

***Economic Theory***

Viktor KOZIUK

**UNDER PRESSURE OF DIGITALIZATION
AND GEOPOLITICAL CHALLENGES:
INTERNATIONALIZATION OF CURRENCIES
AND THEIR RESERVE STATUS****Abstract**

Digitalization and geopolitical challenges are increasingly being viewed as preconditions for the transformation of global monetary order towards stronger multipolarity. However, according to traditional approaches, current status quo is more viable because of the technological neutrality of reserve currency status. At the same time, alternative approaches point to technological opportunities for the internationalization of the renminbi, which would heighten the competition between the main currencies and hurt the U.S. dollar. Critical overview of new theoretical approaches indicates that putting retail CBDC at the heart of changes in global monetary order is too categorical. It is likely that digitalization will affect the technology of international transactions and thus enhance competition between leading currencies in how they support payment services for clients. Meanwhile, CBDC design issues and cooperation between central banks in transborder digital payments create new trade-offs that support the more traditional approach on global monetary competition. Recent demand trends of reserve assets also contribute to stronger rigidity of the international currency system.

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Koziuk, Viktor, DSc (Econ), professor, head of the Department of Economics and Economic Theory, West Ukrainian National University, Ternopil, Ukraine. ORCID: 0000-0002-5715-2983 Email: vic-torkozyuk@ukr.net

Key Words:

global monetary order; international currency; CBDC; reserve assets; digitalization; geopolitics.

JEL: E58, E59, O23, Q33.

4 figures, 1 table, 54 references.

Introduction

Global monetary order has long been a subject of debate. Its list of imperfections often includes the dominance of the U.S. dollar in global transactions, its exorbitant privilege, the fiscal Triffin's dilemma, the global financial cycle, etc. (Koziuk, 2015). However, a multipolar model of the international monetary system does not guarantee a better outcome either. For example, the growing role of emerging market currencies in the structure of global foreign exchange reserves deteriorates the quality of reserve assets. Moreover, there is disparity between the ability of financial systems in many countries to generate safe assets and the demand for them. The uncertain effectiveness of multilateral global liquidity management systems is equally notable. It is no coincidence that active debates on reforms of the international monetary system after the global financial crisis have not yet yielded an obvious conclusion (IMF, 2010; Farhi et al., 2011). The direction of change and whether it is needed at all remains a question that has not found a definitive answer among the international community.

The apparent decline in the role of developed countries in global GDP and the growing importance of China as a global player have long raised questions about the leadership prospects for its currency. Such discussions are routine. At different times, they revolved around the German mark, the Japanese yen, and then the euro. However, China's case is clearly different due to the size of its economy, geopolitical clout, and expectations for growth in its share of global

GDP. Quite optimistic views of the yuan's prospects are fairly popular (Subramanian, 2011).

Despite the ongoing debate about the trajectory of the global monetary order's evolution, at least two trends are clear. The digitalization of money and the prospects for the introduction of CBDC by central banks have a clear reflection on the competition between currencies. Additionally, geopolitical tensions caused by the fascist Moscow's war against Ukraine have their own implications for global monetary processes. The seizure of sovereign assets on such a scale has raised the question of the qualities that reserve assets should have in a world of geopolitical tension. Although this problem is unlikely to be triggered by a significant number of countries, it is enough for it to be raised by those who hold foreign exchange reserves in a concentrated form (on a global scale) and who explicitly or implicitly oppose the United States on the international arena. Digitalization and geopolitics reinforce each other. Some countries that are dissatisfied with the dominance of the U.S. dollar are becoming more explicit in their efforts to find an alternative to the current global monetary system. However, their frustration is increasingly being driven by a desire to limit the United States' ability to use soft power (Buckley & Trzeciński, 2023).

While geopolitical motives create incentives for individual countries to intensify policies that could change the global monetary landscape, digitalization provides structural opportunities for this shift. Moreover, the transformation of the global monetary system under the influence of digital technologies can hypothetically either be based on market forces or be influenced by the policies of individual countries aiming to internationalize their own currencies. It is most likely a *fait accompli* that geopolitics has permeated the competition between currencies.

This article contributes to the debate on the future of the global monetary system. In particular, it emphasizes that new technological capabilities allow for changes in the algorithm of currency internationalization, but they are not a determining factor in radical changes in the structure of global reserve assets. The article also suggests that the hypothesis of optimal digital areas (James et al., 2019; Brunnermeier et al., 2019) may have a geopolitical dimension if the confrontation between geopolitical camps is radicalized. The interoperability of different national CBDCs may turn out to be a point in such confrontation. In particular, privacy protection within the CBDC design can be a serious criterion for the geopolitical fragmentation of the digital global monetary processes.

Literature Overview

Since Moscow's aggression against Ukraine in 2014 and the corresponding imposition of sanctions by several countries in response, the issue of transforming the global monetary order has been discussed with a more distinct focus on the problem of the geopolitical limits of U.S. dollar hegemony. For example, Arslanalp et al. (2022) argued that the dollar's share in global foreign exchange reserves has been slowly but systematically declining. However, this is being offset by central banks increasing their holdings of currencies from a number of small developed countries rather than by them expanding the reserves of the most obvious rival currencies. The increase in the share of gold in foreign exchange reserves is also evidence of rising geopolitical tensions and the search for alternatives to the U.S. dollar (Arslanalp et al., 2023). In contrast, Koziuk (2023) argued that geopolitical aggressiveness is fueled by the ability to accumulate foreign exchange reserves with a subsequent increase in the share of gold, with a caveat of this only being typical for certain countries.

