THE DOLLAR VERSUS THE EURO AS INTERNATIONAL RESERVE CURRENCIES

Menzie D. Chinn
Jeffrey A. Frankel
Hiro Ito

The Dollar versus the Euro as International Reserve Currencies
Menzie D. Chinn, Jeffrey A. Frankel, and Hiro Ito
NBER Working Paper No. 32387
April 2024
JEL No. F33

## **ABSTRACT**

We begin by examining determinants of aggregate foreign exchange reserve holdings by central banks (size of issuing country's economy and financial markets, ability of the currency to hold value, and inertia). But understanding the determination of reserve holdings probably requires going beyond the aggregate numbers, instead observing individual central bank behavior, including characteristics of the holding country (bilateral trade with the issuing country, bilateral currency peg, and proxies for bilateral exposure to sanctions), in addition to the characteristics of the reserve currency issuer. On a currency-by-currency basis, US dollar holdings are somewhat well explained by several issuer characteristics; but the other currencies are less successfully explained. It may be that the results from currency-by-currency estimation are impaired by insufficient sample size. This consideration offers a motivation for pooling the data across the major currencies and imposing the constraints that reserve holdings are determined in the same way for each currency. In this setting, most economic determinants enter with significance: economic size as measured by GDP, size of financial markets as measured by foreign exchange turnover, bilateral currency peg, and bilateral trade share. However, geopolitical variables (bilateral alliance, bilateral sanctions) usually do not enter with significance.

Menzie D. Chinn
Department of Economics
University of Wisconsin-Madison
1180 Observatory Drive
Madison, WI 53706
and NBER
mchinn@lafollette.wisc.edu

Jeffrey A. Frankel
Harvard Kennedy School
79 JFK Street
Cambridge, MA 02138
and NBER
jeffrey_frankel@harvard.edu

Hiro Ito
Portland State University
15787 NW Hackney Dr.
Portland, OR 97229
ito@pdx.edu

# 1. Introduction

In the early years of this century, international use of the dollar began a gradual relative decline, particularly as measured by the currency shares in which central banks hold their international reserves. Some suggested that another currency might overtake the dollar as the leading international currency one day. But the theory of international currencies was based on network externalities: everyone uses the dollar because everybody else uses the dollar. This implied a lot of inertia supporting the incumbent number one currency.

The literature concluded that any rivals could catch up to the dollar only with a substantial lag behind the fundamental determinants. Three fundamental determinants were: size of home economy; size, depth, liquidity and openness of its financial markets; and ability of the currency to hold its value, requiring the self-discipline to resist abusing exorbitant privilege by excessive fiscal and monetary expansion. An historical precedent dominated: it was said that the fundamental determinants underlying the dollar had caught up with those underlying pound sterling by 1918 and yet international use of the dollar had not caught up with the pound until 30 years later.

From its creation in 1999, the euro had immediately become the number two currency. Initially, it appeared to be gaining on the dollar. It satisfied the three key criteria almost as well as the dollar did: the eurozone economy was almost as large as the US economy, European financial markets were almost as big as US financial markets, and the euro country governments had committed to fiscal and monetary discipline at a time when the US was reverting to large budget deficits.[1]

The prospects for the euro as leading international currency started to dim at the time of the Global Financial Crisis. For one thing, the direction of flight of risk-averse investors in late

---

[1] Chinn and Frankel (2007) even suggested that the euro might rival the dollar for the number one slot by 2022, if either of two conditions were met: the UK and Sweden were to join the euro, thus expanding the size of the eurozone's economy and financial markets; and the US were to continue to exploit its exorbitant privilege as reflected in trend depreciation of the dollar. Neither of these conditions were met subsequently: The UK and Sweden, decided not to join; and the euro began a long trend depreciation against the dollar in July 2008. Papers on the euro's growing role included: Portes and Rey (1998), Frieden (2000), Posen (2008), and Goldberg (2010), among many others.

2008 was away from the euro and toward the safe haven of the US, notwithstanding that the sub-prime mortgage crisis had originated in the US.  Moreover, the crisis that erupted in Greece in early 2010 called into question the enforceability of the European fiscal compact and seemingly even the viability of the euro itself.

China's renminbi became the new purported challenger to the dollar.  After all, it increasingly met at least two of the criteria: size of the home economy and ability to maintain its value.  The renminbi increased in value steadily from 2005 to 2014.  Three decades of rapid growth, 1980-2010, seemed to foreshadow that the Chinese economy would surpass the US economy in size by 2021, even when the GDPs were compared at nominal exchange rates rather than PPP rates.[2]  Meanwhile, China resolved to internationalize its currency.  Some forecast that the renminbi would eclipse the dollar as number one international currency as early as 2020.[3]

A lot has changed since the forecasts of euro or renminbi ascendancy were made.

1.  The "new view" of Eichengreen (2010, 2011a) and Eichengreen and Flandreau (2009, 2012) argued that the literature had over-emphasized network externalities and the impregnability of the incumbent lead currency. It concluded, first, that the dollar had in fact caught up with the pound very quickly after World War I and, second, that a unipolar currency system was not the only possible global equilibrium. Rather, the world might be moving in a multi-polar direction.

2.  A second interpretation was added to the notion of a key-currency country's abuse of exorbitant privilege.  In the past, it was thought to be a matter of monetary and fiscal profligacy, as reflected in a tendency for the currency in question to lose value, as measured either by its inflation rate or its trend depreciation against other currencies.[4]  But geopolitical developments involving the use of financial sanctions by the US (especially against Iran and Russia) led some countries to fear that the freedom to use

---

[2]  Frankel (2014).

[3]  Subramanian (2011a, 2011b). See also Dobson and Masson (2009); Ito (2010); Park and Song (2010); Eichengreen (2011b); Prasad and Ye (2012); Frankel (2012); Prasad (2017), and Zhang (2022).

[4]  Relatively recent papers on exorbitant privilege include Farhi and Maggiori (2018) and Gourinchas and Rey (2022).

their dollar reserves could be curtailed in time of crisis. In reaction, Russia and China, in particular, shifted some of their international reserves out of dollars.

3.   The euro lost momentum as an international currency.  The UK and Sweden, after respective deliberative processes, decided not to join the euro.  Indeed, the UK even exited from the EU.

4.  Next, the renminbi lost some of its aura as a rising star.  After 2014, ten years of Chinese net capital inflow turned to net capital outflow, as manifest in a peaking of both foreign exchange reserves and the foreign exchange value of the currency.  The Chinese authorities resolved the conflicting goals of international currency status and the insulation afforded by capital controls by opting for the latter, so that they would be better able to slow capital outflows.  Furthermore, the growth rate of the Chinese economy slowed after 2010.  It became increasingly clear by 2024 that the decades in which the economic growth rate had averaged 10 percent had come to an end.  The debate over the date when China's economy would surpass the US economy -- whether it would be sooner versus later (evaluated at market exchange rates) -- suddenly had to accommodate the possibility that the changeover might not happen at all.  These factors all undermined the perceived inevitability of the rising international role of the renminbi.

