UNIVERSITÄT BAYREUTH

Prof. Dr. Hartmut Egger
Chair of Economics II
International Macroeconomics and Trade

Dollar Dominance and Sanctions

Do financial sanctions on Russia undermine the greenback's dominant reserve currency status?

written by
Vitus Ernst Rennert
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Abstract

This paper examines whether United States' asset freezes on the Central Bank of Russia undermine the dollar's reserve currency dominance. It reviews the related literature on dollar dominance, the determinants of foreign reserve compositions, and financial sanctions. The dollar's share in foreign reserves significantly derives from its broad use international trade and finance, but geopolitical relations also influence reserve holdings. United States' asset freezes pose a threat that central banks' dollar reserves become illiquid and unsafe. However, geopolitical risk is only imminent for geopolitical adversaries of the United States who actively pursue conflicting security interests. A significant reduction in the dollar's share is unlikely, as military allies of the United States account for a larger share of dollar reserves and other currencies do not present credible alternatives.

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List of Abbreviations

BIS	Bank for International Settlements
CBR	Central Bank of Russia
COFER	Currency Composition of Official Foreign Exchange Reserves
CHIPS	Clearing House Interbank Payment System
ECB	European Central Bank
EU	European Union
FX	Foreign Exchange
GDP	Gross Domestic Product
IMF	International Monetary Fund
IMS	International Monetary System
US	United States
USD	United States Dollar
RMB	Renminbi
SWIFT	Society for Worldwide Interbank Financial Telecommunication

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1. Introduction

The dollar is the internationally dominant currency. Its dominance is especially prevalent in the global composition of official foreign exchange (FX) reserves. 58.36% of official reserve holdings are denominated in dollars, totaling USD 6.47 trillion globally (International Monetary Fund [IMF], 2023). Because of the dollar's dominance in the international monetary system (IMS), the United States of America (US) can impose financial sanctions that are considered particularly stinging and impactful for its targets (McDowell, 2023). US financial sanctions restrict countries', organizations', or individuals' access to the dollar-based financial system. They can prohibit US entities from engaging in transactions with targets or freeze targets' assets denominated in dollars. Sanctions are a geopolitical instrument imposed to deter and punish behavior by foreign actors that threaten national security and foreign policy interests. Since the end of the Cold War, financial sanctions have been imposed more often, with the US as the most frequent and prominent issuer (McDowell, 2023; Norrlöf, 2022). In reaction, political scientists (e.g. Drezner, 2015) and US government officials (e.g. Lew, 2016) raised concerns that increased reliance on the dollar as a geopolitical instrument may trigger a "backlash effect" on the dollar (McDowell, 2023, p. 4). Foreign actors may be incentivized to reduce their reliance on the dollar and diversify financial activities into other currencies.

This argument gained new traction in light of Russia's attack on Ukraine in 2022. The US and other nations swiftly responded by imposing financial sanctions on the aggressor. Prominently received was the freezing of the Central Bank of Russia's (CBR) FX reserves. While sanctions against central banks have been imposed before, the measures against the CBR are unprecedented, considering the large number of total reserves frozen and Russia's entanglement in the global economy and politics. With the US at the forefront of sanction efforts, the concern about a backlash against the dollar reached newspaper headlines, citing countries' supposed willingness to reduce reliance on the greenback (Jamrisko & Carson, 2022; Jha, 2023). However, it also led renowned experts to question the persistence of dollar dominance in the future, specifically as a reserve currency. Prominent voices project a multipolar currency system (Gourinchas, 2022), a world of currency disorder (Wolf, 2022), or a further erosion of the dollar's dominance in foreign reserves (Eichengreen, 2022).

Since then, a few scholars have made scientific contributions that analyze the impact of financial sanctions on the IMS. McDowell (2021, 2023) introduces a general framework for analyzing adverse influences of financial sanctions on international currencies. Weiss (2022) breaks down official foreign reserve holdings of US dollar assets by geopolitical relation with the US. Brunnermeier et al. (2022) and Norrlöf (2022) discuss limitations of other international currencies.

This paper examines whether reserve asset freezes on the CBR negatively affect the dollar's reserve currency status. It answers this question in the following way: First, it provides the theoretical foundations on dollar dominance (chapter 2) and reserve currency choice (chapter 3). Then, it considers how an increased threat of US asset freezes impacts central banks' reserve portfolio considerations (chapter 4). Lastly, it discusses the prospects for an ensuing reduction in the dollar's share of global reserves (chapter 5). It does so by drawing on a broader set of existing literature, combining insights from economics and political science.

Importantly, this paper only concerns the *composition* (i.e. currency shares) of *official* foreign reserve holdings. Matters of size or adequacy of official foreign reserves remain untouched. The same holds for asset holdings of foreign private investors. Moreover, the fifth chapter does not consider the possibility that central banks may diversify reserve portfolios in reaction to broader currency changes in international trade and finance.

The remainder of this paper is structured as follows: The second chapter sets the foundation for understanding the dollar's dominance in the IMS. It introduces the different conceptual roles of international currencies and how they are interlinked. It then characterizes the dollar as the dominant currency in all these roles. Lastly, it presents two network effects that lead central banks to favor holding reserves in the dominant currency.

The third chapter zooms in on the topic of foreign reserves. First, it focuses on the rationale for holding reserves and the asset properties central banks generally pursue in their portfolio management. Second, it sheds light on the economic factors that empirical research has found to drive reserve compositions. Lastly, it presents insights from the literature in political science on geopolitical influences on reserve compositions.

With a profound understanding of the underlying dynamics that influence central banks' reserve compositions, the fourth chapter examines the shock induced through 2022's measures against the CBR. First, it analyzes the freezing of the CBR's reserve assets. Then, it assesses how the threat of such asset freezes may impact other central banks'

reserve portfolio considerations. In doing so, it points out that central banks likely perceive the threat of asset freezes differently, depending on their geopolitical relation with the US.

Based on this, the fifth chapter discusses the prospect of a reduction in the dollar's share in global reserve holdings. First, it considers the allocation of dollar reserves by holding countries' geopolitical relation with the US. Second, it discusses whether other currencies present credible alternatives for central banks to diversify into. The third section evaluates the theoretical insights of this paper in light of 2022's developments in foreign reserve holdings. It considers how the dollar's share evolved since February 2022 and reviews preliminary empirical evidence on geopolitical influences.

This paper arrives at the conclusion that US asset freezes on the CBR do not undermine the dollar's reserve currency status. It is unlikely that the threat of asset freezes leads to large reduction in the dollar's share in foreign reserve holdings in the near future.

2. Dollar Dominance

This chapter gives an account of dollar dominance in the IMS. First, it introduces a conceptual framework that distinguishes the different roles of international currencies. Second, it presents the empirical findings that the dollar is most widely used in all of these roles, giving rise to the *dollar dominance* hypothesis. Lastly, it complements empirical observations of dominance with theory by presenting the latest research on network effects between the different roles of the dollar. Studying the different roles, their empirical characteristics, and interactions provides an understanding of the dollar as the globally dominant reserve currency. Moreover, it introduces the notion that the dollar's use for foreign reserves derives from broader dollar use in international trade and finance. This is further explored in Chapter 3, which focuses on foreign reserves specifically.

2.1 The Roles of International Currencies

The literature on international currencies evolves around the three classical functions of money: As a *unit of account,* money is used for the pricing of goods and services. As a *medium of exchange*, money is used to settle financial transactions. Moreover, money is not only used for transactions but also as a safe *store of value*. Lastly, money can not only be distinguished by function, but also by sector. In all of the capacities above, money is relied upon by *private* agents and *official* institutions. Bain & Cohen (1972)

first employed this typology for analyzing the usage of monies in an international, that is, cross-border setting. Resulting from above's typology, they establish six distinct roles in which currencies come to use internationally. Table 1 schemes an adapted version, following Gourinchas et al. (2019) and Krugman (1984).

Table 1 – Roles of International Currencies

Function / Sector	*Private*	*Official*
Unit of Account	Trade invoicing	Anchor
Medium of Exchange	Vehicle	Intervention
Store of Value	Banking International debt	Reserves

Source: adapted from Gourinchas et al. (2019) and Krugman (1984)

Starting with the private sector, international currencies function as a unit of account for the invoicing of international trade. While classical assumptions suggest trade contracts to be denominated in the exporters' or the importers' local currencies, empirical research (e.g. Gopinath, 2016) shows that often this role is assumed by a third currency, one with international status.

This similarly holds for international currencies' function as a medium of exchange in financial transactions. International currencies assume the role of a vehicle in FX markets. Instead of bilaterally exchanging e.g. Mexican peso for Swedish kronor, transactions are usually performed in two steps against the dollar. Important characteristics conferring vehicle status are the depth and liquidity of the currencies' financial markets, guaranteeing low transaction costs (Gourinchas et al., 2019). Lastly, international currencies are relied upon as a store of value. Banks intermediate assets and firms borrow money denominated in international currencies (Gourinchas et al., 2019). Most international assets are denominated in a few relevant currencies.

In the official sector, all roles of international currencies directly regard central banks' monetary policy operations. Countries peg their exchange rate to international currencies (Anchor) and stabilize it by intervening in the deep and liquid FX markets that only international currencies provide (Intervention). Relatedly, these are also the currencies in which countries' official reserve assets are denominated (Reserves). While conceptually separable, Krugman (1984) already noted the strong complementary effects between different roles.

