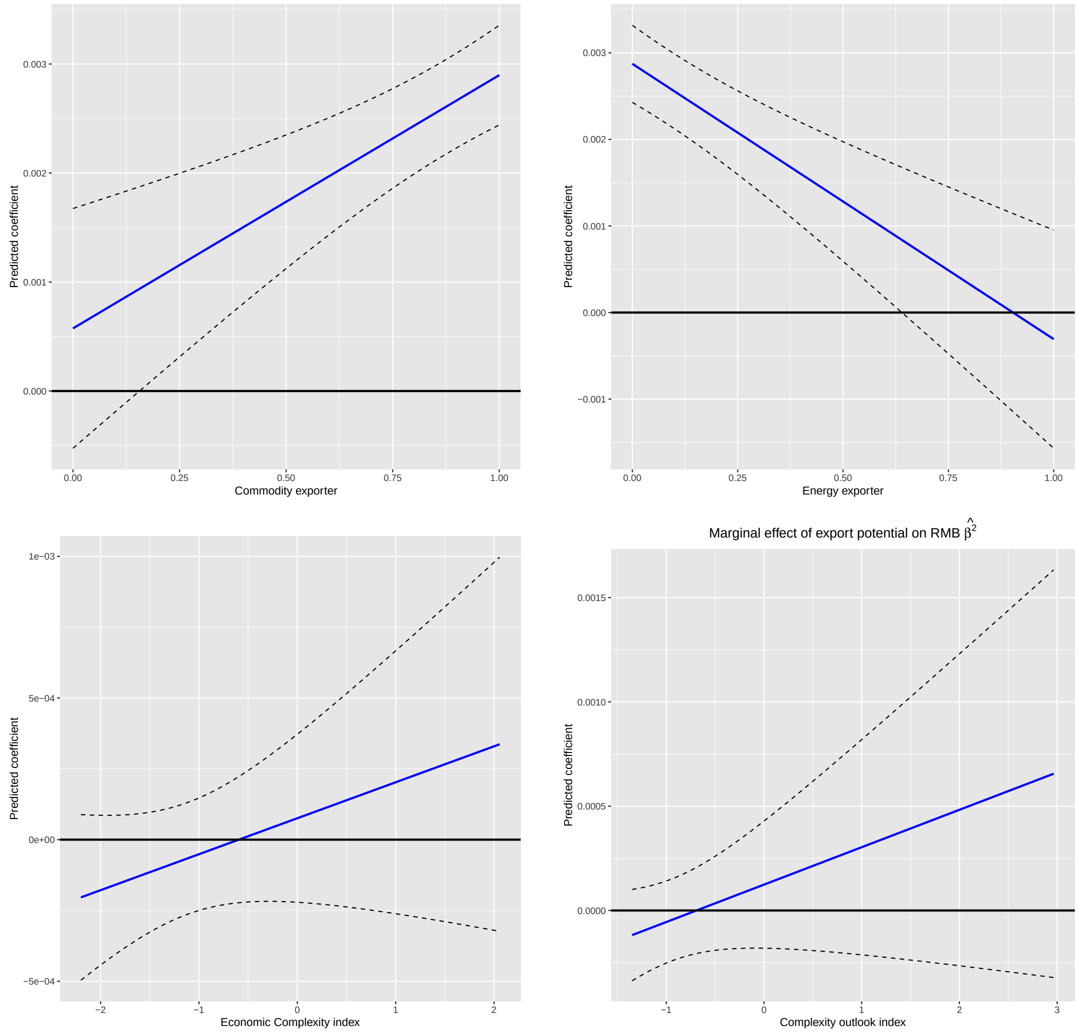
Figure E.4 shows the interactions of export exposure with PTA status, BIT status, BRI status and policy affinity to China. PTA status seems to have no discernable effect. The marginal effect of export exposure is increasing in BIT and BRI status as well as policy affinity to China. This complete set of results helps us illustrate the heterogeneity in "Why" countries care about the RMB. Unlike other SDR currencies, the controls on capital mobility of the RMB changes the dynamics of currencies co-moving with it, making market access through select policy linkages important in scaling the use of the RMB.

Figure E.1 Export exposure's effect on RMB$_o$ $\mathcal{B}^{\hat{2}}_{c,t}$ interacted with import exposure



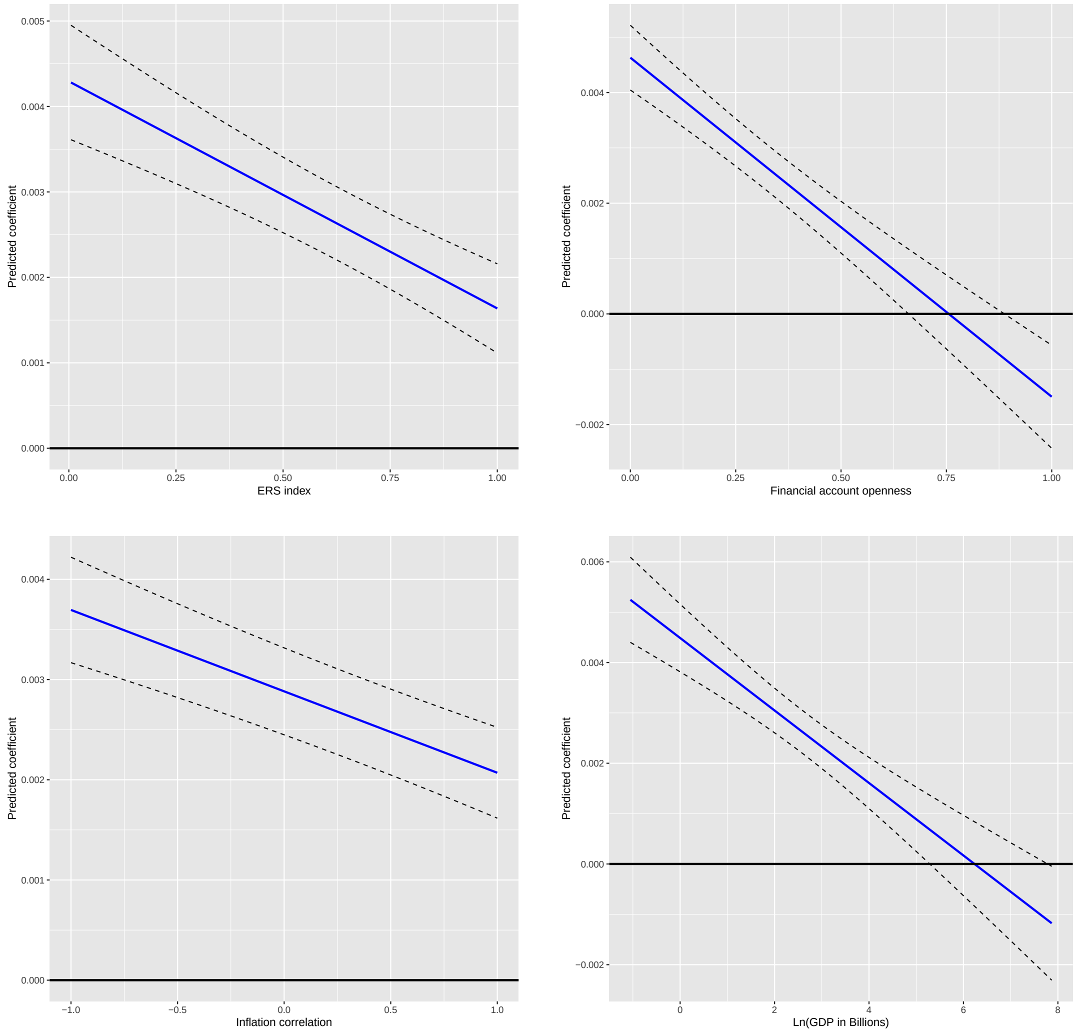
Note: The figure shows the interaction of export exposure to China set at its sample mean with import exposure. We can see that the marginal effect of export exposure on RMB$_o$ $\mathcal{B}^{\hat{2}}_{c,t}$ is decreasing in imports

Figure E.2 Exploring heterogeneity in export exposure's effect on RMB$_o$ $\hat{\mathcal{B}}^2_{c,t}$ across exporter-characteristics