5.  Gold, which had been demoted with the end of Bretton Woods in 1971, returned as a relevant component of the international monetary system.  Some central banks, especially in Asia, resumed active buying and selling gold, as a means of diversifying their international reserves out of dollars.[5]

6. Important new data became available.   First, a few holdout countries, most importantly China, for the first time began to allow the IMF to include their central banks' holdings in the global totals for the currency composition of foreign exchange reserves (Prasad, 2019). Subsequently, it also became possible to derive from public sources data on the currency

---

[5] Arslanalp, Eichengreen, and Simpson-Bell. (2023).

composition of individual central banks' reserve holdings, as in Ito and McCauley (2020) and Chinn, Ito and McCauley (2022).

In light of these six developments, it is a good time to update the investigation of the empirical determinants of foreign exchange holdings.

In the second section of this paper, we elaborate on the developments of the dollar vs. the euro as the key reserve currencies, as well as the Japanese yen, the British pound, and the Chinese yuan, in recent years (since Chinn and Frankel, 2007).

In section 3, we investigate the determinants of individual central bank holdings of reserve currencies, currency-by-currency, bringing to bear information on bilateral relationships. This information includes geopolitical factors that have come to prominence in recent policy debates, namely sanctions. In using individual central banks as the unit of interest, we can exploit the cross-country variation in reserve holdings that was not possible with aggregate reserves.

Nonetheless, despite exploiting the cross-central bank information, the results are not as informative as would be desired. The results from currency-by-currency estimation might be impaired by insufficient sample size or insufficient variation in the data. Refer to Figure 1 for visual evidence as to how little the reserve shares vary over time, as compared to the variation across currencies. This consideration offers a motivation for pooling the data across the major currencies and imposing the constraints that their reserve holdings are determined in the same way across currencies.

In Section 4, we move to investigating currency holdings, imposing the same specification for all reserve currencies, i.e., making the relationship for the USD reserve share and US share of world GDP be the same (possibly nonlinear) relationship as for the JPY reserve share-Japan share of world GDP. In this set of results, a lot of the identified relationships obtaining for reserve shares are driven by the cross-reserve currency variation, rather than the over-time variation.

## 2. Aggregate Reserves and the Aggregate Relationships

At the aggregate level, the dominance of the dollar along various dimensions of an international currency has remained in place. In writing this, it is perhaps useful to recapitulate what constitutes an international currency.

There is a list of uses to which an international currency like the dollar or euro is put. Some familiar functions include: a currency in which central banks and sovereign wealth funds hold international reserves; an anchor currency to which smaller countries' currencies can peg; a currency to use in denominating or invoicing trade and financial transactions; and a vehicle currency for foreign exchange trading.

A standard linguistic analogy can help explain (Kindleberger, 1967).  Filipinos are unlikely to speak Portuguese and Brazilians are unlikely to speak Tagalog.  If a Brazilian wants to communicate with a Filipino, they are likely to find it more convenient to do so via some third language like English or Spanish.  Similarly, if one of them wishes to do business with the other country, they will find it more convenient to transact via some third currency like dollars or euros (the vehicle currency), than to try to find someone who wants to take the other side of a peso-real trade.

A two-by-three table lays out these international uses, as either private or public instances of the classic three functions of money: [6]

**[Table 1 about here]**

The first criterion is the most salient, partly because the data on central banks' reserve holdings are readily available, and the one we focus on in this paper. Figure 1 confirms the dollar's share of foreign exchange reserves has been declining gradually since the turn of the century, resuming an earlier decline during 1978-1992.

**[Figure 1 about here]**

---

[6] The schematic table began with Cohen (1971) and was adopted with slight modifications by Kenen (1983) and Frankel (1992), among others.

Each use of the currencies internationally is highly correlated with the other uses, both causally and statistically (Aiyar et al., 2023). Causally, Gopinath and Stein (2018, 2021), for example, show that international use of a currency to invoice trade (unit of account) is bi-directionally related to use of the currency financially (store of value, particularly in the case of a currency with safe-haven properties, like the dollar and yen). Statistically, a correlation is evident as well. The ranking is similar by different measures: the dollar remains number one, not only by the criterion of reserve holdings, but also by the criteria of denominating or invoicing trade[7], as well as denomination of international debt and loans, foreign exchange turnover (BIS, 2022), and global payments. According to an overall measure of international currency use computed at the Federal Reserve, the dollar remains three times as important as the euro, and far more important than the yen, pound, or renminbi.[8]

Consider foreign exchange turnover, that is, the amount of all trading of foreign exchange taking place within the home country. It is shown (on a scale of 0.0 to 2.0), in Figure 2.


**[Figure 2 about here]**


The correlation between reserves and foreign exchange turnover (redefined to be out of 1.00) is shown below:

**[Figure 3 about here]**


Here is a comparison of the dollar vs. the euro for 2023 for a set of indicators.

**[Figure 4 about here]**

---

[7] Engel (2006), Goldberg and Tille (2008), Gopinath (2015), and Boz et al (2020).
[8] Bertaut, et al, (2021), Figure 10. The measure is a weighted average of five criteria.

Only in the case of global SWIFT payments,[9] does the euro come anywhere close to the dollar's share as of 2023: 32.6 % of payments versus 41.7%. The SWIFT rankings again put the renminbi in fifth place, at a mere 2.3 %. Admittedly, recent growth in the renminbi (RMB) would show up more strongly if data on the Cross-Border Interbank Payment System, which China launched in 2015, or other non-SWIFT alternative payments systems could be included.

Given these correlations, in this study we focus on reserve holdings and their determinants. Nearly two decades ago, two of the coauthors (Chinn and Frankel, 2007) estimated pre-euro relationships between reserve holdings and a set of variables that we thought were important determinants, basing the specification on the empirical literature on international currencies.[10]

1. Patterns of output and trade. The currency of which the home country has a large share in international output and trade has a big natural advantage. For some measures of international currency use – how often a vehicle currency is used in the invoicing and financing of international trade -- other aspects of the pattern of trade may also be relevant. For reserve currency holdings, at the aggregate level, we relied on GDP as our measure of size.

2. The country's financial markets. To attain international currency status, capital and money markets in the home country must be not only open and free of controls, but also deep and well-developed. It is surprisingly difficult to come up with a proxy for size, depth, or development that is available for all the financial centers. As in our 2006 paper, we have opted to use data on foreign exchange turnover in the respective financial centers: New York, London, Frankfurt, Tokyo, etc. This measure differs from worldwide turnover *of* the currencies (dollar, pound, euro, etc.), a variable that would be closer to a measure of

---

[9] SWIFT (April, 2023). The Society for Worldwide International Financial Telecommunications is a messaging system that accompanies inter-bank transactions. It provides the highest-frequency measure of international currency use. Chau, Ilzetski, and Rogoff (2022) and Perez Saiz, Zhang and Iyer (2023).