2.2 The Dominance of the Dollar

In principle, several currencies could fill out these roles. However, the history of the IMS suggests differently. Only a few currencies emerge to carry international relevance, and within that selective group, the concentration centers around one clear leader. In the beginning of the 20th century, the British pound sterling assumed the role of the monetary hegemon (Eichengreen et al., 2018). Since the second world war and beyond the collapse of the Bretton-Woods system that institutionalized the greenback's central role, it is the US dollar. Today, dollars are the most widely used money globally, coining its status as the *dominant* international currency. More precisely, *dollar dominance* can be summarized as a constellation of several empirical findings showing the dollar enjoying the largest share in all roles of international currencies (Gopinath & Stein, 2021). This section presents the empirical findings on the dollar's dominance for each of its three functions.

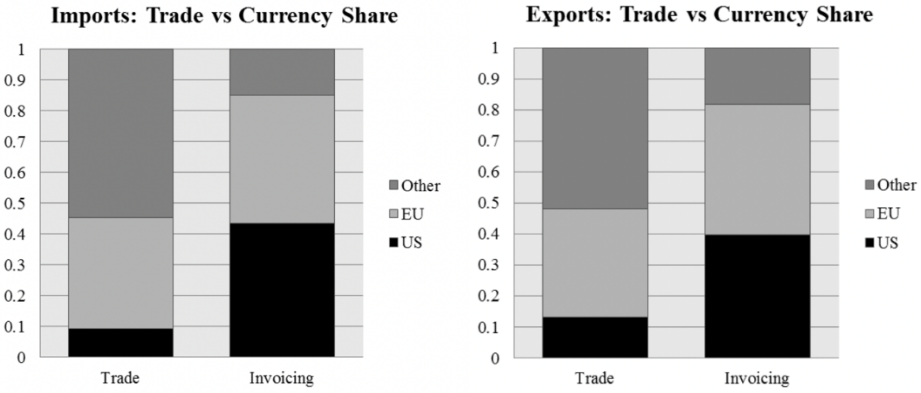
The Dollar as the Dominant Unit of Account

In a sample of 44 countries' trade data representing ca. 56% of global trade from 1999 to 2014, Gopinath (2016) finds that the dollar's share in invoicing international trade vastly exceeds the US' share in global imports and exports. Fig.1 – taken from Gopinath (2016) – plots the shares of countries' imports (exports) from (to) the US, the eurozone, and the rest of the world against the currencies in which they are invoiced (dollars, euros, and others). Specifically, the dollar's invoicing share in imports is 4.7 times the share of imported US goods. To a lesser extent, this holds for global exports, where the share of dollar invoicing exceeds that of US exports 3.1 times. The uniqueness of this characteristic can be best explained by contrasting it with the euro – often characterized as a regionally dominant currency in Europe. For the euro, trade and invoicing shares are much more aligned, with the latter exceeding the former only by 1.2 times (for imports and exports alike).

The greenback also carries significant relevance in the official sector as the currency to which countries peg their exchange rate. Ilzetzki et al. (2019) show that 62% of a 195-country sample maintained the dollar as their anchor currency in 2015. Weighting this group by their production, they account for approximately 50% of global gross-domestic product (GDP, US excluded; Ilzetzki et al. 2019). These metrics come close to the levels of the Bretton-Woods era, which saw countries' pegging to the dollar multilaterally formalized. Ilzetzki et al. (2019, p. 5). regard dollar anchor dominance as an

important indicator of the dollar's overall relevance to global markets, revealing the preferences of monetary authorities worldwide.

Figure 1 – Dollar Dominance in International Trade



Source: taken from Gopinath (2016).

The Dollar as the Dominant Medium of Exchange

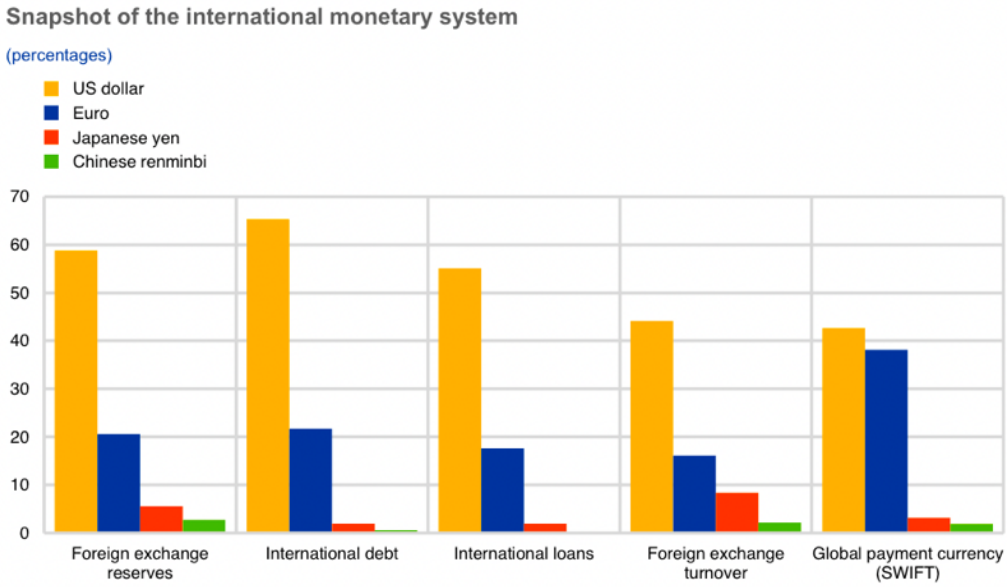
To FX markets, dollars assume a central role. This has much to do with its vehicle currency status outlined in the previous section. The triennial survey of the Bank for International Settlements (BIS) finds that 88.3%[1] of all FX trades featured the dollar on one side as of April 2022 (BIS, 2022). Fig.2 taken from European Central Bank ([ECB], 2022), paints a similar picture. It contrasts the dollar's 45% share in global FX turnover with its competitors euro (ca. 17%) and yen (ca. 8%) as distant followers. These figures reveal the depth and liquidity of dollar markets, which are unparalleled and valued by private and official agents for their transactions. With high market participation, participants can find their counterpart (buyer, seller) more easily, and transaction costs decrease (Krugman, 1984). Moreover, large quantities can be absorbed by sufficient demand and sold without adverse price effects for the seller.

On the official side, central banks' currency of choice for intervention in FX markets is determined by the dominant vehicle currency and by the anchor to which they peg their exchange rate (Gourinchas et al., 2019). The former, since "it is the currency in which most market players transact and may need to obtain emergency financing" (Gourinchas et al., 2019, p. 6). The latter, since it is the currency against which they want to stabilize

[1] With two currencies involved, the sum of individual currency shares in the BIS Statistic totals 200%. This does not hold for the subsequent ECB Statistic. There, the sum equals 100%. This explains the difference in the two figures presented.

their value. This implies that most central banks are involved in buying and selling dollars.

Figure 2 – Dollar Dominance in the International Monetary System



Source: taken from European Central Bank (2022), based on BIS, IMF, Society for Interbank Worldwide Financial Telecommunication (SWIFT) and ECB calculations.

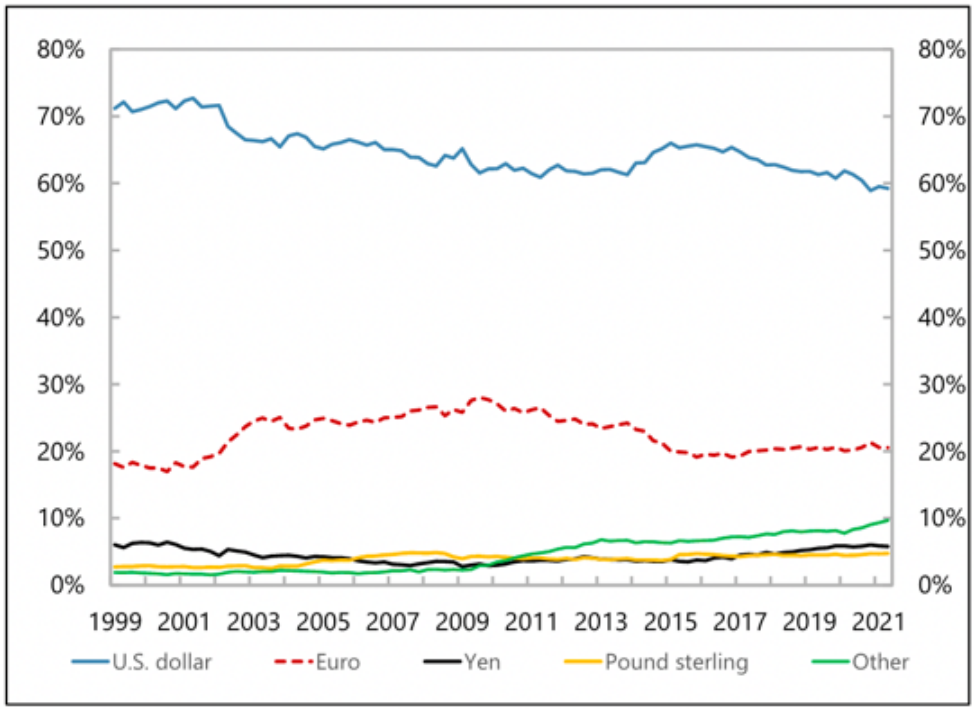
The Dollar as the Dominant Store of Value

The international financial system relies strongly on dollars as a safe instrument for finance and investment. Fig. 2 from European Central Bank, 2022) depicts the currency shares of international debt and international loans with dollar liabilities comprising a record 65% and 55% respectively. This reflects preferences on both corporate borrowers' and global investors' sides. Aside from their local currencies, firms outside the US most often issue debt denominated in dollars. Similarly, global investors usually prefer assets issued in their local currencies, except for dollar-denominated securities (Gourinchas, 2021). In fact, dollar-denominated assets – led by US Treasury bills – are considered globally as the safest instruments to store wealth over time and even though global demand exceeds the issuance of US safe assets, they are integral to the stability of the international financial system (Caballero et al., 2017).