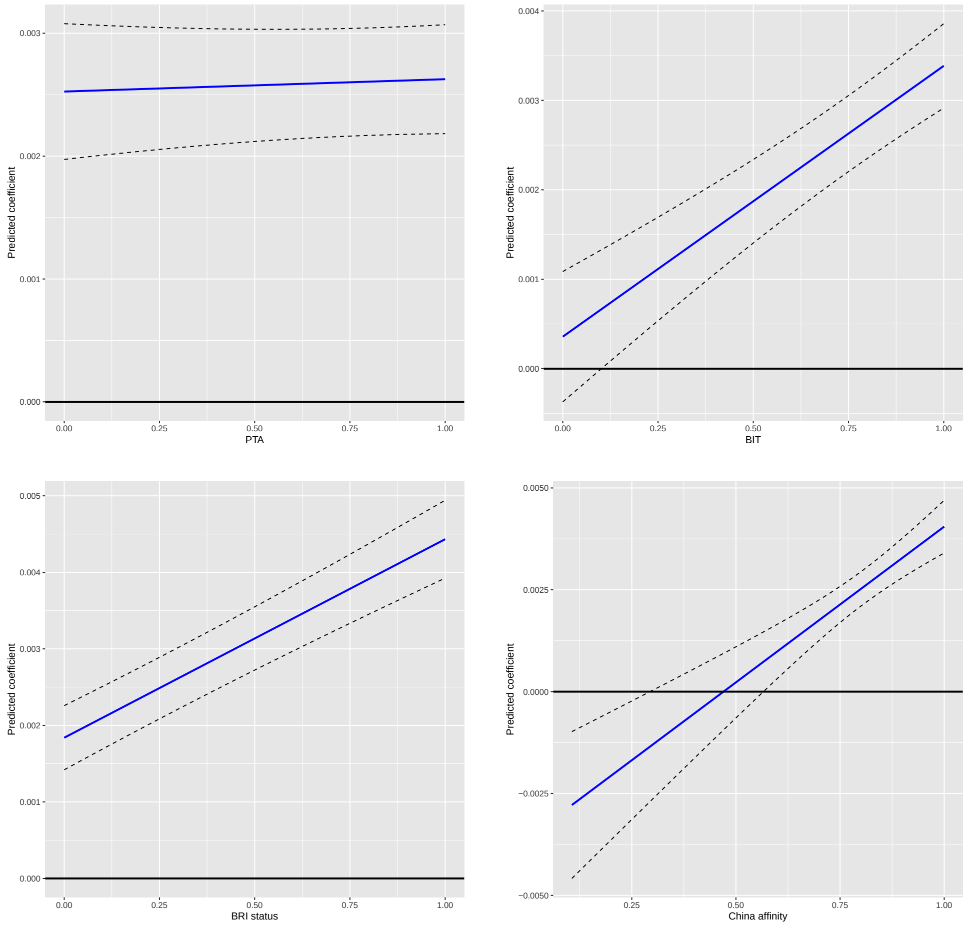
Note: The figure shows the interaction of export exposure to China set at its sample mean with a country's exporter status. We can see that the marginal effect of export exposure on RMB$_o$ $\hat{\mathcal{B}}^2_{c,t}$ is decreasing for energy exporters while it increases for commodity exporters. We can see that the effect of export exposure on RMB$_o$ $\hat{\mathcal{B}}^2_{c,t}$ is unchanged in complexity of exports as well as diversification potential

Figure E.3 Exploring heterogeneity in export exposure's effect on RMB$_o$ $\hat{\mathcal{B}^2_{c,t}}$ across country macro-characteristics



Note: The figure shows the interaction of export exposure to China set at its sample mean with country characteristics. We can see that the marginal effect of export exposure on RMB$_o$ $\hat{\mathcal{B}^2_{c,t}}$ is decreasing in exchange rate stability versus an anchor, GDP, inflation correlation and financial account restrictions

Figure E.4 Exploring heterogeneity in export exposure's effect on RMB$_o$ $\hat{\mathcal{B}^2_{c,t}}$ across policy linkages



Note: The figure shows the interaction of export exposure to China set at sample mean with policy linkages. We can see that the marginal effect of export exposure on RMB$_o$ $\hat{\mathcal{B}^2_{c,t}}$ is increasing in BIT status, BRI status and China affinity

Table E.1 Interaction of export exposure with exporter-status

	Dependent variable:			
	RMB$_o$ $\mathcal{B}^{\hat{2}}_{c,t}$			
	(1)	(2)	(3)	(4)
Export exposure	0.001	0.003***	0.0001	0.0001
	(0.001)	(0.0002)	(0.0002)	(0.0002)
Export complexity			−0.003	
			(0.002)	
Export outlook				−0.001
				(0.002)
Import exposure	−0.001	−0.001*	0.0001	0.0001
	(0.0004)	(0.0004)	(0.0002)	(0.0002)
ERS index	−0.015**	−0.016**	−0.003	−0.003
	(0.006)	(0.006)	(0.002)	(0.002)
GDP	−0.007	−0.0002	−0.005**	−0.004*
	(0.007)	(0.006)	(0.002)	(0.002)
Financial openness	−0.007	0.003	0.0003	−0.0002
	(0.015)	(0.014)	(0.005)	(0.005)
Inflation correlation	0.0003	−0.0001	0.001**	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)
PTA	−0.005	−0.008*	−0.003*	−0.003*
	(0.004)	(0.004)	(0.002)	(0.002)
BIT	0.005	0.005	0.003	0.003
	(0.007)	(0.007)	(0.002)	(0.002)
Reserve dummy	−0.005	−0.005	−0.001	−0.001
	(0.005)	(0.005)	(0.002)	(0.002)
Swap line	−0.002	−0.004	0.002	0.002
	(0.004)	(0.004)	(0.001)	(0.002)
LCY settlement	0.005	0.002	0.005*	0.005*
	(0.009)	(0.009)	(0.003)	(0.003)
BRI	0.012***	0.013***	0.0003	0.0003
	(0.004)	(0.004)	(0.001)	(0.001)
China affinity	0.046**	0.042*	−0.011	−0.011
	(0.022)	(0.022)	(0.009)	(0.009)
US affinity	0.015	0.012	0.002	0.003
	(0.025)	(0.025)	(0.010)	(0.010)
Export exposure:Commodity	0.002***			
	(0.001)			
Export exposure:Energy		−0.003***		
		(0.001)		
Export exposure:Export complexity			0.0001	
			(0.0001)	
Export exposure:Export outlook				0.0002
				(0.0001)
Fixed effects	Country & Year	Country & Year	Country & Year	Country & Year
Observations	1,093	1,093	838	838
R^2	0.154	0.160	0.048	0.046
Adjusted R^2	0.035	0.043	0.009	0.009
F Statistic	11.610*** (df = 15; 958)	12.210*** (df = 15; 958)	2.284*** (df = 16; 731)	2.222*** (df = 16; 731)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns.

Table E.2 Interaction of export exposure with macro-characteristics

	Dependent variable:				
	RMB$_o$ $\mathcal{B}^{\hat{2}}_{c,t}$				
	(1)	(2)	(3)	(4)	(5)
Export exposure	0.003***	0.005***	0.004***	0.004***	0.003***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0002)
Import exposure	−0.0002	−0.001	−0.001	−0.001**	−0.001
	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Financial openness	0.001	0.041***	0.008	−0.002	−0.002
	(0.014)	(0.015)	(0.014)	(0.014)	(0.014)
ERS index	−0.016***	−0.020***	−0.016***	0.004	−0.016**
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)
GDP	−0.002	0.003	0.006	−0.005	−0.007
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Inflation correlation	0.00002	−0.0001	−0.0003	0.0003	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
PTA	−0.006	−0.003	−0.007*	−0.006	−0.006
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
BIT	0.005	0.005	0.005	0.005	0.008
	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)
Reserve dummy	−0.006	−0.005	−0.002	−0.005	−0.006
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Swap line	−0.001	−0.004	0.004	−0.005	−0.006
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
LCY settlement	0.002	−0.002	0.008	−0.002	0.0001
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
BRI	0.012***	0.013***	0.011***	0.012***	0.013***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
China affinity	0.046**	0.049**	0.054**	0.037*	0.046**
	(0.022)	(0.021)	(0.022)	(0.022)	(0.022)
US affinity	0.015	0.019	0.016	0.013	0.007
	(0.025)	(0.024)	(0.025)	(0.025)	(0.025)
Export exposure:Import exposure	−0.00005***				
	(0.00001)				
Export exposure:Financial openness		−0.006***			
		(0.001)			
Export exposure:GDP			−0.001***		
			(0.0001)		
Export exposure:ERS index				−0.003***	
				(0.0004)	
Export exposure:Inflation correlation					−0.001***
					(0.0001)
Fixed effects	Country & Year	Country & Year	Country & Year	Country & Year	Country& Year
Observations	1,093	1,093	1,093	1,093	1,093
R^2	0.151	0.217	0.183	0.175	0.181
Adjusted R^2	0.032	0.107	0.069	0.060	0.066
F Statistic (df = 15; 958)	11.330***	17.648***	14.294***	13.547***	14.113***
Note:					*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns.

Table E.3 Interaction of export exposure with policy-linkages

	Dependent variable:			
	RMB$_o$ $\mathcal{B}^{\hat{2}}_{c,t}$			
	(1)	(2)	(3)	(4)
Export exposure	0.0004	0.003***	0.002***	−0.004***
	(0.0004)	(0.0003)	(0.0002)	(0.001)
BIT	−0.013*	0.005	0.002	0.006
	(0.007)	(0.007)	(0.006)	(0.007)
Import exposure	−0.001	−0.001	−0.001	−0.001
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
ERS index	−0.017***	−0.016**	−0.012**	−0.015**
	(0.006)	(0.006)	(0.006)	(0.006)
GDP	−0.006	−0.004	−0.007	−0.006
	(0.006)	(0.007)	(0.006)	(0.006)
Financial openness	0.007	0.001	0.001	−0.004
	(0.014)	(0.015)	(0.014)	(0.014)
Inflation correlation	−0.0004	0.0001	0.0001	−0.0001
	(0.001)	(0.001)	(0.001)	(0.001)
PTA	−0.002	−0.006		
	(0.004)	(0.005)		
Reserve dummy	−0.006	−0.006	−0.009**	−0.006
	(0.004)	(0.005)	(0.004)	(0.004)
Swap line	−0.006	−0.003	−0.003	0.001
	(0.004)	(0.004)	(0.004)	(0.004)
LCY settlement	−0.0001	0.001	0.003	0.010
	(0.009)	(0.009)	(0.009)	(0.009)
BRI	0.011***	0.013***	−0.010**	0.012***
	(0.004)	(0.004)	(0.004)	(0.004)
China affinity	0.048**	0.046**	0.036*	0.010
	(0.022)	(0.022)	(0.021)	(0.023)
US affinity	0.017	0.017	0.027	0.030
	(0.025)	(0.025)	(0.024)	(0.025)
Export exposure:BIT	0.003***			
	(0.0004)			
Export exposure:PTA		0.0001		
		(0.0002)		
Export exposure:BRI			0.003***	
			(0.0002)	
Export exposure:China affinity				0.008***
				(0.001)
Fixed effects	Country & Year	Country & Year	Country & Year	Country & Year
Observations	1,093	1,093	1,093	1,093
Fixed effects	Country, Year	Country, Year	Country, Year	Country, Year
Observations	1,093	1,093	1,093	1,093
R^2	0.187	0.140	0.248	0.170
Adjusted R^2	0.074	0.020	0.143	0.054
F Statistic	14.712*** (df = 15; 958)	10.422*** (df = 15; 958)	22.568*** (df = 14; 959)	13.989*** (df = 14; 959)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns.