Proponents of the traditional theory of international currency have emphasized that equating the dominance of the U.S. dollar solely with its status as a reserve currency would be a mistake (Cohen, 2012). A currency becomes truly international when it prevails in performing all the functions of international money (Cohen, 1971). The approach based on the pyramid of currencies proves that the full range of international currency functions can be concentrated in a very limited number of monetary units, and the dominance of one of them is natural (Cohen, 1998; 2015). The effects of natural monopoly and positive network externalities support this. An empirical approach based on determining the level of such concentration confirms that it is not so much the number of poles that matters as the distance between them (Cohen & Benney, 2014). The same applies to currency internationalization. A currency acquires international status in the process of its internationalization following a certain algorithm, and the economy of its issuer must meet certain criteria.

Regarding currency internationalization, Cohen (1998; 2015) emphasized that the large size of the economy and lack of restrictions on capital flows are complemented by factors of military and political power. Should the country possess all the above, its currency initially dominates cross-border transactions, then serves as an invoice currency, and finally becomes a reserve currency. This sequence was also supported by Eichengreen (2011a; 2011b). He noted that there are steps between internationalization and international status: the spread of a currency in international payments, followed by active use by private agents abroad, followed by invoicing in that currency (Eichengreen, 2011b). Gopinath and Stein (2021) stressed that a currency becomes dominant when it is both an invoicing and a reserve currency, so the liquidity of reserve assets is maintained

by setting commodity prices (invoicing) and financial prices (pricing) in the same currency.

Kenen (2009) outlined the conditions under which a currency can be considered truly international. First, there are no bans for residents and non-residents on any domestic and cross-border currency transactions. Second, resident companies invoice in local currency for cross-border transactions. Third, non-residents, including official bodies, can hold the currency and assets in it to the extent they wish. Fourth, non-residents, including official bodies, can issue marketable financial securities in such currency. Fifth, residents can issue financial instruments in their own currency in foreign markets. Sixth, international organizations can issue financial instruments in such currency to finance their activities in third countries. Finally, the currency is used as a peg currency or exchange rate currency by official authorities of third countries.

The criteria for considering a currency to be international are hotly debated, but mostly comprise the size of the economy, monetary stability in a broad sense, a strong and liquid financial market, political stability and the rule of law, etc. The emphasis on the relative weight of a particular criterion varies (Frankel, 2023; Cohen, 2015; Eichengreen, 2011b; Subramanian, 2011; Krugman 1984). However, some scholars warn that it is not enough to dominate the economy by the criterion of scale or to have low inflation. Cohen (1966; 2006) was one of the first to point out that the burden of adjusting to shocks is key to the effective performance as an international currency issuer over time. The issuer of an international currency should have a sufficient safety margin in terms of political and economic imperviousness to shocks associated with this status (Germain & Schwartz, 2017). In other words, the burden of adjusting to shocks to foreign demand should be so low that it does not create tensions in the distribution of political and economic power within the country. This criterion clearly explains why not all countries, even those strong enough in terms of economic size and monetary stability, are able to claim the status of a vehicle currency issuer. Cooper (2009) concludes that depth and liquidity of the debt market is one of most important preconditions for reserve status of currency.

In contrast, Eichengreen and Flandreau (2009; 2012) noted that the status of the international currency is more flexible. Eichengreen (2019) juxtaposed empirical and historical approaches, highlighting that there was no tendency toward monopolarity in the long run. Vicquery (2022) proved this by testing the dominant currency hypothesis (i.e., the one that affects the exchange rate of other currencies). The rivalry between the British pound and the U.S. dollar in the interwar period shows that international status is not irrevocable. Flandreau and Jobst (2009) emphasized that strong positive network effects are not a 100% guarantee that the future is unconditionally determined by the past (path dependence). On the other hand, many studies point to extremely strong inertia regarding the status of the reserve currency (Frankel, 2023; Iancu et al., 2020), which makes the current global monetary system rigid. Moreover, Iancu et al. (2020) argued that trade and

peg currency factors are not as strong as financial factors in explaining the inertia of reserve currency status. Koziuk (2015) argued that there is a difference between the factors involved in the internationalization of a currency and those that support the already acquired international status.

A certain alternative to traditional theoretical views on the international monetary system has been forming under the influence of digitalization and geopolitical confrontations. Nevertheless, Clayton et al. (2022) argued that traditional approaches are more applicable to traditional currencies such as the dollar or the euro, even if China chooses an alternative way to internationalize the RMB. The assumption at the level of relevant policies was that China seeks to circumvent the limitations known from historical cases of currencies acquiring international status (see Cohen, 1971; 1998; 2015; Kenen, 2009; etc.). Accordingly, Clayton et al. (2022) did not stress the factor of digitalization and geopolitical changes. Rather, they placed more emphasis on the chosen policy direction, designed to accelerate the internationalization of the renminbi while overcoming the structural limitations of the Chinese economy.

Naef et al. (2022) and Eichengreen et al. (2022) also argued that an alternative way to internationalize the RMB is possible. In their view, it would involve an attempt to reconcile the lack of financial liberalization with the growing role of the renminbi in trade transactions, cross-border payments, and invoicing. The possibility of changing the trajectory of internationalization under the influence of digital technologies was also not excluded by Iancu et al. (2020). Meanwhile, Prasad (2023) suggested that even if the CBDC did not significantly shake the U.S. dollar's position, digitalization and China's leadership in it would play in its favor: the world would rapidly grow more fragmented and the gap between the reserve currency function and the payment and invoicing functions would widen. Buckley and Trzeciński (2022) noted that China was seeking to take advantage of new technological opportunities precisely to make the internationalization possible in an alternative way and that the geopolitical motives for this were obvious.