[10] Among the relevant references are Aliber (1966), Alogoskoufis and Portes (1992), Bergsten (1975), Black (1989), Eichengreen and Frankel (1996), Eichengreen and Mathieson (2000), Frankel (1992, 1995), Kenen (1983), Krugman (1984), Kindleberger (1981), Matsuyama, Kiyotaki and Matsui (1993),McKinnon (1969, 1979), Portes and Rey (1998), Rey (2001), Swoboda (1969), Tavlas (1993), and Tavlas and Ozeki (1992).

international currency use determined simultaneously with the international currency status that we are trying to explain, more than a determinant.

It captures, for example, the pre-eminence of London, which has continued despite the small role of the pound. The turnover measure has the virtue of reflecting all kinds of international financial transactions (both long-term and short-term, banking and securities, bonds and equities).

3. <u>Confidence in the value of the currency</u>. A necessary qualification for a candidate currency is that its value not fluctuate erratically. We relied on three measures – the long-term inflation differential vs. average for OECD countries, the appreciation of the currency in the foreign exchange market, and the volatility of the exchange rate. All three criteria for stability are measured over the preceding five years.

4. <u>Network externalities</u>. An international money, like domestic money, derives its value because others are using it. It is a classic instance of network externalities. In this sense, the current characteristics of a currency are of less importance than the path-dependent historical equilibrium. There is a strong inertial bias in favor of using whatever currency has been the international currency in the past. Hence, the lagged currency share enters. Another implication is that the relationship between the extent of currency importance and the fundamental determinants is nonlinear. In Chinn and Frankel (2007), the preferred specification involved a logit transformation of the reserve shares, thus fitting the interval 0.00-1.00 and also allowing for a sort of tipping point in the middle.

How far off were our estimates of the determination of reserve holdings? It is important to recognize that many of the variables changed values with revisions. That being said, a straightforward application of the currently reported values of the variables -- such as GDP share, inflation, exchange rate volatility, and foreign exchange turnover by location -- to the estimates in column 3 of Table 8.6 (estimated 1973-99) reveals that previous estimates were not qualitatively wrong. Using this specification:

$$z_{it} = -0.648^* + 2.768^* y_{it} - 2.639^* \pi_{it} - 0.981^* \sigma_{it} + 0.446 to_{it} + 0.919^* z_{i,t-1} + u_{it}$$

where $z_{it} \equiv \left( \dfrac{Res_{it}}{1-Res_{it}} \right)$

we obtain the following estimates of USD and EUR shares.

**[Figure 5 about here]**

**[Figure 6 about here]**

These specifications give a big role to observed lagged reserve shares, as the autoregressive coefficient is 0.92.

How well does this equation work for the post-euro period? There are several problems in answering this question. The first is that the persistence in USD and EUR shares seems to be much higher than it was for the USD and other shares, pre-euro. Logit transformations imply that the unit root can be rejected at the 10% level for the USD and EUR. Estimating a panel while imposing the same value on the autoregressive coefficient results in an estimate that is not easily distinguished from unity.

The estimated equation over the 1999-2022 period, with USD, EUR, JPY, GBP and CNY, is:

$$z_{it} = -0.017 - 0.071 y_{it} + 8.047^* \pi_{it} + 2.837 \sigma_{it} - 0.319^* to_{it} + 0.968^* z_{i,t-1} + u_{it}$$

Note that this is an unbalanced panel, with only 5 observations for the RMB. Excluding China does not change the estimates appreciably.

In these estimates, reserves have over the last two decades not behaved in a way consistent with earlier correlations, whether or not the level of reserves is transformed by the logit function. GDP share, inflation, exchange rate volatility and turnover have unanticipated signs.

Some of the puzzling results disappear if all the variables are first differenced. Then the proportion of variance explained (omitting lagged dependent variable) is about 12%, and the coefficient on income becomes significant.  Higher GDP of the country issuing the reserve currency is associated with a higher share or reserves.

The last twenty years have been marked by momentous events which the previous study could not incorporate, with its sample ending in 2003. These include the 2007-08 global financial crisis, the Euro area crisis, the Covid-19 pandemic, and (at the end of the sample) Russia's expanded invasion of Ukraine.[11]

Especially relevant is confidence in the value of the currency, which was gauged in Chinn and Frankel by inflation and exchange rate depreciation. Average rates – as well as variation -- of inflation were generally much lower during the 1999-2023 period than in the earlier sample (1973-98), thus perhaps explaining the loss of the negative coefficient.

However, the Euro crisis highlighted fiscal and banking unions as determinants of credibility. Instead of attempting to augment the specification with an ad hoc measure of a sovereign debt crisis (which would end up being essentially a dummy variable), it makes sense to conclude that we have hit the limits of what aggregate foreign reserves data can tell us.


## 3. Individual Central Bank Behavior, By Reserve Currency

We now turn to explaining how individual central banks determine their holdings of foreign exchange reserves. While there have been several papers that investigate this question, they have focused on limited aspects. For instance, Arslanalp et al. (2022) examine a set of determinants that are separate from those that were considered in Chinn and Frankel (2007), and that focus more on factors that are specific to the holder of reserves (pegs, shares of trade). Goldberg and Hannaoui (2024) bring into the analysis geopolitical and return variables, but focus only on holdings of US dollars.

---

[11] This is a separate issue from why the prediction of the euro overtaking the dollar did not occur. The requirements for this outcome included rapid dollar depreciation over a long span of time, as well the UK joining EMU. In the absence of this condition, Chinn and Frankel (2007) predicted continued dollar dominance.

For this analysis, we rely on the Ito-McCauley data set, described in Ito and McCauley (2020). They draw on data from annual reports, financial statements, and other relevant materials of central banks across the world and collect data on the currency composition of FX reserves of individual countries. They calculate the currency shares of international reserves excluding gold and SDRs. For the Latin America central banks, they relied on data provided by the Latin American Reserve Fund (FLAR). The dataset encompasses 58 countries: 13 advanced economies; 45 emerging and developing economies, as defined by the IMF. By region, 10 Asian-Pacific; 12 African and Middle Eastern; 6 Western European; 17 Eastern European and Central Asian; and 12 Western Hemisphere. The holdings by the issuers of the key reserve currencies themselves, US, Euro, Japan, UK and China, are omitted from the analysis.