E.2 Robustness checks

We check the robustness of our results by adding additional control variables. Bahaj and Reis (2020) document a "neighbourhood effect" of adopting RMB payment infrastructure. Network externalities in adopting a new currency anchor are well known and can cause non-linearities in the rise of a "dominant" currency (Dowd and Greenaway, 1993; Uribe, 1997). Meissner and Oomes (2009) show that trade network externalities are a key determinant of anchor currency choice. Given that our results point to trade linkages being important in determining co-movement with the RMB, it seems prudent to control for significant co-movement of neighbours with the RMB. We define a neighbourhood dummy variable which takes a value 1, if a neighbour as defined by contiguity of the border or a caliper of 1000 kilometre distance from the country's capital, has a significant co-movement with the RMB. We find that the neighbourhood dummy when added to our benchmark specification interacted with export exposure is positive and significant suggesting a weak network effect. Joint export exposure seems to be driver of sensitivity to the RMB for neighbouring currencies.

Most countries have strong trade linkages with both US and China. We control for US trade linkages to see the role of global value chain linkages in determining the co-movement share with the RMB. We find that adding US trade linkages does not alter our baseline results. This makes us confident that our results are driven by export linkages to China. The convertibility of the RMB remains a stumbling block in wider adoption of the RMB but it has managed to make headway as a potential currency for trade invoicing. These robustness checks can be found in Table E.4.

We augment our baseline model with financial linakges in Table E.5. FDI dependence variables load positively but are not significant at standard levels. The results for adding stock market correlations are interesting as it reduces the size of the estimated export exposure coefficient by 10X and changes the sign of the BRI dummy and makes China affinity insignificant. Stock market correlations by itself loads negatively but is not significant. There also seems to be a greater RMB co-movement for countries with less managed exchange rates, more managed capital accounts and larger GDP size. We must note here that only 63 countries have a comparable benchmark stock index for our sample period so there is a bias towards larger countries. Nevertheless, this seems to suggest a role for common portfolio flow shocks, which may be studied in greater detail in future work.

We also change the LHS variable from RMB$_o$ $\hat{\mathcal{B}^2_{c,t}}$ to its variants, exploring the determinants of RMB$_o$ $\hat{\beta}_{c,t}$, RMB$_{o(D)}$ $\hat{\beta}_{c,t}$ and RMB$_{o(D)}$ $\hat{\mathcal{B}^2_{c,t}}$ similar to our benchmark results from Table 9. These results can be found in Tables E.6-E.8. Across all these models, the export exposure variable is always a positive and significant determinant of co-movement coefficients as well as variance share explained by the RMB.

Table E.4 Robustness checks: Neighbour effects and USD trade

	Dependent variable:			
	RMB$_o$ $\mathcal{B}^{\hat{2}}_{c,t}$			
	(1)	(2)	(3)	(4)
Export exposure	0.003***	0.003***	0.003**	
	(0.0002)	(0.0002)	(0.002)	
Import exposure	−0.001	−0.001	−0.001	
	(0.0004)	(0.0004)	(0.001)	
Total trade exposure				0.001***
				(0.001)
ERS index	−0.016**	−0.015**	−0.018	−0.016**
	(0.006)	(0.006)	(0.016)	(0.007)
GDP	−0.004	−0.005	−0.010	0.0002
	(0.007)	(0.007)	(0.008)	(0.008)
Financial openness	0.002	0.0002	−0.0003	−0.001
	(0.015)	(0.015)	(0.009)	(0.016)
Inflation correlation	0.0001	−0.0002	0.0003	−0.0002
	(0.001)	(0.001)	(0.002)	(0.002)
BIT	0.005	0.004	0.005*	0.001
	(0.007)	(0.007)	(0.003)	(0.007)
PTA	−0.005	−0.004	−0.004	0.003
	(0.004)	(0.004)	(0.004)	(0.005)
Reserve dummy	−0.006	−0.005	−0.008	−0.009*
	(0.005)	(0.005)	(0.006)	(0.005)
Swap line	−0.003	−0.001	−0.005	0.0003
	(0.004)	(0.004)	(0.005)	(0.005)
LCY settlement	0.001	0.0003	−0.001	0.006
	(0.009)	(0.009)	(0.007)	(0.010)
BRI	0.013***	0.012***	0.017	0.014***
	(0.004)	(0.004)	(0.014)	(0.005)
China affinity	0.047**	0.050**	0.050	0.061**
	(0.022)	(0.022)	(0.053)	(0.026)
US affinity	0.018	0.011	−0.003	0.016
	(0.025)	(0.025)	(0.014)	(0.030)
Neighbour		−0.001***		
		(0.0003)		
Export exposure:Neighbour	0.002	0.006**		
	(0.003)	(0.003)		
Export exposure (US)			0.0003	
			(0.0002)	
Import exposure (US)			−0.001	
			(0.0005)	
Total trade exposure (US)				−0.0001
				(0.0004)
Fixed effects	Country & Year	Country & Year	Country & Year	Country & Year
Observations	1,093	1,093	1,019	1,019
R^2	0.232	0.243	0.268	0.143
Adjusted R^2	0.124	0.136	0.158	0.017
Residual Std. Error	0.028 (df = 958)	0.027 (df = 957)	0.028 (df = 885)	0.030 (df = 887)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. The Neighbour variable takes a value 1, if a country's neighbour has a significant RMB co-movement. All the variables are lagged by a year to mitigate endogeneity concerns.

Table E.6 Benchmark results: Determinants of $\text{RMB}_o\hat{\beta}_{c,t}$

	Dependent variable:			
	$\text{RMB}_o\hat{\beta}_{c,t}$			
	(1)	(2)	(3)	(4)
Export exposure	0.020^{***}	0.003^{**}	0.003^{**}	0.019^{***}
	(0.004)	(0.002)	(0.002)	(0.004)
Import exposure	−0.007	−0.004	−0.004	−0.008
	(0.007)	(0.003)	(0.003)	(0.007)
Financial openness	−0.122	0.196^{***}	0.199^{***}	−0.085
	(0.244)	(0.050)	(0.048)	(0.242)
ERS index	-0.197^{*}	−0.072	-0.091^{*}	-0.191^{*}
	(0.104)	(0.057)	(0.054)	(0.102)
GDP	-0.187^{*}	0.0004	−0.002	−0.113
	(0.109)	(0.010)	(0.009)	(0.096)
Inflation correlation	0.020	−0.003	−0.006	0.022
	(0.024)	(0.023)	(0.023)	(0.023)
PTA	-0.142^{**}	0.005	0.005	-0.140^{**}
	(0.068)	(0.040)	(0.038)	(0.067)
BIT	0.054	0.012	−0.012	0.065
	(0.110)	(0.038)	(0.035)	(0.109)
Reserve dummy	−0.035	0.095	0.089	−0.033
	(0.076)	(0.062)	(0.061)	(0.076)
Swap line	0.062	0.038	0.022	0.060
	(0.073)	(0.061)	(0.060)	(0.073)
LCY settlement	−0.077	0.066	0.063	−0.076
	(0.149)	(0.124)	(0.122)	(0.148)
BRI	0.090	0.058	0.060	0.093
	(0.067)	(0.063)	(0.063)	(0.058)
China affinity	0.073	−0.089	0.029	−0.103
	(0.370)	(0.274)	(0.242)	(0.335)
US affinity	−0.228	0.182	0.211	−0.100
	(0.420)	(0.304)	(0.294)	(0.378)
Fixed effects	Country & Year	Continent & Year	Year	Country & RMB regime
Observations	1,107	1,107	1,107	1,107
R^2	0.221	0.041	0.038	0.216
Adjusted R^2	0.113	0.016	0.016	0.115
Residual Std. Error	0.465 (df = 972)	0.490 (df = 1078)	0.490 (df = 1082)	0.465 (df = 980)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns.

Table E.5 Robustness checks: Adding financial linakges to the benchmark model

	Dependent variable:		
	RMB$_o$ $\mathcal{B}^2_{c,t}$		
	(1)	(2)	(3)
Export exposure	0.004^{***}	0.001^{***}	0.0001^{**}
	(0.0004)	(0.0002)	(0.00003)
Import exposure	-0.0003	-0.001^{**}	-0.00002
	(0.001)	(0.0005)	(0.00005)
Financial openness	0.021	-0.006	0.002^{***}
	(0.048)	(0.008)	(0.001)
ERS index	-0.033^{***}	-0.007	-0.004^{***}
	(0.011)	(0.009)	(0.001)
GDP	0.014	0.0005	0.0004^{**}
	(0.014)	(0.002)	(0.0002)
Inflation correlation	-0.002	-0.002	-0.0001
	(0.002)	(0.004)	(0.0003)
PTA	-0.002	0.007	0.001
	(0.008)	(0.006)	(0.001)
BIT	0.005	-0.001	0.001
	(0.016)	(0.006)	(0.001)
Reserve dummy	-0.007	-0.004	0.001
	(0.007)	(0.007)	(0.001)
Swap line	-0.004	-0.005	0.0004
	(0.007)	(0.008)	(0.001)
LCY settlement	-0.003	0.006	0.006^{***}
	(0.014)	(0.013)	(0.001)
BRI	0.014^{***}	0.010	-0.001
	(0.005)	(0.010)	(0.001)
China affinity	0.114^{***}	0.085^{*}	0.001
	(0.041)	(0.047)	(0.004)
US affinity	-0.029	0.088^{*}	0.006
	(0.049)	(0.049)	(0.005)
FDI dependence (CDIS)	0.0001		
	(0.0004)		
FDI dependence (AEI)		0.0001	
		(0.0001)	
Stock market correlation			-0.0003
			(0.0005)
Fixed effects	Country & Year	Country & Year	Country & Year
Observations	659	426	583
R^2	0.352	0.121	0.239
Adjusted R^2	0.197	0.057	0.205
Residual Std. Error	0.033 (df = 531)	0.046 (df = 396)	0.005 (df = 557)
Note:			*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. The FDI dependence variables are calculated as share of Chinese FDI in total inward FDI stock of that country. We use CDIS and AEI datasets. The stock market correlation is the one-year correlation of the country's benchmark index versus the Shanghai stock exchange. All the variables are lagged by a year to mitigate endogeneity concerns.