The CBDC factor has given new impetus to discussions on currency competition. Here, a technology-neutral approach can be distinguished, according to which the form of money does not matter for the status of a currency. Waller (2022) emphasized that the scale and breadth of the financial market would not be affected by a change in the form of money. Therefore, issuance of CBDC either by a central bank issuing international currency or by a foreign central bank would not affect the motives for holding assets in international currency. Eichengreen (2021) also suggested that there were no threats to the current global monetary system from retail CBDCs. However, another view held that the growing importance of the renminbi in cross-border transactions and invoicing was based on technological factors as the spread of new digital technologies could significantly affect the global financial landscape (Eichengreen et al., 2022; Buckley & Trzeciński, 2022; Prasad, 2022; 2023; Huang & Mayer, 2022).

This article aims to show that digitalization is unlikely to be a radical factor in the transformation of the global monetary system. Technological factors will allow for new opportunities in the internationalization of the currency, but they are a given. The motives for cross-border ownership of CBDCs may not be as strong as some papers suggest (Eichengreen et al., 2022; Buckley & Trzeciński, 2022; Prasad, 2023; Huang & Mayer, 2022). Privacy as an element of CBDC design can play an important role, and therefore the value factor can reflect the geopolitical dimensions of a more fragmented global monetary order. The tendency to hoard foreign currency reserves will have a significant impact on maintaining the status quo in terms of reserve currencies. Even if signs of multipolarity appear in the performance of several international currency functions, this will not be a fundamental factor of a radical transformation.

Research Results

Impact of digitalization on changes in approaches to analyzing the global monetary order

At one time, the emergence of cryptocurrencies was seen as a threat to the ability of central banks to ensure monetary sovereignty. Their response in the form of the CBDC has started a new branch of discussions about the prospects for the international monetary system. Can digitalization really affect the fundamental processes behind money's international functions and competition for reserve currency status?

The reserve currency status is mostly associated with the highest degree of internationalization. This is because it gives what is known as *exorbitant privilege* (Eichengreen, 2011a). In other words, systematic external demand for the assets of the issuing country makes it possible to maintain lower interest rates within that country, and thus higher consumption levels and greater resilience to the balance of payments. Scholars on global financial imbalances is less optimistic about the benefits of reserve currency status, in particular in terms of the inability to influence the exchange rate downward if other countries try to limit the appreciation of their currencies (Blanchard & Milesi-Ferretti, 2009). Reducing the sensitivity of the export sector to competitive pressures from abroad is also a challenge. In the long run, this reduces the share of the issuing country in global GDP, widening the gap between this share and the share of its assets in the global portfolio (Koziuk, 2015). The accumulation of significant foreign exchange reserves globally is seen as a reason for their more active management (Beck & Weber, 2010). Even if the issue of trust in the U.S. dollar is not directly related to this, the de-

mand for non-traditional currencies in foreign exchange reserves (Arslanalp, 2022) shows that the motives for managing foreign exchange reserves are no less important than the fundamental factors behind a currency's reserve status.

Discussions about the growing role of non-traditional currencies have demonstrated that the likely decline in the role of the U.S. dollar is not, in fact, a guarantee of a Pareto-improvement (IMF, 2010; Maziad et al., 2011; Aiyar et al., 2023). The main reason for this is a decline in the quality of global foreign exchange reserves, primarily a drop in their liquidity. Of course, this has not turned into “boredom of dollar”. Growing demand for gold under the influence of geopolitical tensions has become a more structurally pronounced factor, driving changes in foreign exchange reserve management (Aiyar et al., 2023). However, the reorientation to gold is clearly conditioned by the geopolitical interests of individual countries, rather than the fundamental changes in the nature of the factors that determine the status of reserve currencies (Koziuk, 2023). In other words, the growth in central bank demand for gold has not yet escalated the debate over the prospects for the global monetary order as much as the changes associated with digitalization and the promotion of digital currencies by leading monetary authorities have.

Today, there is a clear division between those who are optimistic that the promotion of the digital renminbi will be a game-changer (Smith, 2019; Buckley & Trzeciński, 2022) and those who believe that the changes will not have radical consequences (Chorzempa, 2021; Prasad, 2022; 2023; Frankel, 2023). At the same time, techno-geopolitics (Huang & Mayer, 2022) or techno-nationalism (Frankel, 2023) are considered to be the key driving forces of changes in global monetary processes. These approaches rely on a completely different perspective. Although international political economy does not reject the idea of geopolitical determination of central banks' choice of reserve assets (Eichengreen et al., 2017), technological change is considered a priority driver for the transformation of the global monetary system (Prasad, 2023). The main path of such transformation can be summarized as follows: leadership in digitalization, in particular in the introduction of a globally accepted CBDC – significant reduction in the cost and improvement of cross-border payments based on technological superiority – the growing role of currency in cross-border transactions – gradual strengthening of positions in the invoicing currency status – strengthening of competitive positions in the international monetary system. At the same time, the cost reduction and acceleration of cross-border transactions is presented as evidence of the competitive advantage of the RMB (Buckley & Trzeciński, 2022; Huang & Mayer, 2022). Some, however, are more reserved regarding such radical expectations from new technologies and emphasize that digital innovations that improve domestic retail payments cannot be automatically extrapolated to the level of global monetary processes (Eichengreen & Viswanath-Natraj, 2022).