Our dependent variable is foreign exchange reserve shares. Since there are few instances of any particular central bank's currency predicted reserves holding at 100% or below 0%, we focus on results based on this variable, allowing easier interpretation of the coefficients. But, as alternatives, we consider two nonlinear specifications. The first is the logit transformation of the shares. The second is a recursive definition of shares, such that the USD share is expressed out of total foreign exchange reserves, the EUR share is divided by total foreign exchange reserves subtracting USD reserves; the JPY share is divided by total foreign exchange reserves minus both USD and EUR reserves; and so on. The recursive approach, an innovation of this paper, has the advantage that it uses data on the holdings of all currencies, while yet obeying the constraint that their shares must add to 1.0.

We estimate the following specification, which includes the reserve currency issuer $i$ variables described in Section 2, augmented with country $j$ specific variables related to the country of central bank that is holding the reserves.

$$z_{ijt} = \beta_0 + \beta_1 y_{it} + \beta_2 \pi_{it} + \beta_3 \sigma_{it} + \beta_4 to_{it} + \beta_5 z_{ij,t-1} + \gamma_1 trade_{ijt} + \gamma_2 peg_{ij,t} + u_{it}$$

Following Ito and McCauley (2020) and Chinn, Ito, and McCauley (2022), this specification includes country $j$'s trade share with country $i$ as well as a dummy variable indicating whether country $j$'s currency is pegged to country $i$.

Finally, we want to assess geopolitical factors which have been recently highlighted, motivated by increased fear of sanctions. One would hypothesize that, the more a country is at

odds with the United States or Europe in geopolitical terms, the more vulnerable it is to sanctions from these places and thus the less dollars and euros it would choose to hold. Goldberg and Hannaoui (2024), Mosler and Potrafke (2020) and Perez-Salz, Zhang and Iyer (2023) use geopolitical proximity as proxied by the frequency with which the country votes in agreement with the United States in United Nations General Assembly resolutions and we use this data in our analysis. Eichengreen, Mehl, and Chitu (2017) and Arslanalp, Eichengreen, and Simpson-Bell (2022), use a dummy variable reflecting whether a country has a defense pact with the United States. The case of Russia notwithstanding, the general finding in these studies is little significant positive effect of these measures of geopolitical proximity on dollar holdings.

The literature on vulnerability to sanctions features an exception for gold. Economists had long believed that central bank holdings of gold were an anachronism. Although monetary authorities in many countries still held some gold, they did not treat it as an active part of their international reserves. More recently, central banks, especially in Asia, have returned to actively buying (and selling) gold. Arslanalp, Eichengreen, and Simpson-Bell 2023) and Ferranti (2023) find that, in recent years, countries that faced a higher risk of US sanctions increased the share of gold in their international reserves more than countries facing a lower risk of US sanctions.

$$z_{ijt} = \beta_0 + \beta_1 \, y_{it} + \beta_2 \pi_{it} + \beta_3 \sigma_{it} + \beta_4 to_{it} + \beta_5 z_{ij,t-1} + \gamma_1 trade_{ijt} + \gamma_2 peg_{ij,t} + \theta_1 voting_{ijt}$$
$$+ \theta_2 sanctions_{ij,t} + u_{it}$$

where *voting* is a dummy variable which indicates whether country *j voting in the UN is similar to that of* reserve currency issuer *i* and *sanctions* is a dummy variable which indicates whether country *j* has had sanctions imposed by country *i* . The sanctions could pertain to either trade or financial transactions.[12]

Tables 2.1 through 2.5 present the estimates from these specifications, on the basis of reserve-currency-by-reserve-currency: USD, EUR, GBP, JPY, and CNY.

---

[12] We have used an "alliance" variable as an alternative geopolitical distance proxy. These results are not as strong as those obtain using the voting variable.

For the USD (Table 2.1), most of the variables that were included in Chinn and Frankel (2007), as explained in Section 2, enter in with expected sign -- in contrast to the aggregate results. The exception is the GDP share; it does not show up as statistically significant. Exchange rate volatility reduces the attractiveness of the reserve currencies: each one percentage point increase in nominal trade-weighted exchange rate volatility reduces holdings by an estimated 3.3-3.6 percentage points. Inflation differentials and foreign exchange turnover location enter in as predicted, but not statistically significantly. Finally, as in the aggregate data, there is a great deal of inertia. The coefficient on lagged reserves is 0.89, implying that deviations have a six-year half-life.

Consistent with the literature, the share of trade with the reserve currency issuer enters significantly. A one percentage point increase in trade share with the US raises the USD share by an estimated 0.07-0.08 ppts. A peg to the USD raises the USD share by an estimated 0.04 ppts. Both of these coefficients are statistically significant and are robustly so across specifications. The adjusted R2 is fairly high, at 0.89, with 935 observations, over 56 central banks.

One geopolitical variable is included in column (2): UN voting distance. This variable enters in significantly, but with a positive sign. Being less aligned with the US seems to result in higher dollar holdings. This is the same (surprising) result as in Goldberg and Hannoui (2023)[13]. A dummy variable for military alliance, which is time invariant, does not enter significantly. In columns (3-5), sanctions imposed on the country by the US do not have significant effects, whether they be, trade sanction, financial sanction, or any sanction.[14]

The Euro is examined in Table 2.2. The basic specification results shown in Column (1) yield coefficients with signs as anticipated, excepting foreign exchange turnover, the coefficient of which is not statistically significant. The proportion of variation explained is even higher, with adjusted $R^2$ at 0.94, for 852 observations over 52 central banks.

---

[13] Their explanation seems to be that the set of countries that vote at odds with the US in the UN tend to have reserve holdings in total that are worryingly low from a precautionary viewpoint, and thus can't afford to diversify out of the dollar, which is the most liquid of the reserve currencies

[14] Sanctions of any sort do have a statistically significant and negative effect when using the logit specification.

A one percentage point increase in GDP share results in a 0.24 ppt increase in EUR reserve share. An increase in inflation by one ppt reduces holding share by 5.7-5.9 ppts. An increase in trade share with the Euro area increases EUR reserve share by 0.07 ppts (the same value as in the USD regression). In contrast to the USD result, a EUR peg has no statistically significant effect, probably because there are so few observations of countries pegged to the euro. The degree of persistence is about the same as for the USD, around 0.92. These coefficient estimates are largely insensitive to inclusion of geopolitical variables.

Greater voting distance from the European Union (column 2) has a negative and statistically significant impact on EUR holdings. This is the effect hypothesized. Meanwhile, European Union sanctions on country $j$ have no significant impact.

The results for the British pound (Table 2.3) show some similarities to those for the Euro. The degree of persistence is high, but not as high as for the USD or EUR. GDP share is statistically significant. A one percentage point increase in the UK GDP share results in a 0.7 ppt increase in the GBP share of holdings. The trade share with the UK is significant in the baseline specification (column 1) at 0.04. However, this result is not robust to the addition of covariates.

The inflation differential has the wrong sign, with statistical significance. Foreign exchange turnover share has no significant impact. Finally, all geopolitical variable coefficients are statistically insignificant.