Table E.7 Benchmark results: Determinants of $\text{RMB}_{o(D)}\hat{\beta}_{c,t}$

	Dependent variable:			
	$\text{RMB}_{o(D)}\hat{\beta}_{c,t}$			
	(1)	(2)	(3)	(4)
Export exposure	0.022^{***}	0.004^{*}	0.005^{**}	0.021^{***}
	(0.005)	(0.002)	(0.002)	(0.005)
Import exposure	-0.021^{**}	-0.008^{*}	-0.007^{*}	-0.019^{**}
	(0.010)	(0.004)	(0.004)	(0.010)
Financial openness	0.458	−0.018	0.029	0.465
	(0.335)	(0.069)	(0.066)	(0.333)
ERS index	−0.072	−0.120	-0.181^{**}	−0.075
	(0.142)	(0.079)	(0.074)	(0.140)
GDP	0.177	0.042^{***}	0.029^{**}	0.147
	(0.149)	(0.013)	(0.013)	(0.132)
Inflation correlation	0.001	−0.015	−0.023	−0.004
	(0.033)	(0.031)	(0.031)	(0.032)
PTA	−0.085	0.059	0.075	−0.085
	(0.094)	(0.055)	(0.053)	(0.092)
BIT	−0.171	0.028	−0.005	−0.173
	(0.151)	(0.052)	(0.048)	(0.149)
Reserve dummy	0.061	0.047	0.031	0.050
	(0.105)	(0.085)	(0.085)	(0.104)
Swap line	−0.120	−0.044	−0.071	−0.115
	(0.100)	(0.084)	(0.083)	(0.100)
LCY settlement	−0.169	−0.044	−0.012	−0.142
	(0.204)	(0.172)	(0.170)	(0.203)
BRI	0.036	0.107	0.127	0.117
	(0.093)	(0.087)	(0.087)	(0.080)
China affinity	0.088	-0.693^{*}	-0.670^{**}	−0.241
	(0.509)	(0.378)	(0.335)	(0.460)
US affinity	−0.531	-0.848^{**}	-0.941^{**}	−0.566
	(0.577)	(0.420)	(0.407)	(0.519)
Fixed effects	Country & Year	Continent & Year	Year	Country & RMB regime
Observations	1,107	1,107	1,107	1,107
R^2	0.238	0.052	0.042	0.234
Adjusted R^2	0.133	0.027	0.021	0.135
Residual Std. Error	0.639 (df = 972)	0.677 (df = 1078)	0.679 (df = 1082)	0.638 (df = 980)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns.

Table E.8 Benchmark results: Determinants of $\text{RMB}_{o(D)}\ \hat{\mathcal{B}^2_{c,t}}$

	Dependent variable:			
	$\text{RMB}_{o(D)}\ \hat{\mathcal{B}^2_{c,t}}$			
	(1)	(2)	(3)	(4)
Export exposure	0.003^{***}	0.001^{***}	0.001^{***}	0.003^{***}
	(0.0002)	(0.0001)	(0.0001)	(0.0002)
Import exposure	-0.001^{**}	-0.001^{***}	-0.001^{***}	-0.001^{**}
	(0.0005)	(0.0002)	(0.0002)	(0.0005)
Financial openness	0.006	−0.005	−0.004	0.007
	(0.016)	(0.003)	(0.003)	(0.016)
ERS index	-0.014^{**}	−0.003	−0.004	-0.014^{**}
	(0.007)	(0.004)	(0.003)	(0.007)
GDP	0.002	0.001	0.0003	0.003
	(0.007)	(0.001)	(0.001)	(0.006)
Inflation correlation	−0.001	−0.002	−0.002	−0.0003
	(0.002)	(0.001)	(0.001)	(0.002)
PTA	−0.002	0.005^{*}	0.004^{*}	−0.003
	(0.004)	(0.003)	(0.002)	(0.004)
BIT	0.001	−0.001	−0.002	0.002
	(0.007)	(0.002)	(0.002)	(0.007)
Reserve dummy	−0.006	−0.003	−0.003	−0.006
	(0.005)	(0.004)	(0.004)	(0.005)
Swap line	−0.006	−0.003	−0.004	−0.005
	(0.005)	(0.004)	(0.004)	(0.005)
LCY settlement	−0.002	0.005	0.006	−0.002
	(0.010)	(0.008)	(0.008)	(0.010)
BRI	0.014^{***}	0.013^{***}	0.013^{***}	0.016^{***}
	(0.004)	(0.004)	(0.004)	(0.004)
China affinity	0.052^{**}	0.022	0.015	0.027
	(0.024)	(0.018)	(0.016)	(0.022)
US affinity	0.011	0.019	0.013	0.006
	(0.027)	(0.020)	(0.019)	(0.024)
Fixed effects	Country & Year	Continent & Year	Year	Country & RMB regime
Observations	1,093	1,093	1,093	1,093
R^2	0.236	0.065	0.063	0.229
Adjusted R^2	0.131	0.040	0.042	0.129
Residual Std. Error	0.030 (df = 959)	0.031 (df = 1064)	0.031 (df = 1068)	0.030 (df = 967)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns.

F Methodology note

Researchers have dealt with the problem of correctly estimating the RMB $\hat{\beta}$ in many different ways. The estimate of the RMB $\hat{\beta}$ depends on how researchers control for multicollinearity when adding the RMB in the FW regression.

The first set of papers ignore the need for controlling of multicollinearity and choose periods of relative RMB flexibility. These papers include Henning (2012), Subramanian and Kessler (2013), Eichengreen and Lombardi (2017) and Park and An (2020). Our RMB exchange rate regime estimations of Equation 2 show that there are no periods of "true" RMB flexibility. The R^2 for the FW regression for the RMB is always greater than 0.8 indicating a tiny RMB_o idiosyncratic variance. The Fratzscher and Mehl (2014) paper is unique in this literature as uses a factor model with an orthogonalised RMB factor with an SDR numeraire. While this is a clean identification strategy for estimating the impact of RMB exchange rate fluctuations, it does not allow for a direct estimation of RMB basket weights for the currencies.

Balasubramaniam *et al.* (2011) is the first paper to orthogonalise the RMB returns to control for its USD peg, but it does so without controlling for the other FW currencies which also have a statistically significant influence on the RMB exchange rate. Given the negligible variance of the orthogonalised RMB_o compared to the other reserve currencies, the RMB_o $\hat{\beta}$ estimated by OLS tends to be greater than 1 given the presence of high leverage observations (due to infrequent but large changes in RMB management), when a parameter restriction is not applied to Equation 3. The size of the unstandardised RMB_o $\hat{\beta}$ may lead a researcher to erroneously infer the RMB_o having the largest basket-weight on a currency. The parameter restriction proposed by Kawai and Pontines (2016) is an attempt to try and solve the issue of large unstable RMB_o $\hat{\beta}$'s.

Recent papers follow the Kawai and Pontines (2016) method of using the NZD as a numeraire and along with a parameter restriction to recover the RMB β (Ito, 2017; Tovar and Nor, 2018; Ito and McCauley, 2019). However, this parameter restriction creates it own set of inference problems. If the parameter restriction does not hold, this technique over-assigns the remaining basket-weight $1-(\beta_{USD}+\beta_{EUR}+\beta_{GBP}+\beta_{JPY})$ to the β_{RMB_o}. This over-assignment of RMB_o basket-weight is particularly problematic for currencies with flexible exchange rates ($\beta_{USD}+\beta_{EUR}+\beta_{GBP}+\beta_{JPY}<0.5$ *and* $R^2<0.85$) or diversified managed floats, who are mis-classified as being part of the RMB bloc. Kawai and Pontines (2016), Tovar and Nor (2018) and Ito and McCauley (2019) themselves acknowledge that their RMB β estimates represent an upper-bound. This still leads to Tovar and Nor (2018) and Ito and McCauley (2019) classifying a large number of currencies and significant share of global GDP into an emerging RMB bloc.

We carefully replicate the methodology from Kawai and Pontines (2016), as they are closest to our estimation strategy and find that the parameter restriction imposed by them *does not hold* in the data. We find that the extent of over-reporting of the RMB β is a function of the R^2 of the modified FW regression. We find that higher the R^2 of the modified FW regression, the lower the mis-reporting of the true RMB β. Once the the R^2 of the modified FW regression falls below 0.85, our technique of using unrestricted parameters is more accurate in detecting the true β parameter.[63]

[63] McCauley and Shu (2019) use a USD numeraire to find the USD/RMB co-movement coefficient for Asian currencies. While this an intuitive way to gauge the strength of co-movements with the RMB, it attributes all the movements in the USD/RMB exchange rate to China specific information. The RMB β is overweight, as the USD-specific component of the exchange rate fluctuation cannot be purged from the USD/RMB exchange rate return.

