ADBI Working Paper Series

DETERMINANTS OF THE INTERNATIONAL USE OF CURRENCIES: IMPLICATIONS FOR US DOLLAR DOMINANCE

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No. 1533
April 2026

Asian Development Bank Institute

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Suggested citation:

Ito, H. and M. Kawai. 2026. Determinants of the International Use of Currencies: Implications for US Dollar Dominance. ADBI Working Paper 1533. Tokyo: Asian Development Bank Institute. Available: https://doi.org/10.56506/AGZO7283.

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The authors are grateful to Serkan Arslanalp and the participants at a World Bank seminar held in April 2025, particularly Ayhan Kose, for their constructive comments. All the remaining errors and deficiencies are those of the authors.

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Abstract

The US dollar (USD) has long been the dominant international currency. The euro (EUR), UK pound (GBP), Japanese yen (JPY), and other advanced economy (AE) currencies have played complementary roles to the USD as international currencies, while emerging market and developing economy (EMDE) currencies including the Chinese yuan (or renminbi, RMB) have been used to a much more limited extent.

This paper identifies the determinants of the shares of both AE and EMDE currencies used for settling international payments, trading in foreign exchange (FX) markets, holding financial assets and liabilities (such as FX reserves, cross-border bank liabilities, and international debt securities), and anchoring other economies' exchange rates and thus forging currency zones. Data for these currency shares, except the last one (i.e., anchor or currency zone shares), are readily available from the International Monetary Fund (IMF), the Bank for International Settlements (BIS), and the Society for Worldwide Interbank Financial Telecommunication SC (SWIFT). Drawing on the authors' earlier study, this paper computes the economic size of the major currency zones (i.e., the USD, EUR, GBP, JPY, and RMB zones), which are defined by the core countries (i.e., the US, the Euro Area, the UK, Japan, and the People's Republic of China (PRC)) as well as the peripheral economies that stabilize their currencies, at least partially, to the respective major currencies.

Following and extending the literature on the determinants of aggregate FX reserves, this paper tests the hypothesis that currency shares are determined by a common set of the economic characteristics of the currency issuers, such as their economic size (defined by their share of global GDP), their per capita GDP, the rate of appreciation and volatility of their nominal effective exchange rate, the change in their general government debt as a ratio of GDP, the degrees of their financial market development and openness, and a lagged dependent variable representing network externalities and inertia. It turns out that economic size, financial market development, and the inertia effect are the primary determinants of currency shares, and that financial market openness also matters in some cases. Using estimated regression equations, the paper conducts a scenario analysis for the RMB.

An important implication of the analysis is that it is likely that the US dollar will remain the dominant international currency for the foreseeable future. Potential challengers to the US and the dollar need to be large in economic size and to be equipped with developed and open financial markets to support their currency internationalization, but it will take time for their currencies to rival the dollar because of the strong inertia effect. However, it is relatively easier for them to increase their anchor currency roles for other economies and expand their currency zones because the inertia effect is weaker for the currency zone share than for the other types of currency share.

Keywords: US dollar dominance, major currency zones, determinants of currency shares, financial market development and openness, network externalities and inertia

JEL Classification: F32, F41

Contents

1. INTRODUCTION

In the period after World War II, the US dollar (USD) has been the dominant "king currency" (Blustein 2025) for various international purposes—conducting cross-border transactions, holding foreign assets and liabilities, and forging a currency zone. The euro (EUR), the UK pound (GBP), the Japanese yen (JPY), and other advanced economy (AE) currencies have played complementary roles to the USD as international currencies, while the use as international currencies of emerging market and developing economy (EMDE) currencies, including the Chinese yuan (or renminbi, RMB), has recently risen, albeit to a much more limited extent. This paper focuses on currency shares for cross-border bank liabilities, official foreign exchange (FX) reserves, international payments and settlements, FX market turnovers, international debt securities, and anchors for forging currency zones.

The first objective of this paper is to identify the determinants of the shares of both AE and EMDE currencies used for the different international purposes. All the international currency data used for the analysis, except the data on currency zones, are readily available from the International Monetary Fund (IMF), the Bank for International Settlements (BIS), and the Society for Worldwide Interbank Financial Telecommunication SC (SWIFT). Drawing on the authors' earlier study (Ito and Kawai 2024), this paper constructs the economic size of the major currency zones (i.e., the USD, EUR, GBP, JPY, and RMB zones), which are defined as the sum of the currency issuers themselves (i.e., the US, the Euro Area, the UK, Japan, and the People's Republic of China (PRC)) and the non-major currency economies that stabilize their exchange rates, at least partially, to the respective major currencies.

Following the voluminous literature on official FX reserve holdings (Chinn and Frankel 2007, 2008; Arslanalp, Eichengreen, and Simpson-Bell 2022; Chinn, Frankel, and Ito 2024), the paper's hypotheses are that a set of characteristics of the currency issuer, such as their economic size, per capita income, exchange rate appreciation and volatility, the change in their public debt as a share of GDP, and their levels of financial market development (FMD) and openness (FMO), as well as a lagged dependent variable representing network externalities and inertia, are the principal factors affecting the use of currencies for the different international purposes. The paper assumes that the currency shares are determined in the same manner across currencies and, thus, estimates the currency shares by pooling data across currencies and currency issuers as well as over time for the period 1980–2021.

The second objective of this paper is to explore the potential for the RMB to become a more important international currency. Using estimated regression equations, the paper conducts a scenario analysis for the RMB. Specifically, the paper examines what would happen to the predicted RMB share if (i) the PRC's GDP became as large as that of the US, (ii) the levels of the PRC's FMD and FMO rose to those of more advanced economies, such as the Republic of Korea, and (iii) the PRC's GDP grew to the US level and at the same time the PRC's FMD and FMO equaled those of the Republic of Korea.

The paper is organized as follows. Section 2 argues that the currency share data used for analysis corresponds to the three functions of an international currency, and briefly explains how major currency zone shares are constructed. Section 3 reviews the trends of the various currency shares used for the regression analysis and finds that the currency share data are highly correlated over time. Section 4 conducts regression analysis to identify the determinants of the various currency shares and provides an interpretation of the results. It shows that the currency shares can be explained by a

set of currency issuer characteristics, such as their economic size, financial market development and openness, and inertia, without assuming an interdependence of the currency shares. Section 5 conducts a simple scenario analysis to demonstrate that it would take a long time for the RMB, as a potential challenger currency, to rival the dollar, although it would take a shorter time to increase its anchor currency role and currency zone because the inertia effect is weaker for the currency zone share than for the other currency shares. Section 6 summarizes the paper, and discusses its implications.

2. INTERNATIONAL CURRENCIES AND DATA

Three Functions of an International Currency

An international currency is one that is used for various international purposes. Just like a domestic currency, an international currency serves three functions—as a unit of account, a medium of exchange, and a store of value. By making a distinction between private users and monetary authorities, the functions of an international currency can be summarized in a 2x3 matrix originally developed by Cohen (1971) and later adapted by Kenen (1983). Table 1 shows a slight modification of this matrix. First, an international currency serves as an international unit of account, since private agents denominate trade and financial transactions in the currency, making it an "invoice" and/or "settlement" currency, and monetary authorities peg or stabilize their exchange rate to the international currency, making it serve as an "anchor" or "reference" currency. Second, it serves as an international medium of exchange, since private players use it as a "vehicle" currency in the FX market, and monetary authorities buy and sell it in the FX market, thus making it an "intervention" currency. Finally, it serves as an international store of value, since private agents hold liquid assets and/or liabilities in the form of bank accounts, loans, borrowings and debt securities denominated in the international currency, and monetary authorities hold it as FX reserves.

Table 1: Functions of an International Currency

Function	Private	Official
Unit of account	Invoice or denomination	Anchor or reference
Medium of exchange	Settlement and FX market vehicle	FX market intervention
Store of value	International assets and liabilities	FX reserves

FX = foreign exchange.

Source: Adapted from Cohen (1971) and Kenen (1983).

This paper covers all the functions of an international currency listed in the table. International payments data, obtained from SWIFT, *RMB Tracker*, indicate the unit of account (denomination) and/or medium of exchange (settlement) functions of an international currency. The major currency zone shares, constructed by the authors as explained below, reflect the official sector's unit of account (anchor) function of an international currency. FX market turnover data, obtained from BIS, *Triennial Central Bank Survey*, reflect the medium of exchange (vehicle) function of an international currency. Cross-border bank liabilities and international debt securities, obtained from BIS, *Locational Banking Statistics* and *International Debt Securities*, respectively, include the private sector's store of value function. FX reserves, obtained from IMF, *Annual Report* and *Currency Composition of Official Foreign Exchange Reserves*

(COFER), are the monetary authorities' holdings of an international currency as an official store of value. Appendix I summarizes the definitions and sources of these data.

Computing the Economic Size of the Major Currency Zones

All the international currency data used for analysis in the paper, except the major currency zone shares, are readily available from SWIFT, BIS, and IMF. While the details are provided in Appendix II, this section briefly explains the procedure for computing the economic size of the currency zones of the major currencies (i.e., the USD, EUR, GBP, JPY, and RMB). It should be noted that the EUR zone before the introduction of the euro in 1999 refers to the Deutsche mark (DEM) zone and that the RMB zone is defined only from 1999.

The procedure adopted here consists of five steps: (i) defining a major currency zone to comprise the country/region of the major currency issuer itself (called the core) and the non-major currency (called peripheral) economies that stabilize or manage their exchange rates against the major currency; (ii) identifying a basket of anchor currencies for each peripheral economy over time; (iii) dividing each peripheral economy's GDP into different major currency zones according to the estimated currency weights, accounting for the tightness or looseness of that linkage; (iv) summing up the GDP portions belonging to each major currency zone across the peripheral economies for each year; and (v) characterizing the residual portion of the peripheral economies not belonging to any major currency zone as a unique zone with a floating exchange rate.

This procedure includes several innovations over the existing literature on the computation of the economic size of the major currency zones. First, based on the approach adopted by Kawai and Akiyama (1998) and Ito and McCauley (2019), and unlike that of Tovar and Nor (2018), Ilzetzki, Reinhart, and Rogoff (2019), and the IMF (2025), the procedure above identifies a basket of major anchor currencies rather than just a single anchor currency for each peripheral economy, and divides peripheral economies into different major currency zones according to the estimated, statistically significant positive basket weights on the major currencies. The anchor currency coefficients which are estimated to be statistically significant and positive, at least at the 10% level, are interpreted as meaningful weights on the major currencies, while statistically insignificant as well as negative coefficients are ignored. Second, following Tovar and Nor (2018), and diverging from Ito and McCauley (2019) and the IMF (2025), the procedure uses the three-step model of Kawai and Pontines (2016) to estimate the weights on the major anchor currencies including the RMB, in addition to the USD, EUR, GBP, and JPY.[1] Third, unlike the earlier literature, the procedure adjusts the estimated weights on the major currencies for the degree of exchange rate stability (ERS),[2] as the peripheral economy may manage its exchange rate against a major currency basket in a tight or a loose way. Fourth and finally, again unlike any of the previous studies, the procedure interprets the residual part of the peripheral economy not belonging to any major currency zone as a floating zone.[3]

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[1] The traditional Frankel–Wei (1994) method yields a serious multicollinearity problem when the RMB is included on the right-hand side of the regression equation, as it is highly correlated with the USD. The Kawai–Pontines (2016) method avoids the multicollinearity problem.

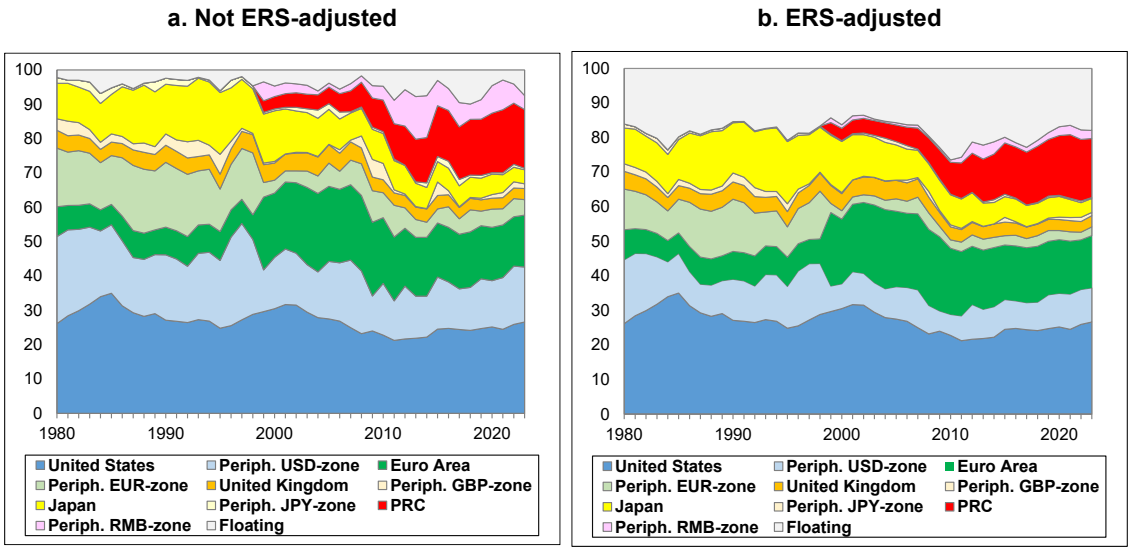
[2] The degree of ERS is constructed from the root mean squared error, which is inversely related to the explanatory power of the Frankel–Wei or Kawai–Pontines regression equation, in such a way that its value ranges between zero (complete currency flexibility) and unity (complete currency pegging).

[3] More specifically, if a peripheral economy rigidly pegs its exchange rate to a major currency basket with the sum of the estimated coefficients being unity, its entire economy is defined as belonging to the

Computed Shares of the Major Currency Zones

Figure 1 reports the estimated size of the major currency zones as percentage shares of world GDP. The world is comprised of between 150 and 181 economies, depending on the year. Figure 1a shows the results when the degree of ERS is not taken into account, while Figure 1b reports the results when the degree of ERS is considered. In each figure, a particular major currency zone is defined as the sum of the core (i.e., the major currency-issuing country or region) and the currency zone formed by the peripheral economies, which is the aggregated value of all the GDP portions of such economies.