The relevance of US safe assets is best characterized by their role in the official sector. Fig. 2 shows the global currency shares of official foreign reserve holdings. As of 2023, dollar-denominated assets comprise 58.36% of FX reserves, totaling USD 6.4 trillion in

absolute terms (European Central Bank, 2022; International Monetary Fund, 2023). Despite the dollar clearly dominating official reserves, scholars have recently highlighted a slow decline in the dollar's share in the past 20 years. Arslanalp et al. (2022) find a 12 percentage-point drop in the dollar's share of global FX reserves from 71% in 1999 to 59% in 2021. Fig.3 illustrates reserve currency shares for that period, demonstrating the mentioned decline. They accredit the decline to active portfolio diversification by central bank reserve managers into "non-traditional reserve currencies" (Arslanalp et al., 2022, p. 6), namely the Chinese renminbi, Canadian and Australian dollars, Swiss francs, and others. As visualized in Fig. 4 (comprised in the "other" category), non-traditional currency's share has risen from negligible levels to 10% over the same timeframe. While the authors propose that dollar reserve dominance may be on the retreat, they view their evidence as rather suggestive of a multipolar currency scenario instead of the euro or renminbi taking the greenback's place (scenarios frequently discussed in the past).

Figure 3 – Currency Composition of Global FX Reserves 1999-2021 (in percent)



Source: taken from Arslanalp et al. (2022), based on IMF COFER database.

Note: The Australian dollar, the Canadian dollar, the Chinese renminbi, the Swiss franc and other currencies not separately identified in the COFER database are summarized under "other".

Although the study of composition shares yields interesting insights, developments in absolute terms must also be considered. At the turn of the century (Q1 2000), the IMF's Currency Composition of Official Foreign Exchange Reserves Database ([COFER], 2023) reported a total of USD 1.8 trillion in FX reserves. At the end (Q4) of 2022, this figure had risen to USD 11.9 trillion. One factor explaining the steady rise throughout that timeframe are large reserve accumulations by emerging markets and commodity-exporting economies, most prominently China (Chiţu et al., 2019).

2.3 Dollar Dominance and Network Effects

The previous section presented the empirical findings constitutive of dollar dominance in the IMS. While the dollar dominates in all conceptually separable domains of international currencies, research on the topic is not confined to isolated categories or pure empirical work. Instead, economists try to account for the underlying dynamics why one currency assumes all these roles in such a strong fashion. Early works (e.g. Kindleberger, 1981; Krugman, 1984) highlighted the importance of network effects in determining international currency choice. Much like the lingua franca of money, the dollar may emerge naturally as the international currency of choice due to its widespread acceptance and liquidity (Kindleberger, 1981). Recently, interest in the topic renewed (e.g. Gopinath & Stein, 2018, 2021; Gourinchas et al., 2019). This section shortly outlines two synergic interactions between the different roles of the dollar. While relevant for understanding the dollar's entrenchment in the IMS, it also builds to the understanding of foreign reserves and its determinants.

Settlements, Vehicles, Interventions, Anchors and Reserves

Based on prior research, Gourinchas et al. (2019) summarize the synergic interaction presented in this paragraph. Currencies of invoicing and settlement are closely related since the currency in which a payment is due is featured at some step in the payment process. Large transaction volumes in dollar markets contribute to the liquidity and safety of the currency: Large quantities can be transacted without adverse price movement (liquidity, as defined in Gourinchas et al., 2019, p. 6), and dollar claims can be assumed "to buy a known quantity of some specific goods at a future date" (safety, as defined in Gopinath & Stein, 2021, p. 785). In turn, safety and liquidity of the dollar are crucial conditions for its status as a vehicle currency (Gourinchas et al., 2019). This has important implications on the policy side: Central banks intervene in FX markets to stabilize the external value of their local currency, whereas only the deep and liquid

markets of vehicle currencies are capable of absorbing (providing) the large quantities induced (extracted) by the policymaker without destabilizing market turmoil (Gourinchas et al., 2019). Central banks are further incentivized to intervene in dollar markets if they choose the dollar as their anchor, for it is the currency they want to stabilize their exchange rate against (Gourinchas et al., 2019). In trying to ensure predictable conditions for domestic actors, the anchor choice is likely to be the dominant currency due to its relevance to domestic firms engaged in international trade (invoicing) and the financial system (external debt). Dominant vehicle and anchor status imply that central banks actively buy and sell dollars as they want to stabilize the domestic currency (Gourinchas et al., 2019). In that way, private agents' dollar invoicing and central banks' FX interventions lead to a buildup of FX reserves, maintained as a buffer for monetary policy.

Invoicing, Banking, and Reserves as Last Resorts

Gopinath & Stein (2021) propose a theoretical model of strategic interactions between dollar invoicing and banking patterns in emerging markets. Due to frequent dollar invoicing of firms and the stability of dollar prices, firms have predictable dollar-denominated spending in the future. In order to ensure future spending on dollar-denominated imports, firms demand deposits and safe assets that generate future income in dollars (Gopinath & Stein, 2021). With an increasing demand for dollar assets, their prices rise and interest rates decrease. As banks in emerging markets are drawn to meet their customer's demand for dollar assets, they seek opportunities to intermediate such claims without becoming exposed to exchange rate risk themselves (Gopinath & Stein, 2021). Aiming to generate dollar revenues to back dollar liabilities with dollar claims across their balance sheet, they are drawn to issue loans due in dollars, even if the recipients only engage in transactions in domestic currency (Gopinath & Stein, 2021). The result is an increase in the issuance of dollar assets and subsequent dollarization of the domestic financial system. Further repercussions on central banks' reserve holding are explored in Gopinath & Stein (2018). As central banks want to stabilize their financial system in the event of a currency crisis, one role associated with this is providing liquidity and emergency financing to domestic actors and act as a lender of last resort. If a considerable portion of firms', households', and banks' payment obligations are dollar-denominated, this implies that the liquidity in need is – to some degree – dollar liquidity (Gopinath & Stein, 2018). A considerable stockpile of dollar reserves then enables central banks to act as a lender of last resort.

This section presented two strategic interactions between the different roles of international currencies. In both, the rationale for accumulating reserves in dollars rests on its use in international trade and private financial markets. This is best captured by Eichengreen (2011), who remarks in his historical analysis that "experience suggests that the logical sequencing of steps in internationalizing a currency is: first, encouraging its use in invoicing and settling trade: second, encouraging its use in private financial transactions; third, encouraging its use by central banks and governments as a form in which to hold foreign reserves". This exemplifies a critical point in the discussion of international reserve compositions. Namely, reserve compositions are not just independently determined by the political and economic preferences of governments and their subordinated central banks. Instead, reserve compositions are significantly shaped by private actors' currency decisions in trade and financial relations. As such, the dollar's dominance in foreign reserves is part of a broader entrenchment of the dollar in the IMS and the global economy.

3. Foreign Reserves

Based on a conceptual typology of international currencies, the last chapter provided an empirical overview over the dollar's dominant role and broad-based entrenchment in the IMS. In doing so, it introduced the concept of FX reserves and established the dollar as the key reserve currency around the globe. This chapter expands on the topic of reserves. While the level and the adequacy of countries' reserves also present topics of scholarly research, this chapter – and paper – focuses on the composition of reserve holdings, since its general concern regards a potential decline in the dollar's global *share*. The chapter specifically examines the factors that determine countries' reserve compositions. The first subchapter outlines the reasons for holding reserves that are established in theory. It also presents the asset objectives that central banks generally want their reserves to fulfill. The second subchapter then points out the economic factors that empirical research in the field has found to determine reserve compositions. Most studies have focused on characteristics of the issuing currency and its economy that promote its use for reserves. Fewer work examined the factors that drive reserve demand on the side of the holding countries. Lastly, the third subchapter compliments the economic factors with insights from political science on geopolitical influences on reserve compositions. In doing so, it also becomes apparent how economic and geopolitical incentives both have favored high dollar reserve shares.

3.1 Central Bank Reserve Management – Reasons & Objectives

Virtually every country holds foreign currency reserves. Despite that, research on reserves is somewhat limited. On the one hand, countries and their economies differ and so do the circumstances central banks have to consider in their reserve management[2]. On the other hand, reserve exposure presents a delicate issue for many central banks, such that they do not publish data, or only report to the IMF and BIS confidentially. The literature on central bank's reserve management operations informs about the general reasons and objectives of foreign reserves. This sets the foundation for an understanding of the economic determinants of reserve compositions that empirical research has established (presented in section 3.2).

Reasons for Holding Reserves

Historically, foreign reserves emerged in the times of 19th century's gold and silver standards as a further way to formally back the domestic currency (Eichengreen et al., 2018). Since then, reasons have evolved significantly. They can be classified according to the purposes for which reserves may be utilized: FX interventions, transaction operations, and wealth diversification (Roger, 1993).

