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Preliminary Considerations

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Digital Money, Cross-Border Payments, International Reserves, and the Global Financial Safety Net—Preliminary Considerations

Seunghwan Kim, Alexei Miksjuk, Narayan Suryakumar, Anita Tuladhar, Delia Velculescu, Yiqun Wu, Jimena Zuniga, and Nick Hallmark

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Contents

Executive Summary

The rapid advent of digital money and assets (DM) raises questions about its implications for the functioning of the international monetary system (IMS). The low transaction costs of digital technologies, their accessibility and ease of automation, and their integration into existing digital services may bring opportunities in the form of higher financial interconnectedness and inclusion but may also add to risks.

This paper explores the possible implications of DM for the IMS from the perspective of cross-border payments, international reserves and the supply of global safe assets, and the global financial safety net. To help inform the discussion, the paper presents empirical analyses of the effect of payment efficiency on international currency adoption for payment/transaction purposes as well as on reserve currency holdings, along with an illustrative modeling scenario of a DM-induced shock for the potential demand for global financial safety net (GFSN) resources.

The findings of this paper suggest that to the extent that DM leads to higher transaction efficiency, it could become more broadly adopted for cross-border payment purposes, alongside existing currencies. The benefits from lower transaction costs and greater financial interconnectedness could lead to greater diversification of risks, stronger trade relationships, and integration of international payment systems. In turn, these could spur the adoption of DM as international reserve assets. However, the empirical evidence linking the possible efficiency from DM with reserve holdings is inconclusive, suggesting that a significant change in efficiency and payment usage or another disruptive force, may need to materialize before current reserve configurations materially change. The adoption of DM could also increase risks, including bank disintermediation, currency substitution, spillovers and capital flow volatility, with implications for the GFSN. Indeed, this paper's modelling simulation results point to potential significant demands on GFSN resources.

To preserve the stability of the IMS with the adoption of DM, policymakers will need to carefully consider the appropriate design of public DM and adequate supervision and regulation of private DM. Coordination among the global standard-setting bodies, regulators, central banks, and multilateral and relevant private-sector institutions will be critical. Enhanced coordination between GFSN layers will also be key to maximizing their effectiveness in a more digitalized world. A shift to a multipolar reserve configuration may require global reserve currency issuers to expand liquidity backstops to improve access to GFSN resources and minimize risks. In a DM world, the role of the IMF would continue to remain critical, although it would need to continue to adapt its surveillance, lending, and capacity development to respond to new challenges.

I. Introduction

We are in the midst of a digital revolution. Although digital technology has been used in finance for some time, recent advancements in connectivity and network development—together with the emergence of distributed ledger technology (DLT)—have spurred the development and proliferation of new forms of digital money and assets (DM), both private and public, including Central Bank Digital Currencies (CBDCs), E-money, and crypto assets, such as global stablecoins (GSCs), as well as security and utility tokens (Box 1).[1] As of October 2023, market capitalization of crypto assets was about $1.3 trillion, with GSC market capitalization at about $125 billion. The Bank for International Settlements identified 86 central banks engaged in some form of CBDC work, while the Atlantic Council indicates that 130 countries are exploring CBDCs, among which the Bahamas, Jamaica, and Nigeria have officially launched CBDCs, the Euro System has finalized their CBDC investigation phase in October 2023, and China, Brazil, and India are actively piloting CBDC projects. Recent geopolitical developments related to Russia's war in Ukraine may further accelerate the proliferation of DM, with geo-economic fragmentation leading some countries to seek alternative forms of reserve assets and/or different payment channels (Aiyar and others 2023).

The rapid advent of DM raises questions about its implications for the functioning of the international monetary system (IMS).[2] The low transaction costs of DM, its accessibility and ease of automation, and its integration into existing digital services may bring opportunities in the form of higher trade and financial interconnectedness but may also add to risks, including spillovers and capital flow volatility.[3]

The literature on the cross-border implications of DM for the IMS is relatively limited. Brunnermeier, James, and Landau (2019) discussed how digital networks and reduced switching costs may lead to more currency competition, internationalization of new currencies for payments/reserves, and development of digital currency areas. IMF (2020a) explored several potential DM adoption scenarios, including a multipolar bloc configuration, and discussed their macro-financial implications, including for currency invoicing and international transactions. Most studies suggest that the role of the US dollar as the dominant reserve currency is unlikely to change quickly (Brunnermeier, James, and Landau 2019, 2022; Carstens 2021), although regional reserve currencies may develop and evolve faster (IMF, 2020a; BIS, IMF, and World Bank 2021). As for CBDCs, Carstens (2019) emphasized their underlying institutional arrangements, which are key to durably preserving their value and ensuring their role as unit of account and store of value, and BIS, IMF, and World Bank (2021, 2022) have examined their use for cross-border payments.

This paper seeks to explore the possible implications of DM for the IMS from the perspective of international currency adoption, the supply of global safe assets, and the global financial safety net. To help inform the discussion, the paper presents empirical analyses of the effect of payment efficiency linked to DM on international currency adoption for payment/transaction purposes as well as on reserve currency holdings,[4] along with an illustrative modeling scenario of a DM-induced shock for the potential demand for global financial safety net (GFSN) resources. Although the paper does not attempt to specify, ex ante, a precise scenario of DM adoption, the quantitative analyses focus on types of DM that are either public (CBDCs) or private and backed by traditional currencies (for example, GSCs). The paper concludes with some preliminary policy implications.[5]

[1] In this paper, unless stated otherwise, the initialism *DM* refers to all forms of digital money and digital financial assets.

[2] The IMS comprises rules and conventions, mechanisms, and institutions that facilitate international trade and cross-border investment.

[3] Cybersecurity, another aspect that adds to risks to the IMS, is beyond the scope of this paper.

[4] Given the lack of sufficiently long time series data on DM, this paper bases measures of payment efficiency on traditional banking relationships and payment corridors and thus may not capture other factors behind DM adoption.

[5] The paper does not address the role of IMF lending or the special drawing right (SDR) in expanding DM as a reserve asset.

Box 1. Forms of Digital Money: What is New

DM comes in many forms, which continue to evolve alongside financial innovations. From a technical point of view, DM can be classified according to different criteria: (1) issuer—whether private or public; (2) denomination—in an existing monetary unit, a basket of currencies, or a new unit of account; (3) convertibility or redemption—at a fixed face value or at the ongoing market value; (4) type of backing—including reserve assets of varying degree of stability and liquidity on which end users may have a direct legal claim, as well as additional public backstops such as access to emergency liquidity; (5) technology—a centralized or decentralized settlement over permissioned or permissionless networks, token based or account based; and (6) end users—wholesale or retail.