Figure 1: Size of Major Currency Zones, % Share of World GDP, Including the Core Countries/Region, 1980–2023



ERS = exchange rate stability; EUR = Euro; GBP = UK pound; JPY = Japanese yen; Periph. = peripheral (economies); PRC = People's Republic of China; RMB = renminbi (Chinese yuan); USD = US dollar.

Note: The euro before its introduction in 1999 refers to the Deutsche mark, and the Euro Area before 1999 refers to Germany. The RMB zone is defined from 1999 and the PRC is assumed to be a periphery economy before 1999.

Source: Computed and compiled by the authors.

The global share of the USD zone has declined since the early 1980s, mainly because of the shrinking shares of the peripheral USD-zone economies. The EUR zone share has also declined because, despite an increase in the size of the Euro Area in 1999, its size has not exhibited a continuously rising trend since then and the peripheral EUR-zone economies have not grown much in size.[4] The shares of the GBP and JPY

currency zones forged by these major currencies. If a peripheral economy stabilizes or manages its exchange rate against a major currency basket in a loose way, its economy is partially divided into the corresponding currency zones, with the remaining portion of the economy treated as constituting an independent floating zone. If a peripheral economy does not stabilize or manage its exchange rate against a major currency basket, its entire economy is judged to be a floating zone.

[4] The size of the Euro Area (Germany before 1999), which was the core of the EUR (DEM before 1999) zone, expanded and that of the peripheral EUR-zone economies shrank in 1999 when Germany and 10 countries adopted the euro as their common currency. Before the introduction of the euro, many European countries as well as other peripheral economies in the rest of the world had more or less stabilized their currencies against the DEM, thus forging a large peripheral EUR (DEM) zone. However, the size of the peripheral EUR-zone economies declined sharply from 1998 to 1999 as the 10 European countries shifted from the peripheral to core economies of the EUR zone.

zones have persistently decreased. In contrast, the RMB zone has expanded in recent years, and its share is now larger than the EUR, GBP and JPY zone shares. Nonetheless, the USD zone remains the largest, and well above the RMB and EUR zones in size. In addition, there is a rising trend over time for the global share of the floating zone in peripheral economies.

The difference between Figures 1a and 1b lies in the different ways of computing the major currency zones and the floating zone formed by the peripheral economies. The size of each major currency zone formed by the peripheral economies is larger in Figure 1a than in Figure 1b, and the size of the floating zone is smaller in Figure 1a than in Figure 1b. The reason for this difference is that the size of each major currency zone reported in Figure 1a, which makes no ERS adjustment, is naturally larger than the size in Figure 1b, which applies an ERS adjustment. This also leads to a smaller floating zone in Figure 1a than in Figure 1b. The difference is particularly significant for the peripheral RMB zone, as many peripheral economies which assign significantly positive weights to the RMB in their currency baskets do so in a relatively loose way, with low levels of ERS.

3. TRENDS IN THE USE OF CURRENCIES FOR THE DIFFERENT INTERNATIONAL PURPOSES

Before analyzing the determinants of the shares of currencies used for the different international purposes, this section reviews the trends in such currency shares over time. This part of the paper confirms the dominance of the US dollar (Gopinath and Stein 2018, 2021; Gopinath et al. 2020) and other AE currencies, and at the same time pays attention to the extent of the international use of EMDE currencies, including the RMB.

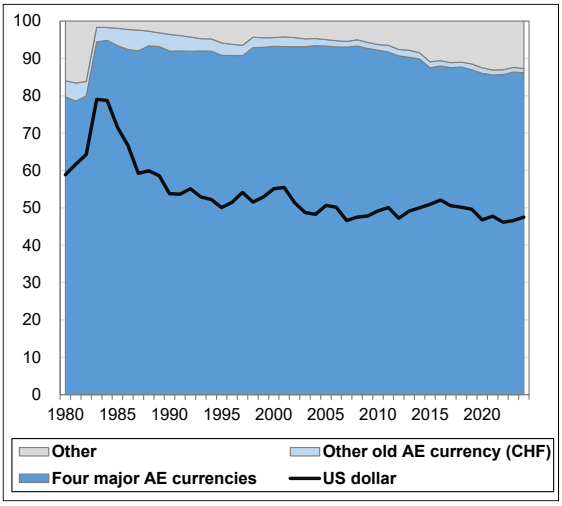
Compositions of Currencies Used for the Different International Purposes

Figure 2 summarizes the trend in the shares of currencies used for the different international purposes (cross-border bank liabilities, FX reserves, international payments, FX market turnovers, and international debt securities) from the perspectives of the US dollar as well as other AE and EMDE currencies. There are two types of AE currency, old and new. Old AE currencies include the four major currencies (i.e., the USD, EUR (or the Deutsche Mark [DEM] before 1999), GBP, and JPY) and the currencies of other industrial countries such as Australia, Canada, Denmark, Iceland, Norway, Sweden, Switzerland and, before the introduction of the euro, those countries which had been European Monetary System members and eventually created the Euro Area in 1999. New AE currencies are those of the economies that have been classified as AEs by the IMF since 1997, such as the Czech Republic; Israel; Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China. There are up to 30 EMDE currencies, such as those of Argentina, Brazil, the PRC (before 1998), India, Indonesia, Mexico, Poland, the Russian Federation, Saudi Arabia, South Africa, Türkiye, the UAE, and eight countries before recently joining the Euro Area.

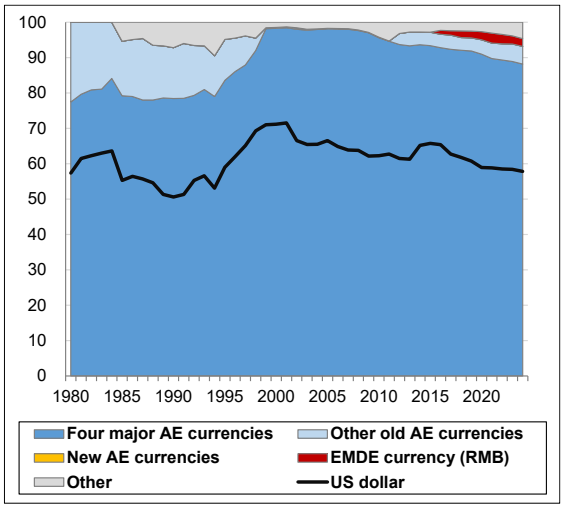
The figures confirm that the US dollar has been used most prominently for all international purposes. In addition, the other old AE currencies have been used frequently, while the new AE currencies and the EMDE currencies are used much less for international purposes.

Figure 2: Currency Compositions for Cross-border Bank Liabilities, FX Reserves, International Payments, FX Market Turnovers, and International Debt Securities Issued (%)

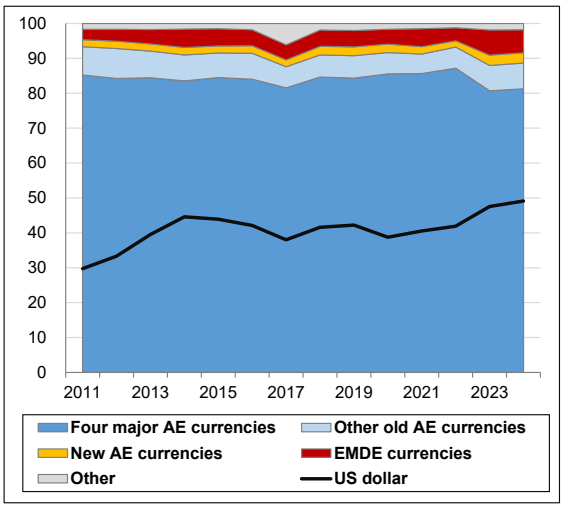
a. Cross-border bank liabilities, 1980–2024



b. FX reserves, 1980–2024



c. International payments, 2011–2024



d. FX market turnovers, 1989–2022

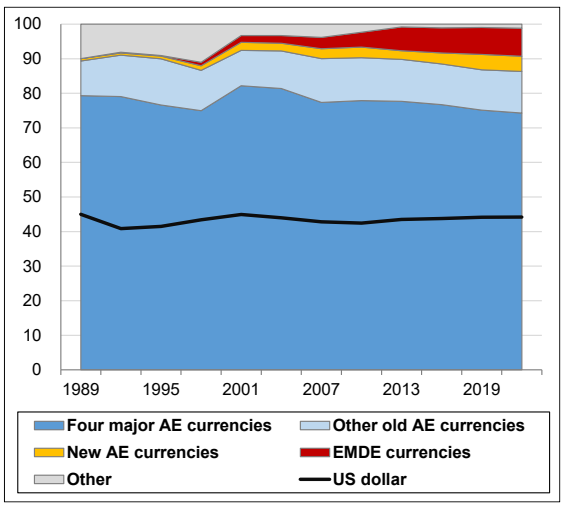


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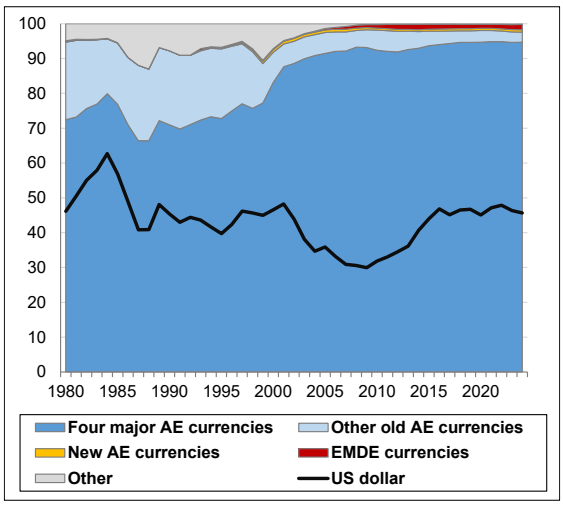
Figure 2 *continued*

e. International debt securities, 1980–2024



AE = advanced economy; CHF = Swiss franc; EMDE = emerging market and developing economy; RMB = renminbi (Chinese yuan).

Note: The four major AE currencies are the US dollar, the euro (or the Deutsche mark [DEM] before the introduction of the euro), UK pound, and the Japanese yen. Other old AE currencies include the Australian dollar, the Canadian dollar, the Danish krone, the Icelandic króna, the New Zealand dollar, the Norwegian krone, the Swiss franc, and the Swedish krona, as well as the 10 legacy currencies of the euro before its introduction (Austrian schilling, Belgian franc, Finnish markka, French franc, Greek drachma, Italian lira, Luxembourg franc, Dutch guilder, Portuguese escudo, and Spanish peseta). New AE currencies include the Hong Kong dollar; the Israeli shekel; the Korean won; the Singapore dollar; and the NT dollar from 1997, as well as two newer currencies, the Czech koruna (from 2009) and the Macanese pataca (from 2016). EMDE currencies include up to 30 currencies, such as the Brazilian real, the Chinese yuan (RMB), the Indian rupee, the Russian ruble, the South African rand, and the currencies of recent Euro Area members before they adopted the euro.

Source: Bank for International Settlements (BIS), *Locational Banking Statistics* for Figure 2a; International Monetary Fund (IMF), *Annual Report*, various years, and *Currency Composition of Official Foreign Exchange Reserves (COFFER)* for Figure 2b; Society for Worldwide Interbank Financial Telecommunication (SWIFT), *RMB Tracker*, various issues. https://www.swift.com/our-solutions/compliance-and-shared-services/business-intelligence/renminbi/rmb-tracker/document-centre for Figure 2c; Bank for International Settlements (BIS), *Triennial Central Bank Survey: Foreign Exchange Turnover* http://stats.bis.org:8089/statx/srs/table/d11.3?f=csv for Figure 2d; and Bank for International Settlements (BIS), *Debt Securities Statistics* (DEBT_SEC2) for Figure 2e.

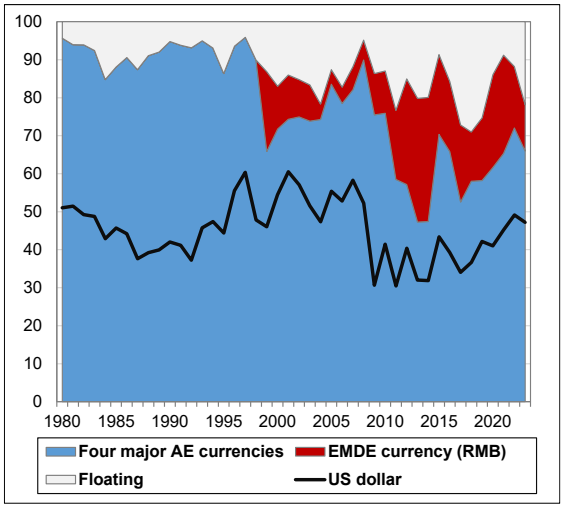
Figure 2a demonstrates that the share of the US dollar in cross-border bank liabilities was, at its highest, about 50% or more, although it has slightly declined over time, and this share is followed by those of the EUR, GBP, JPY, and CHF. Data for new AE and EMDE currencies are not reported by the BIS. Figure 2b shows the currency composition of FX reserves held by all IMF reporting member economies, which represents the most popular measure of the use of international currencies. The share of the US dollar has been the highest, at 50%–70% as the dominant reserve currency. Although not explicitly shown, the share of the EUR has been in the range of 20%–30% since it was introduced in 1999, and the shares of the GBP, JPY and the other old AE currencies have been low, while data on the new AE currencies have not been reported by the IMF. The RMB, the only EMDE reserve currency, which was included in the IMF's special drawing rights basket in 2016, has accounted for at most 2% of global FX reserves, indicating that the RMB is not yet one of the most heavily held reserve currencies.

Figures 2c, 2d, and 2e summarize the currency compositions for international payments, FX market turnovers,[5] and international debt securities. These figures again show that the US dollar has been the most heavily used currency, and that the four major AE currencies dominate the markets. Although not explicitly shown in Figure 2e, it is only in the case of international debt securities that the share of the euro is high and is close to the dollar share, and the share of the four major AE currencies has been rising. The figures also demonstrate that the share of the other AE currencies, both old and new, has been limited, and has been relatively stable for international payments and FX market turnovers, while declining in the case of international debt securities issued. The share of the EMDE currencies has also been limited, and has been stable in the case of international payments while rising in the case of FX market turnovers and international debt securities.