Japanese yen results are reported in Table 2.4. The sample size drops to 465, with only 33 central banks included. The adjusted $R^2$ is at 0.74. In column (1), only lagged JPY reserves, exchange rate volatility and foreign exchange turnover location enter significantly. The last two coefficients also have the wrong sign.

Geopolitical distance as measured by voting patterns is associated with decreased yen holdings. This effect is statistically significant. So too is the impact of sanctions, with the imposition of sanctions associated with a 0.005 ppt reduction in yen holding share. On the other hand, the coefficient is only significant for trade sanctions.

Finally, the Chinese yuan (Renminbi) results are reported in Table 2.5. The data for CNY holdings typically pertains to only the last few years and applies to only 20 countries. The

sample size is then only 231, only a bit more than a quarter of the sample size for USD holdings. The bottom line is that CNY holdings are not explained.

Geopolitical distance is negatively associated with CNY holdings, but not significantly so. One seemingly anomalous result is the finding that imposition of financial sanctions results in an increase in CNY holdings. This result is, however, not robust to alternative specifications (i.e., logit).

Other than the indicated exceptions, the results are largely invariant to using alternative measures of holdings. Regressions using logit shares, or shares defined recursively, are reported in the Appendix.

To recap, while panel regressions across central banks are able to provide some insights not obtainable in the aggregate (total holdings), there is a limit to what relationships can be identified when running the OLS equations for each reserve currency separately. We suspect that the currency-by-currency results are handicapped by insufficient data or insufficient variation in the data. Hence, we turn to examining these reserve currencies pooled simultaneously.

## 4. Individual Central Bank Behavior: Pooled Analysis

In this section, we adduce the results from pooled regressions where we incorporate variation across currencies to explain central bank behavior, rather than just variation across time.  This is our preferred set-up for estimation, because variation across currencies is where the action is.

Table 3 reports the results for the same specifications used in Table 2, except that the data is pooled, each currency with its own intercept. Column (1) shows the estimate for the baseline specification. All six base-case coefficients are correctly signed.  Four of them are statistically significant:  GDP share, exchange rate volatility, anchor currency dummy, and trade shares.  The inflation differential has the expected negative effect on the demand for the currency, but the estimate is not statistically significant, suggesting that exchange rate volatility may better capture the stability of a currency.

A one percentage point increase in GDP share induces an estimated 0.07 ppt increase in currency holding shares, while a one percentage point increase in trade share increases reserve holding share by 0.05 ppts. Finally, in line with the other results, a bilateral currency peg raises reserve currency shares by 0.04 ppts. (This is relevant essentially only for USD and EUR.)

None of the coefficients on vulnerability to sanctions (distance in UN voting behavior) nor actual sanctions (whether trade sanctions, financial sanctions or both) is statistically significant.

The coefficient on the lagged dependent variable is estimated at 0.91, implying a speed of adjustment of 0.09 per year and a half-life of about 7 years.

Next, the results in Table 4 pertain to the dependent variable transformed using the logit transformation. Recall the two motivations for this functional form: it corresponds to a dependent variable that is restricted to the interval (0.00-1.00) and its non-linearity allows for a sort of tipping point. GDP share retains its significance, as does the currency peg dummy and trade share.

Goldberg and Hannoui (2023) point out that (i) Switzerland holds a high fraction of its reserves in euros, because it trades so much with euro countries, which is in turn largely attributable to geographic proximity to the eurozone; and (ii) Switzerland's weight in the conventional results increases over time, because the country has run such large balance of payments surpluses. This would produce an apparent shift from dollars to euros in the aggregate numbers, even if no individual central bank shifted from dollars to euros. Further, as noted, (iii) the composition of Russia's holdings has shifted away from dollars. Goldberg and Hannoui find that these two countries, Switzerland and Russia, by themselves explain the downward trend of the dollars share in the aggregate statistics. We re-estimated our equation while excluding Switzerland or Russia. We find little effect on our estimates.

One geopolitical variable is included in column (2): UN voting distance. This variable enters in significantly:, being farther in proximity results in higher holdings. This is the same result as in Goldberg and Hannoui (2023).

As with the simple shares regression, none of the sanction-related variables enters the logit equation with statistical significance.

Finally, in Table 5, we report the results when the recursively defined foreign exchange shares are used as the dependent variable (and a different constant is allowed for each recursively defined share). The results are qualitatively the same. However, the degree of persistence is lower, with the coefficient on the lagged dependent variable at about 0.78. Moreover, the proportion of variation explained for this dependent variable is also lower, at 0.9.

In addition, we evaluated whether the shares regression results are robust to the use of tobit, where we take into account the fact that shares below 0% or above 100% shares do not make much sense. The regressions using logit variables also take this aspect into account, but tobit facilitates the comparison of coefficient estimates. We find that the magnitude of coefficients, as well as instances of statistical significance, do not change much with the application of tobit.

## 5. Conclusion

Some conclusions, in brief:

- Relative GDP is important.
- Along with the high estimated level of persistence, this helps explain why the dollar retains dominance as reserve currency.
- Of the variables that measure the ability of a currency to hold its value compared to other currencies, exchange rate volatility is generally of the right sign (negative) and significant, while the inflation differential is generally of the right sign (also negative), but insignificant.
- The hypothesized effect of financial market size is important, because it could help explain why the dollar is still well ahead of the euro and why the renminbi still lags behind the pound and the others. But we find little evidence of its effect, as proxied by the amount of foreign exchange trading in the home country.
- The euro is held in large part due to bilateral trade (which follows from bilateral geographic distance).
- Bilateral geopolitical proximity (congruence in UN voting) induces higher reserve currency holdings in the cases of the euro and pound. But, apparently, not the dollar.

17

- Otherwise, the dummy variable for sanctions and other geopolitical variables do not show up as significantly important…yet.

# References

Aizenman, Joshua, Yin-Wong Cheung, and Xingwang Qian. 2020. The Currency Composition of International Reserves, Demand for International Reserves, and Global Safe Assets. *Journal of International Money and Finance*, 102, 102-120.

Alogoskoufis, George, and Richard Portes. 1992. European Monetary Union and International Currencies in a Tripolar World. In *Establishing a Central Bank: Issues in Europe and Lessons from the US*, ed. Matthew Canzoneri, Vittorio Grilli, and Paul Masson, Cambridge: Cambridge University Press, pp. 273–302

Arslanalp, Serkan, Barry Eichengreen, and Chima Simpson-Bell. 2022. "The stealth erosion of dollar dominance and the rise of nontraditional reserve currencies*." Journal of International Economics*, 138: 103656.