In theory, the possibility of transforming the global monetary system stems from the concept of digital currency areas (James et al., 2019; Brunnermeier et

al., 2019). This approach is based on the principles of the optimal currency area theory regarding the benefits of exchange rate fixation, but with a significant difference. It implies the existence of an ex-territorial network-connected space where transactions are carried out using digital money specific to that network. The platform business model of networking creates very strong positive externalities for participants and maximizes the cost of entry. The platforms are also information-intensive, creating additional value for customers by combining many services to support their transactions. Affiliation with a particular network is determined by the platform's ability to offer the best unbundling and rebundling of money functions within payment services. Thus, competition between platforms based on this ability leads to the emergence of a network that, spreading globally, self-reproduces positive externalities for participants.

The optimal digital area approach is crucial to understanding why increasing presence of a currency in the digital environment strengthens its status as an international currency even without sufficient support in terms of capital mobility or a developed financial market. Dominance in the digital cross-border transactions is fully consistent with the initial stage of internationalization according to the traditional view (leadership in international payments – invoicing – reserve currency) (Cohen, 1998; 2015; Eichengreen, 2011a; 2011b). This also corresponds to views that emphasize technology (Prasad, 2023). Allegedly, the ability to build a network based on a national digital currency opens new opportunities for its internationalization (James et al., 2019) as the digital capabilities of such a currency should guarantee more competitive functionality that would be acceptable to a large number of consumers in many countries. However, it is important to switch to invoicing in such a currency within the network (Brunnermeier et al., 2019). In fact, if the invoicing is an extension of the competitive advantages in terms of a particular CBDC's functionality and is a decentralized decision of the network participants, the optimal digital area will automatically reflect the internationalized status of such a currency and support it through the benefits for its participants. It is only natural that, given the positive effects of the network and the high cost of entry, the network that forms the first optimal digital area will hold the competitive advantage.

The idea of a link between the hierarchy of currencies in the global monetary system and the speed of their digitalization confirms the notion that first step mover advantages are of fundamental importance to the subsequent developments. They involve both the speed of CBDC implementation by leading global players and the nature of competition for international currency status. Cong and Mayer (2022) depict this in a sequential model of the order in which countries will choose to digitize their currencies. The model assumes that fiat currencies with different degrees of internationalization, cryptocurrencies, and CBDCs compete with each other in the modern world. A country that issues a currency with the potential for internationalization seeks to be the first to introduce CBDC. Its digitalization is seen as a factor in strengthening its international position. Issuers of international currencies take a step back in order to maintain their positions, or at

least not to lose them. Countries with weak currencies find themselves facing additional competitive pressure on national currency: they are opposed by CBDCs of leading countries and private cryptocurrencies.

Cong and Mayer's (2022) sequential model quite nicely reflects China's desire to take advantage of its leadership in digitalization to gain additional benefits in the field of internationalization. It also illustrates the additional risks faced by weaker currencies. Here, the phenomenon of digital dollarization is considered as an element of competition between currencies in the digital setting, in contrast to earlier views from the standpoint of financial stability as described in a number of works on CBDC (Mancini-Griffoli et al., 2018). However, the motivation of developed countries for CBDCs seems to be theoretically biased in the Cong and Mayer's (2022) model. The Fed, the ECB, or the Bank of England place much more emphasis on improving the quality of payment services than on competition in global monetary processes. At the same time, the design of CBDCs continues to be a subject of debate.

As Huang and Mayer (2022) show, the United States and China have chosen opposite options for regulating the crypto industry. The United States does not ban cryptocurrencies completely, relying on digital innovations and new financial products generated by the private sector to give the financial system an innovative impetus. At the same time, the United States is in no hurry to introduce the digital dollar. Meanwhile, China is introducing CBDC amid a complete ban on cryptocurrency transactions, focusing financial innovations on the digital renminbi.

Such differences in approaches to fintech are hardly neutral with regard to the international status of currencies. The United States apparently expects to maintain a better competitive position in the financial sector, which is more attractive to private agents from the rest of the world. The dollar's status as a leading vehicle currency is to be maintained indirectly through the competitive capabilities of a more innovative financial system. However, China is focusing more on being the first to introduce CBDC, which can be used as a springboard to increase the volume of private cross-border payments, reduce their cost, and improve the functionality of digital services. This approach, again, fits into the theoretical framework of optimal digital areas and a new, more technologically oriented vision of currency internationalization.

It should also be noted that developed countries prioritized improving the efficiency of payment services before the start of an open geopolitical confrontation and increased risks of global economic fragmentation. Geopolitical fragmentation can affect international currencies through several major channels, namely politically motivated trade regionalization, shrinking global supply chains and their reorientation, relocation of FDI, and changes in priorities for managing foreign sovereign assets (Aiyar et al., 2023). Such channels are more likely to have a negative impact on the potential exclusive dominance of the dollar. state that the emergence of a China-US trade bloc is likely to reduce the dollar's share in international payments in the long run if the former pursues an aggressive policy of

pushing the renminbi in exchange for access to the Chinese market (Chahrour & Valchev, 2023). It is likely that the seizure of Moscow's sovereign assets has affected the confidence in the main reserve currencies – the U.S. dollar and the euro. Presumably, the Fed and the ECB should investigate compensating measures to mitigate the risks of a decline in the global role of their currencies. This would fit into the logic of Cong and Mayer's (2022) model regarding the sequence in which countries prefer to implement CBDCs, however, such a compensatory approach appears excessive from a more traditional view of international currencies (Cohen, 1971; 1998; 2015; Kenen, 2009).

Technology and geopolitics vs. system rigidity: from demand for foreign exchange reserves to transaction privacy

Technological factors allow for the emergence of an alternative trajectory for the internationalization of the renminbi, which is expected to result in a more diverse configuration of the global monetary system. Geopolitical tensions make the technological factor particularly important. It is increasingly looking like a bet in a geopolitical casino that could yield a life-changing win or easily turn into one of many middling efforts to reshape the global monetary system without contributing to its stability.