For an asset to satisfy the definition of money, it needs to be widely accepted as (i) reliable store of value, (ii) unit of account, and (iii) medium of exchange (IMF 2023). Some private forms of DM—such as deposits, held in a digital form with banks, and e-money with nonbank financial service providers—are akin to physical notes and coins; others resemble investment products. Many crypto assets are not backed by other assets and, by most standards, do not represent money, because they do not meet the above three criteria. Instead, they represent investment products held and traded for speculative purposes, and their value can fluctuate significantly. Some crypto assets, such as stablecoins, are typically backed by safe and liquid assets (for example, deposits, precious metals) or other investments (for example, commercial paper) and aim to maintain a stable value relative to another asset (for example, the US dollar) or a pool of assets. However, some stablecoins are not backed by safe assets but rather seek price stabilization through an algorithm and can be backed by crypto assets. Currently, stablecoins are used primarily to facilitate transactions (for example, trading, lending, borrowing) of other digital assets predominantly on or through digital-asset trading platforms. In this manner, they create a bridge between volatile crypto assets and stable financial assets.

Stablecoins (and, to some extent, other crypto assets), with their underlying transaction technology, have the potential for wider usage by households and firms as a means of payments. To the extent that these assets can preserve their value—thus acting as a store of value—they can exhibit some characteristics of money. However, it remains to be seen if wide acceptance as store of value, unit of account, and medium of exchange is really achievable for some of these assets. Recent episodes of crypto market turmoil highlighted significant risks associated with some crypto assets, with the collapse of TerraUSD, a popular algorithmic stablecoin, in May 2022 and the bankruptcy of the largest cryptocurrency exchanges, FTX, in November 2022 having notable implications for the crypto asset market.

Many central banks are considering issuing CBDCs (e.g., Allen and others 2020; Bank of England 2020; Bindseil 2020; BIS 2021a). There are multiple ongoing experiments with using wholesale CBDCs for cross-border payments. Although retail CBDCs are currently being considered or being used only for domestic purposes, they could also be considered in the future for cross-border use. Conceptually, CBDCs could be used for international payments as follows:

- The same CBDC is used for domestic and cross-border payment (that is, residents of one country have access to the CBDC of another country). In this case, the issuer of the CBDC would—by determining the scope and rules for domestic use—implicitly also determine its use across borders. For instance, issuers of a CBDC can impose domestic limits on accounts and transactions, implicitly constraining its cross-border use and the extent for currency substitution. Identification of customers (for example, account holders) could facilitate the task of detecting, monitoring, and controlling the use of CBDCs across borders, supporting capital flow management implementation.
- Domestic CBDCs are used for cross-border and cross-currency payment through interoperable multi-CBDC (mCBDC) arrangements[1/.] Such interoperability among CBDCs requires strong international collaboration, which could be achieved at various levels (for example, consistency of technical, legal, regulatory, and supervisory standards; shared technical interface or clearing mechanism; integration of several CBDCs into a single mCBDC payment system).

[1/] Each counterparty sends and receives payments in its domestic CBDCs, such as the mCBDC Bridge project between the Hong Kong Monetary Authority, the Bank of Thailand, the Digital Currency Institute of the People's Bank of China, the Central Bank of the United Arab Emirates, and the Bank for International Settlements (BIS) Innovation Hub; or the experiment between the Monetary Authority of Singapore and Banque de France, or Project Dunbar between the Reserve Bank of Australia, Bank Negara Malaysia, Monetary Authority of Singapore, and South African Reserve Bank alongside the Bank for International Settlements).

II. Digital Money and Cross-Border Payments

A key motivation often cited for DM adoption is lower transaction costs due to higher payment efficiency.[6] By leveraging new digital technology, reducing the number of intermediaries, and enhancing openness and competition, digital money has the potential to make payments cheaper, faster and more transparent, especially across borders. Thus, quantifying the impact of improvements in payment efficiency on international currency adoption for transaction purposes could provide insights into the potential international use of DM. The US dollar has been the dominant currency for international payment transactions for many decades. However, technological innovations in payment systems could alter the incentives for using new currencies by increasing accessibility at reduced costs, leading to an eventual shift in the configuration of international currency use.

[6] See BIS (2022), Board of Governors of the Federal Reserve System (2022), and US Department of Treasury Reports (2021, 2022).

Indeed, early experience with fast payment systems suggests that their efficiency in terms of cost and speed of transactions has bolstered their usage in several jurisdictions (Box 2).

Box 2. Efficiency Gains under Fast Payment Systems[1]

A fast payment system (FPS) is one in which the transmission of the payment message and the availability of the final funds to the payee occur in real time or near real time on a 24/7 basis. FPS uses traditional forms of money—that is, bank deposits—but often employs central bank infrastructure and leverages many of the technological innovations for DM payments.

The last decade has seen rapid developments in FPS. An increasing number of jurisdictions (more than 60 as of 2021; Committee on Payments and Market Infrastructure (CPMI) 2021) adopted such technology to facilitate domestic retail payments, including Europe (TIPS), Singapore (FAST), Thailand (PromptPay), and Malaysia (Paynet). Use of FPS for cross-border payments has been more limited, although there have been recent attempts to link domestic FPSs bilaterally between countries, such as between Singapore and Thailand in 2021, and through a central platform in project Nexus (BIS 2021b). For such cross-border payments, challenges remain on several technological, regulatory, and legal fronts.

Relative to more traditional means of payments—such as cash, checks, and credit and debit card systems—FPSs are often noted for their speed, convenience, and reduced cost for end users. FPSs tend to be very cost-efficient for domestic payments, with costs decreasing over time (BIS 2021b). For Thailand, Lamsam and others (2018) estimated the cost of an “e-payment” to be 0.46 baht per transaction vis-à-vis 1.26 baht for a cash transaction. For the UK, the FPS cost was estimated to be GBP 0.14 per transaction in 2008 and GBP 0.02 in 2014, which is much lower than estimated costs for cash, checks, and credit transfers (USD 1.21, 2.79, and 1.95, respectively; Deloitte 2019). In several jurisdictions the service has been made free of charge for end users. For cross-border payments between Singapore and Thailand, FPS is estimated to have brought down costs from 15 percent to 3 percent (IMF 2022b). DM and DLT technology may be able to lower these costs even further.