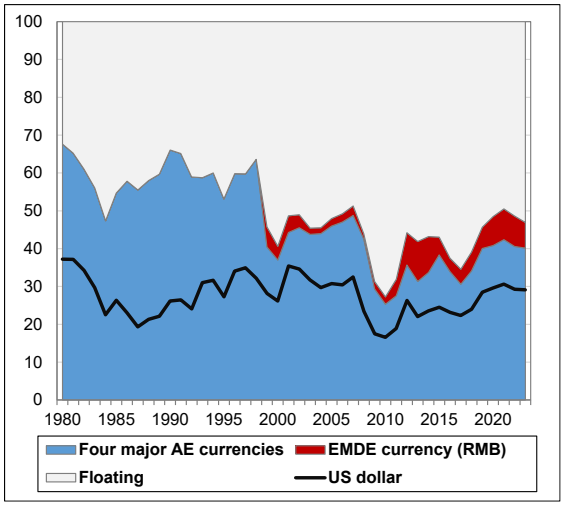
Figure 3 depicts the estimated shares of the major currency zones, that is, the zones for the US dollar, the four major AE currencies (including the US dollar), and one EMDE currency (i.e., the RMB), as well as the floating zone formed by the peripheral economies. These shares are measured as ratios of the peripheral economies' total GDP, not the world's total GDP. Figures 3a and 3b report the cases with no ERS adjustment and with ERS adjustment, respectively.

Figure 3: Shares of Major Currency Zones Formed by Peripheral Economies (%)

a. Major currency zones without ERS adjustment, 1980–2023



b. Major currency zones with ERS adjustment, 1980–2023



AE = advanced economy; EMDE = emerging market and developing economy; RMB = renminbi (Chinese yuan).

Note: The four major AE currencies are the US dollar, the euro, the UK pound, and the Japanese yen. A reference to the euro before its introduction in 1999 is to the Deutsche mark (DEM), and the Euro Area before 1999 refers to Germany. The RMB zone is defined from 1999.

Source: Computed and compiled by the authors.

[5] Although the BIS data on FX market turnovers are reported in such a way that the sum of the percentage shares of the individual currencies totals 200%, because two currencies are involved in a single FX market transaction, all the shares are divided by two so that the revised sum becomes 100% as in the case of the other figures.

Both figures indicate that the share of the USD-zone formed by the peripheral economies has not changed much between 1980 and 2023, while the share of the four major AE currency zones has declined over time. The latter reflects the fact that the share of peripheral EUR-zone economies has declined since 2000, despite a jump increase in 1999, and that the shares of the peripheral GBP- and JPY-zone economies have shrunk. In contrast, the share of peripheral economies forming the only EMDE currency zone, that is, the RMB zone, has expanded since the global financial crisis and has become comparable to the size of the peripheral EUR-zone economies. In 2023, the share of the peripheral RMB-zone economies (12% and close to 7%, without and with ERS adjustment, respectively) was almost the same as that of the peripheral EUR-zone (13% and above 7%, without and with ERS adjustment, respectively). The share of the floating zone has grown over time and is much larger with ERS adjustment than without.

Correlations Between the Shares of Currencies Used for Different International Purposes

This subsection demonstrates that the correlations between the various currency shares are high. Table 2 shows the correlation coefficient matrix for the share of each major currency and the Swiss franc. Some shares are positively correlated with each other for a certain currency, while other shares are negatively correlated with each other, without exhibiting specific patterns of correlations. In addition, for all currencies examined in the table, cross-border bank liabilities are always positively correlated with FX market turnovers and international debt securities; FX reserves are always positively correlated with FX market turnovers; and FX market turnovers are always positively correlated with international debt securities. The average correlation coefficient is relatively high for the RMB, at 0.52 (involving ERS-unadjusted currency zones, CZ1) and 0.66 (involving ERS-adjusted currency zones, CZ2), followed by the correlation coefficients for the Swiss franc at 0.50 and the US dollar at 0.27 (involving both CZ1 and CZ2). For the UK pound, the average correlation coefficient is negative.

If the data on the different currencies are combined, however, the correlation coefficients turn out to be much higher. Table 3 summarizes the correlation coefficients for all currencies, the four major AE currencies, the other AE currencies (including both old and new), and the EMDE currencies. When all the currencies are combined, all the correlation coefficients are positive and high, with the average correlation coefficient being 0.84 (involving CZ1 or CZ2). The correlation coefficient matrix for the four major AE currencies exhibits the highest average correlation coefficient among the four currency groups shown in the table, at 0.88 (involving CZ1) and 0.87 (involving CZ2). The average correlation coefficient for the EMDE currencies is the lowest, at 0.50 (involving CZ1) and 0.57 (involving CZ2).

Table 2: Correlation Coefficient Matrix for Each Major Currency and the Swiss Franc

2a. US dollar, 1980–2024

	CBBL	FXR	IP	FXMT	IDS	CZ1	CZ2
CBBL	1.00						
FXR	–0.14	1.00					
IP	–0.11	–0.20	1.00				
FXMT	0.15	0.23	0.79	1.00			
IDS	0.72	–0.12	0.68	0.41	1.00		
CZ1	0.06	0.37	0.47	0.27	0.12	1.00	
CZ2	0.00	0.21	0.44	0.28	0.26	0.79	1.00

2b. Euro, 1980–2024

	CBBL	FXR	IP	FXMT	IDS	CZ1	CZ2
CBBL	1.00						
FXR	0.89	1.00					
IP	0.31	0.62	1.00				
FXMT	0.37	0.24	–0.46	1.00			
IDS	0.83	0.91	0.47	0.22	1.00		
CZ1	–0.67	–0.66	0.66	–0.19	–0.74	1.00	
CZ2	–0.71	–0.72	–0.11	–0.30	–0.82	0.95	1.00

2c. UK pound, 1980–2024

	CBBL	FXR	IP	FXMT	IDS	CZ1	CZ2
CBBL	1.00						
FXR	0.45	1.00					
IP	0.73	–0.74	1.00				
FXMT	0.56	0.30	–0.96	1.00			
IDS	0.82	0.64	0.93	0.12	1.00		
CZ1	–0.28	–0.13	–0.08	–0.34	–0.27	1.00	
CZ2	–0.51	–0.28	–0.34	–0.24	–0.60	0.73	1.00

2d. Japanese yen, 1980–2024

	CBBL	FXR	IP	FXMT	IDS	CZ1	CZ2
CBBL	1.00						
FXR	0.77	1.00					
IP	–0.14	0.66	1.00				
FXMT	0.77	0.49	–0.38	1.00			
IDS	0.87	0.71	–0.61	0.66	1.00		
CZ1	–0.15	–0.08	0.11	0.31	–0.11	1.00	
CZ2	–0.32	–0.28	0.07	–0.06	–0.18	0.73	1.00

2e. Swiss franc, 1980–2024

	CBBL	FXR	IP	FXMT	IDS
CBBL	1.00				
FXR	0.85	1.00			
IP	0.57	0.32	1.00		
FXMT	0.84	0.87	–0.37	1.00	
IDS	0.92	0.98	0.79	0.94	1.00

2f. Renminbi (Chinese yuan), 1980‑2024

	FXR	IP	FXMT	IDS	CZ1	CZ2
FXR	1.00					
IP	0.48	1.00				
FXMT	0.88	0.92	1.00			
IDS	0.23	0.89	0.95	1.00		
CZ1	0.18	–0.36	0.43	0.61	1.00	
CZ2	0.97	0.05	0.55	0.68	0.87	1.00

CBBL = cross-border bank liabilities; CZ1 = ERS-unadjusted currency zones; CZ2 = ERS-adjusted currency zones; FXMT = foreign exchange market turnovers; FXR = foreign exchange reserves; IDS = international debt securities; IP = international payments.

Note: The euro before its introduction in 1999 refers to the Deutsche mark (DEM).

Source: Compiled by the authors.

Table 3: Correlation Coefficient Matrix for All Currencies and AE and EMDE Currencies

3a. All currencies, 1980–2024

	CBBL	FXR	IP	FXMT	IDS	CZ1	CZ2
CBBL	1.00						
FXR	0.96	1.00					
IP	0.96	0.89	1.00				
FXMT	0.96	0.98	0.92	1.00			
IDS	0.93	0.87	0.99	0.91	1.00		
CZ1	0.85	0.86	0.66	0.82	0.67	1.00	
CZ2	0.80	0.81	0.78	0.82	0.66	0.96	1.00

3b. Four major AE currencies, 1980–2024

	CBBL	FXR	IP	FXMT	IDS	CZ1	CZ2
CBBL	1.00						
FXR	0.95	1.00					
IP	0.96	0.85	1.00				
FXMT	0.95	0.98	0.83	1.00			
IDS	0.93	0.85	0.98	0.79	1.00		
CZ1	0.85	0.87	0.87	0.88	0.71	1.00	
CZ2	0.80	0.81	0.84	0.83	0.64	0.98	1.00

3c. Other AE currencies, old and new, 1980–2024

	CBBL	FXR	IP	FXMT	IDS
CBBL	1.00				
FXR	0.85	1.00			
IP	0.56	0.65	1.00		
FXMT	0.84	0.15	0.76	1.00	
IDS	0.92	0.38	0.72	0.66	1.00

3d. EMDE currencies, 1980–2024

	FXR	IP	FXMT	IDS	CZ1	CZ2
FXR	1.00					
IP	0.51	1.00				
FXMT	0.88	0.79	1.00			
IDS	0.23	0.81	0.88	1.00		
CZ1	0.18	-0.36	0.43	0.61	1.00	
CZ2	0.97	0.05	0.55	0.68	0.87	1.00

AE = advanced economy; CBBL = cross-border bank liabilities; CZ1 = ERS-unadjusted currency zones; CZ2 = ERS-adjusted currency zones; EMDE = emerging market and developing economy; FXMT = foreign exchange market turnovers; FXR = foreign exchange reserves; IDS = international debt securities; IP = international payments.

Note: The four major AE currencies are the US dollar, the euro (Deutsche mark before the introduction of the euro in 1999), UK pound, and the Japanese yen.

Source: Compiled by the authors.

The high correlation across the various uses of currencies that is observed in Table 3a, which is used for the regression analysis in the next section, might lead researchers to argue that some currency shares affect other currency shares. It may well be the case, but the high correlation itself does not explain causation among the different currency shares. It is even possible that a set of common factors drive different currency shares in similar ways, thereby creating high correlations.

4. DETERMINANTS OF THE SHARES OF CURRENCIES USED FOR THE DIFFERENT INTERNATIONAL PURPOSES

This section examines the determinants of the various currency shares discussed in the previous sections. Its approach is to extend the rich literature on the determinants of currency compositions of aggregate FX reserves to other types of currency shares, namely the shares for cross-border bank liabilities, international payments, FX market turnovers, international debt securities, and major currency zones.

Literature on the Determinants of the currency Compositions of Aggregate FX Reserves

The currency compositions of aggregate FX reserves have been studied extensively |in the literature. Recent prominent studies in this area include those of Chinn and Frankel (2007, 2008), Ito and McCauley (2020), Arslanalp, Eichengreen, and Chima Simpson-Bell (2022), and Chinn, Frankel, and Ito (2024). Researchers have taken two approaches to analyzing the FX reserve currency share: they may focus on currency-issuer factors as possible determinants of the FX reserve currency shares, using global aggregate data, or they may focus on demand-side factors as possible determinants of FX reserve currency shares, using a panel of economy-specific observations. Chinn and Frankel (2007, 2008) used the aggregate approach while the other studies combined both approaches.

Chinn and Frankel (2007, 2008) attempted to identify the determinants of FX reserve currency shares for the period 1973–98, before the advent of the euro, and examined the euro's potential to challenge the US dollar as the dominant reserve currency. Choosing the logit of the currency shares as the dependent variable, they found that the statistically significant determinants of reserve currency shares included: the economic size of the currency-issuing country, measured by GDP; the financial market development and depth, captured by the size of FX market turnovers in the financial centers of the reserve currency country (New York, London, Frankfurt, Tokyo, Zurich, etc.); confidence in the currency's value, proxied by the inflation rate, the lagged trend rate of change in the currency's exchange rate, and exchange rate volatility; and the effect of inertia, represented by a lagged dependent variable. Using the estimated parameters on pre-1999 data, they predicted that the euro's share would rise in the post-1999 period and even surpass the dollar's share, on the assumption that the Euro Area's economic size exceeded that of the US. Chinn and Frankel (2008) suggested that, although their econometric analysis focused only on the FX reserve currency role, similar conclusions would apply to other types of international currency use. That is, country size, financial depth, and confidence in the currency's value would affect private agents' decisions regarding which currencies to hold for transactions and as a store of value.

Ito and McCauley (2020) compiled a new dataset on the currency compositions of the FX reserves held by 58 central banks over the period 1999–2017, and attempted to identify the determinants of the reserve currency shares. They found that the reserve currency shares for individual economies were strongly affected by the currency's role as a unit of account and as an anchor in the FX market. That is, the dollar's share in the reserves for each economy was determined by the dollar invoicing of exports and the currency's co-movement with the dollar. These two factors, taken together, accounted for the bulk of the variance in the dollar's share in FX reserves. Aizenman, Cheung, and Qian (2020) also used individual economies' FX reserve compositions, and found that economies that trade more with the four major AE countries or regions (i.e., the US, the Euro Area, the UK, and Japan) and that peg their exchange rates to the four major AE currencies tend to hold a larger share of these currencies as FX reserves. Arslanalp, Eichengreen, and Simpson-Bell (2022) observed that the falling trend in the share of dollar reserves over time has been accompanied by an increase in the shares of nontraditional reserve currencies, such as the Australian dollar, the Canadian dollar, and the RMB, rather than in the shares of the traditional major AE reserve currencies, namely the euro, the UK pound, and the Japanese yen. In their regression analysis of the currency shares of aggregate FX reserves for 1970–2020, they found that the economic size of the currency-issuing country, the rate of change in the currency's exchange rate, the CPI inflation differential, the exchange rate volatility, the FX market turnover, and a change in the debt to GDP ratio all enter with their expected signs, although the FX market turnover is not always statistically significant.