The expansion of new technologies suggests that the more convenient functionality of a digital currency allows for its internationalization based on market forces. However, the emergence of new technologies does not automatically change the way the global financial system functions, i.e., the supply of safe assets remains inelastic. It does bring new challenges, which create additional difficulties in the course of internationalization of the challenger-currencies.

The issue of reserve currencies is the most critical point in discussions about the sustainability and prospects of the global monetary order. This is both the pinnacle of currency internationalization and a reflection of the ability to ensure macrofinancial stability. Moreover, competition in reserve assets is a more complex phenomenon institutionally than competition in cross-border payment services. Therefore, slow changes in reserve currencies largely determine the rigidity of the transformation of the global monetary system in a broader sense. On the other hand, reserve currency status is what engenders the traditional discontent with the U.S. dollar in the form of its excessive privilege, compounded by geopolitical discontent in the ability to impose restrictions on U.S. dollar-denominated sovereign assets.

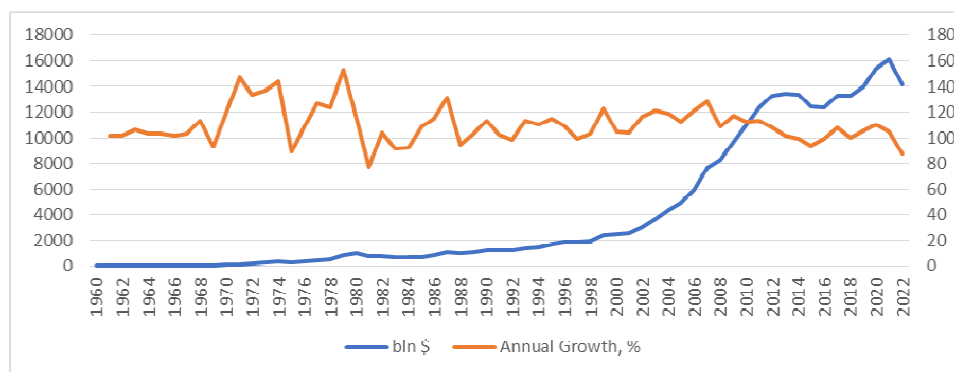
Setting aside the question of why some countries may be unhappy with the risk of being sanctioned, there are more reasons than mere capacity of the U.S.

financial market for the U.S. dollar retaining its status as the main reserve currency for a long time. The reserve status is determined by the qualities of the assets generated by the financial system, i.e., the supply of assets. Meanwhile, the demand for such assets is determined by the tendency of central banks to hoard foreign exchange reserves. At the same time, the scale of foreign exchange reserve hoarding and significant asymmetries in the degree of such holdings allow for the possibility that the reserve asset market could be influenced by factors that ensure its resilience and by factors that enable central banks to diversify their foreign assets (Koziuk, 2015). Taken together, this could lead to a system of reserve currencies less inclined toward multipolarity. Rather, it would reproduce elements of a monopolistic competition market with a clear leader. The latter would lose or gain market share depending not so much on fundamental factors as on variations in preferences for managing foreign exchange reserves over time. However, the very fact of structurally determined demand for foreign exchange reserves supports a certain stability of this particular market configuration. The approach outlined by Koziuk (2015) is somewhat different from the more formal variant of Farhi and Maggiori (2018, 2019), who also conclude that a multicurrency world is different from one with a hegemonic leader, but neither better nor worse. In both cases, the demand for foreign exchange reserves is an important attribute of the current global monetary system's ability to restore equilibrium over time.

Trends in the accumulation of foreign exchange reserves indicate that central banks' interest in further hoarding foreign assets will continue, despite a certain decrease in their holdings in recent years (Figures 1-4).

Figure 1

Global foreign exchange reserves, 1960-2022

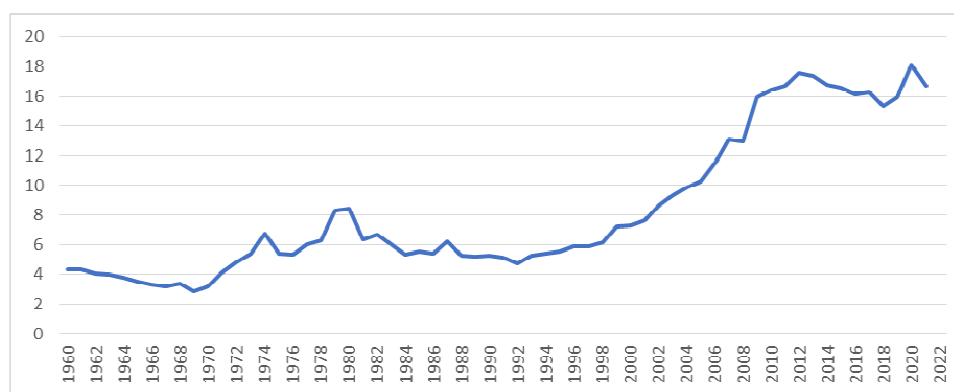


Source: designed by the author based on data from the IMF and the World Bank.

Thus, the data in Fig. 1 indicate that both the absolute and relative growth rates of global foreign exchange reserves have slowed down significantly in recent years. In some years, the volume of global foreign exchange reserves decreased. A return to the exponential trend of their growth, which was observed from 2002 to 2014, is unlikely. This is confirmed by the data on the ratio of global foreign exchange reserves to GDP (Figure 2).