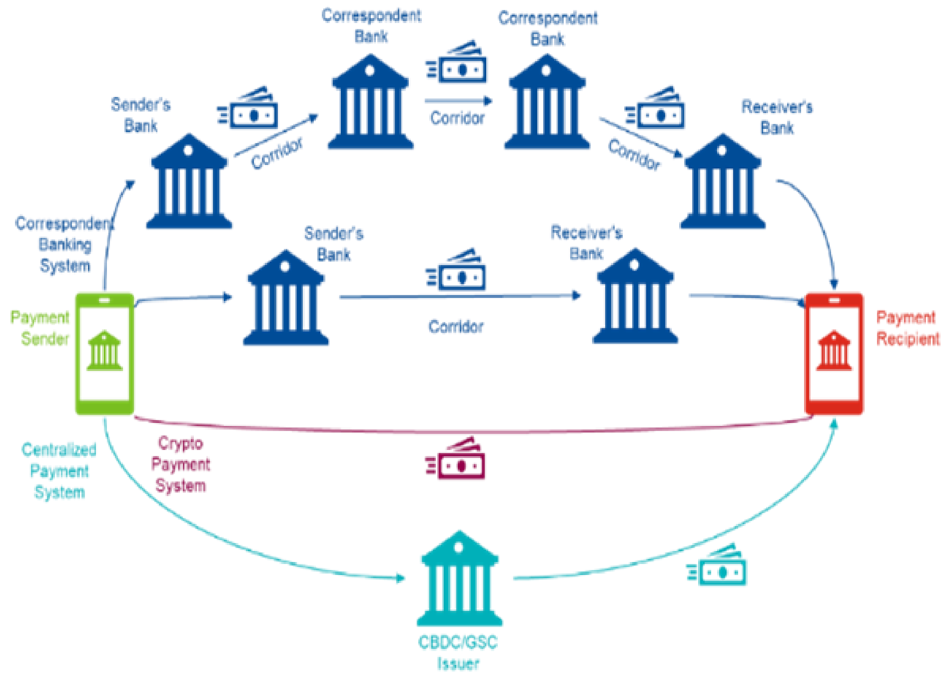
Reflecting, in part, these efficiency gains, usage of FPSs has grown rapidly in several jurisdictions—in terms of both transaction volume and value. For example, in Australia, the transaction volume grew to an annualized rate of about 40 payments per capita by the end of the fourth year of adoption, while in Sweden and Denmark the number reached more than 40 and 60 payments per capita, respectively, by the sixth year of adoption (Fitzgerald and Rush 2020; Lowe 2022). Similarly, rapid growth in value and volume has been observed in India, Mexico, and the UK (CPMI 2016) and in several ASEAN countries (Khiaonarong and Humphrey 2022).

1/ Prepared by Jakree Koosakul (SPR).

This paper complements the literature by quantifying the role of payment infrastructure in the use of international currencies. This study builds on several related studies, including those on (1) *dollar dominance,* which show that the US dollar is a dominant global currency in invoicing of international trade, bank funding, corporate borrowing, and central bank reserve holdings (Farhi and Maggiori 2016; Gopinath and Stein 2021); (2) *multipolar IMS*, which suggest that the IMS may potentially evolve away from the dollar into a multipolar system (Eichengreen and Flandreau 2009; Eichengreen, Mehl, and Chiţu 2018; Eichengreen 2019); and (3) *network effects*, which highlight strong network effects in the use of international currencies (Matsuyama, Kiyotaki, and Matsui 1993; Rey 2001).

In the absence of a sufficiently comprehensive and long time series on DM or fast payment systems transactions, this analysis is based on the observation that an increase in the number of direct payment corridors for existing currencies transacted in the current payment system—defined as the unique payment routes between banks in a source and destination country in a given currency—can be used as a proxy for lower costs and thus higher payment efficiency (Figure 1). This is because the more corridors that exist between banks transacting across borders in any given currency, the greater the probability that a transaction taking place between those jurisdictions, in that currency, will be taking place between correspondent banks along one of these direct corridors. And the more direct bank relationships that exist between jurisdictions, allowing for transactions in different currencies, the greater will be the efficiency in the global payments system by (1) providing for shorter linkages or direct payments between payors and recipients and (2) increasing competition between banking intermediaries, which drives down costs and fees associated with payment processing. Although there is no direct evidence associating the number of corresponding relationships with transaction costs, some preliminary evidence suggests that remittance costs are higher the fewer the number of active corresponding relationships (Rice, von Peter, and Boar 2020).

Figure 1. Cross- Border Payment Configurations



Source:IMF staff calculations.

To examine the relationship between payment efficiency and international adoption of payment currencies, this paper employs a logit regression. The regressions use a country's share of currency usage as the dependent variable. Payment efficiency--using the number of payment corridor as a proxy—is included as an explanatory variable, along with lagged currency usage (capturing inertia effect), lagged partner country's currency usage (capturing network effect), trade share, stock market capitalization (capturing financial depth), and inflation for each currency-issuing country. To overcome the endogeneity issue, this paper employs a Bartik-type instrumental approach by using the sum of growth in active routes in each currency, weighted by each currency's share in country *c* in the previous period. This approach assumes that growth of the total number of active routes relative to USD is exogenous to the shares of active routes in each currency.[7] The baseline empirical specification is:[8]

$$\begin{aligned} Payment\ Currency\ Share_{c,i,t} &= \alpha_{c,i} + \delta_t + Payment\ Currency\ Share_{c,i,t-1} + Partner\ Payment\ Currency\ Share_{c,i,t-1} \\ &+ Trade\ Share_{c,i,t} + Financial\ Market\ Size_{c,i,t} + Efficiency_{c,i,t} + \varepsilon_{i,t} \end{aligned}$$

The regression results suggest a positive correlation between our measure of payments efficiency—which, as the data indicate[9], has generally increased for existing payment systems between 2014 and 2022—and

[7] For Bartik instruments, see Goldsmith-Pinkham, Sorkin, and Swift (2020). To strengthen the analysis on the relationship with payment efficiency, future work could focus on investigating the exogeneity of key initial shares, adjustment dynamics (see Jaeger, Ruist, and Stuhler 2018), and instrument strength for the Arellano-Bond regressions. More granular data, when available, would help explore the relationship between payment corridors and capital flows, and heterogeneity across payment type, as well as compare well-established payment corridors with less-established ones.

[8] Where $\alpha_{c,i}$ is a country-currency random/fixed effect, δ_t is a time-fixed effect, Partner Payment Currency share$_{c,i,t-1}$ is the lagged partner country's currency use, Trade Share$_{c,i,t}$ is the share of country c' s trade with currency issuer i, Financial Market Size$_{c,I,t}$ is currency issuer i's stock market capitalization, Efficiency$_{c,i,t}$ is the number of country c' s payment corridors in currency I, and $\varepsilon_{i,t}$ is the error term.