Table F.1 Methodological choices in the literature and their limitations

Paper	Model inputs	Limitations
Balasubramaniam *et al.* (2011)	CHF numeraire, Orthogonalise RMB returns from USD	Residual has EUR and JPY component; Multi-collinearity
Henning (2012)	Choose periods of RMB flexibility	No periods of true RMB flexibility
Subramanian and Kessler (2013)	CHF numeraire, Choose periods of RMB flexibility	No periods of true RMB flexibility
Fratzscher and Mehl (2014)	SDR numeraire, Factor model with orthogonalised RMB	Direct currency-basket weights due to using a regional factor
Kawai and Pontines (2016)	NZD numeraire, Orthogonalise RMB returns from FW regression; Use a parameter restriction to extract the RMB $\hat{\beta}$	Parameter restriction does not hold, over-weights the RMB $\hat{\beta}$
Ito (2017)	CHF numeraire, Orthogonalise RMB returns from FW regression; Use a parameter restriction to extract the RMB $\hat{\beta}$	Parameter restriction does not hold, over-weights the RMB $\hat{\beta}$
Eichengreen and Lombardi (2017)	Same as Subramaniam-Kessler (2013); Choose Periods of RMB flexibility	No periods of true RMB flexibility
McCauley and Shu (2019)	USD numeraire	Attributes all the variation in USD/RMB exchange rate to China specific information, USD/RMB $\hat{\beta} > 0.5$ is considered as evidence of currency being in the RMB bloc
Tovar and Nor (2018)	Multiple numeraires, Orthogonalise RMB returns from FW regression; Use a parameter restriction to extract the RMB $\hat{\beta}$	Parameter restriction does not hold, over-weighting the RMB $\hat{\beta}$
Park and An (2020)	CHF numeraire, Choose periods of RMB flexibility to estimate $\hat{\beta}$	No periods of true RMB flexibility

Adapted from Kawai and Pontines (2016)

Note: This table provides a short summary of the various methodologies employed in the literature for determination of RMB exchange rate regimes and their limitations.

Our main contribution to the literature is that we do not infer the relative importance of the RMB in the exchange rate arrangements using the estimated RMB $\hat{\beta}$. We use a simple standardised $\hat{\mathcal{B}}^2$ measure to infer the economic significance of co-movements with the RMB_o, embedded in a structural breaks framework. This has some distinct advantages compared to other approaches in the literature. First, we can allow our coefficients to be unrestricted for our full sample of currencies. The unrestricted and unstandardised coefficients provide clearer insights into the sensitivity to a currency to *large but infrequent* 1% RMB_o moves.[64] Second, this allows us flexibility in ignoring issues of numeraire choice. Different numeraires lead to different estimates of RMB_o $\hat{\beta}$, but the variance of the RMB_o is small, making estimates of RMB_o $\hat{\mathcal{B}}^2$ similar across numeraires. Third, standardised squared coefficients allow for direct comparison of the shares of the reserve currencies in explained variance of a currency. Unstandardised coefficients, whether they are estimated via a parameter restriction or not are *not scale invariant* and should not be directly compared to each other. This is the biggest pitfall in inference of FW regression augmented with a regressor like the RMB_o which has a very small variance.

The rest of the appendix is organised as follows. We replicate the Tables from Kawai and Pontines (2016) in appendix F.1 to show the invalidity of their proposed parameter restriction. Appendix F.2 shows the robustness of our results to numeraire-choice by presenting results with a CHF numeraire.

[64] Researchers who restrict the RMB coefficient to be $1 - (\beta_{USD} + \beta_{EUR} + \beta_{GBP} + \beta_{JPY})$ underestimate the impact of idiosyncratic RMB revaluations for RMB trackers irrespective of the strictness of currency management in these currencies. These restricted coefficients would also underestimate RMB_o $\hat{\mathcal{B}}^2$ as its squared standardised $\hat{\beta}$.

F.1 Replication results

Figure F.1 Table 1 from Kawai and Pontines (2016)

Table 1
Estimation results using the new method, 1 January 2000–30 September 2013.

	US dollar	Euro	Yen	Pound	RMB	R²	P-value
RMB	0.967*** [0.003]	0.017*** [0.002]	0.008** [0.003]	0.002 [0.003]	–	0.991	–
Hong Kong dollar	0.987*** [0.001]	0.003*** [0.001]	0.003*** [0.001]	0.002* [0.001]	0.004*** [0.001]	0.998	0.450
Korean won	0.633*** [0.026]	0.039** [0.020]	0.03 [0.022]	0.079*** [0.026]	0.220*** [0.019]	0.768	0.205
New Taiwan dollar	0.805*** [0.011]	0.039*** [0.008]	0.043*** [0.007]	0.037*** [0.010]	0.076*** [0.007]	0.924	0.785
Cambodian riel	0.996*** [0.011]	0.012 [0.011]	−0.008 [0.009]	−0.003 [0.012]	0.003 [0.008]	0.897	0.231
Indonesian rupiah	0.755*** [0.028]	−0.028 [0.029]	0.053** [0.024]	0.048 [0.030]	0.171*** [0.022]	0.411	0.377
Lao PDR kip	0.973*** [0.014]	0.038* [0.023]	−0.018* [0.011]	0.003 [0.018]	0.005 [0.009]	0.821	0.504
Malaysian ringgit	0.836*** [0.013]	0.053*** [0.009]	−0.036*** [0.009]	0.031*** [0.010]	0.117*** [0.009]	0.999	0.315
Philippine peso	0.811*** [0.016]	0.048*** [0.013]	0.000 [0.013]	0.020 [0.015]	0.121*** [0.011]	0.723	0.631
Singapore dollar	0.576*** [0.011]	0.137*** [0.011]	0.103*** [0.009]	0.046*** [0.010]	0.139*** [0.008]	0.911	0.474
Thai baht	0.702*** [0.015]	0.065*** [0.012]	0.119*** [0.010]	0.021 [0.013]	0.094*** [0.009]	0.847	0.299
Vietnam dong	0.996*** [0.005]	−0.004 [0.006]	0.002 [0.006]	0.001 [0.006]	0.005 [0.004]	0.996	0.804
Mongolian togrog	1.018*** [0.019]	0.011 [0.019]	−0.017 [0.0015]	−0.018 [0.020]	0.006 [0.013]	0.696	0.589
Indian rupee	0.796*** [0.017]	0.069*** [0.012]	−0.046*** [0.011]	0.053*** [0.013]	0.127*** [0.011]	0.956	0.609

Lao PDR = Lao People's Democratic Republic, RMB = renminbi.
Notes: (a) The estimates for the RMB are obtained from first-step regression equation (6) and those for other currencies are obtained from a set of second-step regression equations (8).
(b) *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Values in brackets are the estimated robust standard errors.
(c) P-values in the last column represent statistics to test the null hypothesis that $\gamma_1+\gamma_2+\gamma_3+\gamma_4+\gamma_5=1$ in equation (7). P-values show that the null cannot be rejected at the 10% level for any of the currencies considered.*Source:* Authors' computation.

Table F.2 Replication of Table 1

Country	USD	EUR	GBP	JPY	RMB	R^2	p-val (LH)
Hong Kong Dollar	0.99***	-0.00	0.00	0.00***	0.00***	1.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
Korean Won	0.70***	-0.01	0.09***	0.02	0.19***	0.56	0.00
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)		
New Taiwanese Dollar	0.85***	0.02***	0.04***	0.01***	0.07***	0.88	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		
Cambodian Riel	0.99***	0.01	0.00	-0.01	0.01***	0.85	0.09
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		
Indonesian Rupiah	0.88***	-0.03	0.03	0.02	0.09***	0.58	0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)		
Laos Kip	0.99***	0.01	-0.00	0.00	0.00	0.94	0.52
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		
Malaysian Ringgit	0.92***	0.01	0.03***	-0.04	0.08***	0.85	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		
Philippine Peso	0.87***	0.02	0.03***	-0.01	0.09***	0.77	0.00
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)		
Singapore Dollar	0.60***	0.13***	0.05***	0.09***	0.14***	0.86	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		
Thai Baht	0.77***	0.03***	0.02	0.09***	0.09***	0.78	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		
Vietnamese Dong	1.00***	-0.01	0.00	-0.00	0.01***	0.96	0.01
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)		
Mongolian Togrog	0.98***	0.01	0.00	-0.01	0.02***	0.84	0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		
Indian Rupee	0.83***	0.04***	0.06***	−0.04***	0.12***	0.74	0.00
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)		

Note: $*, **, ***$ represent significance at 10%, 5% and 1% levels respectively

Note: This table shows the replication of Table 1 from Kawai and Pontines (2016) depicting that the parameter restriction of all the coefficients in the augmented Frankel-Wei regression adding up to 1 does not hold in the data, except for the Laos Kip. We also try the linear hypothesis test with weekly data and the null hypothesis of $\sum_{c=1}^{5} \hat{\beta}_{c,t} = 1$ is rejected with lower frequency data as well.