Using the same model specification as that of Chinn and Frankel (2007, 2008), Chinn, Frankel, and Ito (2024) argued that the reserve currency shares over the period 1999–2022 do not behave in a way that is consistent with their earlier studies. That is, they found unanticipated signs for the economic size, the inflation rate, the exchange rate volatility, and the FX market turnover, while the coefficient on inertia, that is, the lagged dependent variable, was much larger and not easily distinguishable from unity. Utilizing Ito and McCauley's data on the currency compositions of the FX reserves held by individual economies, they identified the determinants of FX reserve holdings by focusing on the characteristics of reserve-holding economies—such as bilateral trade with the reserve-issuing country, bilateral currency pegs, and bilateral geopolitical factors—in addition to the characteristics of reserve-issuing countries or regions. Pooling data across the reserve currencies for individual economies, they found key determinants that enter with significance: economic size as measured by GDP, bilateral currency pegs, bilateral trade shares, and some geopolitical factors, but not the inflation rate, the rate of change in the exchange rate, or the FX market turnover.

There is a growing literature on the interactions and synergies in the international use of a currency in its different roles—as a medium of exchange, a unit of account, and a store of value. For example, in discussing the dominance of the US dollar as an international currency, Gopinath and Stein (2018, 2021) emphasized the mutually reinforcing synergies between the use of the dollar as a trade denomination, as stocks of international bank liabilities, and as FX reserve holdings. Ito and McCauley (2020) found a nexus in the currency composition between external debts and FX reserves. Although the presence of interactions, synergies, and nexuses among the various currency shares cannot be denied, these results need to be interpreted with caution, because all the currency shares could be endogenous and determined by a set of common exogenous factors.

The Estimation Model

As this paper attempts to identify the determinants of the shares of currencies used for the different international purposes at global aggregate levels, it focuses on the currency-issuer factors affecting the global aggregate shares. Adopting a model similar to that of Chinn and Frankel (2007, 2008), Arslanalp, Eichengreen, and Simpson-Bell (2022), and Chinn, Frankel, and Ito (2024), this paper specifies the same regression equation to estimate the shares of currencies used for the different international purposes over the period 1980–2021, as follows:

$$z_{jt} = \beta_0 + \beta_1 y_{jt} + \beta_2 pcy_{jt} + \beta_3 e_{jt} + \beta_4 \sigma_{jt} + \beta_5 gd_{jt} + \beta_6 fmd_{jt} + \beta_7 fmo_{jt} + \beta_8 y_{jt} \times fmd_{jt} + \beta_9 y_{jt} \times fmo_{jt} + v_t + u_{jt}.$$

Here, s_{at} is the logit function of a currency share, defined as $ln(x_{jt}/(1-x_{jt}))$, where x_{jt} is the share of currency j used for various international purposes in year t, y_{jt} is the natural log of the global share of GDP of the currency-j issuer in year t, pcy_{jt} is the natural log of the per capita GDP of the currency-j issuer in year t, e_{jt} is the annual rate of appreciation of the nominal effective exchange rate (NEER) of currency j in year t, σ_{jt} is the natural log of the NEER volatility of currency-j in year t, gd_{jt} is the annual change in general government (GG) debt as a ratio of GDP of the currency-j issuer in year t, fmd_{jt} is the natural log of the financial market development index of the currency-j issuer in year t, fmo_{jt} is the natural log of the financial market openness index of the currency-j issuer in year t, and v_t is a set of yearly dummies. Instead of using FX market turnover data, as has been done in previous studies, this paper adopts the currency issuer's indices of financial market development (FMD) and openness (FMO), because FX market turnover data cannot be readily obtained for many economies, while the latter indices are available for most of them. There are two interactive terms on the right-hand side of the equation, namely $y_{jt} \times fmd_{jt}$ and $y_{jt} \times fmo_{jt}$, to capture the joint effects of size and financial market development/openness. The regression is performed with or without the lagged dependent variable, z_{jt-1}, on the right-hand side of the equation to capture the effect of inertia.

The regression analysis is conducted for the period 1980–2021.[6] The number of currencies covered in the regression varies according to the type of currency share being investigated. In the case of cross-border bank liabilities, only five AE currencies—the four major AE currencies (the USD, EUR, GBP, and JPY) plus the CHF—are analyzed. In the case of FX reserves, 11 currencies, including the four major AE currencies, six other old AE currencies, and the RMB, are examined. In the case of international payments, 23 currencies, including the four major AE currencies, seven other old AE currencies, two new AE currencies, and 10 EMDE currencies, are studied. In the case of FX market turnovers, 46 currencies, including the four major AE currencies, 17 other old AE currencies, six new AE currencies, and 19 EMDE currencies, are considered. In the case of international debt securities, 57 currencies, including the four major AE currencies, the 10 legacy currencies of the euro (until 1998), 15 other old AE currencies, seven new AE currencies, and 21 EMDE currencies, are taken up. Finally, in the case of currency zones, five major currencies, including the four major AE currencies and the RMB, are analyzed. The definitions and sources of the data used for the regression analyses are listed in Appendix I.

[6] The end year is 2021 as the financial market development (FMD) index is available only up to 2021.

Estimation Results

The first hypothesis to be tested in this paper is that the economic size, per capita income, exchange rate appreciation, financial market development, and financial market openness of a currency-issuing country contribute positively to the use of its currency for the different international purposes, while exchange rate volatility and a change in general government (GG) debt contribute negatively to the international use of the currency. The second hypothesis is that the lagged dependent variable has a strong positive effect on the currency share, representing the power of network externalities or inertia. An additional hypothesis is that the interactions between the economic size and financial market development and openness assist with explaining the international use of currencies.

The regression results for the shares of different currencies used for cross-border bank liabilities, FX reserves, international payments, FX market turnovers, and international debt securities are reported in Table 4, which excludes the lagged dependent variable on the right-hand side, and in Table 5, which includes the lagged dependent variable. Each of these tables also reports results with and without the interactive terms between economic size and financial market development and openness. The tables summarize not only the estimated coefficient on each explanatory variable but also the total effects of economic size (EcS), financial market development (FMD), and financial market openness (FMO) when the interactive terms are included. The total effects of EcS, FMD, and FMO are computed as $\hat{\beta}_1 + \hat{\beta}_8 \cdot \overline{fmd} + \hat{\beta}_9 \cdot \overline{fmo}$, $\hat{\beta}_6 + \hat{\beta}_8 \cdot \bar{y}$, and $\hat{\beta}_7 + \hat{\beta}_9 \cdot \bar{y}$, respectively, where $\hat{\beta}_k$ (k = 1, 6, 7, 8, and 9) are the estimated coefficients and $\overline{fmd}$, $\overline{fmo}$, and $\bar{y}$ are the sample averages of FMD, FMO, and EcS, respectively.

The results in Table 4 indicate that the hypotheses above cannot be rejected in most cases, although there are a few exceptions. First, economic size always has a statistically significant positive sign, no matter whether the interactive terms are included or not. Second, per capita GDP has a significantly positive sign, with the sole exception being for international payments, for which the estimated coefficient is insignificantly negative. Third, exchange rate volatility sometimes exhibits results contrary to prior expectations: it has the expected negative sign for cross-border bank liabilities, FX reserves, and international settlements, but it has significantly positive signs in the cases of FX market turnovers and international debt securities. Fourth, exchange rate appreciation has a significantly positive sign in the case of cross-border bank liabilities, international debt securities, and possibly international payments, while it has a statistically insignificant sign in the case of FX reserves and FX market turnovers (with the interactive terms included). Fifth, a change in GG debt has the anticipated significantly negative sign only in the case of cross-border bank liabilities, and not in the case of FX reserves; this is in contrast to the results of Arslanalp, Eichengreen, and Simpson-Bell (2022). Sixth, financial market development and openness (FMD and FMO) always have statistically significant positive signs, except in the case of FX reserves, for which the impact of FMD is significantly positive but that of FMO is statistically insignificant. Seventh and finally, in all cases, the presence of the interactive terms provides higher explanatory power, measured by the adjusted R^2, than their absence.

Table 4: Estimation of Currency Shares, $ln\left(\frac{x}{1-x}\right)$, Without the Lagged Dependent Variable, for 1980–2021

	Cross-border Bank Liabilities		FX Reserves		International Payments		FX Market Turnovers		International Debt Securities	
	(4-1)	(4-2)	(4-3)	(4-4)	(4-5)	(4-6)	(4-7)	(4-8)	(4-9)	(4-10)
Economic size (EcS)	1.435***	1.341***	1.756***	2.161***	0.880***	1.131***	0.990***	0.990***	1.179***	1.474***
	(0.050)	(0.073)	(0.047)	(0.082)	(0.038)	(0.063)	(0.042)	(0.066)	(0.035)	(0.053)
Per capita GDP	1.199***	0.901***	0.788***	1.087***	–0.131	–0.072	0.333***	0.278***	0.556***	0.453***
	(0.252)	(0.248)	(0.189)	(0.185)	(0.103)	(0.079)	(0.086)	(0.082)	(0.069)	(0.068)
NEER appreciation	0.510**	0.610***	0.033	0.060	0.357	0.520***	–0.422*	–0.352	0.490**	0.490**
	(0.237)	(0.213)	(0.256)	(0.230)	(0.245)	(0.188)	(0.228)	(0.215)	(0.207)	(0.200)
NEER volatility	–0.673***	–0.607***	–0.560***	–0.376***	–0.377***	–0.521***	0.349***	0.324***	0.282***	0.345***
	(0.142)	(0.128)	(0.127)	(0.117)	(0.094)	(0.072)	(0.093)	(0.087)	(0.084)	(0.081)
Change in GG debt	–2.829*	–2.425	0.459	–1.005	–1.083	–0.011	0.098	0.699	0.095	–0.190
	(1.628)	(1.464)	(1.603)	(1.456)	(1.303)	(1.003)	(0.799)	(0.757)	(0.712)	(0.688)
FMD	2.655***	3.092***	2.047***	6.821***	0.941***	1.661	1.709***	0.369	1.202***	2.862***
	(0.586)	(1.037)	(0.271)	(1.140)	(0.299)	(1.025)	(0.231)	(0.643)	(0.184)	(0.506)
FMO	1.306***	–3.031***	0.245	–0.045	1.227***	4.141***	0.633***	3.305***	1.542***	3.293***
	(0.274)	(1.028)	(0.219)	(0.738)	(0.219)	(0.429)	(0.160)	(0.442)	(0.130)	(0.374)
EcS x FMD		0.158		1.595***		0.237		–0.300**		0.257***
		(0.391)		(0.399)		(0.215)		(0.118)		(0.093)
EcS x FMO		–2.041***		0.042		0.735***		0.562***		0.363***
		(0.414)		(0.258)		(0.084)		(0.086)		(0.071)
References:										
Total effect of EcS	1.435***	1.546***	1.756***	1.579***	0.880***	0.837***	0.990***	0.892***	1.179***	1.082***
Total effect of FMD	2.655***	2.671***	2.047***	2.231***	0.941***	0.510***	1.709***	1.714***	1.202***	2.671***
Total effect of FMO	1.306***	2.401***	0.245	–0.166	1.227***	1.065***	0.633***	0.785***	1.542***	1.152***
Adjusted R^2	0.83	0.86	0.84	0.87	0.80	0.88	0.85	0.86	0.77	0.79
No. of observations	187	187	270	270	220	220	332	332	1,222	1,222
No. of currencies	5	5	11	11	23	23	46	46	57	57
Years covered	1980–2021		1980–2021		2011–2021		1989–2019		1980–2021	

EcS = Economic size (share of world GDP); FMD = financial market development; FMO = financial market openness; FX = foreign exchange; GG = general government; NEER = nominal effective exchange rate.

Notes: (1) * p<0.1; ** p<0.05; *** p<0.01. (2) Numbers in parentheses are the estimated standard errors.

(2) All right-hand side variables are in natural log, except the NEER appreciation (rate) and change in GG debt (as a ratio of GDP).

(3) Yearly dummies are included but not reported to conserve space.

(4) Total effects of EcS, FMD, and FMO are obtained by using the average values of the relevant variables.

Table 5: Estimation of Currency Shares, $ln\left(\frac{x}{1-x}\right)$, with the Lagged Dependent Variable, for 1980–2021

	Cross-border Bank Liabilities		FX Reserves		International Payments		FX Market Turnovers		International Debt Securities	
	(5-1)	(5-2)	(5-3)	(5-4)	(5-5)	(5-6)	(5-7)	(5-8)	(5-9)	(5-10)
Economic size (EcS)	0.081***	0.085**	0.087***	0.089**	0.071***	0.100***	0.165***	0.124**	0.094***	0.094***
	(0.029)	(0.034)	(0.027)	(0.040)	(0.018)	(0.032)	(0.036)	(0.049)	(0.016)	(0.024)
Per capita GDP	–0.023	–0.023	–0.052	–0.053	–0.004	–0.002	0.082	0.078	0.040*	0.037
	(0.063)	(0.067)	(0.044)	(0.050)	(0.025)	(0.025)	(0.050)	(0.050)	(0.024)	(0.024)
NEER appreciation	0.067	0.071	0.097*	0.098*	0.205***	0.195***	–0.039	–0.045	0.116*	0.125*
	(0.055)	(0.056)	(0.056)	(0.056)	(0.058)	(0.058)	(0.127)	(0.127)	(0.069)	(0.070)
NEER volatility	0.047	0.045	–0.029	–0.027	–0.069***	–0.069***	0.089*	0.083	0.053*	0.055*
	(0.036)	(0.036)	(0.029)	(0.029)	(0.023)	(0.025)	(0.053)	(0.053)	(0.028)	(0.028)
Change in GG debt	–1.021***	–1.021***	0.013	–0.004	–0.152	–0.215	–0.039	1.070	–0.587**	–0.579**
	(0.375)	(0.379)	(0.353)	(0.358)	(0.327)	(0.327)	(0.127)	(0.657)	(0.237)	(0.238)
FMD	0.380***	0.404	0.110*	0.068	0.074	0.760**	0.312**	–0.181	0.131**	–0.000
	(0.142)	(0.275)	(0.066)	(0.300)	(0.074)	(0.325)	(0.140)	(0.364)	(0.063)	(0.182)
FMO	–0.049	–0.137	–0.009	0.061	–0.037	–0.273	–0.110	0.005	0.016	0.195
	(0.068)	(0.273)	(0.048)	(0.181)	(0.059)	(0.170)	(0.096)	(0.285)	(0.047)	(0.135)
EcS x FMD		0.005		–0.018		0.149**		–0.095		–0.029
		(0.101)		(0.101)		(0.068)		(0.067)		(0.034)
EcS x FMO		–0.044		0.027		–0.045		0.015		0.036
		(0.116)		(0.063)		(0.033)		(0.054)		(0.025)
Lagged dependent variable	0.946***	0.942***	0.956***	0.955***	0.942***	0.946***	0.815***	0.813***	0.919***	0.917***
	(0.019)	(0.022)	(0.014)	(0.016)	(0.017)	(0.023)	(0.028)	(0.031)	(0.010)	(0.010)
Reference:										
Total effect of EcS	0.081***	0.089***	0.087***	0.089***	0.071***	–0.181***	0.165***	0.173***	0.094***	0.093***
Total effect of FMD	0.380***	0.391***	0.110*	0.120*	0.074	0.513	0.312*	0.260*	0.131**	0.138**
Total effect of FMO	–0.049	–0.020	–0.009	–0.017	–0.037	1.073	–0.110	–0.065	0.016	0.024
Adjusted R^2	0.99	0.99	0.99	0.99	0.99	0.99	0.96	0.96	0.97	0.97
No. of observations	187	187	266	266	195	195	292	292	1,185	1,185
No. of currencies	5	5	11	11	22	22	45	45	57	57
Years covered	1980–2021		1980–2021		2011–2021		1989–2019		1980–2021	

EcS = Economic size (share of world GDP); FMD = financial market development; FMO = financial market openness; FX = foreign exchange; GG = general government; NEER = nominal effective exchange rate.