[9] The cross-border payments data capture financial transactions across 209 countries and 35 currencies, with monthly observations between May 2013 to December 2020.

currency use for payment purposes (Table 1.1).[10] The analysis also points to significant inertial and network effects, positive effects from both trade linkage and financial depth, and a negative effect from inflation. These results are in line with the findings of He and Yu (2016), although this latter study focused on currency turnover shares in foreign exchange (FX) markets rather than in payments, as done here. Importantly, the novel element included in the current paper's analysis to proxy for efficiency—namely, the change in payment corridors in a particular currency—is found to be associated with a statistically significant positive change in the use of that currency for payment purposes. An analysis of the marginal effects (Table 1.2) suggests that a unit increase in payment efficiency (that is, a doubling of the number of corridors compared with those of January 2013) could result in an increase in currency shares for payment purposes between 4 and 9 percent.

In sum, this analysis suggests that improvements in payment efficiency can significantly affect international adoption of currencies for trade and financial transactions. The introduction of new payments technologies such as DM, including CBDCs, could thus lead to more international adoption of these new forms of money, further spurring global interconnectedness. The literature has gone further to note that the proliferation of DM usage and its related technology could, in turn, foster digital currency areas and increased interconnectedness (Brunnermeier, James, and Landau 2019). However, the quantitative results should be interpreted with caution, given that this paper's measure of efficiency—based on traditional corresponding bank relationships rather than direct data on DM usage—may miss other factors that may influence DM usage. Indeed, the level of efficiency that digital currencies can achieve would depend also on the payment systems solutions and their interoperability, underlying technology, regulatory compliance costs, and design features. For crypto assets, there is little evidence yet of such efficiency gains (IMF 2023a).

III. Digital Money and International Reserves

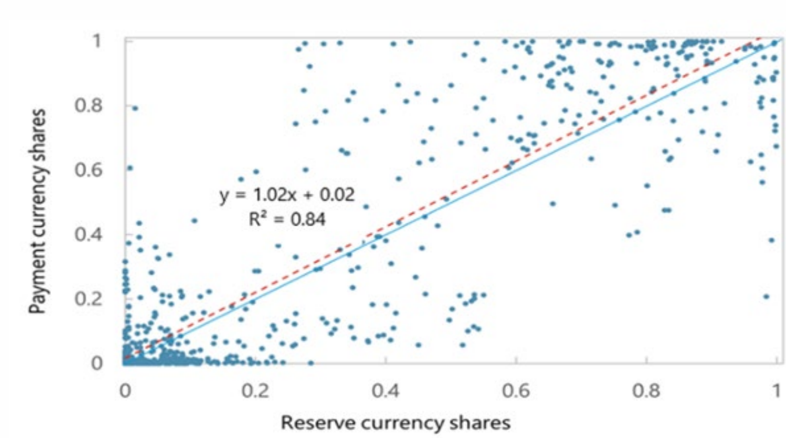
As discussed earlier, DM could present an opportunity to generate benefits from lower transaction costs and greater financial interconnectedness, which could lead to greater diversification of risks and important gains from market integration and stronger trade relationships. Moreover, the new DM technology has the potential to foster greater integration in international payment systems. Should these benefits increase the acceptability and usage of DM for cross-border transaction purposes, a key question is whether DM would lead to a change in the global reserve configuration and the supply of global reserve assets.

[10] We do not differentiate between payment technologies but rather show that if DM increases cross-border payment efficiency, it will likely lead to wider use of DM in international payments. Gains from using DM-specific technologies for cross-border payments remain to be seen, with payment infrastructure still being developed and many projects at the pilot stage, and such gains may go beyond an increase in payment efficiency (for example, reducing switching costs and strengthening network effects; Brunnermeier, James, and Landau 2019). More generally, DLT may increase the scope for private money to be used for international transactions.

The literature does not offer a clear answer. One common view is that new DM entrants will not displace the US dollar as the dominant reserve currency in the medium term, given the latter's wide dominance and the highly inertial nature of global reserve holdings (Triffin 1960). Indeed, IMF (2020b) analyzed the drivers of the currency composition of international reserves and concluded that inertia in reserve currency shares has remained the key driver of reserves, having grown in significance since the global financial crisis (GFC).[11] However, the paper also noted that advances in payments technologies could lessen switching costs, weakening existing "network effects" and inertia. Arslanalp and others (2022) documented an increasing share of nontraditional reserve currencies issued by smaller countries, attributed to active portfolio diversification amid declining transaction costs, growing liquidity of foreign exchange markets, increasing stock of reserve portfolios, and low interest rates on traditional currencies. Brunnermeier, James, and Landau (2019) also highlighted that changes in networks and users could be a stronger driver of reserve currency configurations than other macroeconomic factors. Geo-economic fragmentation can reenforce DM-induced disruptions and further stimulate countries to reassess the composition of their reserve portfolio to reduce dependency on the US dollar, on the basis of national security and other considerations (Aiyar and others 2023).

The evidence suggests a link between reserve holdings and the adoption of currencies for transaction purposes. The previous section identifies a link between payment efficiency and the adoption of currencies for transaction purposes. A simple partial analysis of the correlation between the payment currency shares and the reserve currency shares confirms a strong and positive correlation between them (text Figure 2). This suggests that the medium of exchange and store of value roles of international currencies are correlated, and thus DM could become a factor influencing the adoption of currencies for reserve purposes.

Figure 2. Reserve Currency Shares versus Payment Currency Shares



Source: IMF staff calculations.

To test empirically whether payment efficiency leads to an increase in central banks' reserve currency holdings, this paper updates and builds on the work of Iancu and others (2020) to include payment efficiency as an additional explanatory variable for the change in reserve holdings. As in the previous section, payment corridors are used as a measure of payment efficiency. The empirical specification includes country-currency and year fixed effects, random effects, and the Arellano-Bond estimator (with limitations due to the small sample size).[12] A Tobit model addressing the fractional nature of the dependent variable delivers qualitatively similar results. This paper estimates the model separately for advanced economies and emerging and developing economies due to different drivers of reserve holdings and also different data availability across the two sets of countries. The reserve share of currency i in country c's reserve portfolio in year t is modeled as:[13]

[11] The analysis used both IMF Currency Composition of Official Foreign Exchange Reserves (COFER) data of aggregate reserve shares and a newly compiled panel data set of individual countries' reserve holdings, by currency.