Nowadays, reserves are mostly regarded as an instrument by which central banks can influence their currencies' external value (i.e. its exchange rate). To do so, central banks occasionally need to intervene in FX markets. If the domestic currency experiences appreciation pressures, central banks would buy foreign by selling domestic currency. This leads to a buildup of FX reserves in central banks' balance sheets. To resist depreciation pressures, they require FX liquidity to be able to buy domestic currency again. Countries who peg their exchange rate to an external anchor need to monitor fluctuations closely and intervene more often (Chiţu et al., 2019). Countries whose exchange rate freely floats do not necessarily need to intervene, as the exchange rate can adapt to developments on FX markets. Still, their central banks may intervene if developments on FX markets become disorderly. This involves balance of payment shocks such as interrupted capital inflows (Chiţu et al., 2019). In such circumstances, foreign reserves allow the central bank to act as a lender of last resort in foreign currency liquidity to its domestic banking system. This is especially relevant for countries with significant dollarization of their banking sector. Thereby, reserves serve as a precautionary buffer or self-insurance to cover the monetary liabilities needed for intervention in FX markets and exchange rate policy (Chiţu et al., 2019).

[2] For a collection of case study analysis, consider Bjorheim (2020)

Central banks also play a crucial role in facilitating cross-border and cross-currency transactions. With this role comes a set of operational activities that aims to meet domestic actors' transaction demands in foreign currencies (Nugée, 2000). Through foreign reserves, central banks can provide FX liquidity to private actors and the government that need to service foreign currency liabilities and debt obligations abroad (Nugée, 2000). FX for these activities could also be bought on spot in the market. However, foreign reserve can smooth out payment schedules and enable cheaper external borrowing, as they signal the ability that the country is able to meet its obligations in foreign currencies (Nugée, 2000).

Lastly, reserves may be held out for purposes of wealth diversification. On its own, this is a minor reason for holding reserves in the first place, as returns on reserve assets are usually lower than on other asset classes. However, large accumulations of foreign reserves since 2000 have been accompanied by a stronger pursuit of return motives on reserve assets and a rising number of sovereign wealth funds (Nugée, 2020). As such, wealth considerations do influence central banks' reserve management (Nugée, 2000; Roger, 1993).

Asset Objectives

Three objectives for central banks' reserve assets follow from the motives discussed. Virtually all central banks pursue assets with these properties in their reserve portfolio management: security, liquidity, and – within the confinements of both – returns (Borio et al., 2008; Nugée, 2000, 2020). As seen, reserves are held – to some degree – out of precautionary reasons while amounting to a large portion of countries' official assets in general and central banks' balance sheets specifically. In order to ensure preservation of public capital and minimize balance sheet risks, central banks want to hold risk-free safe assets (Borio et al., 2008). Safe assets carry little risk that the borrower will default on its debt (credit risk) and that future payment flows derived from it will fall relative to alternatives in other currencies due to exchange rate movements (currency risk; McDowell, 2023). The US government has never defaulted on its debt, which is why US Treasury bonds are – similar to public debt of other advanced economies – considered one of the safest instruments globally (McDowell, 2023). Additionally, the dollar is generally perceived to have a stable (external) value. As countries peg their exchange rate to the dollar, currency risk is further reduced. Moreover, it enjoys the status as a global safe haven, meaning that the dollar tends to appreciate in times of global financial distress.

Another risk central banks want to minimize in their portfolio is that assets cannot be sold and converted into cash quickly to meet financial demands for transaction operations or FX interventions (liquidity risk; McDowell, 2023). While holding reserves is motivated by their eventual liquidation, it is hardly possible to predict when exactly reserves need to be utilized, as FX interventions or transaction operations react to market developments. Therefore, reserve management needs to ensure that assets are readily available on a large scale whenever needed (Nugée, 2000). As such, central banks value highly liquid assets, such that transactions can take place rapidly and with little impacts on price (Borio et al., 2008). As for the dollar, the market for US Treasuries is considered the deepest and most liquid public debt market in the world (Brunnermeier et al., 2022).

Lastly, central banks usually indicate that they maximize returns on their assets within the confinements set by security and liquidity. Considering the size of foreign reserve portfolios and the income they may generate the pursuit of return objectives is reasonable. While financial management frameworks differ, return objectives often find implementation in the form of investment tranches or allocated risk budgets. Pursuit of return objectives has developed concurrent to the large accumulation of reserves in the past 20 years and is likely to be higher for central banks with substantially large portfolios, such as Saudi Arabian or Hong Kong Monetary Authorities (Nugée, 2020).

3.2 Economic Determinants of Reserve Compositions

Based on an understanding of the rationale for holding reserves, this paper proceeds to the determining factors of reserve compositions. In studying the determinants of reserve compositions, one can distinguish two empirical approaches. These correspond with two types of data available, the usual bottleneck in reserve research. The first string of research seeks to explain reserve currency shares and status at the *global* level. The underlying data gives aggregated currency shares, not distinguishing between the countries *holding* reserves. As such, it only captures characteristics of the *issuing* countries as explanatory of their currencies' shares. In turn, the second string of research aims to account for the considerations and characteristics of *holding* countries that drive compositions individually. It uses data provided and distinguished by country. Since country-level data is only rarely reported and available to the public, research in this area has been scarcer than its aggregate counterpart. The first subsection presents findings on issuing country's characteristics that drive global aggregates. The second subsection focuses on holding country's characteristics that drive individual compositions.

Reserve Status and Characteristics of the Issuer

Research on aggregate compositions has established three characteristics of the currency's issuer as most relevant in determining reserve status: economic size and relevance to global trade, confidence in the currency's stable value and the issuer's credibility, and financial markets' depth and liquidity. Additionally, there are two more general effects at work: inertia and network externalities.

Countries with a large share in global output, trade and finance enjoy "a big natural advantage" (Chinn & Frankel, 2006, p. 19) in international currency choice. Most studies (Chinn & Frankel, 2006; Eichengreen et al., 2019; Iancu et al., 2022) empirically measure economic size as the issuing country's share of global GDP. In that sense, global reserve currency shares are consistent with GDP shares led by the US and followed by the Euro area, China, Japan and the United Kingdom. Some (Iancu et al., 2022) also include issuer's trading volumes with the rest of the world, reflecting relevance to global trade.

Another determinant for reserve currency choice is confidence in the currency's stable value (Chinn & Frankel, 2006), also referred to as the issuer's credibility (Eichengreen et al., 2019; Iancu et al., 2022). The studies mentioned above measure credibility by looking at inflation volatility and exchange rate depreciations, which bear the potential of reducing the value of reserve assets. As foreign reserves comprise a large portion of central banks' assets, the stability of their value presents an important condition in reserve currency choice. Especially, since issuing countries' stance on fiscal and monetary policy can strongly influence exchange and inflation rates, and thereby the value of reserve assets.

Another factor established by the literature is the status of issuer's financial markets. Capital markets must be open and well-developed, as well as deep and liquid for central banks to acquire significant amounts of assets (Chinn & Frankel, 2006). This point is rather intuitive considering that the rationale for holding reserves largely rests on the ways in which they can be used, that is liquidized. Chinn & Frankel (2006) measure the development of issuing countries' financial markets by FX turnover in its financial center.

Lastly, historical evidence suggests that changes in reserve currency status occur very slowly. Most empirical studies (e.g. Arslanalp et al., 2022; Eichengreen et al., 2019; Iancu et al., 2022) consider an inertial bias that favors to hold reserves in the currency which has been the reserve currency in the past. The significance and relevance of iner-

tia is well established and suggests that historical ties may be a stronger influence to currency choice than short-term economic characteristics (Iancu et al., 2022). Inertia in reserve currency choice is further enhanced by the network externalities which influence international currency choice in general, as explored in chapter 2 (Iancu et al., 2022). Interestingly, Eichengreen et al. (2016) discover that since the collapse of the Bretton Woods system, network effects have weakened while the effects of economic fundamentals of the issuer as well as inertia have become stronger.

Reserve Compositions and the Demands of the Holder

Country-level data allows for an investigation that looks beyond issuing country's economies and captures how characteristics of holder's economies influence their reserve demand. Dooley et al. (1989) and Eichengreen & Mathieson (2000) first made influential contributions based on confidential disaggregated IMF COFER data. Their results lend support to the hypothesis that individual compositions are strongly determined by their use for transaction operations and FX interventions. Both studies find a country tends to hold more reserves in a given currency the more it trades with the issuing country, the more of its cross-border financial flows are denominated in that currency, and when it is pegged to that currency. In a later revisit, Iancu et al. (2022) notice financial flows to be particularly relevant to emerging economies, while trade flows impact advanced economies more strongly.

3.3 Geopolitical Determinants of Reserve Compositions

Dating back to Susan Strange's work on the British pound sterling (1971), political scientists have emphasized the relevance of politics to international monetary relations. The literature on reserve currencies identifies three motives through which geopolitical relations in the form of national security considerations impact reserve compositions. Whereas these motives are well established theoretically, available empirical evidence can merely be treated as suggestive of causal relationships.

Confidence in Military Power

The first motive relates to an economic factor established in the last chapter. Confidence in a currency as a stable store of value largely results from sound economic fundamentals of the issuing country, a track record of internal and external price stability, and the credibility of the authorities to safeguard those. Political scientists have argued that the issuer's credibility not only derives from its economic policy credentials, but also its military power (Helleiner, 2008). Norrlöf (2020) and Helleiner (2008) note that the US'

ability to defend one's borders and advance security interests internationally is seen to promote foreign confidence in the dollar, particularly at times of international conflict. This view is informed by historical evidence, looking at the coincidence of currency dominance and geopolitical power in the case of the British pound sterling at the end of the 19th century, and the US dollar after the second world war (McNamara, 2008).