Notes: (1) * p<0.1; ** p<0.05; *** p<0.01. (2) Numbers in parentheses are the estimated standard errors.

(2) All right-hand side variables are in natural log, except the NEER appreciation (rate) and change in GG debt (as a ratio of GDP).

(3) Yearly dummies are included but not reported to conserve space.

(4) Total effects of EcS, FMD, and FMO are obtained by using the average values of the relevant variables.

Table 6: Estimation of the Major Currency Zone Share, $ln\left(\frac{x}{1-x}\right)$, With and Without the Lagged Dependent Variable for 1980–2021

	ERS-unadjusted				ERS-adjusted			
	(6-1)	**(6-2)**	**(6-3)**	**(6-4)**	**(6-5)**	**(6-6)**	**(6-7)**	**(6-8)**
Economic size (EcS)	1.431***	2.648***	0.303***	0.698***	1.293***	2.610***	0.203***	0.537***
	(0.141)	(0.233)	(0.108)	(0.210)	(0.144)	(0.235)	(0.098)	(0.200)
Per capita GDP	–0.155	0.290	0.103	0.240	0.305	0.779**	0.193	0.321
	(0.326)	(0.313)	(0.198)	(0.216)	(0.335)	(0.474)	(0.188)	(0.207)
NEER appreciation	-0.017	–0.021	–0.036	–0.042	0.261	0.257	0.036	0.044
	(0.434)	(0.383)	(0.257)	(0.255)	(0.446)	(0.387)	(0.243)	(0.242)
NEER volatility	–1.542***	–1.360***	–0.513***	–0.533***	–1.564***	–1.367***	–0.397**	–0.425***
	(0.250)	(0.223)	(0.160)	(0.159)	(0.266)	(0.224)	(0.152)	(0.152)
Change in GG debt	–2.165	–1.096	0.778	0.674	–3.406	–2.209	1.134	0.993
	(3.232)	(2.877)	(1.925)	(1.927)	(3.319)	(2.900)	(1.827)	(1.835)
FMD	0.081	12.495***	–0.358	3.148*	–0.734	12.644***	–0.635	2.254
	(1.098)	(2.432)	(0.647)	(1.738)	(1.127)	(2.451)	(0.611)	(1.663)
FMO	–0.303	–3.072**	–0.088	–1.370	–0.390	–3.249**	–0.078	–1.054
	(0.363)	(1.492)	(0.217)	(1.021)	(0.373)	(1.498)	(0.206)	(1.462)
EcS x FMD		4.777***		1.409**		5.131***		1.158*
		(0.951)		(0.676)		(0.958)		(1.049)
EcS x FMO		–0.808		–0.421		–0.821		–0.312
		(0.543)		(0.367)		(0.547)		(0.349)
Lagged dependent variable			0.790***	0.737***			0.840***	0.791***
			(0.048)	(0.054)			(0.045)	(0.052)
Reference:								
Total effect of EcS	1.431***	1.131***	0.303***	0.318***	1.293***	0.963***	0.203***	0.212***
Total effect of FMD	0.081	1.778*	–0.358	–0.010	–0.734	1.133	–0.635	–0.355
Total effect of FMO	–0.303	–1.259***	–0.088	–0.427	–0.390	–1.407***	–0.078	–0.341
Adjusted R^2	0.45	0.57	0.81	0.82	0.42	0.57	0.83	0.84
No. of observations	191	191	189	189	191	191	189	189
No. of currencies	5	5	5	5	5	5	5	5
Years covered	1980–2021	1980–2021	1980–2021	1980–2021	1980–2021	1980–2021	1980–2021	1980–2021

EcS = Economic size (share of world GDP); FMD = financial market development; FMO = financial market openness; FX = foreign exchange; GG = general government; NEER = nominal effective exchange rate.

Notes: (1) * p<0.1; ** p<0.05; *** p<0.01. (2) Numbers in parentheses are the estimated standard errors.

(2) All right-hand side variables are in natural log, except the NEER appreciation (rate) and change in GG debt (as a ratio of GDP).

(3) Yearly dummies are included but not reported to conserve space.

(4) Total effects of EcS, FMD, and FMO are obtained by using the average values of the relevant variables.

Table 5 reports the estimation results with the lagged dependent variable included in each regression equation to capture the effects of inertia. Many variables turn out to lose statistical significance, as observed by Ito and McCauley (2020) and Chinn, Frankel, and Ito (2024), who estimated the currency shares of FX reserves. It should be noted that the explanatory power is virtually the same whether or not the interactive terms are included. Also, in all cases, the lagged dependent variable has large coefficients, sometimes exceeding 0.95 but always significantly less than 1, which suggests the presence of strong inertia.

The table demonstrates that economic size tends to have a significantly positive sign in most cases, but not for international payments, for which the estimated coefficients are significantly negative when the interactive terms are included. Per capita GDP has a significantly positive sign only for international debt securities and without the interactive terms. Exchange rate appreciation now has a significantly positive sign for FX reserves, international payments, and international debt securities, but not for cross-border bank liabilities and FX market turnovers, for which the estimated coefficients are statistically insignificant. Exchange rate volatility now has a significantly negative sign only in the case of international settlements, while it has a significantly positive sign in the case of international debt securities. The change in GG debt has a significantly negative sign in the case of cross-border bank liabilities and international debt securities, but its impact on FX reserves is statistically insignificant. FMD tends to have a significantly positive sign in the case of cross-border bank liabilities, FX reserves, international debt securities, and possibly FX market turnovers, while the estimated coefficient is statistically insignificant in the case of international payments. In contrast, FMO no longer has a significantly positive sign in any of the estimated equations.

Table 6 reports the estimation results for the major currency zone share for both the ERS-unadjusted and the ERS-adjusted cases, as well as with and without the lagged dependent variable on the right-hand side. The table provides some new insights not observed in Tables 4 or 5. First, the coefficient for the lagged dependent variable, when included on the right-hand side, is now smaller than in the case of Table 5, suggesting a more limited degree of inertia for the major currency zone share than for other currency shares. Indeed, the logit of the major currency zone share has the shortest half-life of 2–4 years, while those of the shares of other currencies have longer half-lives, such as 15 years for FX reserves, 12 years for cross-border bank liabilities and international payments, 10 years for FX market turnovers, and 8 years for international debt securities.[7]

Second, the estimation results are similar whether or not an ERS adjustment is made. Economic size continues to have a significantly positive sign. Per capita GDP has a negative sign, although not always statistically significant. Exchange rate appreciation and the change in GG debt have statistically insignificant coefficients, while exchange rate volatility has a significantly negative sign in most cases. FMD and FMO do not have significantly positive signs in most cases, particularly when the lagged dependent variable is included.

[7] A half-life period is calculated as $ln(1/2)/ln\theta$, where θ is the estimated coefficient for the lagged dependent variable, which is positive and less than unity. For example, FX market turnovers exhibit a half-life of 3.3–3.4 periods, which means a half-life of 10 years as the data are observed every 3 years.

The overall estimation results show that economic size, FMD, and inertia tend to play a major role in determining the shares of currencies used for the different international purposes. The results are different depending on whether or not the inertia effect is considered in the regression equation. When the inertia effect is neglected, both FMD and FMO tend to have significantly positive signs, except for the currency zone shares. When the inertia effect is considered, FMD tends to have a significantly positive sign while FMO does not. These results suggest that the role of FMO in determining currency shares cannot be completely denied.

5. SCENARIO ANALYSIS FOR THE RMB

Experts and policymakers around the world have been exploring the potential for currency alternatives to the US dollar to emerge. Chinn and Frankel (2007, 2008) examined the future potential of the euro as an FX reserve currency by using the estimated regression equation of FX reserve shares. Lai (2021) investigated the potential of the RMB to function as a major international payments currency by using an estimated gravity model. This section explores the further potential of the RMB as a major international currency to rival the US dollar. The estimation results in the previous section allow a simulation analysis of the issue.

Simulation Procedures

The simulation analysis here focuses on two important determinants of international currency shares, economic size (EcS), and FMD and FMO combined. More specifically, following an approach similar to that adopted by Lai (2021), the analysis considers the following three scenarios:

- the PRC's GDP becomes as large as that of the US;
- the PRC raises the degrees of its FMD and FMO to the levels of the Republic of Korea (ROK); and
- the PRC's GDP becomes the same as that of the US and, at the same time, the PRC's FMD and FMO levels become the same as those of the ROK.

In the first scenario, simulations are carried out for all currency shares by using the estimated regression equations, on the assumption that the PRC's GDP is equal to the GDP of the US in 2021 (2019 in the case of FX market turnovers).[8] In the simulations, two associated changes are considered, that is, that the PRC's per capita GDP also rises and that the global GDP shares of all other economies decline because of an increase in global GDP reflecting the rise in the PRC's GDP. In the second scenario, the PRC's FMD and FMO rise to the levels of the ROK,[9] while all other economies' FMDs and FMOs are unchanged. The third scenario is a combination of the first and second scenarios.

[8] This means that the PRC's GDP rises from $17.820 trillion to $23.681 trillion in 2021 for the simulation of all currency shares except for FX market turnovers (and from $14.280 trillion to $21.540 trillion in 2019 for the simulation of FX market turnovers).

[9] This means that the PRC's FMD and FMO rise from 0.633 to 0.818 and from 0.387 to 0.582, respectively, in 2021 (and from 0.631 to 0.830 and from 0.376 to 0.501, respectively, in 2019).

Such a scenario analysis can reveal which of economic size and financial market development/openness is more influential in a rise in the international use of the RMB. In addition, a comparison between the simulation results using regression equations that exclude and those that include the lagged dependent variable can reveal the importance of the inertia effect, which Lai (2021) did not examine.

Table 7 reports the results of the simulation exercises for the shares of the RMB, the USD, and other selected AE currencies. Tables 7a and 7b, respectively, summarize the results when the regression equations that exclude and include the lagged dependent variable are used for the simulations. The estimated regression equations used for the simulations are (4-4), (4-6), (4-8), (4-10), (6-2), and (6-6), reported in Table 4 and Table 6, when the lagged dependent variable is excluded, and (5-4), (5-6), (5-8), (5-10), (6-4), and (6-8), reported in Table 5 and Table 6, when the lagged dependent variable is included.

The Table has four columns for each international use of a currency. Column (1) represents the actual or observed currency shares for the year 2021 (except FX market turnovers which are for the year 2019). Column (2) reports the simulated currency shares when the PRC's GDP is assumed to be the same as the US GDP. Column (3) provides the simulated currency shares when the PRC's FMD and FMO are assumed to be the same as those of the ROK. Column (4) shows the simulated currency shares when the PRC's GDP is assumed to be the same as that of the US and its FMD and FMO are assumed to be the same as those of the ROK. The simulations are all for the year 2021 or 2019 (for FX market turnovers).[10]

[10] In reporting the simulation results, some adjustments are made. First, fitted values for the year 2021 (or 2019 for FX market turnovers) are obtained by using the same estimated regression equations without changing any of the right-hand side variables. Second, the simulated values are proportionally adjusted so that the fitted values for 2021 (or 2019 for FX market turnovers) become the same as the actual values. Third, if the sum of all the currency shares exceeds 1, all the currency shares are proportionally adjusted downwards so that the adjusted sum does not exceed 1.