[12] This analysis uses a panel of 42 economies with data available for some or all years from 2013 to 2018 for reserve holdings in the main four reserve currencies (US dollar, euro, Japanese yen, and British pound).

[13] Where: $\alpha_{c,i}$ is a country-currency random/fixed effect, δ_t is a time-fixed effect, $\textit{Trade Share}_{c,l,t}$ is the share of country *c*' s trade with reserve issuer *l* at time t, $\textit{FX Alignment}_{c,l,t}$ is the estimated country *c*' s exchange rate co-movement with the reserve currency *l* at time t, $\textit{Financial Links}_{c,l,t}$ is either the share of country *c*' s public debt or cross-border bank claims denominated in reserve currency *l* at time t, *and* $\textit{Payment corridor}_{c,l,t}$ is country *c*' s payment corridor in the reserve currency *l* at time t.

$$Reserve\ Share_{c,i,t} = \alpha_{c,i} + \delta_t + Reserve\ Share_{c,i,t-1} + Trade\ Share_{c,i,t} +$$

$$+ FX\ Alignment_{c,i,t} + Financial\ Links_{c,i,t} + Payment\ corridor_{c,i,t} + \varepsilon_{i,t}$$

The results suggest large and significant inertia effects and the importance of financial links, more than trade links, as key drivers of reserve currency holdings. This is in line with the findings of Iancu and others (2020). Payment efficiency is, however, not statistically significant under most regression specifications; this may suggest that large gains in efficiency (along with other factors, such as credibility of DM issuers, etc.) may be needed to overcome the strong inertial forces that drive reserve holdings. Nevertheless, these results must be interpreted cautiously given data limitations (less than a decade of annual data available in this analysis).[14] Further work is needed to ascertain the effect of efficiency on reserve configuration and what this may imply for the advent of DM.

Other possible drivers of reserve currency adoption besides payment efficiency could also play a role in the emergence of CBDCs denominated in a currency other than the US dollar or GSCs backed by non-dollar currencies as a new type of reserve asset alongside existing reserve assets. For example, the share of nontraditional reserve currencies has been gradually rising over the past few years, albeit from a low level. More fundamental changes in the global reserve configuration could take substantial time to materialize, unless other disruptive forces, such as rapid and profound technological innovations or heightened geopolitical fragmentation, expedite the transition to DM (IMF 2020b). Such developments could bring diversification and accessibility benefits to the IMS, although they could also come with transition and financial stability risks pertaining to increased volatility in demand for safe assets ((Farhi, Gourinchas, and Rey 2011).

IV. Digital Money and the Global Financial Safety Net

While increased usage of DM can have important benefits in terms of cost efficiencies, greater financial interconnectedness, and possibly a more diversified supply of global reserve assets, it may also increase risks that could exacerbate capital flow volatility and global spillovers. In turn, these risks could result in more demand on GFSN resources and may potentially affect the configuration of the GFSN itself.

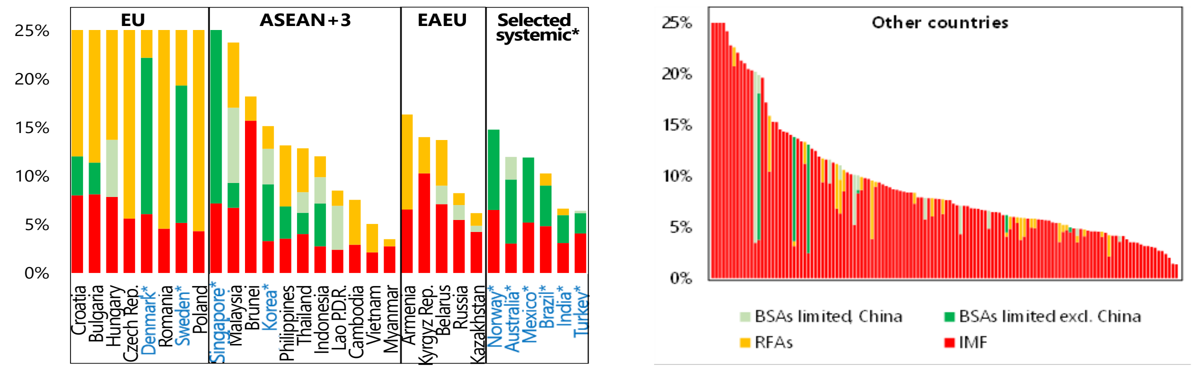
The GFSN comprises countries' international reserves, bilateral swap arrangements (BSAs), regional financial arrangements (RFAs), and the IMF.[15] While global reserves have increased in recent years (to about $14 trillion),[16] reserve adequacy is uneven, with some countries falling short and others opting for too much self-insurance. Other GFSN layers amount to about $4 trillion. However, access to BSAs and RFAs varies, with many economies not covered by such arrangements. Only the IMF provides nearly universal access to external financing (Figure 3) and is expected to serve a catalytic role in attracting other financing. The adequacy of GFSN remains subject to debate, especially in a rapidly changing and shock-prone world (for example, Denbee, Jung, and释Paternò 2016; Scheubel and Stracca 2016; IMF 2016a; Iancu, Kim, and Miksjuk 2021).

Figure 3. GFSN Coverage excluding Reserves by Countries, end-2020
(in percent of GDP)

[14] Because the dataset covered data starting from 2013, only six years of annual data are available (2013–18) for reserve currency shares in this paper's dataset. See Iancu and others (2020) for details on the dataset on reserve currency shares, which covers 42 economies' reserve holdings, by currency, based on official data published by individual central banks.

[15] Market instruments for insurance against crises is another GFSN layer (IMF 2016a), but this paper does not consider them because of their limited use.

[16] Reserve accumulation has been partly driven by AEs' foreign exchange operations in the context of the effective lower bound. The risk of sanctions may lead to reduced reserve holdings and higher reliance on restrictive CFMs measures (Brunnermeier, James, and Landau 2022).



Source: Iancu, Kim, and Miksjuk (2021).

Notes: The charts exclude countries with unlimited BSAs, China, and Venezuela; the bars for non-euro area EU countries and Singapore are truncated. Systemic countries, marked with asterisks and blue type, are identified as top 10 countries (besides those excluded above) with the highest alpha-centrality measures for portfolio investments and interbank positions. Other countries include 132 countries, with country names omitted for lack of space. ASEAN+3 refers to the Association of Southeast Asian Nations Plus Three, EAEU stands for the Eurasian Economic Union.