Dollar Reserves for Security Guarantees

The second motive does not relate to an economic factor but presents a genuinely geopolitical motive of its own. It can best be stylized by considering the US role as a military and monetary hegemon: A global military power, the US is engaged in several mutual defense partnerships with smaller countries. In turn, US allies benefitting from defense commitments are often drawn towards dollars in their foreign reserves (McDowell, 2021; Posen, 2008). There is a clear theoretical rationale that underlies this point: Dollar reserve assets are mostly comprised of sovereign debt by the US government in the form of treasury bills. As such, allies' reserve assets function as loans to the US government (McDowell, 2021). Moreover, the large scale and scope of dollar reserve holdings lower interest rates for US public debt, further reducing the US government's costs for debt service. In turn, this allows the US to cheaply finance military spending and consistently run fiscal and external deficits. Thereby, US allies can bestow additional economic benefits on their partner, while improving their own security in the process (Norrlöf, 2020). Fittingly, this motive is known as a 'quid pro quo' between the issuer and holder of reserve assets and security guarantees.

The classical example for the quid pro quo presents the case of the US and Western Germany in the 1960s, as examined in a case study by Zimmermann (2002). The stationing of military troops in Western Germany gave rise to US expectations that Germany partly offset the cost of deployment by supporting the dollar under the gold-exchange standard (Norrlöf, 2020). In the context of the Vietnam War, the US increasingly experienced balance of payment pressures as it ran large external deficits partly owing to war expenditure, military presence and investments in Europe (Deutsche Bundesbank, n.d.). Still under the gold-exchange standard, the US feared large conversions of European dollar holdings to gold. Similarly, Western Germany feared American efforts to contain the external deficit, which may have seen the withdrawal of American troops from Europe as a result (Deutsche Bundesbank, n.d.). In 1967, this led to an official letter by Bundesbank president Karl Blessing to the Chairman of the Federal Reserve William Martin, explicitly assuring that the Federal Republic intends to

maintain its dollar reserves and will refrain from any large scale conversions or withdrawals (Deutsche Bundesbank, n.d.).

Political Affinity

Liao & McDowell (2016) go beyond security ties in examining the effect of countries' international political preferences (measured in the form of United Nations General assembly voting behavior) on reserve holdings. Identifying 37 central banks that added the renminbi to their reserve portfolio, they find that political affinity to China increases countries' likelihood to diversify into renminbi assets. As such, countries may prefer to hold foreign reserves in the currencies of issuing countries they agree with on political questions that are not related to security issues (Norrlöf, 2020). While acknowledged in the subsequent literature (Iancu et al., 2022; Norrlöf, 2020), few studies have expanded on the political affinity motive.

4. Financial Sanctions

The last chapter examined central banks' considerations in managing reserve portfolios and which economic and geopolitical aspects influence portfolio compositions. This chapter examines the implications of financial sanctions on the CBR in 2022. The first section shortly presents the measures targeting the CBR and then analyzes how asset freezes impacted its reserve portfolio. The second section assesses how the threat of such asset freezes may impact other central banks' portfolio considerations in light of previous findings. It points out that the perception of geopolitical risk of asset freezes likely differs among countries and then reviews suggestive evidence.

4.1 Reserve Asset Freezes on the Central Bank of Russia

On February 24, 2022, the Russian Federation escalated its war of aggression against Ukraine in an attempt to invade its neighboring state. A coalition of the US, the European Union, the United Kingdom, Japan, Australia and Switzerland swiftly responded by imposing severe sanctions on Russia. Sanction measures focus on the economic and financial realm, aiming to cut Russia off from international trade and global financial flows. Prominently received were measures targeting the Central Bank of Russia. Specifically, the US Treasury's Office of Foreign Assets Control (OFAC) prohibited US entities from engaging in transactions with the CBR, effectively immobilizing any assets of the CBR held in the US or by US entities (US Department of the Treasury, 2023). Based on the last available information on Russian reserve holdings, total Rus-

sian official foreign assets before the war were reported to combine for a worth of USD 630 billion, of which euros (32.2%), gold (21.7%), and dollars (16.4%) comprised the largest portions (CBR, 2022). Total reserves frozen by the coalition are estimated at USD 300 billion (Nelson et al., 2023). The exact number of frozen reserves denominated remains unclear and has not been publicly communicated. The only relevant reserve issuer which refrained from sanction measures was China. The share of Russian reserves denominated in renminbi was reported at 13.1% in 2022 (CBR, 2022).

Importantly, sanctions have also stripped the CBR from its ability to intervene in FX markets. Other noteworthy measures in the financial realm were the disconnection of several Russian banks from messaging provider SWIFT, the prohibition of US banks from engaging in correspondence banking relationships with Russia, and asset freezes of private entities. OFAC imposed similar freezes on the monetary authorities of Libya (in 2014), Iran (in 2019), and Afghanistan (in 2021) before and transferred access to central bank funds from Venezuelan President Nicolás Maduro to opposing Juan Guaidó in 2020 (Norrlöf, 2022). Nevertheless, the CBR asset freezes can be described as unprecedented in scope and scale due to the coordinated nature among all Western reserve issuers, the large number of total reserves frozen, Russia's entanglement in the global economy, and its relevance in international politics. This escalation step comes at a time in which financial sanctions generally have been on the rise[3]. The regimes targeted "tend be non-democratic, known human rights abusers that have foreign policy preferences that run contrary to US preferences" (McDowell, 2021, p. 643). At the core of the US ability to issue stinging financial sanctions at their own will lays the broad-based dominance of the dollar in the IMS, which many countries – particularly those targeted by sanctions – may rather perceive as a dollar-dependence of their economies.

Impact Analysis

Prohibiting transactions with the CBR strips it from accessing the half of its reserve assets held in Western countries. These measures hit at the heart of the CBR's portfolio objectives: Its reserve strategy explicitly pursues assets that are secure, liquid, and offer returns (CBR 2022), matching the properties generally pursued and outlined in section 3.1. Through asset freezes, Russian reserves denominated in major Western currencies have become illiquid and unsafe. The CBR cannot sell its assets for cash nor convert them into other currencies. Moreover, it is unclear when and under which circumstances

[3] E.g., McDowell (2021) measures the total number of executive orders instructing OFAC to issue restrictive financial measures since 2000. At 22 in 2000, the number of executive orders has increased steadily to 80 in 2018.

the CBR will regain access to those assets. Additionally, there is an ongoing discussion about potentially seizing Russian reserves to finance Ukraine's reconstruction (Lawder, 2023). Lastly, assets denominated in Western currencies neither generate returns, as payment flows on Russian reserves cannot reach their creditor.

The implications of reserves' illiquidity carry the most significant relevance in the short term: Since Spring 2022, the CBR has been incapable of performing the types of policy operations in dollars or euros (and with less importance in other Western currencies), which constitute the use and rationale of reserves in the first place (see 3.1). Following the commencement of military actions in February, Russia experienced a sharp decline in its exchange rate, with the Rubel losing half of its external value vis-a-vis the dollar. Itskhoki & Mukhin (2022) accredit this drop to the quick disconnection of the Russian economy from international capital flows, namely through reserve asset freezes, the exclusion of Russian banks from international borrowing markets, and the expectation of severe export sanctions. With disconnected ruble exchange markets and non-available reserves, the CBR could not stabilize its exchange rate through intervention in FX markets. Subsequent efforts in restabilizing the ruble's external value were successful, yet had the CBR resorting to crude, unconventional measures. Immediately after the rapid depreciation, the CBR increased the interest rate from 9.5% to 20%, followed by strict controls on withdrawal and outflows of foreign currency capital, mandatory conversion of exporters' foreign currency surpluses into rubles, and harsh taxes on conversions into Western currencies (Itskhoki & Mukhin, 2022; Turak, 2022). European energy importers were even confronted with efforts by Vladimir Putin himself to change invoicing currency and mechanism of European energy payments to Russia's needs (Gojdka, 2022). In June, the Russian government defaulted on dollar- and euro-denominated sovereign bonds, as it could not access US and EU-based reserves to service USD 100 million in interest payments for both (Aminu & Olivares-Caminal, 2022).

As the previous chapter outlined, reserves are largely held as a precaution to meet operational and interventional demands in times of crisis or external shock. In the case of Russia, its extensive holdings were frequently referred to as its 'war chest' (e.g. Turak, 2022). Interestingly, it is precisely the moment central banks would want to rely on their reserves in which Western asset freezes disabled the CBR from making practical use of its assets.

As such, the adverse impact on the CBR is relatively clear. As frozen reserve assets have become illiquid and unsafe, it cannot access a considerable amount of its financial

means. Moreover, it must resort to unconventional monetary policy measures instead of intervening in FX markets. Presumably, the CBR would ex post prefer to have a smaller position of its reserves in Western currencies targeted by sanctions.

4.2 The Threat of Reserve Asset Freezes for Other Central Banks

Such an uncommon event in the history of international monetary relations unlikely goes unnoticed by other central banks. Yet, the broader effect on the considerations of central banks around the globe seems less clear and is likely to be context-dependent and heterogenous. Moreover, the scarce prior work in the field has primarily focused on how geopolitical affairs positively influence reserve holdings by mutually bestowing economic and political benefits on the issuer and holder. Only recently have scholars started to focus on adverse influences through sanctions. Nevertheless, one can reasonably analyze and discuss the effect on other countries in light of the substance covered so far.

Section 4.1 shows that asset freezes render it impossible for targeted central banks to use their reserve assets for their intended economic purposes. Thereby, the threat of financial sanctions introduces a possibility that countries' reserve assets become effectively useless, that is unsafe and illiquid. As the threat of sanctions negatively impacts the expected liquidity and security of dollar assets, this exposes central banks to risk in their reserve portfolios. McDowell (2021) describes the exposure in reserve portfolios as *political risk* of international currency use[4], which central banks have to manage in addition to economically established credit, currency and liquidity risks.