Figure 2

Global foreign exchange reserves as a percentage of global GDP, 1960-2022

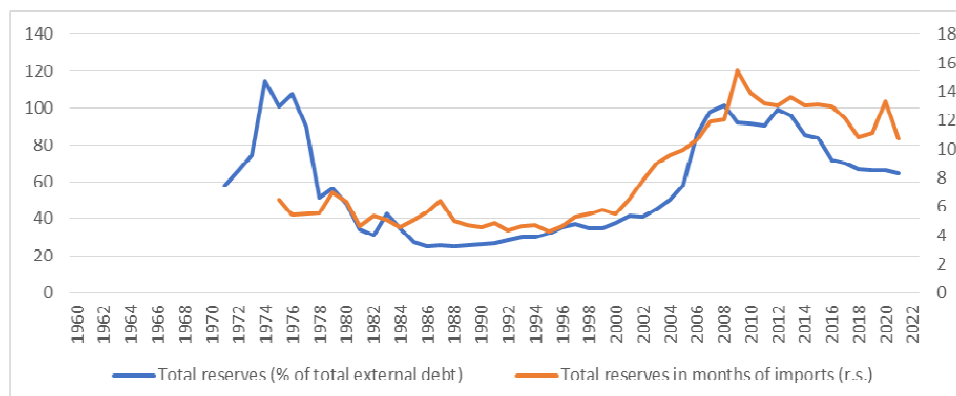


Source: designed by the author based on data from the IMF and the World Bank.

As shown in Fig. 2, the ratio of foreign exchange reserves to GDP has not grown significantly in recent years. The exponential trend of reserves growth to GDP from 2002 to 2014 (Fig. 2) corresponds to the rate of their volume (Fig. 1). In both cases, central banks were trying to rebuild reserves after losing them.

The reason why monetary authorities in many countries are seeking to rebuild foreign assets may stem from a longer-term trend of declining relative reserve adequacy ratios. Figure 3 shows that reserve coverage of months of imports and reserve coverage of external debt on a global scale, although exceeding traditional metrics, have been deteriorating for a long time. The global financial crisis marked a turning point, after which the above-mentioned adequacy ratios did not return to the previous trend and even worsened.

Figure 3

Adequacy of global foreign exchange reserves

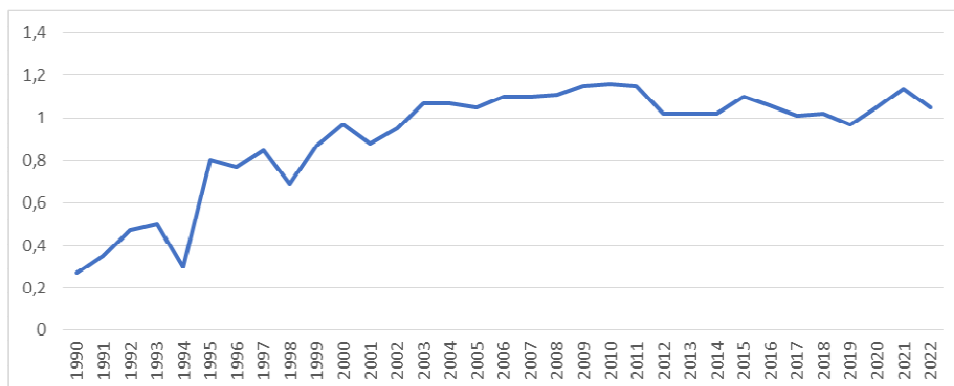
Source: designed by the author based on data from the IMF and the World Bank.

Of course, foreign exchange reserves are not the only means of adjustment to external shocks. Many emerging markets have made significant efforts to improve the effectiveness of flexible exchange rates and financial market development as adjustment tools. However, the continued decline in the relative coverage of foreign exchange reserves despite efforts to rebuild them suggests that the risks of vulnerability to global shocks have hardly diminished. The fact that the external debt reserve coverage ratio declined faster than the reserve coverage ratio of months of imports indicates that vulnerability is not being offset by alternative channels of adjustment to shocks. The stagnation of the ratio between the total reserves and the reserves adequate under the ARA metric (Figure 4) also proves that the problem of vulnerability remains relevant to the global macrofinancial stability agenda.

As figure 3 and 4 show, the relative coverage of reserves in the world has declined. While it has not dropped to the point that threatens permanent destabilization, the very fact that the relative coverage of reserves has declined as central banks have tried to restore their levels indicates that global demand for reserve assets will persist for a long time. If there are no radical changes in the supply of reserve assets in the foreseeable future, the reserve asset system should remain highly rigid, despite China's efforts to accelerate the internationalization of the renminbi.

Figure 4

Ratio of total global foreign exchange reserves to global foreign exchange reserves adequate under the ARA metric



Source: designed by the author based on data from the IMF.

The demand for reserve assets is subject to the attempts to ensure macro-financial stability, so naturally it cannot be conditioned by technological considerations. The motives for holding or diversifying foreign assets may go beyond economic concerns, which is typical for gold, for example (Arslanalp et al., 2023; Koziuk, 2023). Similarly, the reorientation to an alternative model of reserve assets through the inclusion of cryptocurrencies, commodities, or production facilities does not necessarily mean that the technological factor is the key to competition between different classes of reserve assets. Such a reorientation is possible only in individual cases and most likely for a short time – until the first serious shock. It is no coincidence that the growing role of non-traditional reserve currencies (Arslanalp et al., 2022) does not match the technological advantages of the respective central banks in digitalization.