This section seeks to explore the potential implications of risks related to DM adoption for the GFSN. The adoption of foreign-issued DM (such as CBDCs and GSCs) could lead to negative macroeconomic impacts in adopter countries through several channels. First, by reducing transaction costs and other frictions, the availability of DM could cause or exacerbate disintermediation and/or currency substitution by leading residents to swap foreign currency deposits in their local banking systems for DM or other foreign-currency assets. It could also stoke the substitution of residents' local-currency portfolio investments with DM or other foreign-currency assets, leading to currency substitution. And it could also result in a decline in local-currency bank deposits in favor of DM or foreign assets, leading to both disintermediation and currency substitution simultaneously—and potentially to banking and liquidity distress. Lower demand for local currency could also put pressure on the exchange rate market, leading to reserve losses and/or depreciation, depending on the FX regime, and eventually to currency and confidence shocks, which could strain both public- and private-sector balance sheets, leading to negative feedback loops.[17] Other riskier DM asset classes, such as crypto assets and access to DLT, which facilitate the ability to avoid capital flow management (CFM) measures, could add to risks by further spurring financial disintermediation, with possible systemic implications for global financial stability (He and others, 2022).

To gauge the potential demand for GFSN resources related to a DM-induced shock, this paper develops an illustrative quantitative scenario using a multilayered global network model as in Porter and others (2022). The model uses network analysis techniques to examine how economic and financial contagion spread through the global economy once a country or group of countries deemed as highly vulnerable are subject to an exogenous shock to the return on their external liabilities. The model has been used previously to quantify the systemic effects of contagion from global shocks (Porter and others, 2022), including climate-change related shocks (Tovar, Wu, and Zheng, 2022).Specifically, each country (node in the network) i is endowed with foreign

[17] For example, Laeven and Valencia (2018) estimated the fiscal costs associated with financial crises at 6.7 percent of GDP in high-income countries and 10 percent of GDP in low- and middle-income countries.

exchange reserves at *t* = 0 in an amount of R_{i0} dollars. The change in foreign exchange reserves of country *i* at time t ($\Delta R_{i,t}$) can be described by the following expression:[18,19]

$$\Delta R_{i,t} = \underbrace{\sum_{j \neq i} TB_{ij}\left(e_{ji,t-1}\right)}_{Trade\ revenues} + \underbrace{\sum_{j \neq i}^{\in ND_t} a_{ij}\, r_{j,t}\, e_{j,t}}_{Return\ on\ net\ foreign\ Assets} - \underbrace{\sum_{j \neq i} a_{ji}\, r_{i,t} e_{i,t}}_{Return\ on\ net\ foreign\ liabilities} + \underbrace{EF_{it}}_{GFSN\ financing}$$

A liquidity crisis emerges when country *h* (or a set of countries) is hit by a shock to its external liabilities and, in an extreme case, it is unable to fulfill interest payments due, $a_{jh} r_{h,t}$. This implies an external financing need that creates pressure as international reserves decline for all countries with exposure to country *h*.

The model incorporates two amplification mechanisms: country risk premia and asset price co-movements. Risk premia are sensitive to a country's *distance to default*, captured by the difference between a country's stock of international reserves and reserve adequacy metric. Moreover, countries under financial distress trigger increases in the risk premia of other countries with similar risk profiles, which is calibrated using interest rate correlations and CDS shifts during periods of financial stress driven by exogenous shocks. The model also allows for domestic policy responses (fiscal and monetary) to mitigate contagion effects from countries that experience default. Specifically, when a country faces a contagion shock, the model assumes a fiscal consolidation of 2 percent of GDP and a depreciation of its currency by 5–10 percent, depending on the strength of its asset links to the defaulting country.

This exercise considers an illustrative tail scenario in which countries with real, financial, and/or external vulnerabilities are assumed to adopt cross-border forms of DM (public CBDCs or private GSCs) issued by large and systemic economies (or large private entities in systemic countries). This is assumed to trigger in the adopting countries a shift away from domestic assets and lead to financial disintermediation, capital outflows, exchange-rate pressures, bank runs, and reserve losses. Given the external and financial vulnerabilities already present in these countries, this paper assumes a tail scenario that such negative dynamics ultimately result in a default on their cross-border obligations.

Countries with preexisting external and financial vulnerabilities and that are prone to DM adoption could be particularly vulnerable to DM-induced shocks. Key drivers of DM adoption include (1) distrust in local currency and/or in the local banking system, which in turn is likely associated with the high external and financial vulnerabilities such as high external debt, current account imbalances, low reserves, and financial fragilities; (2) for GSCs and CBDCs, trade and financial ties with the issuer as a means to reduce the cost of transactions; (3) financial exclusion; (4) the population's inclination to adopt financial innovation products; and (5) the opportunity to avoid regulations. Crypto assets specifically could also be in demand for their anonymity, for potentially high returns from speculative activity, and to avoid regulations.

To identify the most vulnerable countries, this paper uses the methodology developed in IMF (2021a), focusing on key indicators of external and financial vulnerability. Although the scenario discussed here does not refer to a crypto-shock, to identify those countries that could be more prone to adoption of DM, this paper uses the index of crypto adoption, as reported by TripleA, based on 2021 ownership data, as well as trade or financial ties with

[18] Where TB_{ij} denotes country i's trade balance with country j, a_{ij} denotes country i's asset holdings against country j, $r_{j,t}$ is country *j*'s specific interest rate on its liabilities at time t, $e_{i,t}$ is the nominal effective exchange rate of country i at time t, and $EF_{it} = EF_{BSA;i,t} + EF_{RFA;\,i,t} + EF_{IMF;\,i,t}$ is the external financing provided to country i at time t by the various layers of the GFSN, namely by BSAs, RFAs, and the IMF.