Figure F.2 Table 2 from Kawai and Pontines (2016)

Table 2
Monte Carlo experiment results ($n = 2000$, $\rho = 0.99$)

True Coefficients (1) USD	RMB	Henning and Subramanian–Kessler Approach (2) RMSE	Ho–Ma–McCauley Approach (3) RMSE	Balasubramaniam–Patnaik–Shah Approach (4) RMSE	New Approach (5) RMSE
0.9	0.05	0.4412	0.0311	0.2206	0.0307
0.8	0.15	0.4552	0.0310	0.2276	0.0305
0.7	0.25	0.4590	0.0313	0.2295	0.0314
0.6	0.35	0.4589	0.0325	0.2294	0.0321
0.5	0.4	0.4660	0.0310	0.2330	0.0304
0.4	0.55	0.4351	0.0310	0.2176	0.0308
0.3	0.65	0.4535	0.0318	0.2267	0.0312
0.2	0.75	0.4377	0.0311	0.2189	0.0307
0.1	0.85	0.4508	0.0317	0.2254	0.0313

RMB = renminbi, RMSE = root mean square error, USD = US dollar.
Note: ρ is the correlation between the simulated US dollar and the RMB.*Source:* Authors' calculations.

Table F.3 Replication of Table 2

True β_{USD}	True β_{RMB}	BPS-RMSE	KP-RMSE
0.90	0.05	0.0274	0.0228
0.85	0.10	0.0475	0.0492
0.80	0.15	0.0689	0.0787
0.75	0.20	0.0907	0.1090
0.70	0.25	0.1127	0.1395
0.65	0.30	0.1347	0.1701
0.60	0.35	0.1569	0.2007
0.50	0.45	0.1791	0.2178
0.40	0.55	0.2458	0.3236
0.35	0.65	0.2903	0.3850
0.20	0.75	0.3347	0.4464
0.10	0.85	0.3793	0.5080

Note: Monte Carlo experiment results with (n=2000, ρ=0.99), reported averages. BHPS refers to the method employed in Balasubramaniam *et al.* (2011), a variant of which is used in this paper. KP refers to the methodology used by Kawai and Pontines (2016)

Figure F.3 Table 3 from Kawai and Pontines (2016)

Table 3
Goodness of fit of the estimation results using the Balasubramaniam et al. (2011) approach and the new method

Currency Start date–End date	Balasubramaniam–Patnaik–Shah Approach: With CHF as Numeraire (1)	Balasubramaniam–Patnaik–Shah Approach: With NZD as Numeraire (2)	New Approach: With CHF as Numeraire (3)	New Approach: With NZD as Numeraire (4)
Malaysian ringgit 14 Oct 2005–11 Jun 2007	0.51	0.41	0.76	0.89
New Taiwan dollar 14 Oct 2005–11 Feb 2011	0.27	0.39	0.75	0.91
Vietnam dong 16 Oct 2009–11 Feb 2011	0.48	0.53	0.68	0.80

CHF = Swiss franc, NZD = New Zealand dollar.

Table F.4 Replication of Table 3

	Weekly data			Daily data		
Currency	BPS	BPS	KP	BPS	BPS	KP
Numeraire	CHF	NZD	NZD	CHF	NZD	NZD
Malaysian ringgit 14 Oct 2005-11 Jun 2007	0.865	0.942	0.934	0.855	0.918	0.910
New Taiwanese dollar 14 Oct 2005-11 Feb 2011	0.823	0.904	0.900	0.808	0.870	0.866
Vietnamese dong 16 Oct 2009-11 Feb 2011	0.889	0.935	0.934	0.848	0.888	0.890

BPS refers to the method employed in Balasubramaniam *et al.* (2011), a variant of which is used in this paper. KP refers to the methodology used by Kawai and Pontines (2016)

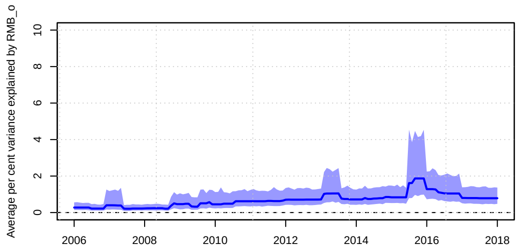
F.2 Does changing the numeraire alter the results?

We explore the implications of changing the numeraire from our benchmark New Zealand Dollar (NZD) to the Swiss Franc (CHF) in this section. Sensitivity to numeraire choice is one of the well-known problems of using the FW regression to detect basket weights. Using the CHF as an numeraire has its own set of problems given its EUR floor peg during 2011-2015. Nevertheless, it is the original numeraire in the estimation of the FW regression and it slightly changes our results. There are 59 currencies that show a significant co-movement with the RMB_o using a NZD numeraire, whereas there are 61 currencies that show a significant co-movement with the RMB_o using the CHF numeraire. Out of these currencies, 57 currencies are shared between both numeraires with little or no difference in their RMB_o $\hat{\mathcal{B}}_t^2$ estimates and identified currency periods.

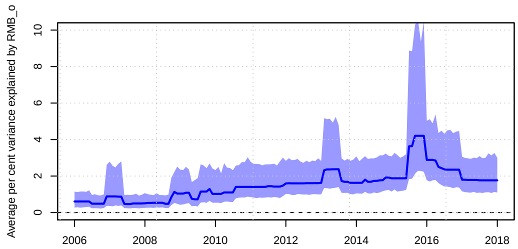
Using the CHF numeraire, there are 4 additional currencies that show a significant movement versus the RMB in our sample period. This includes 3 large currencies: the Brazilian Real, the Mexican Peso and the Swedish Krona, as well as the New Zealand Dollar which is used as our primary numeraire. Figure H.7 plots the results of our estimation with a CHF numeraire. This difference in currencies identified as RMB trackers does not change our benchmark results meaningfully.[65] Figure F.4 shows the average unweighted and weighted RMB_o $\hat{\mathcal{B}}_t^2$ with the CHF numeraire and it is similar to the results we get with the NZD numeraire. The midpoint estimate of the share of the RMB_o is larger with a CHF numeraire on average, but the range remains the same for the full sample as well as RMB trackers between 0-10%.[66] With a CHF numeraire, we would conclude that the RMB has slightly greater influence on global exchange rate arrangements with the RMB_o having 1-4% share in explained variance for RMB trackers, excluding periods of depreciation.

[65] The average estimated RMB_o $\hat{\beta}_t$ is slightly larger with the CHF numeraire but it is likely driven by structural breaks in the CHF exchange rate.
[66] See Figure 5 for a comparison with results estimated using a NZD numeraire

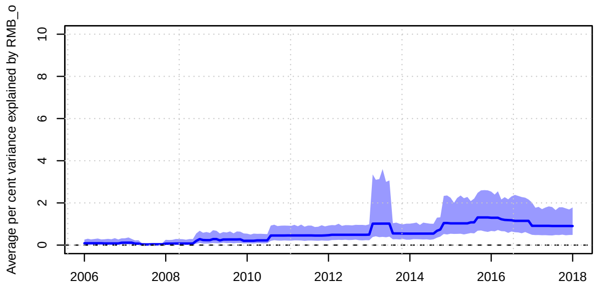
Figure F.4 Unweighted mean and GDP weighted RMB_o share in explained variance



a. Full sample



b. RMB trackers



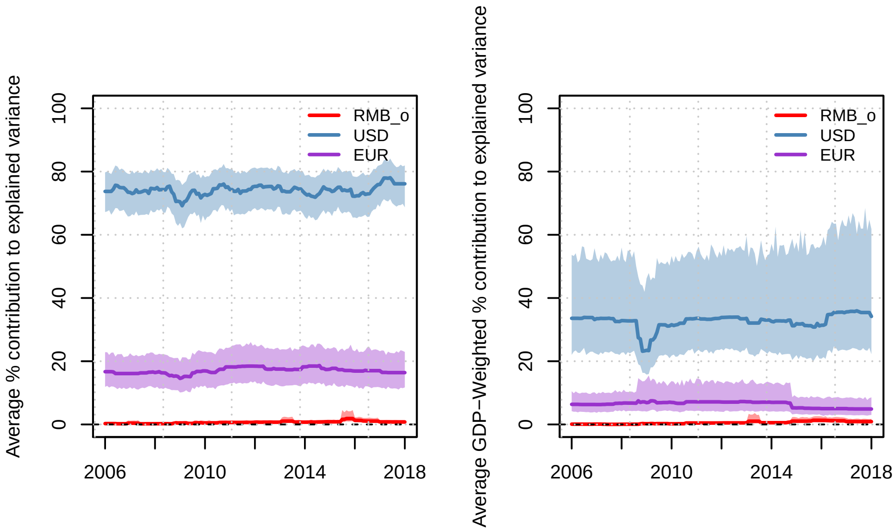
c. GDP-weighted

Note: This figure in the top-left panel shows the unweighted contributions of RMB_o in the augmented FW regression for 135 national currencies with a CHF numeraire. This figure in the top-right panel shows the average variance contribution of RMB_o for the 61 currencies who track the RMB. The figure in the bottom panel shows the PPP GDP-weighted RMB_o variance share. As we set statistically insignificant $\hat{\mathcal{B}}^2$ to zero, the measure for GDP-weighted $\mu_{\hat{\mathcal{B}}_t^2}$ is identical for the full sample and RMB trackers.

Figure F.5 shows the share in explained variance for the USD, EUR and RMB_o over the sample period using estimates with a CHF numeraire. The average shares in explained variance of the USD, EUR and RMB_o are larger using the CHF numeraire indicative of a better model-fit as compared with the NZD. Nevertheless, (See Figure 6), the average global share in explained variance for the USD and EUR is much greater than that for the RMB_o. Changing numeraire does affect the classification of currencies as RMB trackers as well as change the magnitude of $\hat{\mathcal{B}}_t^2$. However, using standardised $\hat{\mathcal{B}}_t^2$ metrics does not change our inference about the RMB's role in global exchange rate arrangements.

Irrespective of numeraire choice, researchers would arrive at the same conclusion: The RMB's importance and global influence are growing, but its importance as an additional/latent anchor of exchange rate policy is minuscule when compared to the USD and EUR.