Arslanalp, Serkan, Barry Eichengreen, and Chima Simpson-Bell. 2023. "Gold as International Reserves: A Barbarous Relic No More?" *Journal of International Economics,* 145*, 103822.*

Aysan, Ahmet Faruk, Ender Demir, Giray Gozgor, and Chi Keung Marco Lau. 2019. "Effects of the Geopolitical Risks on Bitcoin Returns and Volatility." *Research in International Business and Finance* 47: 511–18.

Bapat, Navin A., and T. Clifton Morgan. 2009. "Multilateral Versus Unilateral Sanctions Reconsidered: A Test Using New Data." *International Studies Quarterly* 53, no.4: 1075-1094.

Bertaut, Carol, Bastian von Beschwitz, and Stephanie Curcuru. 2021. *The International Role of the US Dollar*. *Fednotes*, October 6. Washington: Federal Reserve System. Available at https://www.federalreserve.gov/econres/notes/feds-notes/the-international-role-of-the-u-s-dollar-20211006.html.

BIS (Bank for International Settlements). 2022. *Triennial Central Bank Survey of Foreign Exchange*. December. Basel. Available at http://www.bis.org/statistics/rpfx22.htm .

Boz, Emine, Camila Casas, Georgios Georgiadis, Gita Gopinath, Helena Le Mezo, Arnaud Mehl, and Tra Nguyen. 2020. *Patterns in Invoicing Currency in Global Trade*. Washington: International Monetary Fund.

Chau, Vu, Ethan Ilzetzki, and Kenneth Rogoff. 2022. *Zipf's Law for International Currencies*. March. Cambridge, MA: Harvard University.

Chinn, Menzie, and Jeffrey Frankel, 2007, "Will the Euro Eventually Surpass the Dollar as Leading International Reserve Currency?", in *G7 Current Account Imbalances: Sustainability and Adjustment*, edited by Richard Clarida (University of Chicago Press), pp. 285-332.

Chinn, Menzie D., Hiro Ito, and Robert N. McCauley. 2022. "Do central banks rebalance their currency shares?." *Journal of International Money and Finance* 122, 102557.

Chiţu, Livia, Barry Eichengreen, and Arnaud Mehl. 2014. "When did the dollar overtake sterling as the leading international currency? Evidence from the bond markets." *Journal of Development Economics* 111: 225-245.

Cohen, Benjamin J. 1971. The *Future of Sterling as an International Currency*. London: Macmillan.

Dobson, Wendy, and Paul Masson. 2009. Will the Renminbi Become a World Currency? *China Economic Review* 20, no. 1: 124–35.

ECB. 2023. *The international role of the euro*.

Dooley, Michael, J. Saul Lizondo, and Donald Mathieson. 1989. "The Currency Composition of Foreign Exchange Reserves." *IMF Staff Papers* 36: 385–434. Washington: International Monetary Fund.

Eichengreen, Barry. 2010. "Managing a Multiple Reserve Currency World." In *The Future Global Reserve System: An Asian Perspective* A Project of the Asian Development Bank, Manila, ed. Jeffrey Sachs, Masahiro Kawai, Jong-Wha Lee, and Wing Thye Woo: Chapter 4. {The project is at https://aric.adb.org/grs/about.php.}

Eichengreen, Barry. 2011a. *Exorbitant Privilege: The Rise and Fall of the Dollar and the Future of the International Monetary System*. Oxford: Oxford University Press.

Eichengreen, Barry. 2011b. The Renminbi as an International Currency. *Journal of Policy Modeling* 33, no. 5: 723–30.

Eichengreen, Barry. 2021. Will Central Bank Digital Currencies Doom Dollar Dominance? *Project Syndicate*, August 9.

Eichengreen, Barry, and Marc Flandreau. 2009. "The Rise and Fall of the Dollar (or When Did the Dollar Replace Sterling as the Leading Reserve Currency)?" *European Review of Economic History* 13, no. 3: 377–411.

Eichengreen, Barry, and Marc Flandreau. 2012. "The Federal Reserve, the Bank of England and the Rise of the Dollar as an International Currency, 1914–39." *Open Economies Review* 23, no. 1: 57–87.

Eichengreen, Barry, and Jeffrey Frankel. 1996. "The SDR, Reserve Currencies, and the Future of the International Monetary System." In *The Future of the SDR in Light of Changes in the International Financial System*, ed. Michael Mussa, James Boughton, and Peter Isard. Washington: International Monetary Fund: 337-378.

Eichengreen, Barry, and Donald Mathieson. 2001. "The Currency Composition of Foreign Exchange Reserves: Retrospect and Prospect." In *The Impact of EMU on Europe and the Developing Countries*, ed. Charles Wyplosz: 269-293. Oxford: Oxford University Press.

Eichengreen, B., Mehl, A. and Chiṭu, L., 2019. Mars or Mercury? The geopolitics of international currency choice. *Economic Policy*, *34*(98), pp.315-363.

Eichengreen, Barry, Arnaud Mehl, and Livia Chitu. 2017. *How Global Currencies Work*. Princeton, NJ: Princeton University Press.

Eichengreen, Barry, Livia Chiṭu, and Arnaud Mehl. 2016. "Stability or upheaval? The currency composition of international reserves in the long run." *IMF Economic Review* 64: 354-380.

Engel, Charlers. 2006. "Equivalence results for optimal pass-through, optimal indexing to exchange rates, and optimal choice of currency for export pricing." *Journal of the European Economic Association* 4.6: 1249-1260

Farhi, Emmanuel, and Matteo Maggiori. 2018. "A Model of the International Monetary System." *Quarterly Journal of Economics* 133, no. 1: 295–355.

Ferranti, Matthew. 2023. Hedging Sanctions Risk: Cryptocurrency in Central Bank Reserves. Chapter 2 of PhD thesis, Department of Economics, Harvard University, Cambridge, MA.

Frankel, Jeffrey. 1992. "On the Dollar." In *The New Palgrave Dictionary of Money and Finance*. London: Macmillan Press Reference Books.

Frankel, Jeffrey. 1995. "Still the Lingua Franca: The Exaggerated Death of the Dollar." *Foreign Affairs* 74, no. 4: 9–16.

Frankel, Jeffrey. 2012. "Internationalization of the RMB and Historical Precedents." *Journal of Economic Integration* 27, no. 3: 329–65.

Frankel, Jeffrey, 2015, "China is Not Yet Number One," *Frontiers of Economics in China*, 10, 1: 1-6.

Frieden, Jeffry. 2000. The Political Economy of the Euro as an International Currency. In *The Euro as a Stabilizer in the International Economic System*, ed. Robert Mundell and Armand Clesse. Boston: Kluwer Academic Publishers: 203-213.

Goldberg, Linda. 2010. Is the International Role of the Dollar Changing? *Current Issues in Economics and Finance* 16, no. 1.

Goldberg, Linda S., and Oliver Hannaoui. 2024. "Drivers of Dollar Share in Foreign Exchange Reserves." *FRB of New York Staff Report* 1087.