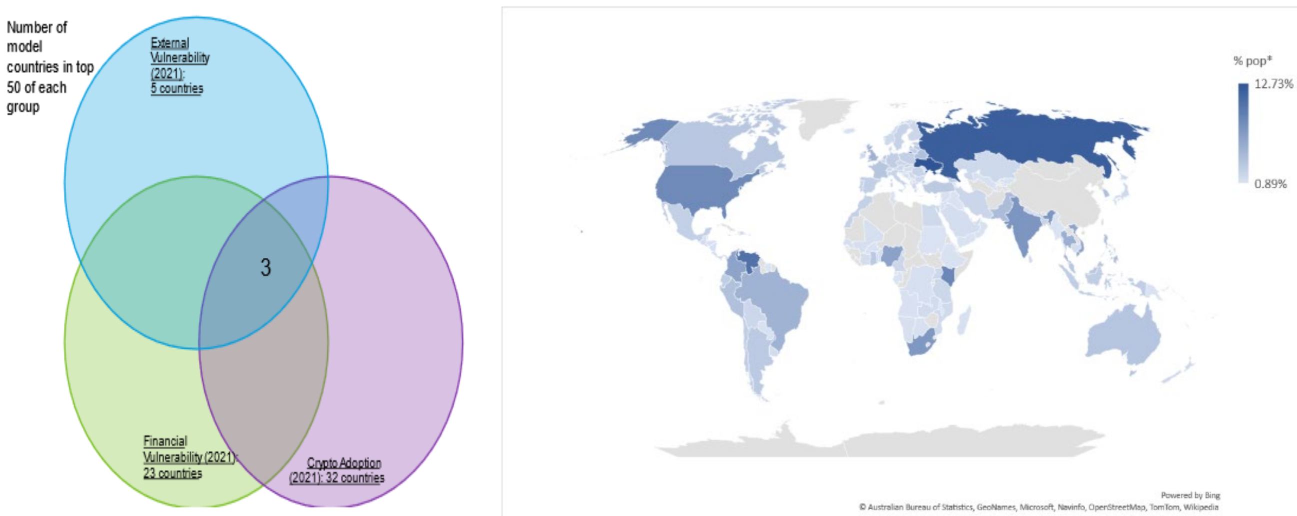
[19] The model uses 2020 data for 63 countries (36 AEs, 27 EMs), representing 85 percent of global GDP on (1) cross-country trade (IMF Direction of Trade Statistics), (2) interbank claims (BIS Locational Banking Statistics), (3) portfolio investment (IMF Coordinated Portfolio Investment Survey), and (4) foreign direct investments (IMF Coordinated Direct Investment Survey).

the United States, the Euro area, and China, using export data (2020) from the IMF Direction of Trade Statistics (DOTS) and liabilities data (2020) from the same data set underlying the calibration of the multilayered network model, including cross-border bank claims and direct and portfolio investment. The analysis identifies 32 countries as vulnerable to crypto adoption, 23 to financial risks, and 5 to external imbalances. Of these, a handful of countries are identified as vulnerable to all three. In the network model, which captures economic and financial interlinkages among economies, default in these vulnerable countries triggers cascading effects on the external financing needs of other countries through direct trade and financial exposures, amplified through changes in risk premia and asset price co-movements.

Figure 4. Identifying the Countries Most Vulnerable to DM Shocks

Vulnerable Countries

Crypto Adoption *(percent of population),* TripleA



Source: IMF staff calculations.

The model results suggest that reserve losses associated with such an illustrative DM-induced shock and the demand on the GFSN (after monetary and fiscal adjustment is taken into account) could be significant, up to $1.2 trillion (compared to a total firepower of the GFSN of around $18 trillion).[20] While the precise numerical estimates should be interpreted with caution, given that they are sensitive to the model assumptions, they can provide a broad estimate of the relative magnitude of the potential consequences of shocks that may be induced by the adoption of cross-border DM by vulnerable countries on the global economy and the GFSN. Indeed, to the extent that DM may also lead to an increase in global interlinkages and to amplification of shocks, the consequences could be even larger. However, due to the model's limitations, such amplification channels are excluded from the current analysis.

On the supply side, CBDC issuers could provide ex ante liquidity backstops, particularly to counterparties with large holdings of their CBDCs. Similarly, regional reserve issuers may have strong incentives to customize and strengthen bilateral liquidity support facilities to maintain the stability of the currency bloc or to promote the use of the regional currency. New RFAs could emerge in response to DM adoption, particularly among countries using a common CBDC or GSCs that may see their trade and financial interconnectedness increase and thus may choose to strengthen liquidity safeguards jointly to minimize spillovers. Moreover, countries using common CBDCs or mCBDC arrangements could reinforce liquidity buffers through RFAs to support the robust

[20] These estimates are in line with other estimates obtained with the network model applied to climate-related shocks (Tovar Mora, Wu, and Zheng 2022).

functioning of their cross-border payment system. Wider use of regional currencies in cross-border transactions and reserve holdings might also increase countries' capacity to bolster RFAs by lending in regional currencies.

In sum, DM could bring both risks and opportunities to the GFSN. DM may lead to an increase in demand for GFSN resources by fostering new shocks via currency substitution, exchange rate depreciation, and bank runs or by amplifying existing shocks. In turn, this could incentivize policymakers to expand the GFSN as a way to both mitigate shocks and promote the use of regional DMs. Thus, the GFSN may increase in size but could also become more uneven, further fragmenting funding markets and amplifying shocks.

V. Conclusions and Preliminary Policy Implications

This paper suggests that DM adoption, to the extent that it increases efficiencies, could lead to broader DM use for transaction purposes and eventually to an increased supply of global reserve assets**.** First, by reducing costs and bolstering trade, global adoption of some forms of DM, particularly CBDCs or GSCs, could alter the currency use in cross border payments. Indeed, the analysis suggests a positive correlation between efficiency (an expected benefit of DM) and currency usage for transaction purposes. Although the evidence so far is more limited and the empirical results inconclusive, some forms of DM, such as CBDCs or fully backed GSCs, could eventually emerge as new reserve assets alongside existing ones. Thus, DM could foster diversification of reserve currencies, which could lead to an increase and broadening of the supply of global safe assets; geopolitical developments may accelerate the materialization of this outcome.

The adoption of DM, however, if not adequately coordinated and supervised, could also amplify existing vulnerabilities and pose new risks to global financial stability and the IMS. As noted in the literature, widespread cross-border adoption of DM without appropriate safeguards or interoperability could be accompanied by increased currency substitution, greater spillovers across countries and sectors, and higher volatility of capital flows—leading to faster and deeper crises. Official adoption of privately issued DM, especially crypto assets, as a legal tender would be detrimental to macro-financial stability, financial integrity, and consumer protection.[21] As this paper's illustrative modeling simulation suggests, DM-induced shocks could lead to material demands on the GFSN. On the supply side, reserve-issuing policymakers could provide ex-ante liquidity backstops to support adoption of their CBDCs.

To preserve and increase the stability of the IMS, policymakers will need to address risks through appropriate design of CBDCs, interoperability among them and with existing systems, regulation of private DM, and enhanced policy coordination with relevant public and private institutions. While these issues are not addressed in this paper, emerging research suggests that careful design of CBDCs with inclusivity and cross-border considerations in mind could help to not only protect financial intermediation and financial stability but also preserve the efficiency of CFM measures when they are deemed necessary [22]. For GSCs and other crypto assets, effective regulatory frameworks are needed to safeguard monetary sovereignty, guard against capital flow volatility, maintain the effectiveness of CFM measures, address legal risks, implement financial integrity standards, and re-enforce domestic and international collaboration (IMF 2023a).