Table 1 shows the leaders among non-traditional currencies in the structure of central banks' foreign assets, according to Arslanalp et al. (2022). The quantified values of the relevant central bank's progress in implementing CBDC are added. The monetary authorities are not motivated to hold foreign assets denominated in these currencies because of the stage at which the respective central banks are in the process of implementing CBDCs. On the surface, it may seem that the countries presented in Table 1 are close to the forefront of preparations for the introduction of centrally issued digital money. But in truth, this reflects the development of their financial sector. They have sufficient fiscal space, macro-financial stability, and stable political institutions. Combined with this, their

financial systems already generate enough safe assets to be considered for foreign exchange reserve diversification. At the same time, they would be unlikely to gain a prominent place in the ranking of reserve assets according to traditional views on international currencies. Still, a more complex model of the reserve asset market makes such a situation quite possible (Koziuk, 2015).

Table 1

Major non-traditional reserve currencies and the progress of the central banks in implementing CBDCs

Currency	USD billion	Share, %	Progress measured by the Atlantic Council	Progress measured by the BIS
Total	1070	100	–	–
AUD	217	20	4	2
CAD	247	23	3	2
RMB	272	25	4	2
CHF	21	2		2
Other	315	29	–	–
KRW	81	8	4	2
SEK	63	6	4	2
SGD	51	5	4	2
NOK	49	5	3	2
DKK	47	4	1	1
NZD	12	1	2	1
HKD	11	1	4	2

Note: Grouped by the author. Data on currencies are from Arslanalp et al. (2022). Data on the BIS's assessment of progress as of 2020 are from Auer et al. (2020). The data on the Atlantic Council's assessment of progress for 2023 is based on the interpretation of the results presented in the Atlantic Council CBDC Tracker (Mühleisen, 2022). Each relevant milestone is assigned a value: Launched – 5; Pilot – 4; Development – 3; Research – 2; Inactive – 1; Canceled – 0.

Another dimension of the technological advantages of CBDCs in competing for international currency status concerns the design of central banks' digital currencies themselves and, consequently, the demand for them. Most of the studies that predict the benefits of CBDCs for leaders in currency internationalization assume an almost automatic demand for them, and that on a cross-border scale (Cong & Mayer, 2022; Prasad, 2023). Huang and Mayer (2022) and Buckley and

Trzeciński (2022) also conclude that CBDCs can radically reduce the cost of cross-border payments by acting as an alternative to SWIFT, and therefore China will gain an advantage in the competition for the status of an international currency. However, while the technological basis for cheaper cross-border payments is hard to question, it remains to be seen to what extent the design of a retail CBDC will be a factor in the progress of internationalization. Such design will be important even for the development of an international standard for the interoperability of either retail or wholesale central bank digital currencies.

The issue of design is crucial in determining how much CBDCs will be in demand. The success of a CBDC among residents of a particular country does not guarantee similar success among non-residents. There are different models for opening e-wallets, different approaches to the volume of CBDC issuance and the nature of transactions that they can be used for. Equally important is the question of whether non-residents will have access to national retail CBDCs at all, as this is a matter of monetary sovereignty. If China wants to maintain such sovereignty, a completely liberal approach to non-resident ownership of retail digital renminbi is unlikely to work. Similarly, there should be a sufficiently elastic supply of CBDCs and a virtually unlimited response to increasing demand for them so as to meet the needs of cross-border transactions on the scale of many progressing economies. This brings the problem closer to the traditional analysis of international currencies, pointing to a clear overestimation of technological advantages as grounds for competition for international currency status.

Another challenging aspect of CBDC design is privacy. In the digital world, privacy/anonymity is based on a combination of technology and institutions, and therefore cannot be an attribute of money as such, unlike all other historical forms of money. Hence, the acceptability of CBDCs at the level of a particular country will largely rely on the correspondence between the protection of privacy/anonymity of transactions and the preferences of the respective society. The cross-border distribution of a single CBDC, whatever its potential to compete for the status of an international means of payment, will rely on more than just the established network of users within the country of issuance. Such expansion will primarily depend on acceptance in multiple countries, whose residents would need to have the ability to use such a CBDC not only in bilateral settlements with the issuing country, but also with third countries. This means that the design of digital money should make assumptions about the prospects for demand from abroad if internationalization is to be a priority, which raises obvious questions as to the technological and institutional dimensions of monetary sovereignty. The political regime and guarantees of rights and freedoms are given an unexpected expression in the right to anonymity of money transactions. Research on the institutional and behavioral drivers of demand for CBDCs shows that a single design standard for centrally issued digital currencies across countries is unlikely. Economic agents may sacrifice privacy for convenience mostly when they do not trust monetary regulators (Koziuk & Ivashuk, 2022). On the other hand, the more de-

veloped countries become, the more economic agents begin to value the privacy of transactions. Countries differ quite a bit in their preferences for transaction anonymity (Auer et al., 2022).

Thus, combining the preferences of economic agents across countries is important. For a retail CBDC of a particular country to become internationalized, there must be no restrictions on its ownership by non-residents, and the latter must agree to the format of transaction privacy offered by the issuer. That is, creation of an optimal digital network, as suggested by James et al. (2019) and Brunnermeier et al. (2019), potentially requires behavioral, cultural, and institutional compatibility. Therefore, the optimal digital network appears to be a more complex entity than it seems at first glance. The geopolitical factor plays a role here. Privacy protection may be taken as a criterion of guarantees on rights and freedoms. Thus, differences in its standards may become a valid rationale for joining an optimal digital network, the composition of which would be determined by the participation of countries with different political regimes. In other words, if a CBDC-issuing central bank originates from an authoritarian country and claims to be a leader in the creation of such a network based on the internationalization of its own currency, the participation of private agents from countries with high potential for international transactions will be limited. Thus, if the issue of monetary sovereignty is important for such a central bank, it is unlikely that a retail CBDC will become a driver of internationalization on a globally significant scale.