Figure F.5 Comparing the average variance contribution of RMB_o, USD and the EUR



Note: This figure compares the variance contribution of RMB_o, USD and the EUR in the augmented FW regression with a CHF numeraire for 135 national currencies. The left and right panels show the unweighted and GDP-weighted variance contributions respectively.

For completeness, We re-estimate our benchmark regressions from Table 9 in Table F.5 using the CHF numeraire estimates of RMB_o $\hat{\mathcal{B}}^2_{c,t}$. The results are qualitatively similar. Our main variables of interest, export exposure and BRI linkages are robust to change in numeraire. The coefficient for import exposure, financial openness and GDP are similar across both numeraire variants as well. The ERS index loads in the correct direction but is no longer statistically significant. GDP is negative and significant in our benchmark model 1. Policy affinity to China is no longer statistically significant when using the CHF numeraire, indicating lack of robustness as a predictor for the full sample. LCY settlement facilities and BRI are positive and significant, with their coefficients being 2-3X larger in this estimation.

Table F.5 Benchmark results: Determinants of $\text{RMB}_o\ \hat{\mathcal{B}}^2_{c,t}$

	Dependent variable:			
	$\text{RMB}_o\ \mathcal{B}^2_{c,t}$			
	(1)	(2)	(3)	(4)
Export exposure	0.003^{***}	0.001^{***}	0.001^{***}	0.003^{***}
	(0.0003)	(0.0001)	(0.0001)	(0.0003)
Import exposure	-0.0001	-0.001^{***}	-0.001^{***}	-0.0002
	(0.0005)	(0.0002)	(0.0002)	(0.0005)
Financial openness	0.008	0.005	0.006^{*}	0.009
	(0.017)	(0.004)	(0.004)	(0.016)
ERS index	-0.012	-0.008^{*}	-0.013^{***}	-0.011
	(0.007)	(0.004)	(0.004)	(0.007)
GDP	-0.015^{**}	0.002^{***}	0.002^{**}	-0.011^{*}
	(0.007)	(0.001)	(0.001)	(0.007)
Inflation correlation	-0.001	-0.001	-0.002	-0.0002
	(0.002)	(0.002)	(0.002)	(0.002)
PTA	-0.007	-0.001	-0.002	-0.007
	(0.005)	(0.003)	(0.003)	(0.005)
BIT	0.012	0.001	-0.004	0.013^{*}
	(0.007)	(0.003)	(0.003)	(0.007)
Reserve dummy	0.001	0.007	0.006	0.001
	(0.005)	(0.005)	(0.005)	(0.005)
Swap line	-0.002	-0.002	-0.005	-0.002
	(0.005)	(0.005)	(0.005)	(0.005)
LCY settlement	0.025^{**}	0.042^{***}	0.043^{***}	0.024^{**}
	(0.010)	(0.009)	(0.009)	(0.010)
BRI	0.016^{***}	0.013^{***}	0.013^{***}	0.016^{***}
	(0.005)	(0.005)	(0.005)	(0.004)
China affinity	0.030	0.009	0.018	0.010
	(0.025)	(0.020)	(0.018)	(0.023)
US affinity	-0.002	0.026	0.023	-0.001
	(0.028)	(0.023)	(0.022)	(0.026)
Fixed effects	Country & Year	Continent & Year	Year	Country & RMB regime
Observations	1,104	1,104	1,104	1,104
R^2	0.413	0.132	0.115	0.406
Adjusted R^2	0.332	0.109	0.095	0.329
Residual Std. Error	0.032 (df = 969)	0.036 (df = 1075)	0.037 (df = 1079)	0.032 (df = 977)
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: Export and import exposure are measured in terms of share of exports/imports to China as per cent of total exports and imports using the IMF-DOTS dataset. Financial openness and ERS index come from Aizenman *et al.* (2010)'s trilemma indices, higher values of these indices represent closed economies and stricter exchange rate management. GDP is measured in terms of ln(GDP in billions), inflation correlation is measured as 12 month CPI correlation of a country with the Chinese CPI. PTA, BIT, Reserve Dummy, LCY settlement, Swap line and BRI are dummy variables that take a value 1 in the year a country enters into such an arrangement with China. China and US affinity are variables that come from Bailey *et al.* (2017) dataset. Higher values indicate higher policy concordance. All the variables are lagged by a year to mitigate endogeneity concerns.

G Considering recent co-movements: Reform and trade war period

The PBoC has gradually altered the daily fixing of the RMB since the large devaluation in Aug 2015. This period is described in detail by McCauley and Shu (2019). The increase in RMB flexibility after 2015, along with the fluctuations in the RMB exchange rate due to the "trade-war" between the United States and China gives us an opportunity to look at recent anchoring behaviour in light of these changes.

This period is split into two phases, both marked by bouts of unanticipated RMB_o depreciation. The first phase lasts between Aug 2015 to Mar 2018. This phase is marked by RMB exchange rate reform and stabilisation of the USD/RMB exchange rate. It must be noted that the USD/RMB exchange rate faced depreciation pressure during this phase mostly due to domestic factors from China, including a stock market draw-down and capital flight.

The second phase starts in March 2018 when the United States initiates proceedings to impose tariffs and investment restrictions on Chinese firms and capital. Jeanne (2020) finds that a third of the unanticipated depreciation in the RMB during 2018 to be driven by "trade war" related news. This trade disagreement lasts roughly 2 years from 22nd March 2018 to 15th January 2020 till both countries agree to sign the "Phase One" trade deal.[67] The policy uncertainty over this 2015-2020 period could have had an adverse effect on RMB internationalisation and adoption.[68]

Table G.1 RMB exchange rate regime break dates

	Start Date	End Date	R^2	USD	EUR	GBP	JPY	Intercept	Variance
1	2015-08-14	2016-02-19	0.91	0.97***	-0.28**	-0.14	0.15	0.25	0.28
				(8.78)	(-2.21)	(-0.99)	(1.60)		
2	2016-02-26	2017-08-04	0.96	0.73***	0.15***	0.04*	0.04	0.05	0.07
				(23.38)	(3.73)	(1.80)	(1.58)		
3	2017-08-11	2020-01-31	0.78	0.71***	0.15	0.13**	-0.03	0.01	0.30
				(9.67)	(1.51)	(2.22)	(-0.50)		

Note: *p<0.1; **p<0.05; ***p<0.01

We re-estimate Equation 2 with weekly data after the devaluation on August 7th, 2015. This exercise yields two breaks in the RMB exchange rate regime at our preferred weekly frequency. These dates seem to roughly correspond to RMB-fixing reform dates. We use this model as the basis for our piece-wise orthogonalisation strategy. One can notice that the trade war period does not show up as change in the exchange rate regime. This is probably because of the unpredictable nature of trade negotiations along with PBoC's commitment not to allow a disorderly depreciation after the events of 2015. This reflected in the reduction of the positive intercept across the three identified regimes in Table G.1.

We run our set of augmented FW models for our set of national currencies looking at the period between Sep 2015-Jan 2020, stopping before the outbreak of COVID-19 in China and find that 44 currencies have co-moved with the RMB_o in post-2015 period with 32 currencies co-moving

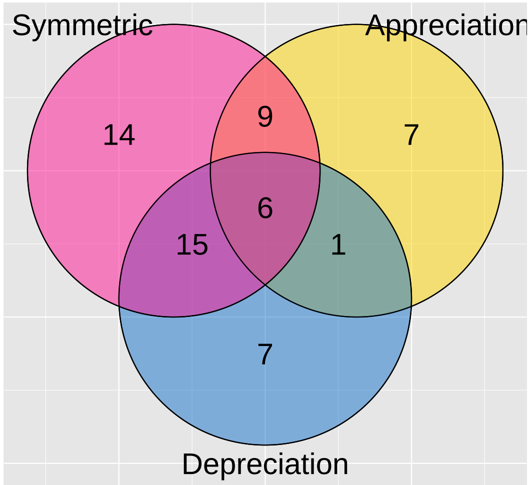
[67] See https://reut.rs/3duywgC for a timeline of the US-China "trade-war".

[68] During this period, the US Treasury named China as a currency manipulator in August 2019. The Phase One trade deal also included a section on currency manipulation, which commits the PBoC to achieve a "market-determined" RMB exchange rate regime as per the IMF and G20's policies. The Trump administration removed the "currency-manipulator" label from its January 2020 FX report before the Phase One deal was officially announced given the agreement on currency manipulation. See Section 5 in https://bit.ly/3gLNvVj for additional details

with RMB$_o$ as of Jan 2020. Figure G.1 shows the full set of currencies that show a significant co-movement with the RMB for this period.

Utilising our spline specification we find that there are 15 (a total of 59) additional currencies that show a significant co-movement with the RMB during this recent 5 year period.