To achieve the aforementioned goals, coordination among the global standard-setting bodies, regulators, central banks, and multilateral and relevant private-sector institutions will be critical. In particular, collaboration among international financial institutions on global principles is needed to effectively regulate GSCs and crypto assets [23]. Enhanced coordination between GFSN layers will also become increasingly vital to maximize the GFSN's

[21] See Adrian and Weeks-Brown (2021) and IMF (2023b).

[22] See IMF (2023c) Fintech Note.

effectiveness in a more digitalized world. BSAs and RFAs may need to be expanded, including to those outside DM blocks, and upgraded to include precautionary instruments that can guard against new risks stemming from DM. A potential shift to a multipolar reserve configuration may require global reserve currency issuers to substantially expand liquidity backstopping mechanisms to minimize the risk of disorderly switching between reserve currencies and improve access to GFSN resources.

The role of the IMF would continue to remain critical in a DM world. As more members adopt DM as a means of payment and/or store of value, all core areas of Article IV consultations would potentially be affected—monetary, exchange rate, financial sector, fiscal, and structural. If spillovers from members' policies increase, Article IV consultations would need to increasingly cover this area (IMF 2021c). Analysis of risks arising from DM would also need to be reflected in IMF Financial Sector Assessment Programs. At the multilateral level, efforts will need to be bolstered on developing DM taxonomies, monitoring trends, identifying key risks, and giving advice on design issues to mitigate risks, as well as continuing to provide a platform for global dialogue and cooperation. The IMF can also play a key role in the provision of capacity development, especially in helping countries with weak capacity to avoid a digital divide and ensuring new solutions work for all countries. The size of the IMF and its lending toolkit would need to continue to be reassessed to ensure the Fund is adequately resourced to be able to support members with financial assistance, including precautionary, in a more DM-driven world.

Table 1.1. Payment Currency: Logistic Regression

Dependent Variable: Currency Share

	(1)	(2)
Lagged currency share	6.100***	6.103***
	(0.062)	(0.062)
Lagged partner currency share	3.412***	3.382***
	(0.094)	(0.095)
Market cap/ GDP	–0.233***	–0.227***
	(0.046)	(0.046)
Inflation	–0.108***	–0.107***
	(0.01)	(0.01)
Trade share	1.623***	1.573***
	(0.072)	(0.073)
Efficiency	0.091***	
	(0.021)	
Corridors (100,000s)		0.391***
		(0.086)
N	275981	275981
Pseudo R2	0.64	0.64

Standard errors in parentheses
* $p < .1$ ** $p < .05$ *** $p < .01$
Note: Entity and time fixed included

bSource: IMF staff calculations.

Table 1.2. Payment Currency: Logistic Regression—Marginal Effects

Currency	Marginal Efficiency Effect (in percent)	Marginal Corridors Effect (in percent)
CNY	108.93	143.91
EUR	106.61	125.81
GBP	108.71	142.57
JPY	108.64	142
USD	103.76	115.94

Note: Marginal effect calculated based on one- unit increase to all countries as of December 2020. The unit of corridor is in 100,000s.
Source: IMF staff calculations.

Table 2.1. Reserve Currency Regressions

Variables	(1) FE_EM	(2) FE_AE	(3) RE_EM	(4) RE_AE	(5) AB_EM	(6) AB_AE	(7) tobit_EM	(8) tobit_AE
Lagged reserve share	0.52***	0.58***	0.88***	0.96***	0.96***	0.96***	0.52***	0.58***
	(0.07)	(0.08)	(0.04)	(0.02)	(0.02)	(0.02)	(0.09)	(0.08)
Trade Share	0.00	0.07	−0.03	−0.05**	−0.05**	−0.05**	0.01	0.07
	(0.20)	(0.25)	(0.03)	(0.02)	(0.02)	(0.02)	(0.16)	(0.23)
FX alignment	−0.05***		0.06***	0.01	0.01	0.01	−0.05***	−0.17**
	(0.01)		(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.07)
Debt share	0.04		0.06*				0.04	
	(0.11)		(0.03)				(0.11)	
Efficiency	0.17	-0.08	0.02				0.18*	-0.09
	(0.10)	(0.10)	(0.02)				(0.09)	(0.09)
Bank claim share		0.27***		0.06***		0.06***		0.28***
		(0.05)		(0.01)		(0.01)		(0.06)
Constant	0.10***	0.07	−0.00	−0.00	−0.00	−0.00		
	(0.03)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)		
Observations	648	139	648	139	139	139	648	139
R-squared	0.30	0.41						
Number of panelid	117	24	117	24	24	24		

Robust standard errors in parentheses
*** $p < .01$, ** $p < .05$, * $p < .1$

Table 2.2. Reserve Currency Regressions

Variables	(1) FE_EM	(2) FE_AE	(3) RE_EM	(4) RE_AE	(5) AB_EM	(6) AB_AE	(7) tobit_EM	(8) tobit_AE
Lagged reserve share	0.51***	0.58***	0.88***	0.96***	0.96***	0.96***	0.52***	0.59***
	(0.07)	(0.08)	(0.03)	(0.01)	(0.01)	(0.01)	(0.09)	(0.08)
Trade Share	0.04	−0.01	−0.01	−0.05**	−0.05**	−0.05**	0.04	−0.02
	(0.19)	(0.21)	(0.02)	(0.02)	(0.02)	(0.02)	(0.16)	(0.19)
FX alignment	−0.04***		0.06***	0.01	0.01	0.01	−0.04***	−0.10***
	(0.01)		(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)
Debt share	0.06		0.06*				0.05	
	(0.11)		(0.03)				(0.11)	
Efficiency		0.02					0.01	
		(0.03)					(0.01)	
Bank claim share		0.26***		0.06***		0.06***		0.27***
		(0.05)		(0.01)		(0.01)		(0.05)
Constant	0.11***	0.04	−0.01	−0.00	−0.00	−0.00		
	(0.03)	(0.06)	(0.01)	(0.02)	(0.02)	(0.02)		
Observations	629	139	629	139	139	139	629	139
R-squared	0.29	0.40						
Number of panelid	113	24	113	24	24	24		

Robust standard errors in parentheses
*** $p < .01$, ** $p < .05$, * $p < .1$

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