Table 7: Scenario Analyses for the RMB

7a. Simulation results using regression equations that do not include the lagged dependent variable (inertia effect)

	FX Reserves				International Payments				FX Market Turnovers				International Debt Securities				Currency Zones, ERS-unadjusted				Currency Zones, ERS-adjusted			
	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both
RMB	2.8	12.6	6.8	20.9	2.7	2.3	10.5	9.5	2.2	3.4	5.1	8.0	0.4	0.9	2.3	4.7	25.9	33.5	33.6	39.7	8.1	21.3	10.0	23.8
USD	58.8	55.1	57.6	50.3	40.5	38.6	37.5	37.9	44.1	41.8	43.3	41.8	47.2	44.5	45.8	44.5	45.2	42.1	45.2	41.3	30.6	28.1	30.6	28.1
EUR	20.6	18.5	20.2	16.8	36.7	34.8	33.9	34.1	16.2	15.0	15.8	15.0	38.4	35.6	37.3	35.6	14.1	13.4	14.1	13.1	8.1	7.7	8.1	7.7
GBP	4.8	4.1	4.7	3.8	5.9	5.5	5.5	5.4	6.4	5.9	6.3	5.9	7.9	7.2	7.7	7.2	4.4	4.0	4.4	3.9	2.7	2.4	2.7	2.4
JPY	5.5	4.7	5.4	4.3	2.6	2.4	2.4	2.4	8.4	7.8	8.2	7.8	1.4	1.3	1.4	1.3	1.6	1.4	1.6	1.3	1.0	0.9	1.0	0.9
CAD	2.4	2.0	2.3	1.9	1.6	1.5	1.5	1.5	2.5	2.3	2.5	2.3	0.5	0.5	0.5	0.5	–	–	–	–	–	–	–	–
AUD	1.8	1.4	1.8	1.3	1.3	1.1	1.2	1.1	3.4	3.1	3.3	3.1	1.0	0.8	0.9	0.8	–	–	–	–	–	–	–	–
CHF	0.2	0.1	0.2	0.1	0.7	0.7	0.7	0.7	2.5	2.3	2.4	2.3	0.7	0.6	0.7	0.6	–	–	–	–	–	–	–	–

7b. Simulation results using regression equations that include the lagged dependent variable (inertia effect)

	FX Reserves				International Payments				FX Market Turnovers				International Debt Securities				Currency Zones, ERS-unadjusted				Currency Zones, ERS-adjusted			
	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both	(1) Act.	(2) GDP	(3) FMD/O	(4) Both
RMB	2.8	2.5	2.9	2.6	2.7	2.7	2.8	2.8	2.2	2.5	2.1	2.4	0.4	0.5	0.5	0.5	25.9	33.2	24.6	31.5	8.1	12.9	7.2	11.4
USD	58.8	58.7	58.8	58.7	40.5	40.4	40.5	40.4	44.1	43.8	44.1	43.8	47.2	47.0	47.2	47.0	45.2	44.3	45.2	44.3	30.6	30.0	30.6	30.0
EUR	20.6	20.5	20.6	20.5	36.7	36.6	36.7	36.6	16.2	16.0	16.2	16.0	38.4	38.3	38.4	38.3	14.1	13.9	14.1	13.9	8.1	8.0	8.1	8.0
GBP	4.8	4.8	4.8	4.8	5.9	5.9	5.9	5.9	6.4	6.3	6.4	6.3	7.9	7.9	7.9	7.9	4.4	4.3	4.4	4.3	2.7	2.6	2.7	2.6
JPY	5.5	5.5	5.5	5.5	2.6	2.6	2.6	2.6	8.4	8.3	8.4	8.3	1.4	1.4	1.4	1.4	1.6	1.5	1.6	1.5	1.0	1.0	1.0	1.0
CAD	2.4	2.4	2.4	2.4	1.6	1.6	1.6	1.6	2.5	2.5	2.5	2.5	0.5	0.5	0.5	0.5	–	–	–	–	–	–	–	–
AUD	1.8	1.8	1.8	1.8	1.3	1.3	1.3	1.3	3.4	3.4	3.4	3.4	1.0	1.0	1.0	1.0	–	–	–	–	–	–	–	–
CHF	0.2	0.2	0.2	0.2	0.7	0.7	0.7	0.7	2.5	2.4	2.5	2.4	0.7	0.7	0.7	0.7	–	–	–	–	–	–	–	–

AUD = Australian dollar; CAD = Canadian dollar; CHF = Swiss franc; ERS = exchange rate stability; EUR = euro; FMD = financial market development; FMO = financial market openness; FX = foreign exchange; GBP = UK pound; GDP = gross domestic product; JPY = Japanese yen; RMB = renminbi (Chinese yuan); USD = US dollar.

Note: The analysis considers three scenarios. The individual columns refer to the following: Act. = actual (for the year 2021 except FX market turnovers which are for the year 2019); GDP = the PRC's GDP rises to the level of US GDP; FMD/O = the PRC's FMD and FMO rise to the levels of those of the Republic of Korea (ROK); Both = the PRC's GDP rises to that of the US and its FMD and FMO rise to those of the ROK. The table reports the simulated shares of only 8 currencies and does not report those of other currencies whose data are available.

Source: Computed and compiled by the authors.

Interpretation of the Simulation Results

The simulation results reported in Table 7a (which neglects the inertia effect) reveal that a rise in the PRC's economic size and an improvement in its FMD and FMO would cause a notable increase the RMB share. The positive impact of economic size on the RMB share is stronger than the positive impact of FMD/FMO for FX reserves and currency zones with ERS-adjustment, while the opposite is true for international payments, FX market turnovers, and international debt securities. The combined impact of the two changes is large, particularly for FX reserves and currency zones (with or without ERS adjustment).

These results are not necessarily observed in Table 7b, which considers the inertia effect. The impact of economic size on the RMB share is stronger than the impact of FMD/FMO for FX market turnovers and currency zones (with or without ERS adjustment), while the impact of FMD/FMO is stronger than the impact of economic size for FX reserves and international payments. The combined impact of these two is similar for international debt securities. However, the magnitude of the increase in the RMB share is much less than that reported in Table 7a. In other words, the positive impacts of economic size and FMD/FMO on the RMB share are much more limited in the presence of inertia than in its absence.

This means that, even if the PRC's economic size grew fast and its FMD and FMO improved significantly, it would take a long time for the RMB to become a highly used international currency. In other words, the status of the US dollar as the dominant international currency is not likely to decline quickly, even if there are some positive developments that would boost the role of the RMB and threaten the dominance of the dollar, because of the inertia effect. However, it would be easier for the RMB to increase its role as an anchor currency for other economies and to expand its currency zone because the inertia effect is weaker for the currency zone share than for other currency shares.

6. CONCLUDING REMARKS

This paper has confirmed that the US dollar has long been dominant in the global monetary system, has identified the determinants of the use of currencies for different international purposes, and has explored the potential for the RMB to challenge the dominance of the dollar. The estimation results demonstrate that it is not only the currency issuer's characteristics, such as its economic size and its financial market development and openness, but also the inertia effect, that are the critical determinants of the extent of currency use for different international purposes. These results suggest that it would be difficult for competing currencies, like the euro and the RMB, to rival the dollar within a short time horizon because of the presence of strong inertia. However, potential challengers such as the PRC may find it easier to promote their currencies as an anchor and expand their currency zones, because the inertia effect for the anchor currency function is weaker than that for the other functions of an international currency.

A set of positive attributes of the US has supported the global dominance of the dollar. The US is clearly the largest economy in the world, and it offers an open, deep, broad, and liquid financial market protected by the rule of law to allow global investors to hold dollar assets and liabilities with confidence. It maintains relatively stable macroeconomic performance under an independent central bank, the Federal Reserve (Fed). The Fed has also addressed global liquidity shortage problems during times of

stress and crises, such as the global financial crisis and the COVID-driven crisis, through currency swap lines and other measures. Currently, there is no country or region that can rival the US and offer an alternative international currency comparable to the dollar. This suggests that short-term threats to dollar dominance are limited as a result of the strong inertia effect.

However, this does not mean that dollar dominance will be sustained indefinitely. The dominance could be substantially eroded under two sets of conditions that would be significant enough to overcome the inertia effect. One is that adverse developments and events taking place in the US reduce the country's overall status as the world's leading economic, political, and military power and the perceived safety and stability of the dollar. The other is that favorable developments and progress occurring in competing countries boost their economies and the attractiveness of their currencies. Currently, even when confidence in the dollar is shaken, global investors and businesses continue to stick to dollars because of the absence of a realistic alternative. In the longer run, however, the two sets of conditions above could undermine the dollar's international role and enhance the use of alternative currencies.

Various adverse developments and events could endanger the global supremacy of the US and the dollar. First, the share of the US in world GDP is expected to continue declining over time. This will eventually make it difficult for the rest of the world to keep relying on the dollar, whose value is strongly affected by the Fed's monetary policy, which attempts to maintain macroeconomic and financial stability for the US, not for the world as a whole. Second, excessive use of the "exorbitant privilege" by the US, such as the easy ability to finance current account deficits at low borrowing costs,[11] could lead to larger deficits and continue to worsen the US's net international investment position (NIIP). A worsening NIIP would make dollar assets less stable and safe, and impair the very foundation that supports dollars as attractive assets. Third, policies that damage the credibility of US governance and institutions could jeopardize the dollar's role as the globally dominant currency. The Trump administration has launched an attack on the US's most vital assets, such as the confidence that other economies, including allies, have in the US as a responsible country, the supply of global public goods (for climate change mitigation, global health, poverty reduction, etc.), the appreciation of scientific research and universities, an open immigration policy, the independence of the central bank, and the rule of law. Such an attack, if maintained for years, could have cumulative, negative implications for the US and the dollar.

Favorable developments and progress made in Europe and the PRC, the two largest potential challengers to the US, could enhance their economic growth and the credibility of their currencies as alternatives to the dollar. Even though the Euro Area is a large economy with developed and open financial markets and robust and stable institutions, the region has not experienced the type of dynamic growth enjoyed by the US and is not yet fully integrated, making the euro sovereign debt market much smaller than the US treasury market. If the Euro Area economies were to go through deeper

[11] See Eichengreen (2012). The exorbitant privileges the US enjoys include: (i) the ability to borrow at low cost: the US can borrow at lower interest rates than other economies because of a high global demand for dollars as liquid and safe assets; (ii) the ability to conduct international business in its home currency: US multinational banks and corporations have an advantage in cross-border business because they can use their home currency without facing exchange risks; (iii) the ability to run persistent current account deficits: the US can run larger current account deficits than other economies without facing a balance of payments constraint because of the ease of financing the deficits in dollars; (iv) the ability to maintain greater monetary policy autonomy: the Fed has greater flexibility in setting monetary policy without being affected by other economies' monetary policies and facing the trilemma constraint; and (v) the ability to raise seigniorage revenue: the US can obtain goods and services from other economies by supplying dollars to the rest of the world.

economic reform and become fully integrated through the establishment of a fiscal, and even a political, union and the introduction of a digital euro, the euro could become much more attractive as an international currency and rival the dollar. The PRC's authoritarian system, weak governance and institutions, and capital account restrictions prevent global investors from holding large amounts of RMB assets. If the country were to embark on fundamental economic, institutional, and even political reforms, and fully open the capital account, the PRC could boost its economic growth and the international use of the RMB. Also, the PRC's efforts to develop new payments systems to facilitate cross-border transactions in RMB without the involvement of US banks and dollars, through the expanded Cross-border Interbank Payment System (CIPS), and the start of the actual operations of mBridge for the digital RMB, could encourage the RMB to become a serious challenger to the US dollar.

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APPENDIX I: DEFINITIONS AND SOURCES OF VARIABLES USED IN THE REGRESSION ANALYSIS

Dependent Variables		
Variable	**Definition**	**Source**
Currency share in cross-border bank liabilities	Logit of a currency's share in cross-border bank liabilities	Bank for International Settlements (BIS), *Locational Banking Statistics*
Currency share in foreign exchange reserves	Logit of a currency's share in foreign exchange reserves	International Monetary Fund (IMF), *Annual Reports*, various issues, and *Currency Composition of Official Foreign Exchange Reserves (COFER)*
Currency share in international payments	Logit of a currency's share in international payments	Society for Worldwide Interbank Financial Telecommunication (SWIFT), *RMB Tracker*, various issues
Currency share in foreign exchange market turnovers	Logit of a currency's share in foreign exchange market turnovers	BIS, *Triennial Central Bank Survey: Foreign Exchange Turnover*, various issues
Currency share in international debt securities issued	Logit of a currency's share in international debt securities issued	BIS, *Debt Securities Statistics*
Share of a major currency zone, without ERS adjustment	Logit of the share of a major currency zone in peripheral economies, without adjustment for exchange rate stability (ERS)	Authors, based on the procedure explained in Appendix II
Share of a major currency zone, with ERS adjustment	Logit of the share of a major currency zone in peripheral economies, with ERS adjustment	Authors, based on the procedure explained in Appendix II
Explanatory Variables		
Variable	**Definition**	**Source**
Economic size (EcS)	Log of the nominal GDP in US dollars of a currency-issuing country/region as a share of global GDP	World Bank, *World Development Indicators*
Per capita GDP	Log of nominal GDP per capita in US dollars of a currency-issuing country/region	World Bank, *World Development Indicators*
Nominal effective exchange rate (NEER) appreciation	60-month moving average of the log first difference of the NEER of a currency-issuing country/region	BIS, *Effective Exchange Rate Indices* (nominal, narrow and broad), and IMF, *International Financial Statistics*
NEER volatility	Standard deviation of the log first difference of the NEER of a currency-issuing country/region over moving 60-month windows	BIS, *Effective Exchange Rate Indices* (nominal, narrow and broad), and IMF, *International Financial Statistics*
Change in general government (GG) debt	Annual change in GG debt as a ratio of GDP of a currency-issuing country/region	IMF, *World Economic Outlook database*
Financial market development (FMD)	Log of the financial market development index of a currency-issuing country/region	IMF, *Financial Development Index database*
Financial market openness (FMO)	Log of the financial market openness index of a currency-issuing country/region	Authors, based on the procedure explained in Appendix III

APPENDIX II: COMPUTATION OF THE ECONOMIC SIZE OF THE MAJOR CURRENCY ZONES

This appendix explains the procedure for computing the economic size of the currency zones formed by the major currencies (i.e., USD, EUR [or Deutsche mark (DEM) before 1999], GBP, JPY, and RMB). For this purpose, a basket of anchor currencies for each economy over time is first identified, and then the economic size of the major currency zones is computed, using estimated weights for the anchor currencies. Among the literature on this issue, the studies by Kawai and Akiyama (1998), Tovar and Nor (2018), Ilzetzki, Reinhart, and Rogoff (2019), Ito and McCauley (2019), Ito and Kawai (2024), and IMF (2025) are most relevant to this paper.

To identify the anchor currencies, the paper uses the Frankel and Wei (1994) method for the period when the RMB does not play a major currency role, and adopts the three-step model of Kawai and Pontines (2016) for the period when the RMB is a potential anchor currency.