The case of Russia illustrates an important point in that regard. Firstly, reserve freezes are usually part of broader economic sanction packages involving measures such as export and import bans, prohibition of financial transactions, or asset freezes on private actors. Secondly, reserve freezes are generally considered very harsh measures and require significant events, such as military actions and breaches of international law, to trigger them. As such, both triggering events and the response through sanctions are likely to disrupt targeted countries' patterns of international trade and financial flows. Therefore, as Weiss (2022) notes, asset freezes are likely to be imposed precisely during those events in which central banks typically want to liquidate them to stabilize the domestic economy. Brunnermeier et al. (2022, p. 196) coin this a "tail risk" of sanctions since they come with low probability but high impact. Both sources consider this aspect

[4] This paper uses the term geopolitical risk.

especially important in creating an incentive for central banks to divest away from dollars, as central banks can only hedge against tail risks by reducing their exposure (Brunnermeier et al., 2022).

Country-Dependence and Conditionality

Countries around the globe are not equally threatened by US financial sanctions. Countries with strong geopolitical relations, diplomatic ties, security alliances, or foreign policy interests similar to the US are less likely to face sanctions and will perceive their dollar assets to be under little risk of sanctions. Even more so, a considerable fraction of advanced, reserve-issuing economies participates in restrictive measures on the CBR, meaning they find themselves on the same side as their partners instead of a potential target. Additionally, asset freezes come with a strong conditionality. In the case of Russia, it took a full-scale military invasion of another country to trigger them. Brunnermeier et al. (2022) note that standard financial relations can generally not be expected to hold under such events, finding precedent e.g. in France and Britain refusing to hand over gold reserves to the Soviet Union after annexing Baltic countries in the 1940s, or the blocking of cross-border payments to Japan in 1937 during the Second Sino-Japanese War. For modern times, Weiss (2022) highlights that in adopting sanctions on foreign central banks, the US government has indicated national security threats as reasons for measures on Libya, Iran, and Afghanistan, and breaches of international law for measures on Russia. In contrast to US allies and countries in support of the US-led economic and political order, those already targeted by US restrictive measures likely perceive a greater risk of reserve freezes. The same holds for countries to which the typical conditions that trigger US financial sanctions apply, namely non-democracies with contrasting foreign policy and international security interests.

Suggestive Evidence

In an empirical case study, McDowell (2021) tests the claim that the threat of US financial sanctions generates geopolitical risk that raises the expected cost of using the dollar for targeted and at-risk governments. In analyzing the cases in which sanctions threat is most likely to cause efforts of de-dollarization (Russia, Venezuela, Türkiye), he finds evidence suggestive of that implication. In the case of Russia, McDowell (2021) finds clear changes in the CBR's international currency use and attitude towards the dollar following the imposition of sanctions in 2014 and their enhancement in 2018. Whereas the dollar's share in CBR holdings only gradually declined from 49 to 44 percent be-

tween 2006 to 2014 (Iancu et al., 2022), it declined sharply after severe measures in April 2018. While the CBRs total reserve holdings increased between March and June 2018, dollar holdings decreased by over 10 percent (McDowell, 2021). During the same period, the CBR built up a proportionately sized stock of reserve assets denominated in renminbi, reflecting a restructuring of the bank's reserve portfolio (McDowell, 2021). In total, the dollar's share of CBR reserve holdings plummeted from approx. 54% at the beginning of 2017 to roughly 30% in the third quarter of 2019 (Iancu et al., 2022). The renminbi tranche emerged from negligible levels to 13%, and the euro's share increased between 5 and 10% to 38%. Using data reported to the IMF by the CBR, Iancu et al. (2022) find a statistically significant correlation between 2018's drop in the dollar's share and the imposition of financial sanctions. This matches remarks by CBR governor Elvira Niabiullina in 2019, as she stated in an interview that "we try to diversify our international reserves composition because we estimate all the possible risk, economic and geopolitical risks." (as cited in McDowell, 2023). Patterns of diversification can also be found in Russian trade and cross-border payments. After 2014's measures, the CBR developed its own financial messaging system as an alternative to dollar and euro-dominated SWIFT. In 2015, Russia switched invoicing of energy exports to China from dollars to renminbi (Farchy, 2015). In the cases of Venezuela and Türkiye, the evidence is more mixed. Both governments criticized dollar dominance and dependence of their economies, but there is less manifestation of concrete diversification policies. While the empirical evidence suggests a relationship between the threat of sanctions, the perception of risk in dollar use, and a critical stance towards the dollar, research lacks advanced empirical analysis and adequate data to arrive at conclusive and reliable results. Especially for cases in which sanctions threat is less imminent.

5. Reserve Divestment

The last chapter established that the threat of financial sanctions is likely to negatively affect central banks' inclination to hold reserve assets in dollars, at least for some countries. The remainder of this paper discusses the prospect of an ensuing reduction in the dollar's share of global reserves. Its analytical focus lies on dollar divestment that is 'directly' induced through central banks' increased perception of geopolitical risk, i.e. asset freezes. A reduction in dollar reserves may also come 'indirectly' as a result of diversification efforts in countries' trade and financial patterns. This is not the concern of this paper. This chapter particularly points to geopolitical and economic conditions

that restrict significant dollar divestment for now, bar deeper changes in countries' trade, financial and policy patterns. First, it assesses the structure of global dollar reserve holdings along geopolitical lines based on Weiss (2022). Second, it considers whether there are viable alternatives to the dollar, pointing to the persistence of dollar dependence in the IMS and shortcomings of other reserve currencies. Third, it gives an empirical overview of developments in global reserve aggregates since February 2022. The last section evaluates the ways in which dollar divestment is already happening and whether there is a visible manifestation of a backlash effect.

5.1 The Structure of Foreign Official Dollar Asset Holdings

Chapter 3 introduced geopolitical influences on reserve compositions and highlighted the importance of military and defense arrangements. Chapter IV showed that the perception of sanctions risk and any associated backlash effect is country-specific and context-dependent. Motivated by similar considerations, Weiss (2022) analyzes the structure of foreign countries' dollar reserve holdings by geopolitical relation with the US. The analysis bases on confidential US Treasury data on official foreign investors' position in US safe assets. It includes those assets typically held as reserves, namely Treasury bills, government-sponsored agency debt, and short-term liabilities of US financial institutions. Included assets total USD 5.24 trillion, containing ca. 75% of dollar-denominated reserves in the IMF's aggregated COFER database (Weiss, 2022).[5]

Specifically, Weiss calculates the share of dollar assets held by countries with strong geopolitical relations to the US since these are less likely to perceive sanctions risk and divestment incentives. Military alliances are considered a strong form of international cooperation between countries. As regards reserves, they are documented to generate support of the dollar with US allies (see section 3.3).

Classification by Military Relation

Weiss (2022) classifies countries by geopolitical relation to the US as follows: There are two forms through which the US is engaged in formal alliances with other countries. Mutual defense partnerships, and the designation of a Major Non-NATO Ally (Weiss, 2022). Mutual defense partnerships come in the form of multilateral and bilateral arrangements. Multilateral arrangements include the North Atlantic Treaty Organization (NATO) with Canada and European countries, the Rio Treaty with countries in Latin

[5] Due to the confidential nature of the data, there is little to no complimentary literature available in this matter. This section presents the analysis from Weiss (2022) and therefore draws strongly from it.

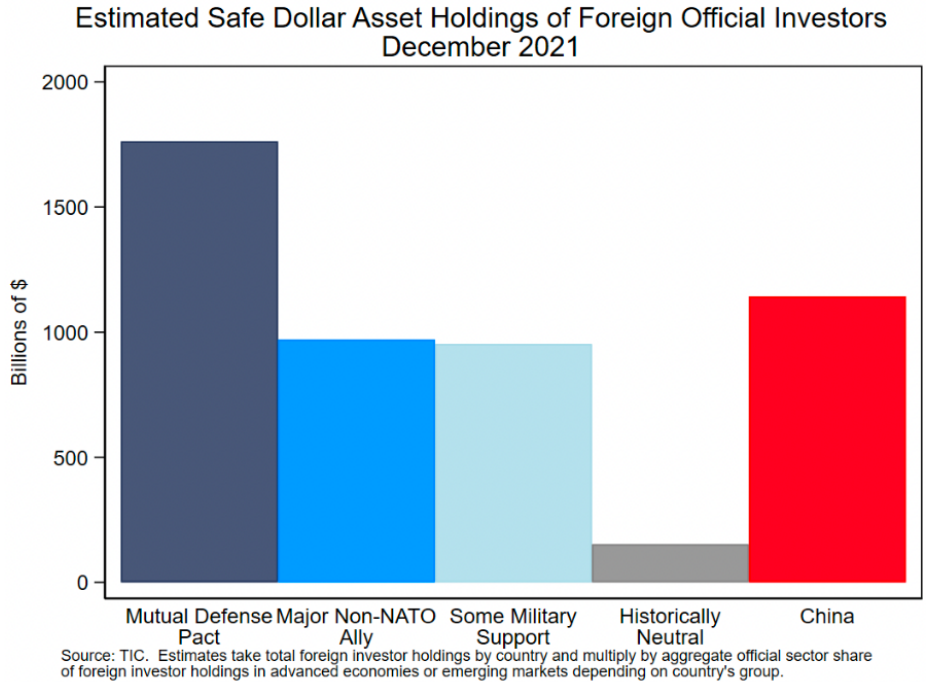
America, and the security treaty with Australia and New Zealand (ANZUS). Bilateral arrangements exist with Japan, South Korea and the Philippines. Moreover, the US government has granted Major Non-NATO Ally Status to 13 countries it is not engaged in previously mentioned partnerships with. This group includes nine countries in the middle east, three in South-East Asia, and Taiwan. Non-NATO Ally Status does not entail military defense commitments but enables intensified defense trade and close security cooperation (US Department of State, 2021). Moreover, there are 12 countries that – without formal ally status – have some form of military tie with the US through imports of military goods and joint military exercises (Weiss, 2022). Again, most are located in the middle east and South-East Asia. Lastly, while wary of military engagements, the historically neutral European countries of Finland, Ireland, Sweden, and Switzerland are also considered to generally support the existing geopolitical and economic order (Weiss, 2022). Since the beginning of the war, Finland has joined NATO, while Sweden's accession is pending. Switzerland and Ireland have also imposed sanctions on Russia and the CBR. An exact breakdown of which countries are included in each category can be found in Appendix A.1. Contrasting the groups of countries that engage in some form of geopolitical partnership or alignment with the US, the author also reports estimated figures for the People's Republic of China. It is the largest holder of foreign reserves (in general, not exclusive to US assets) worldwide (Reuters, 2023). Most studies consider China as the geopolitical adversary to the US (see e.g. Mühleisen, 2022; Norrlöf, 2022; Weiss, 2022). Tensions between both powers have recently manifested in the economic (trade tariff conflict) and military realm (Taiwan conflict).