Wholesale CBDCs designed specifically for cross-border payments are a different matter entirely, at the very least because the mutual adoption of CBDCs by different central banks, whether bilaterally or multilaterally, requires a certain level of coordination. This applies to both purely technical and political aspects of the issue. Existing CBDC interoperability projects of different central banks have not yet been tested by geopolitical problems. They mostly answer the question of the technological compatibility of different models of digital money. But even in this case, there are obstacles to the smooth development of the optimal digital area of the renminbi. CBDC design comes to the fore once again. If geopolitical considerations are extended to interoperability projects, the compatibility of CBDC designs may become delicately politicized. Here, transactional privacy can play a crucial role, as attitudes toward its protection differ significantly in Europe, the United States, and China.

The development of CBDC interoperability projects will obviously result in the emergence of a certain technological or design standard that key stakeholders will consider optimal. Currently, this issue has not yet reached the stage of practical implementation, but the theoretical problem of standardizing CBDC designs is already being discussed (Huang & Mayer, 2022; Buckley & Trzecinski, 2022). China's participation in such discussions is mainly conditioned by the fact that multifunctional systems of mutual CBDC recognition by partner countries require cooperative behavior. However, cooperative behavior is sometimes seen here as a way to influence the process towards results in line with the individual

goals of the participating actors (Frankel, 2023). Regardless of the motives that countries pursue in working on CBDC interoperability projects, the circle of participants in such projects will sooner or later be determined by the principles of forming optimal coalitions. However, reaching a compromise on many technical issues between multiple countries is doubtful altogether (Eichengreen, 2021).

If we extrapolate this to the theoretical construct of optimal digital areas, we can assume the emergence of optimal CBDC interoperability areas. They would combine the benefits to participants from the opportunity to increase the efficiency of international payments, improved customer service, and expanded benefits of money digitalization, on the one hand. On the other hand, they would be shaped by the extent to which countries mutually recognize approaches to CBDC design. Thus, the issue of privacy may become a criterion for the countries' division and preferences for a particular optimal CBDC interoperability area. Of course, this is the most radical option, which assumes that in the event of increased geopolitical confrontation the issue of CBDC design could escalate to the point where the conditional boundaries of optimal CBDC interoperability areas are determined by political rather than economic considerations. The alternative suggests that even if the world becomes more fragmented for global monetary reasons, multicurrency will allow for more coordination, not less (Frankel, 2023). "Dollar trap" prevents the world from disorderly shift from current dominant dollar status even if its role in payments diminishes (Prasad, 2022).

The impact of digital technologies on internationalization processes is unlikely to be entirely based on market forces. Leadership in the introduction of retail CBDC may theoretically allow for an advantage in global monetary competition based on market drivers, i.e., when technologies contribute to an alternative historical trajectory of internationalization, and the demand for such a CBDC is based on the preferences of economic agents. However, a rigid association of technology, market drivers of internationalization, and changes in the configuration of the global monetary system ignores the design of retail CBDCs and the issuer's readiness to circulate them freely among non-residents. In contrast, wholesale CBDCs involve less direct competition and more coordination, and therefore the alternative trajectory of internationalization in the digital world is likely to be less radical than techno-enthusiasts assume. That is, there are two different options in this trade-off. In the case of retail CBDCs: market-driven internationalization in the new digital environment vs. CBDC design that is acceptable for monetary sovereignty and global acceptability. In the case of wholesale CBDCs: leadership in standardizing CBDC design requirements vs. CBDC design acceptable to monetary sovereignty and involving as many participants as possible in CBDC interoperability projects. Both trade-off options allow for a slow transformation of the global monetary system in terms of currency competition for the role of international means of payment, but hardly touch the core of this system, i.e., reserve assets. Of course, the risks of sovereign immunity under the influence of geopo-

litical tensions do not disappear. However, the reliance on the technological factor for a radical reformatting of the global monetary order seems to be overestimated.

Conclusions

Digitalization and geopolitical challenges have become prerequisites for testing traditional approaches to the internationalization of a currency and its international role. The prospects for the introduction of CBDC, especially by China, are often perceived as a powerful driver for the transformation of the global monetary system based on market forces. The theoretical approach of optimal digital area and currency competition in the digital environment reinforce the idea that the technological factor can be considered a prerequisite for the emergence of a new trajectory in currency internationalization that favors China and weakens the prospects of the U.S. dollar.

Most views of the RMB's technology-driven competitive advantage appear to be overly optimistic. First, the international status of a currency is not based solely on the functional advantages of payment services that support retail transactions. Second, CBDC design matters. Monetary sovereignty goals may not be consistent with a CBDC design that is compatible with additional internationalization impulses. Third, the demand for CBDCs may depend on the design, in particular, on how well the privacy issue is addressed. Fourth, cross-border CBDC operations are likely to require cooperation among central banks, with the result that unilateral advantages in technology may be limited by multilateral requirements for CBDC design interoperability. Fifth, geopolitical tensions may escalate to the point where the issue of compatibility of CBDC designs for international payments is politicized. As a result, an optimal interoperability area may emerge, i.e., mutual recognition of CBDCs or a cooperative mechanism for their use for cross-border payments will follow the lines of geopolitical alliances. Sixth, the slowdown in the growth of foreign exchange reserves is not reason to believe that global demand for reserve assets will decline. The nature of reserve assets relies on the ability of the financial sector to generate safe assets and provide liquidity, etc. Therefore, technological changes and geopolitical challenges will allow for greater multicurrency in terms of cross-border payments. The core of the global monetary system will remain unchanged for a long time.

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Received: August 5, 2023.

Reviewed: August 15, 2023.

Accepted: August 27, 2023.