Figure G.1 Asymmetry in global sensitivity to the RMB$_o$



Note: This figure shows counts of currencies which have a linear sensitivity to the RMB$_o$ compared with countries who react asymmetrically to RMB$_0$ appreciation and RMB$_0$ depreciation for 2015-2020 period

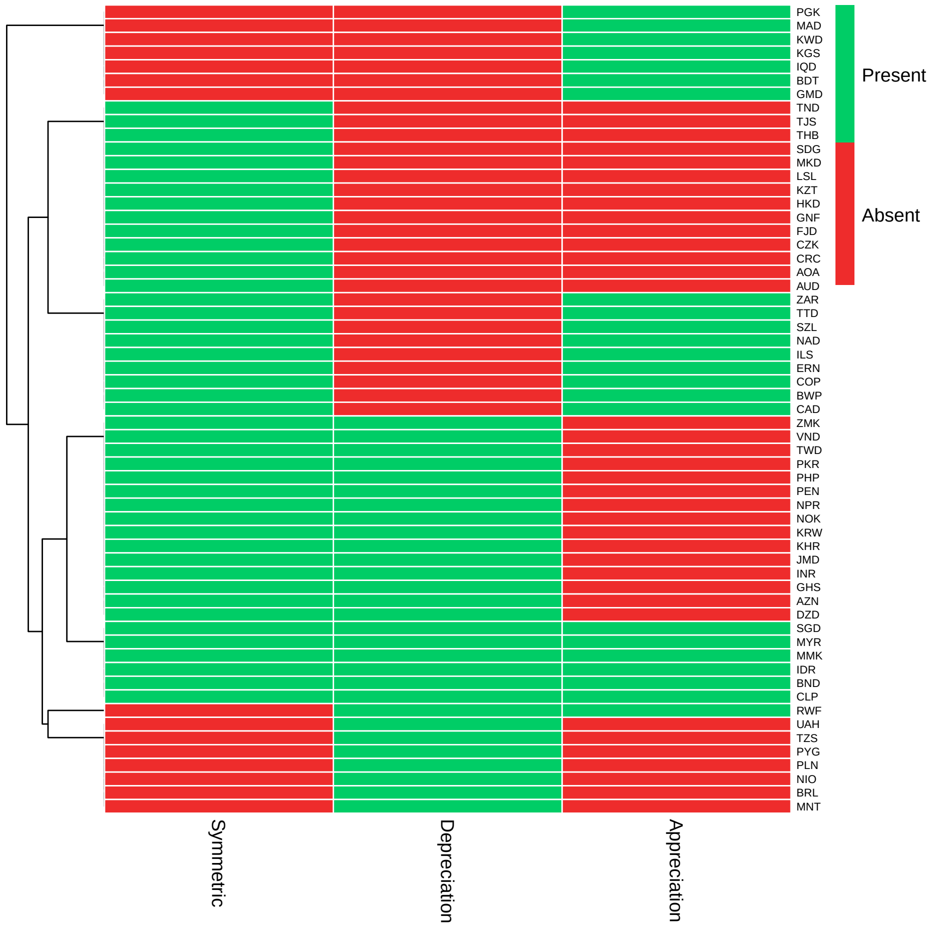
Starting from the smallest single set, the Rwandan Franc shows a differential response to RMB appreciation and depreciation and does not have a significant RMB$_o$ coefficient. Rwanda is one of the key countries in China's Belt and Road initiatives in Africa and this asymmetric sensitivity to RMB movements may be a consequence of those linkages. There are 7 currencies that only show a significant co-movement with RMB appreciation. These currencies are mostly Dollar peggers who appreciate when then the RMB$_o$ appreciates. There are 7 currencies that only show a sensitivity to RMB depreciation. In this set, the Brazilian Real, Tanzanian Shilling, Ukrainian Hryvnia and Polish Zloty are major currencies that show a strong tendency to depreciate when the RMB$_o$ depreciates, indicating a strictly one-sided movement. These 15 currencies do not show a significant co-movement with the RMB$_o$ for the full distribution of appreciation and depreciation.

The Malaysian Ringgit, Singapore Dollar, Burmese Kyat, Indonesian Rupiah, Brunei Dollar and Chilean Peso show a symmetric sensitivity to the RMB but show as well as a differential response to RMB appreciation and depreciation on further inspection. These countries may broadly be categorised as some of the closest trackers of the RMB in the post RMB fixing reform period.

The remaining 38 currencies have some combination of general sensitivity as well as specific co-movement to depreciation or appreciation over different regime-periods. There are 9 currencies that show a general sensitivity along with specific co-movements with RMB appreciation. The South African Rand, Colombian Peso, Canadian Dollar and Israeli Shekel show a positive RMB$_o$

coefficient as well as a positive $RMB_{o(A)}$ coefficient, implying appreciation when the RMB appreciates. With exception of some currencies like the Shekel, most of these currencies are at the flexible end of managed floating and share demand shocks with China through commodity trade.

Figure G.2 Asymmetry in global sensitivity to the RMB_o: 2015-2020

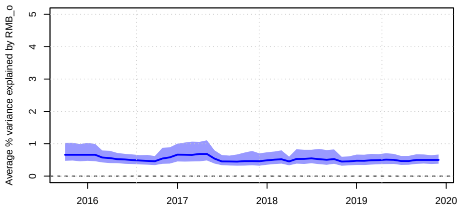


Note: This figure shows classification of currencies which have a linear sensitivity to the RMB_o compared with countries who react asymmetrically to RMB_0 appreciation and RMB_0 depreciation for the 2015-2020 period

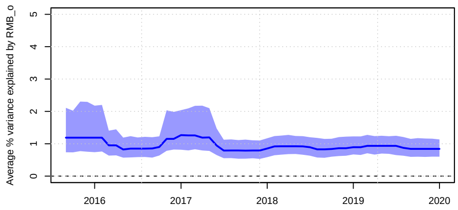
There are 14 currencies who show a positive symmetric coefficient with the RMB. This set includes the major RMB watchers like the Australian Dollar, Thai Baht, Angolan Kwanza and the Hong Kong Dollar. The Hong Kong Dollar is a currency board with a large USD weight, but has started showing co-movements with the RMB after September 2018. This might be a consequence of the Hong Kong Dollar being part of the China Foreign Exchange Trade System (CFETS) basket as well as greater influence of the RMB in Hong Kong markets. The largest set, in line with previous results, is currencies that show a positive RMB_o coefficient and a positive $RMB_{o(D)}$ coefficient. Currencies of major China competitors like Indian Rupee, Korean Won, Taiwanese Dollar and Philippine Peso are the key currencies in this set.

We repeat our analysis from the main paper by looking at average global RMB$_o$ $\hat{\mathcal{B}}^2$ coefficient. The spike in share of explained variance observed in 2015 (Panel b, Figure 5) for RMB trackers after the RMB's devaluation episode does not seem to have been persistent. Once we start the sample after the RMB devaluation, we find similar results as before wherein the average variance contribution of the RMB$_o$ does not exceed 2% of a currency's explained variance.

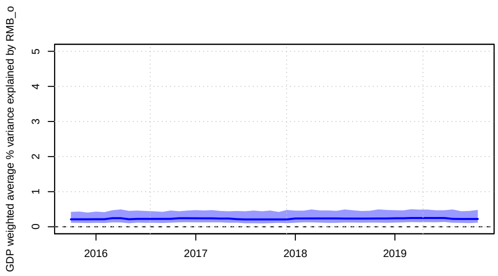
Figure G.3 Unweighted mean and GDP weighted RMB$_o$ share in explained variance: 2015-2020



a. Full sample



b. RMB trackers

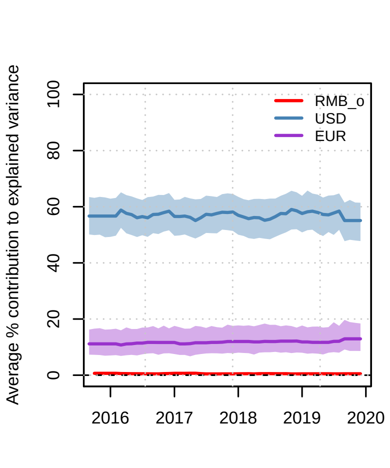


c. GDP-weighted

Note: This figure in the top-left panel shows the unweighted contributions of RMB$_o$ in the augmented FW regression for 135 national currencies. This figure in the top-right panel shows the average variance contribution of RMB$_o$ for the 44 currencies who track the RMB. The figure in the bottom panel shows the PPP GDP-weighted RMB$_o$ variance share. As we set statistically insignificant $\hat{\mathcal{B}}^2$ to zero, the measure for GDP-weighted $\mu_{\hat{\mathcal{B}}_t^2}$ is identical for the full sample and RMB trackers.

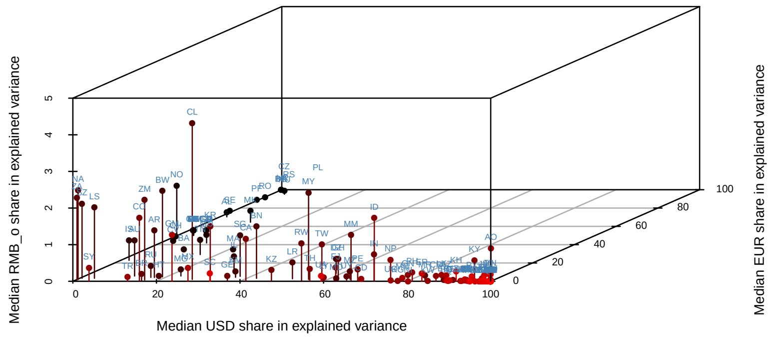
Figure G.6 indicates that post 2015 period has been marked by a re-linking with the USD. The GDP-weighted estimators seem to suggest that the EUR and RMB are more similar in their global effect than they seem compared to the pre-RMB fixing reform period. This however hides the fact that the fact that the EUR zone has many peggers to the Euro, using the Euro as the primary anchor currency, something the RMB does not currently have. There has been a strong movement towards the USD pole at the expense of the EUR. Figure G.7 shows the median share in explained variance for the USD, EUR and RMB. The RMB does not seem to made any progress in this 2015-2020 period as an anchor currency potentially due to trade war and policy uncertainty.

Figure G.4 Comparing the average variance contribution of RMB$_o$, USD and the EUR



Note: This figure compares the variance contribution of RMB$_o$, USD and the EUR in the augmented FW regression for 135 non-SDR currencies. The left and right panels show the unweighted and GDP-weighted variance contributions respectively for the period Sep 2015-Jan 2020

Figure G.5 Comparing the median variance contribution of RMB$_o$, USD and the EUR: 2015-2020



Note: This figure compares the median variance contribution of RMB$_o$, USD and the EUR for the period 2015-2020

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