Reserve Holdings by Military Relation

Fig. 4 from Weiss (2022) shows dollar asset holdings of foreign official investors in billions under above's classification. In December 2021, the holdings of mutual defense partners totaled approximately USD 1.75 trillion. Major Non-NATO Allies accounted for a lesser sum of USD 1 trillion. Taken together, US allies held ca. 55% of foreign official investor's dollar assets. This figure shows little variation in the last ten years, not falling below 50% nor exceeding 60% (Weiss, 2022). The previous subsection also introduced two groups of countries that are not engaged in formal alliances with the US but can also be expected to be under lesser risk of sanctions. Countries with some form of military tie to the US held virtually the same amount as Non-NATO Allies, just shy of USD 1 trillion, accounting for 15 to 20% of total official investor's foreign dollar assets (Weiss, 2022). As the author does not give the confidential shares for the group

of historically neutral countries and China, one can look at Fig. 4's rougher estimates. While historically neutral countries accounted for a relatively minor sum of assets, China incorporates a special role. With an estimated position of USD 1.2 trillion (between 20 to 25%), it is the largest official holder of US assets that does not engage in some form geopolitical partnership or alignment with the US.

Figure 4 – Foreign Dollar Asset Holdings by Geopolitical Relation with the US



Source: taken from Weiss (2022), estimations based on Treasury International Capital data.

5.2 Dollar Dependence & Lack of Alternatives

Aside from taking a closer look at the geopolitical circumstances of global dollar reserves, one can also reconsider the economic aspects outlined in chapters 2 and 3. This section points to the economic benefits of holding dollar reserves and the lack of credible alternative currencies that fulfill the conditions to become a reserve issuer on a larger scale.

Dollar Dependence

In a technical sense, central banks maintaining flexible exchange rates do not need to hold reserves at all. However, regardless of exchange rate regime, there are concrete economic incentives for holding reserves, which tend to be strong in the case of the dollar. These incentives are not contingent upon geopolitical relations. They reflect econo-

mies' FX needs (*Holder's Demands*) that can only be met by a few international currencies (*Issuer's Characteristics*) and are determined by currency choice in international trade and financial relations. The complementary effects between the different functions of international money not only favor the incumbent dominant currency (*Network Effects*). They also flow mainly in one direction, which sees currencies' use for foreign reserves at its end (ECB, 2022). In fact, the research presented in previous chapters finds that the direction of causality in international currency choice flows from functions in the private sector – the dollar's widespread use for invoicing trade and settling payments, its relevance in banking and asset markets – to functions in the official sector – dollar pegs and interventions – which ultimately constitutes the rationale for holding reserves in dollars. This yields the basis for two crucial insights. First, while divestment in the short term can reduce central banks' expected cost in the form of geopolitical risk, it comes at economic costs, specifically regarding central banks' FX activities. Aiyar et al. (2023) expect divestors to encounter higher transaction costs and difficulties in carrying out central bank operations. Moreover, they consider divestors' reserve portfolios subject to higher economic risks following a geopolitical shift away from the dollar. For many central banks that do not perceive an imminent threat of reserve freezes, economic incentives are likely to outweigh the geopolitical risk of sanctions (Weiss, 2022). Second, the economic incentives for holding reserves in dollars will remain unless the IMS sees broader diversification patterns in invoicing, cross-border payments, and debt issuance (Weiss, 2022). As such, significant change in international reserve compositions is more likely to come as a result of or at least be accompanied by broader diversification (ECB, 2022). Until then, economic incentives work in favor of the incumbent reserve currency.

Lack of Alternatives

The previous section argued that central banks will continue to demand – at least in the short term – dollar reserves as it reflects FX needs of their economies. This section points to restrictions on the issuers' side of reserve currency choice. Central banks willing to reduce their share of dollar reserves lack credible alternatives in the form of sufficiently safe and liquid assets in other currencies. First, other Western reserve currencies do not present a safe haven from sanctions. Instead, asset freezes were closely coordinated with Western partners, which saw Russian assets in euro, pound, yen, francs, Canadian and Australian dollars targeted in similar fashion. Still, countries may perceive the risk of being targeted by sanctions from either of these reserve issuers differently,

depending on their respective geopolitical relations. In a similar vein, Russia reduced its share of dollar reserves in favor of euros following US sanctions in 2018 (see section 4.2). This exemplifies that when events are sufficient to trigger measures as harsh as asset freezes by one issuer, targeted countries may be quick to find themselves sanctioned by others as well. As such, the Chinese renminbi is the only reserve currency that presents a credible alternative for evading sanctions. However, Western reserve currencies accounted for 94% of global FX reserves at the end of 2021 (Weiss, 2022).

While geopolitical considerations constrain the number of alternatives to the dollar conceptually, there are also serious doubts that any other currency even fulfills the economic conditions to rival the dollar's share in foreign reserves to begin with. Even for the euro, skeptics have continuously highlighted the lack of a large and liquid treasury bond market (Brunnermeier et al., 2022) paired with the fragmentation of euro area capital markets (Claeys & Wolff, 2020). As for the renminbi – the most promising alternative for evading sanctions – there are also serious doubts that it presents a credible alternative from an economic standpoint. The biggest concerns regard shortcomings in the institutional setup of renminbi financial markets, infrastructure for international payments (Mühleisen, 2022), and restrictions on China's capital account (Brunnermeier et al., 2022). As a result, there are strong limitations to the amount of renminbi-denominated assets and bonds foreign investors can access. In the past, China had been reluctant to ease capital controls (Mühleisen, 2022), and its political willingness and economic capability to absorb capital inflows on a large scale remains an open question (Norrlöf, 2022).

5.3 Divestment so Far?

This subchapter looks at the empirical developments since February 2022 to assess whether actual divestment and diversification patterns are observable.

Total FX reserves declined by approximately one trillion from USD 12.9 trillion in Q4 2021 to USD 11.9 trillion in Q4 2022 (IMF, 2023). Throughout that timespan, dollar claims reduced from approx. USD 7.1 trillion to USD 6.5 trillion. These developments do not indicate significant changes in the relative demand for reserve currencies, as the decline in absolute terms progressed proportionately to the overall composition. Since the end of 2021, the dollar's share has remained relatively stable at 59%. Similarly, the euro did not diverge strongly from its 20% share, nor did the renminbi at 2.6%. As such, there are prima facie no signs that the greenback's reserve currency status suffered in 2022.

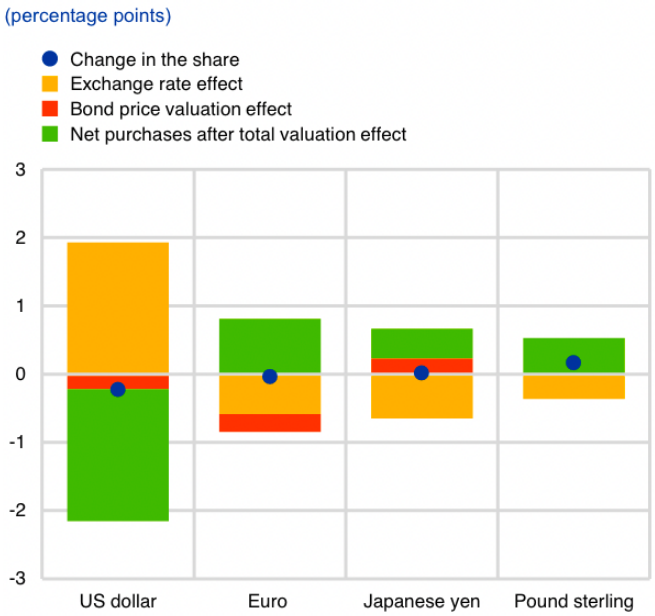
A more detailed analysis, based on a broader set of data, can be found in the ECB's latest report on the international role of the euro. It reviews 2022's empirical developments in foreign reserve holdings and specifically discusses the effects of geopolitical fragmentation risks. As such, its insights fit for an empirical evaluation of the effects discussed in this paper.