AII-1 Identifying Anchor Currencies through the Frankel–Wei and Kawai–Pontines Methods

The Frankel–Wei method attempts to find the influence of the exchange rate movements of the major currencies on the exchange rate movements of economy *j*'s currency using the following estimation model:

$$\Delta ln\left(\frac{j}{NZD}\right)_t = \beta_0 + \beta_1 \Delta ln\left(\frac{USD}{NZD}\right)_t + \beta_2 \Delta ln\left(\frac{EUR}{NZD}\right)_t + \beta_3 \Delta ln\left(\frac{GBP}{NZD}\right)_t + \beta_4 \Delta ln\left(\frac{JPY}{NZD}\right)_t + u_t \qquad (1)$$

where $\Delta ln\left(\frac{j}{NZD}\right)_t$ and $\Delta ln\left(\frac{k}{NZD}\right)_t$ are the rates of change in the exchange rates of the currency of economy *j* and major currency *k* (= USD, EUR, GBP, or JPY) against the New Zealand dollar, the numéraire currency.[1] The currencies included in the right-hand side of the estimation equation can be thought of as comprising an implicit basket of major currencies for economy *j*. Therefore, $\hat{\beta}_k$, the estimated coefficient on the rate of change in the exchange rate of major currency *k*, is interpreted as the weight of currency *k* in the implicit basket. If the currency of economy *j* is pegged to a major currency or a basket of major currencies, we must have either $\hat{\beta}_k = 1$ for a certain *k* or $\sum_{k=1}^{K'} \hat{\beta}_k = 1$ for the *K' (≤ K)* currencies included in the implicit basket.[2] The estimation model is applied to each of the sample currencies by using overlapping, rolling windows of 36 months.[3]

[1] In other studies, different numéraires such as the Swiss franc (CHF) and the Special Drawing Right (SDR) are chosen. Accordingly, this paper has also tried CHF and SDR as numéraire, but the basic estimation outcomes are intact with minor quantitative differences.

[2] Considering that the estimated betas represent weights in the implicit basket, the constraint of $\sum_{k=1}^{K} \hat{\beta}_k = 1$ is imposed in the estimation.

[3] The estimation also includes a dummy variable that takes the value of one if the monthly rate of change in the exchange rate of the economy's currency is greater than 10% in absolute terms, so as to minimize noise from exchange rate disruptions such as the abandonment of an exchange rate regime or the sudden re/devaluation of the currency. Similarly, the regression includes a dummy variable that takes the value of one in the first month after the introduction of the euro.

The basic assumption here is that monetary authorities employ an implicit basket of currencies for the purpose of exchange rate stabilization or management, or the market drives the economy's exchange rate in a way that is linked to a basket of major currencies. Exchange rate responses to a change in the value of the implicit basket vary across economies and sample periods. Before the introduction of the euro in 1999, the DEM is chosen in place of the EUR. For the economies of the former French and Belgian colonies, the French franc (FRF) and the Belgian franc (BEF) were, respectively, the actual anchor currencies for exchange rate stabilization, but the DEM is used in the regression analysis instead of the francs.

In this paper, an important modification is made to the Frankel–Wei model because the RMB is treated as a potential major anchor currency after 1999.[4] There is no question that the RMB has become a major anchor currency, in the sense that it, together with other major currencies, influences the movements of the exchange rates of a number of economies.[5] However, merely including the exchange rate movements of the RMB in equation (1) would be problematic. The RMB used to be pegged to the US dollar, and it is still tied to dollar movements to some extent, which means that the RMB's exchange rate movements are highly correlated with those of the dollar. This creates a serious multicollinearity problem and would make the estimated β's inaccurate. To overcome this problem, the analysis here adopts the method of Kawai and Pontines (2016).

The Kawai–Pontines method involves three steps. The first step is to regress the rate of change in the RMB exchange rate on those of other major currencies, using 36-month windows, as follows:

$$\Delta ln\left(\frac{RMB}{NZD}\right)_t = \phi_0 + \phi_1\,\Delta ln\left(\frac{USD}{NZD}\right)_t + \phi_2\,\Delta ln\left(\frac{EUR}{NZD}\right)_t + \phi_3 \Delta ln\left(\frac{GBP}{NZD}\right)_t + \phi_4\,\Delta ln\left(\frac{JPY}{NZD}\right)_t + \omega_t \quad (2)$$

The estimation of equation (2) provides the estimated residual, $\widehat{\omega}_t$, as:

$$\widehat{\omega}_t = \Delta ln\left(\frac{RMB}{NZD}\right)_t - [\,\hat{\phi}_0 + \hat{\phi}_1 \Delta ln\left(\frac{USD}{NZD}\right)_t + \hat{\phi}_2 \Delta ln\left(\frac{EUR}{NZD}\right)_t + \hat{\phi}_3 \Delta ln\left(\frac{GBP}{NZD}\right)_t + \hat{\phi}_4 \Delta ln\left(\frac{JPY}{NZD}\right)_t\,] \quad (3)$$

Thus, the estimated residual, $\widehat{\omega}_t$, eliminates the part of the RMB movement that is affected by the movements of major currencies, particularly the USD. As the second step, using $\widehat{\omega}_t$, the Kawai–Pontines estimation equation that is the counterpart of equation (1) becomes:

$$\Delta ln\left(\frac{j}{NZD}\right)_t = \gamma_0 + \gamma_1 \Delta ln\left(\frac{USD}{NZD}\right)_t + \gamma_2 \Delta ln\left(\frac{EUR}{NZD}\right)_t + \gamma_3 \Delta ln\left(\frac{GBP}{NZD}\right)_t + \gamma_4 \Delta ln\left(\frac{JPY}{NZD}\right)_t + \gamma_5 \widehat{\omega}_t + v_t \quad (4)$$

One may consider estimating equation (4) and obtaining the weight on the RMB, $\hat{\gamma}_5$, but Kawai and Pontines (2016) showed that doing this does not necessarily yield good results. The proposed estimating equation is the following third step, after subtracting $\widehat{\omega}_t$ from both sides of equation (4), under the assumption that $\gamma_1 + \gamma_2 + \gamma_3 + \gamma_4 + \gamma_5 = 1$:

[4] The choice of 1999 is arbitrary, and if the RMB did not play a major anchor currency role, the estimation results would be expected to confirm this. Although the RMB was effectively pegged to the USD from 1999 to mid-2005, some economies may have stabilized their currencies against the RMB, not the USD. Indeed, when the PRC left its USD peg in July 2005, Malaysia followed the PRC, and a few other economies adjusted their exchange rates following the RMB exchange rate movement.

[5] See Kawai and Pontines (2016), Tovar and Nor (2018), Ito and McCauley (2019), and Ito and Kawai (2024).

$$\Delta ln\left(\frac{j}{NZD}\right)_t - \widehat{\omega}_t = \gamma_0 + \gamma_1\left[\Delta ln\left(\frac{USD}{NZD}\right)_t - \widehat{\omega}_t\right] + \gamma_2\left[\Delta ln\left(\frac{EUR}{NZD}\right)_t - \widehat{\omega}_t\right] + \gamma_3\left[\Delta ln\left(\frac{GBP}{NZD}\right)_t - \widehat{\omega}_t\right] + \gamma_4\left[\Delta ln\left(\frac{JPY}{NZD}\right)_t - \widehat{\omega}_t\right] + v_t \quad (5)$$

From equation (5), the estimate of the RMB weight is obtained as: $\hat{\gamma}_5 = 1 - \hat{\gamma}_1 - \hat{\gamma}_2 - \hat{\gamma}_3 - \hat{\gamma}_4$. Kawai and Pontines demonstrated that this three-step estimation procedure yields results that are robust, stable, and accurate. This three-step method is applied to the rolling regressions from January 1999 to December 2023.

As examples, Table AII-1 summarizes the regression results for India and South Africa for selected years during the period 1980–2023. It reports not only the estimated coefficients on the anchor currencies but also the values of the root mean squared error (RMSE) of the regressions and the exchange rate stability (ERS) index, which is explained below. The table shows that a single currency or a basket of currencies is identified as an anchor for exchange rate stabilization or management purposes. The USD is the most popular anchor currency, followed by the EUR (or DEM in 1980–1998) and then the GBP, while the role of the JPY has been limited. The RMB has emerged as exchange rate anchor since 1999.

Table AII-1: Frankel–Wei and Kawai–Pontines Estimation Results for India and South Africa

Country	Year	USD	EUR	GBP	JPY	RMB	RMSE	ERS
India	1980	0.369***	0.047	0.580***	0.004	–	0.0118	0.6129
	1990	0.824***	0.062	0.325***	–0.211***	–	0.0077	0.7473
	2000	0.779***	–0.076	0.151*	0.073*	0.073	0.0087	0.7147
	2010	0.508***	0.312**	0.188	–0.001	–0.008	0.0213	0.3037
	2020	0.708***	0.053	–0.120	–0.050	0.409***	0.0158	0.4847
	2023	0.792***	0.088	0.079	–0.026	0.067	0.0093	0.6979
South Africa	1980	0.948***	–0.017	0.056	0.013	–	0.0073	0.7620
	1990	0.285**	0.524**	0.064	0.127	–	0.0217	0.2910
	2000	0.501*	0.240	–0.328	0.125	0.462***	0.0278	0.0898
	2010	0.678**	0.929**	0.097	–0.699***	–0.005	0.0306	0.0000
	2020	–0.256	0.015	0.010	0.037	1.194***	0.0306	0.0000
	2023	–0.055	0.712*	–0.051	–0.091	0.411	0.0293	0.0523

ERS = exchange rate stability; EUR = Euro; GBP = UK pound; JPY = Japanese yen; RMB = renminbi (Chinese yuan); RMSE = root mean squared error; USD = US dollar.

Note: The Frankel–Wei and Kawai–Pontines methods are applied to the periods 1980–1998 and 1999–2023, respectively. EUR refers to DEM (Deutsche mark) in 1980–1998. A single asterisk (*), two asterisks (**), and three asterisks (***) indicate that the coefficients are statistically significant at the 10%, 5%, or 1% levels, respectively.

Source: Compiled by the authors from their estimations.

AII-2 Defining the ERS Index from the RMSE

In this paper, the root mean squared error (RMSE) obtained from the Frankel–Wei or Kawai–Pontines regression model is chosen to define a measure of exchange rate stability for each economy (Bleaney and Tian 2020),[6] because it gauges how tightly or

[6] In a similar context, Kawai and Akiyama (1998) chose the standard error of a regression and Ito and Kawai (2021) used the adjusted R^2.

loosely an economy's exchange rate follows those of a basket of major currencies. An index for exchange rate stability (ERS) is defined by calculating the annual average of the RMSE for each economy.[7]

In addition, indices for the ERS for major currencies other than the US dollar are constructed. For the euro, UK pound, and the Japanese yen, the RMSE is obtained by regressing each exchange rate only on the USD rate, utilizing the Frankel–Wei method. Therefore, the ERS index for Euro Area member countries is a common value. For the RMB, the RMSE is obtained from equation (2), which regresses the RMB rate on the USD, EUR, GBP, and JPY rates. For the US dollar, the degree of ERS is not defined.

A low level for RMSE means that the estimation model exhibits a good fit, which suggests that the economy of concern tends to have high degrees of exchange rate *stability.* In contrast, a high level for RMSE means that the estimation model does not provide a good fit, which suggests that the economy tends to have high degrees of exchange rate *flexibility.* To define the ERS index for economy *j,* the RMSE is converted as follows:

$$ERS_j = \frac{\left(RMSE(p(90)) - RMSE_j\right)}{\text{Max}\left(RMSE(p(90)) - RMSE_j\right)} \quad (6)$$

Here, *RMSE(p(90))* is the 90th percentile of RMSE. In this way, the ERS index ranges between 0 and 1, where 0 means no exchange rate *stability* (or the highest level of exchange rate *flexibility*), and 1 means rigid exchange rate *stability* (or the lowest level of exchange rate *flexibility*).

AII-3 Computing the Economic Size of the Major Currency Zones

In computing the economic size of the major currency zones, this paper takes the following approach. First, each major currency zone consists of its core, that is, the US, the Euro Area (or Germany before 1999), the UK, Japan, or the PRC (after 1999), and the peripheral economies that stabilize or manage their exchange rates against a major currency or a basket of major currencies. The PRC is treated as a peripheral economy until 1998 and as a possible core country from 1999 onward. Second, unlike Tovar and Nor (2018) and Ilzetzki, Reinhart, and Rogoff (2019), who defined each peripheral economy as belonging to the zone forged by a single major currency, this paper divides each peripheral economy into different currency zones according to the estimated basket weights for the major currencies. The estimated anchor currency coefficients which are significantly positive, at least at the 10% level, are interpreted as meaningful weights for the major currencies.[8] Third, in dividing each peripheral economy into several currency zones, the paper considers two types of currency weights, one that does not take into account the degree of ERS and the other that considers the ERS index. The latter approach is a real innovation adopted in this paper, going beyond the literature. Fourth, the total economic size, measured by GDP, of a major currency zone

[7] Because of the unique distribution of RMSE, which is skewed to the left with a fat tail on the right-hand side, the RMSE values are winsorized at and above the 90th percentile.

[8] If the estimated coefficients are statistically insignificant, they are replaced by the value 0. If the estimated coefficients are statistically significant and negative, they are treated as missing values. If the sum of the significantly positive coefficients exceeds unity, they are proportionally re-scaled downward so that the sum of the new weights becomes unity. If the sum of the significantly positive coefficients falls short of unity, their values themselves are used as currency weights and the remaining part is considered as a residual, i.e., not belonging to any major currency zone.

formed by the peripheral economies is calculated as the aggregated sum of their portions belonging to this currency zone.

The third point above means that, when the ERS index is taken into account, the division of a peripheral economy into different currency zones applies the currency weights adjusted for ERS. For example, for an economy with a currency basket with a very high degree of ERS (i.e., the economy's exchange rate is tightly stabilized), the full or almost the full portion of the economy belongs to the zones forged by the major currencies. In contrast, for an economy with a currency basket with a very low degree of ERS (i.e., the exchange rate is largely flexible), no or almost no portion of the economy belongs to the major currency zones, meaning that the economy is judged as having its own unique floating rate zone. For an economy with a currency basket with an intermediate degree of ERS (the exchange rate is loosely managed), less than the full portion of the economy belongs to the major currency zones. Essentially, each of the weights used for allocating the peripheral economy into a major currency zone is the multiple of the estimated coefficient for the major currency and the ERS index.[9]

Table AII-2 summarizes the actual currency weights used for India and South Africa during the period 1980–2023. It shows the case when there is no adjustment of the currency weights for the ERS index (Table AII-2a), as well as the case when there is such an adjustment (Table AII-2b). In both cases, the currency weights are the significantly positive coefficients, assuming insignificant coefficients to be zero and ignoring significantly negative coefficients. In the case of no ERS adjustment, an additional downward re-scaling of the currency weights is made if the sum of the significantly positive weights exceeds unity, so that the re-scaled weights sum up to unity. In the case of ERS adjustment, the actual currency weights are obtained by first multiplying the significantly positive weights reported in Table AII-1 and the ERS index and then re-scaling the multiplied coefficients downward if their sum exceeds unity so that the final currency weights sum up to unity. The table also reports the residual as the difference between unity and the sum of the final currency weights, defining the share of the floating zone for each economy.