Goldberg, Linda S., and Cédric Tille. 2008. "Vehicle Currency Use in International Trade." *Journal of International Economics* 76, no. 2: 177–92.

Gopinath, Gita. 2015. *The International Price System*. Jackson Hole Symposium, vol. 27. Federal Reserve Bank of Kansas City.

Gopinath, Gita, and Jeremy C. Stein. 2018. "Trade Invoicing, Bank Funding, and Central Bank Reserve Holdings. "*American Economic Review Papers and Proceedings* 108: 542–46.

Gopinath, Gita, and Jeremy C. Stein. 2021. "Banking, Trade, and the Making of a Dominant Currency." *Quarterly Journal of Economics* 136, no. 2: 783–830.

Gourinchas, Pierre-Olivier, and Helene Rey, 2022, "Exorbitant privilege and exorbitant duty." DP 16944 (CEPR Press: Paris and London).

Grubel, Herbert G. 1963. *World Monetary Reform: Plans and Issues*. Stanford, CA: Stanford University Press.

Iancu, Alina, Lucine Lusinyan, Yiqun Wu, Andrea Gamba, Sakai Ando, Gareth Anderson, Neil Meads, Ethan Boswell, and Shushanik Hakobyan. 2022. "Reserve Currencies in an Evolving International Monetary System." *Open Economies Review*, *33*(5), 879-915.

Ito, Takatoshi. 2010. "China as Number One: How about the Renminbi?" *Asian Economic Policy Review* 5, no. 2: 249–76.

Ito, Hiro, and Robert N. McCauley. 2020. "Currency Composition of Foreign Exchange Reserves." *Journal of International Money and Finance* 102: 102104.

Kenen, Peter. 1983. *The Role of the Dollar as an International Currency*. Occasional Paper No. 13. New York: Group of Thirty.

Kenen, Peter. 1987. "Changing Views about the Role of the SDR and Implications for Its Attributes." In *The International Monetary System and Its Reform, Part II*, ed. Sidney Dell, 373–85. Amsterdam: North Holland.

Kindleberger, Charles. 1967. *The Politics of International Money and World Language*. Essays in International Finance, No. 61. Princeton, NJ: Princeton University Press.

Kindleberger, Charles. 1981. *International Money*. London: George Allen & Unwin.

Kindleberger, Charles. 1995. "Is the Dollar Going the Way of Sterling, the Guilder, the Ducat, and the Bezant?" *The International Economy*, no. 3: 609–11. Reprinted in Kindleberger. 1999. *Essays in History: Financial, Economic, Personal*. Ann Arbor: University of Michigan Press.

Krugman, Paul. 1984. "The International Role of the Dollar: Theory and Prospect." In *Exchange Rate Theory and Practice*, ed. John Bilson and Richard Marston, 261–78. Chicago: University of Chicago Press.

Lindert, Peter. 1969. "Key Currencies and Gold: 1900-1913." *Princeton Studies in International Finance* 24: 16–22.

Matsuyama, Kiminori, Nobuhiro Kiyotaki, and Akihiko Matsui. 1993. "Toward a Theory of International Currency." *Review of Economic Studies* 60 (April): 283–07.

Mosler, Martin, and Niklas Potrafke. 2020. "International Political Alignment During the Trump Presidency: Voting at the UN General Assembly." *International Interactions* 46, no. 3: 481–97.

Obstfeld, Maurice, and Haonan Zhou. 2022. *The Global Dollar Cycle. Brookings Papers on Economic Activity* (Fall). Washington: Brookings Institution.

Park, Yung Chul, and Chi-Young Song. 2010. "RMB Internationalization: Prospects and Implications for Economic Integration in East Asia." *Asian Economic Papers* 10, no. 3.

Portes, Richard, and Hélène Rey. 1998. "The Emergence of the Euro as an International Currency." *Economic Policy 13,* no. 26: 306–43.

Park, Yung Chul, and Chi-Young Song. 2010. RMB "Internationalization: Prospects and Implications for Economic Integration in East Asia." *Asian Economic Papers* 10, no. 3.

Perez Saiz, Hector, Longmei Zhang and Roshan Iyer. 2023. "Currency Usage for Cross Border Payments," *IMF Working Paper* No. 2023/072.

Posen, Adam S. 2008. "Why the Euro Will Not Rival the Dollar." *International Finance* 11, no. 1: 75–100.

Prasad, Eswar, 2017, *Gaining Currency: The Rise of the Renminbi* (Oxford: Oxford University Press).

Prasad, Eswar. 2019. *Has the Dollar Lost Ground as the Dominant International Currency?* Washington: Brookings Institution. Available at https://www.brookings.edu/wp-content/uploads/2019/09/DollarInGlobalFinance.final_.9.20.pdf.

Prasad, Eswar, and Le (Sandy) Ye. 2012. *The Renminbi's Role in the Global Monetary System*. Washington: Brookings Institution.

Rey, Hélène. 2001. "International Trade and Currency Exchange." *Review of Economic Studies* 68, no. 2: 443–64.

Subramanian, Arvind. 2011a. *Eclipse: Living in the Shadow of China's Economic Dominance* Washington: Peterson Institute for International Economics.

Subramanian, Arvind. 2011b. *Renminbi Rules: The Conditional Imminence of the Reserve Currency Transition*. Working Paper Series 11-14. Washington: Peterson Institute for International Economics.

SWIFT. R*MB Tracker: Monthly Reporting and Statistics on Renminbi (RMB) Progress towards Becoming an International Currency*. Available at http://www.swift.com/our-solutions/compliance-and-shared-services/business-intelligence/renminbi/rmb-tracker/rmb-tracker-document-centre  (accessed April 2023).

Takagi, Shinji. 2011. "Internationalizing the Yen, 1984–2003: Unfinished Agenda or Mission Impossible?" In *Asia and China in the Global Economy*, ed. Y.W. Cheung and G. Ma, 219-244. Singapore: World Scientific Publishing.

Tavlas, George. 1993. "The Deutsche Mark as an International Currency." In *International Finance: Contemporary Issues*, ed. Dilip Das, 566–79. London: Routledge.

Tavlas, George, and Yuzuru Ozeki. 1992. *The Internationalization of Currencies: An Appraisal of the Japanese Yen*. IMF Occasional Paper 90. Washington: International Monetary Fund.

Voeten, Erik, Anton Strezhnev, Michael Bailey. 2009. "United Nations General Assembly Voting Data."

Zhang, Longmei. 2023. *Capital Account Liberalization and China's Financial Integration*. *M-RCBG Associate Working Paper Series*. Cambridge, MA: Harvard University.