Developments in Foreign Reserve Portfolios

Overall, ECB staff (2023) find no significant evidence that geopolitical risk has reduced the demand for Western reserve currencies since the beginning of 2022. The large drop in total reserves can mainly be explained by valuation effects and FX interventions that occurred in the wake of global tightening of monetary policy and a strong appreciation of the dollar (ECB, 2023). 2022 saw central banks of advanced economies increasing their policy rates continuously in reaction to high inflation. In the US, the Federal Reserve System increased the Federal Funds Rate by 4.5%, translating into higher yields and lower prices on US Treasury bonds (ECB, 2023). Taking the example of a typical reserve asset, the three-year yield on US Treasury bonds increased by 2.6 percentage points, whereas bond price indices fell sharply, performing US bonds' "worst year on record" (Iacurci, 2023). Similar events occurred in other advanced economies, with three-year yields increasing for an average of over two percentage points among G7 countries, bar Japan (ECB, 2023).

As such, the decline in total reserves can partly be explained by falling prices on reserve assets in all major reserve currencies (ECB, 2023). Another explanation can be found in the dollar's strong appreciation in 2022, which saw its nominal effective exchange rate increasing by eight percentage points. Measured in current dollar terms, this led to a strong devaluation of assets in other currencies, most prominently euros, yen, pound sterling, and renminbi (ECB, 2023). Lastly, 2022 saw large volumes of net sales and purchases of reserve assets owing to active portfolio management and – to a lesser degree – FX interventions by central banks. Net sales and purchases in 2022 mirrored conventional patterns of reserve management that aim to offset valuation effects on currency shares (ECB, 2023). The little movement in aggregate shares despite strong macroeconomic dynamics can mainly be accredited to central banks' offsetting portfolio adjustments.

Figure 5 – Changes and Effects in the Share of Selected Currencies in Global Official FX Reserves in 2022



Source: ECB (2023), based on IMF, Federal Reserve Board and ECB calculations.

Fig. 5 – taken from ECB (2023) – breaks down 2022's effects on the *shares* of dollars, euros, yen and sterling in global official reserve assets. As yields for dollar and euro assets hiked faster than others, bond price valuations led to minor reductions in the dollar's and euro's share. In turn, exchange rate movements impacted all currencies across the board remarkably. The share of dollar assets increased by nearly two percentage points due to exchange rate effects, whereas the euro and yen's shares reduced by approximately half a percentage point as a result. Fig. 5 indicates the effect of net sales and purchases in offsetting exchange rate effects on currency shares. In the case of the dollar, central banks were net sellers to the amount of USD 293 billion, equaling two percentage-points of its global share and adequately compensating for appreciation effects. Aside from active portfolio management, some fraction of net dollar sales occurred in the context of large volume FX interventions (most prominently by China and Japan) to stabilize exchange rate movements vis a vis the dollar (ECB, 2023). For the other reserve currencies whose assets lost in value due to depreciation vis a vis the dollar, central banks were net purchasers. As for the euro, net purchases reached approximately one percentage point, totaling EUR 50 billion. ECB staff accredit the offsetting character of 2022's net sales and purchases to central banks actively rebalancing their portfolio shares following the dollar's appreciation (2023).

Lastly, two more aspects must be considered for a proper picture of last year's foreign reserve developments. Diversification into minor reserve currencies proceeded more slowly than in previous years. The share of currencies other than the dollar, euro, pound, yen, or renminbi increased by just 0.5 percentage points.

In contrast, central banks acquired large volumes of gold in 2022. While data voluntarily reported to the IMF only shows an increase of 0.9 percentage points, the World Gold Council's report on Gold Demand Trends 2022 suggests differently. Complementing IMF figures with own data sources, they estimate net purchases by central banks in 2022 at 1,136t (World Gold Council, 2023). As such, 2022's demand more than doubles the annual net purchases of the two previous years and presents a record high dating back to 1950. Emerging markets accounted for a big fraction of net purchases, with Türkiye (148t) and China (62t) the largest purchasers, followed by Egypt (47t), Qatar (35t), India (33t), Iraq (34t) and the United Arab Emirates (25t).

Geopolitical Influences

Admittedly, 2022's empirical developments in foreign reserves offer limited grounds to suspect a strong influence by geopolitical effects. ECB staff (2023) examine the extent to which 2022's development depend were influenced by geopolitical alliances more closely. The basis for this is an index that assesses the degree of countries' geopolitical alignment with the US versus China and Russia[6]. Advanced economies tend to be more closely aligned with the US while emerging and developing economies are closer to China and Russia. Identifying countries that actively diversified into minor reserve currencies in 2022, the study finds no correlation between the accumulation of assets into minor reserve currencies and geopolitical alignment (ECB, 2023). A different picture emerges in analyzing diversification into gold in 2022 against the geopolitical index. There, they find a statistically significant correlation between countries' accumulation of gold and their degree of alignment with Russia and China. The closer countries are geopolitically aligned with China and Russia, the more they increased the share of gold in their foreign reserve portfolio in 2022 (ECB, 2023).

[6] Proxies that influence the index are: Track record of being targeted by US', Chinese, and Russian sanctions; Shares of Military Imports from US, Russia and China; Participation in China's Belt and Road Inititative; and voting record on the resolution of the Eleventh Emergency Special Session of the United Nations General Assembly adopted on 2 March 2022 on Russia's invasion of Ukraine.

6. Conclusion

This paper examined whether asset freezes on the CBR negatively affect the dollar's reserve currency status.

The second chapter depicted how the dollar's dominance is entrenched in the IMS. The dominant currency benefits from substantial network effects between its different roles, which leads central banks to favor holding foreign reserves in dollars. Network effects flow mainly in one direction, meaning dollar use in foreign reserves derives from its use in international trade and financial relations.

The third chapter presented the rationale and determining factors that drive central banks' reserve holdings. Foreign reserves are mostly held out of precautionary reasons for financing transaction operations and policy interventions in FX markets. As such, central banks value highly liquid and secure assets. These assets are mostly issued by countries with considerable economic size, large and deep financial markets, and a credible track record of their currencies' stability. However, defense commitments and political affinity with the issuing country also play a role. Importantly, holding reserves in a given currency can be seen as a way of financially supporting the issuer's military activities.

The fourth chapter examined how the threat of financial sanctions impacts central banks' reserve portfolio considerations. The threat of US asset freezes introduces a possibility that central banks' dollar assets become unsafe and illiquid. As dollar assets' expected liquidity and security worsen, reserve portfolios are exposed to geopolitical risk. However, the perception of such risk likely differs among countries depending on their geopolitical relation with the US. Asset freezes have only been imposed on countries whose foreign policy and international security interests substantially differ from those of the US and who are willing to pursue these actively, e.g. in violation of international law.

The fifth chapter pointed to several reasons why the dollar's share in global reserves is unlikely to decrease substantially in the short term. Importantly, US military allies held approximately 55% of official foreign investors' dollar assets at the end of 2021 (following estimations by Weiss, 2022). Moreover, there exist little to no credible alternatives to the dollar as the key reserve currency right now. As long as international trade and financial flows continue to be highly dollarized, the economic incentives for central banks to hold foreign reserves in dollars remain. Other Western reserve currencies do not present a sanctions-safe haven. Large-scale diversification into the renminbi

is restricted by China's closed capital account, shortcomings of its financial markets and international payment infrastructure.

As such, the overall question of this paper can be answered in the following way: The measures against the CBR do not undermine the dollar's reserve currency status. It is unlikely that the threat of asset freezes leads to large reduction in the dollar's share in foreign reserve holdings in the near future. Still, the risk of asset freezes makes holding dollar reserves less attractive for countries geopolitically not aligned with the US. However, economic incentives to hold dollar reserves remain, and credible diversification alternatives face other limitations.

Certainly, the insights of this paper face substantial restrictions in methodology. First, this paper has only discussed the question theoretically, based on the existing literature on dollar dominance, foreign reserve compositions, and financial sanctions. Analyzing the situation in a formal model may yield quantitively interpretable insights that give a more precise account of central banks' reaction to the geopolitical risk of asset freezes. Ultimately, it is up to future empirical research to examine the influence of geopolitical relations on reserve diversification following February 2022. Although substantial diversification has not been observed so far, the issue demands further empirical analysis based on country-level data.

Other restrictions arise from considerations of content and scope. This paper only discussed the prospect of central banks diversifying their reserve portfolio away from the dollar in reaction to the risk of asset freezes. However, financial sanctions generally target a broader set of countries' official and private actors. If diversification efforts manifest in other domains of international currency use, this may ultimately weaken central banks' economic incentives to hold dollar reserves. Also, other reserve issuers – most prominently China – may overcome the current shortcomings of their financial system that prevent their currency from rivaling the dollar's share in global reserves.

Lastly, China is also the geopolitical adversary of the US that accounts for the largest sum of US dollar reserve assets. In that way, the future of the dollar's share in foreign reserves will be influenced by China both from an issuing and holding side. In light of a looming conflict between China and the US around Taiwan, further research on the interlinks between geopolitics and foreign reserves may become even more relevant.

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Appendix

A.1 Groups of Countries by Military Alliance with the US

Countries member to a mutual defense pact with the US: Belgium, Denmark, France, Germany, Greece, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Turkey, United Kingdom, Croatia, Slovenia, Albania, Czech Republic, Slovakia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Canada, Japan, Korea, Philippines, Australia, New Zealand, Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay

Countries with US Major Non-NATO Ally Status, but without a mutual defense pact: Bahrain, Israel, Jordan, Kuwait, Malaysia, Pakistan, Qatar, Singapore, Taiwan, Thailand, Morocco, Tunisia, Egypt

Countries receiving some military support by the US: Ukraine, Bangladesh, Hong Kong, India, Indonesia, Iraq, Saudi Arabia, Timor-Leste, United Arab Emirates, Vietnam, Mexico, South Africa

Historically neutral countries before February 2022: Finland, Ireland, Sweden, Switzerland