It turns out that, without ERS adjustment (Table AII-2a), the final currency weights are the same as those reported in Table AII-1, except when downward re-scaling is carried out, while with ERS adjustment (Table AII-2b), the final currency weights are much smaller. In addition, the size of the residual becomes larger with the ERS adjustment than it is without. An interesting case is South Africa for 2010 and 2020. In the absence of ERS adjustment, the country's entire economy belonged to a combination of the USD zone (42%) and the GBP zone (58%) in 2010, and to the RMB zone (100%) in 2020. However, once ERS adjustment is carried out, South Africa did not belong to any currency zone and instead belonged entirely to the floating zone in 2010 and 2020. Essentially, the country assigned some weights to the major currency zones but in the context of highly flexible exchange rate arrangements in these years.

[9] More precisely, a peripheral economy that assigns significantly positive weights $\hat{\beta}_k$ (k = 1, 2, .., K) to a basket of major currencies with a certain level of ERS is divided into these major currency zones according to the adjusted weights given by $\hat{\beta}_k$ x ERS.

Table AII-2: Final Currency Weights Used for India and Africa, 1980–2023

a. Not adjusted for the exchange rate stability (ERS) index							
Country	**Year**	**USD**	**EUR**	**GBP**	**JPY**	**RMB**	**Residual**
India	1980	0.369	0.000	0.580	0.000	–	0.051
	1990	0.717	0.000	0.283	–	–	0.000
	2000	0.777	0.000	0.151	0.073	0.000	0.000
	2010	0.508	0.312	0.000	0.000	0.000	0.180
	2020	0.634	0.000	0.000	0.000	0.366	0.000
	2023	0.792	0.000	0.000	0.000	0.000	0.208
South Africa	1980	0.948	0.000	0.000	0.000	–	0.052
	1990	0.285	0.524	0.000	0.000	–	0.191
	2000	0.501	0.000	0.000	0.000	0.462	0.037
	2010	0.422	0.578	0.000	–	0.000	0.000
	2020	0.000	0.000	0.000	0.000	1.000	0.000
	2023	0.000	0.712	0.000	0.000	0.000	0.288
b. Adjusted for the exchange rate stability (ERS) index							
Country	**Year**	**USD**	**EUR**	**GBP**	**JPY**	**RMB**	**Residual**
India	1980	0.226	0.000	0.355	0.000	–	0.418
	1990	0.616	0.000	0.243	–	–	0.141
	2000	0.557	0.000	0.108	0.052	0.000	0.283
	2010	0.154	0.095	0.000	0.000	0.000	0.751
	2020	0.343	0.000	0.000	0.000	0.198	0.459
	2023	0.553	0.000	0.000	0.000	0.000	0.447
South Africa	1980	0.722	0.000	0.000	0.000	–	0.278
	1990	0.083	0.152	0.000	0.000	–	0.765
	2000	0.045	0.000	0.000	0.000	0.041	0.914
	2010	0.000	0.000	0.000	–	0.000	1.000
	2020	0.000	0.000	0.000	0.000	0.000	1.000
	2023	0.000	0.037	0.000	0.000	0.000	0.963

EUR = euro; GBP = UK pound; JPY = Japanese yen; RMB = renminbi (Chinese yuan); USD = US dollar.

Note: "–" means no data are available.

Source: Compiled by the authors from their estimations.

Table AII-3 reports the estimated size of the major currency zones for India and South Africa, measured by GDP, in both the absence and the presence of ERS adjustment. The estimated size of the currency zones is obtained by multiplying the GDP of each economy for the particular year and the final currency weights applied for that year. The residual part is the size of the economy's floating zone.

Table AII-3: Estimated Size of Currency Zones for India and South Africa, 1980–2023

a. Not adjusted for the exchange rate stability (ERS) index, USD Billion

Country	Year	GDP	USD Zone	EUR Zone	GBP Zone	JPY Zone	RMB Zone	Residual (Floating)
India	1980	186	69	0	108	0	–	10
	1990	321	230	0	91	–	–	0
	2000	468	364	0	71	34	0	0
	2010	1,676	851	523	0	0	0	302
	2020	2,675	1,695	0	0	0	979	0
	2023	3,568	2,826	0	0	0	0	742
South Africa	1980	89	85	0	0	0	–	5
	1990	126	36	66	0	0	–	24
	2000	152	76	0	0	0	70	6
	2010	417	176	241	0	–	0	0
	2020	338	0	0	0	0	338	0
	2023	381	0	271	0	0	0	110

b. Adjusted for the exchange rate stability (ERS) index, USD Billion

Country	Year	GDP	USD Zone	EUR Zone	GBP Zone	JPY Zone	RMB Zone	Residual (Floating)
India	1980	186	42	0	66	0	–	78
	1990	321	198	0	78	–	–	45
	2000	468	261	0	51	24	0	133
	2010	1,676	259	159	0	0	0	1,258
	2020	2,675	918	0	0	0	530	1,227
	2023	3,568	1,972	0	0	0	0	1,596
South Africa	1980	89	65	0	0	0	–	25
	1990	126	10	19	0	0	–	96
	2000	152	7	0	0	0	6	139
	2010	417	0	0	0	–	0	417
	2020	338	0	0	0	0	0	338
	2023	381	0	14	0	0	0	367

EUR = euro; GBP = UK pound; JPY = Japanese yen; RMB = renminbi (Chinese yuan); USD = US dollar.

Note: "–" means no data are available.

Source: Compiled by the authors from their estimations.

Table AII-4 reports the estimated size of the major currency zones for the entire world, as shares of world GDP, for selected years during the period 1980–2023. The world is comprised of between 150 and 181 sample economies, depending on the year. A particular major currency zone is defined as the sum of the core country or region and the zone formed by the peripheral economies, which is the aggregated value across all these economies.

One can observe several points. First, the global share of the USD zone has declined over time because the share of peripheral USD-zone economies in the world has declined while the share of the US has been steady. Second, the global shares of the EUR, GBP, and JPY zones have gradually declined over time, mainly because of declines in the shares of peripheral economies stabilizing their currencies against the euro, the UK pound, and the Japanese yen, as well as declines in the shares of the UK and Japanese GDPs in the world GDP. Third, in contrast, the share of the RMB zone has increased persistently over time because the shares of both the PRC and the peripheral RMB-zone economies have risen, reaching close to 21% and 19% of global GDP in 2023 without and with ERS being considered, respectively. The RMB zone is now the second largest after the USD zone. The residual part, that is, the floating zone among the peripheral economies, shows a rising trend over time, reaching 7% and 18% of global GDP in 2023 without and with ERS adjustment, respectively.

Table AII-4: Economic Size of Major Currency Zones, % Shares in World GDP, 1980–2023

a. Not adjusted for the exchange rate stability (ERS) index

	World GDP		USD Zone			EUR Zone			GBP Zone			JPY Zone			RMB Zone			
Year	USD Bill	%	Total	United States	Periph.	Total	Euro Area	Periph.	Total	United Kingdom	Periph.	Total	Japan	Periph.	Total	PRC	Periph.	Residual (Floating)
1980	11,450	100.0	51.5	26.1	25.3	25.8	8.7	17.1	8.5	5.2	3.3	12.0	10.3	1.7	–	–	–	2.2
1990	22,987	100.0	46.2	27.1	19.1	27.0	8.1	18.9	8.3	5.0	3.3	16.2	14.5	1.8	–	–	–	2.4
2000	33,856	100.0	45.4	30.5	14.9	22.5	18.7	3.8	5.4	5.0	0.5	15.3	14.8	0.5	6.7	3.6	3.1	4.7
2010	66,610	100.0	37.9	22.8	15.1	26.4	19.1	7.3	8.5	3.8	4.8	9.2	8.7	0.5	13.3	9.2	4.0	4.7
2020	85,763	100.0	38.6	25.2	13.4	20.9	15.6	5.3	4.2	3.2	1.1	6.4	6.0	0.4	25.3	17.3	8.0	4.6
2023	106,172	100.0	42.6	26.6	16.0	19.6	15.2	4.5	4.6	3.2	1.4	4.5	4.0	0.5	21.2	17.1	4.1	7.4

b. Adjusted for the exchange rate stability (ERS) index

	World GDP		USD Zone			EUR Zone			GBP Zone			JPY Zone			RMB Zone			
Year	USD Bill	%	Total	United States	Periph.	Total	Euro Area	Periph.	Total	United Kingdom	Periph.	Total	Japan	Periph.	Total	PRC	Periph.	Residual (Floating)
1980	11,450	100.0	44.6	26.1	18.5	20.5	8.7	11.7	7.3	5.2	2.2	11.5	10.3	1.2	–	–	–	16.1
1990	22,987	100.0	39.0	27.1	11.9	23.2	8.1	15.1	7.6	5.0	2.6	14.8	14.5	0.4	–	–	–	15.4
2000	33,856	100.0	37.7	30.5	7.2	21.1	18.7	2.4	5.3	5.0	0.3	15.0	14.8	0.3	4.6	3.6	1.0	16.3
2010	66,610	100.0	28.8	22.8	6.0	21.6	19.1	2.5	4.3	3.8	0.6	8.9	8.7	0.2	9.9	9.2	0.7	26.5
2020	85,763	100.0	34.9	25.2	9.7	18.2	15.6	2.6	3.9	3.2	0.7	6.3	6.0	0.3	19.8	17.3	2.5	16.9
2023	106,172	100.0	36.5	26.6	9.8	17.7	15.2	2.5	4.2	3.2	0.9	4.3	4.0	0.3	19.4	17.1	2.3	17.9

EUR = Euro; GBP = UK pound; JPY = Japanese yen; Periph. = peripheral (economies); PRC = People's Republic of China; RMB = renminbi (Chinese yuan); USD = US dollar.

Note: Each major currency zone includes the major currency country (or region) itself and the peripheral economies that assign statistically significant, positive coefficients, at the 10% level, to that major currency. EUR refers to DEM (Deutsche mark) in 1980–1998, and the Euro Area refers to Germany in 1980–1998, the eleven member countries of the Euro Area in 2000, the sixteen members in 2010, and the nineteen members in 2020–2023. The PRC is treated as a peripheral economy during 1980–1998. The residual is the part that cannot be explained by the identified currency zones and hence is considered to represent a floating rate zone.

Source: Compiled by the authors from their estimations.

APPENDIX III: CONSTRUCTION OF THE FINANCIAL MARKET OPENNESS (FMO) INDEX

The index of financial market openness (FMO) is constructed by using the *de facto* measure of financial openness developed by Lane and Milesi-Ferretti (2001, 2007, 2017), who compiled data for international investment positions for about 180 economies between 1970 and 2020. They normalized the sum of total external assets and total external liabilities as ratios of GDP and total trade value (exports plus imports), and regarded these ratios as measures of financial market openness.

In this paper, several modifications to the Lane and Milesi-Ferretti measures are made. First, normalizing external assets and liabilities by GDP and total trade has both merits and disadvantages, so this paper uses the average for both ratios.[1]

Second, including official FX reserves in total external assets for the purpose of defining a measure of financial market openness can be problematic, because monetary authorities' FX reserve holdings should not be treated in the same way as private holdings of foreign assets. One can think of the PRC and several other East Asian economies, which may appear as "financially open" if their massive FX reserves are included in their total external assets but in fact have tight controls on international capital movements and FX transactions.

Third, the measures of financial market openness defined by total external assets and liabilities less FX reserves as ratios of GDP and total trade tend to have an explosive path, which needs to be addressed. Indeed, Quinn Schindler, and Toyoda (2011) show that the measures are nonstationary. Therefore, it is necessary to transform the sum of total external assets and liabilities as ratios of GDP and total trade in a rational way.

Given these observations, the FMO index is constructed in the following steps. The first step is to calculate two measures of financial market openness by normalizing the sum of external assets and liabilities, less official FX reserve assets, as ratios of, respectively, GDP and total trade. The next step is to obtain the average of the two:

$$FMO\_1_{jt} = \frac{1}{2}\left\{\frac{\text{Total Assets}_{jt} + \text{Total Liabilities}_{jt} - \text{Official Reserve Assets}_{jt}}{GDP_{jt}} + \frac{\text{Total Assets}_{jt} + \text{Total Liabilities}_{jt} - \text{Official Reserve Assets}_{jt}}{(EX+IM)_{jt}}\right\} \quad (7)$$

[1] Normalizing the sum of total external assets and liabilities as a ratio of GDP would make the financial market openness measure susceptible to business cycles. Also, it would make the measure for large economies such as the US appear unnecessarily low and that for international financial centers—such as Ireland; Luxembourg; Singapore; and Hong Kong, China—extremely high, much higher than that of the US which has, presumably, one of the most open financial markets in the world. Normalizing the sum of total external assets and liabilities as a ratio of total trade, on the other hand, would make the financial market openness measure less susceptible to business cycles and more balanced for financial centers. It, however, tends to penalize economies that are highly open to international trade, such as Singapore.

The final step is to express the FMO measure obtained by (7) as an index that is stationary and bounded between 0 and 1. For this purpose, the paper assumes that advanced economies, as a group, achieved full financial market openness as of the late 1990s. Using this assumption, the financial openness measure for advanced economies in the period from 1995 to 1999 is calculated as FMO_1_{ADV} and regarded as the highest level of financial market openness.[2] Then the FMO index is defined as FMO_1_{jt} divided by FMO_1_{ADV}:[3]

$$FMO_{jt} = \frac{FMO\_1_{jt}}{FMO\_1_{ADV}} \text{ where } 0 \leqq FMO_{jt} \leqq 1 \quad (8)$$

Thus, the FMO index is a *de facto* indicator rather than a *de jure* indicator, and ranges between 0 (the lowest degree of financial market openness) and 1 (the highest degree).

[2] Luxembourg is excluded from the calculation since it is an extreme outlier because of its role as an international financial center. The *de jure* indicator of FMO developed by Chinn and Ito (2006, 2008) also shows that the level of financial market openness reached its highest level in the mid-1990s and has plateaued since then.

[3] Any FMO_{jt} taking a value above one is assumed to be one.