# Data Appendix

| *Variable* | *Description* |
|---|---|
| Ratio of GDP to total World GDP | Ratio of GDP of five major currency issuers in USD (converted at official exchange rates) to GDP of world aggregate. Sources: IMF, International Financial Statistics. Euro area, world GDP data from IMF, World Economic Outlook. |
| Inflation differentials | Calculated as log difference of monthly CPI of each major currency issuer, averaged with moving 60-month windows, subtracted by the log difference of monthly CPI of industrialized countries. Source: IMF, International Financial Statistics. |
| Rate of appreciation | Calculated as the 60-month moving average of the log first difference of the nominal effective exchange rate (NEER) of each major currency issuer. Source: Bank for International Settlements (BIS). |
| Exchange rate volatility | Calculated as the standard deviation of the log first difference of the NEER of each major currency issuer over moving 60-month windows. Source: BIS. |
| FX turnover ratio | Is daily turnover (in billions of dollars) divided by the total of turnover of the 5 major currency issuers. The data are available for 1998, 2001, and every three years. Observations in-between survey years log-linearly interpolated. Source: BIS. |
| Stock market liquidity | Stock market capitalization (SMKC) as a share of GDP of each of the five major currency issuers; stock market total value (SMTV) as a share of GDP; stock market turnover (SMTO) ratio of domestic shares (%). |
| Military alliance | It is the dummy variable that takes a value of one for a country signs treaty with relevant country issuer country. Source: Voeten, Streszhnev, Bailey (2009). |
| Sanction | The dummy taking a value 1 if there are any kind of financial sanctions between sender $i$ and target $j$, 0 otherwise. The data source is the Global Sanction Data Base (GSDB). |
| financial sanction | The dummy taking a value 1 if there are financial sanctions between sender $i$ and target $j$, 0 otherwise. GSDB |
| trade sanction | The dummy taking a value 1 if there are trade sanctions between sender $i$ and target $j$, 0 otherwise. GSDB |
| *Dependent Variable* | |
| Share of gold in total international reserves | It is the ratio of gold to total foreign exchange reserves, i.e., $\frac{gold\ holding}{Total\ reserves}$. |
| Share of USD in FX reserves | It is the share of USD in FX reserves ($RV_{USD}$; $0 < RV_{USD} < 1$). The data source is Ito and McCauley (2020) and Chinn, Ito, and |

McCauley (2021).

| | |
|---|---|
| Share of EUR in FX reserves | It is the share of EUR in FX reserves that excludes $RV_{USD}$, calculated as: $$\frac{RV_{EUR}}{\left(1-RV_{ESD}\right)}.$$ |
| Share of GBP in FX reserves | It is the share of GBP in FX reserves that excludes $RV_{USD}$ and $RV_{EUR}$, calculated as: $$\frac{RV_{GBP}}{\left(1-RV_{USD}-RV_{EUR}\right)}.$$ |
| Share of JPY in FX reserves | It is the share of JY in FX reserves that excludes $RV_{USD}$, $RV_{EUR}$, and $RV_{GBP}$, calculated as: $$\frac{RV_{JPY}}{\left(1-RV_{USD}-RV_{EUR}-RV_{GBP}\right)}.$$ |

The estimations are done with the OLS method. The major currency issuers: the US, the euro member countries, the UK, Japan, and China are not included in the estimations.

**Table 1. Roles of an International Currency**

| Function of money | Private actors | Governments |
|---|---|---|
| Store of value | Safe haven for international investors | International reserves held by central banks |
| Medium of exchange | Transactions currency for international banking. Currency substitution (private dollarization in unstable economies). | Vehicle currency for foreign exchange intervention |
| Unit of account | Denominating trade and financial transactions | Anchor to which smaller currencies can peg |

## Table 2-1: USD Share in FX reserves (simple ratios)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.890 (0.022)*** | 0.879 (0.022)*** | 0.879 (0.022)*** | 0.878 (0.022)*** | 0.878 (0.022)*** |
| GDP ratio | -0.097 (0.111) | -0.098 (0.115) | -0.104 (0.132) | -0.092 (0.104) | -0.111 (0.115) |
| ER volatility | -3.253 (1.259)** | -3.334 (1.313)** | -3.378 (1.368)** | -3.248 (1.260)** | -3.546 (1.329)** |
| Inflation diff. | -0.635 (1.295) | -0.523 (1.336) | -0.567 (1.343) | -0.530 (1.318) | -0.545 (1.338) |
| Share of trade w US | 0.072 (0.019)*** | 0.078 (0.020)*** | 0.077 (0.020)*** | 0.077 (0.019)*** | 0.079 (0.020)*** |
| USD as Anchor | 0.042 (0.010)*** | 0.036 (0.009)*** | 0.036 (0.009)*** | 0.036 (0.009)*** | 0.035 (0.009)*** |
| FX turnover, location | 0.284 (0.390) | 0.224 (0.397) | 0.216 (0.411) | 0.224 (0.397) | 0.214 (0.393) |
| Political distance US | | 0.010 (0.005)* | 0.010 (0.005)* | 0.010 (0.005)* | 0.011 (0.005)** |
| US_sanctions | | | 0.001 (0.007) | | |
| US_trade | | | | 0.004 (0.019) | |
| US_financial | | | | | -0.006 (0.009) |
| *N* | 935 | 896 | 896 | 896 | 896 |
| Adj. R2 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| # of countries | 56 | 54 | 54 | 54 | 54 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

## Table 2.2: EUR Share in FX reserves (simple ratios)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.916 (0.023)*** | 0.910 (0.026)*** | 0.909 (0.025)*** | 0.910 (0.026)*** | 0.908 (0.026)*** |
| GDP ratio | 0.243 (0.107)** | 0.235 (0.107)** | 0.240 (0.110)** | 0.238 (0.111)** | 0.241 (0.109)** |
| ER volatility | -2.024 (1.581) | -1.698 (1.626) | -1.681 (1.641) | -1.673 (1.661) | -1.677 (1.641) |
| Inflation diff. | -5.924 (2.103)*** | -5.751 (2.140)*** | -5.786 (2.129)*** | -5.743 (2.144)*** | -5.804 (2.130)*** |
| Share of trade w EURO area | 0.074 (0.026)*** | 0.072 (0.025)*** | 0.069 (0.026)*** | 0.071 (0.025)*** | 0.070 (0.024)*** |
| EUR as Anchor | 0.016 (0.011) | 0.010 (0.011) | 0.011 (0.011) | 0.010 (0.012) | 0.011 (0.011) |
| FX turnover, location | -0.113 (0.171) | -0.128 (0.173) | -0.128 (0.172) | -0.128 (0.174) | -0.127 (0.171) |
| Political distance euro | | -0.009 (0.005)* | -0.009 (0.005)* | -0.009 (0.005)* | -0.009 (0.005)* |
| Euro_sanctions | | | 0.003 (0.007) | | |
| Euro_trade | | | | 0.003 (0.009) | |
| Euro_financial | | | | | 0.006 (0.009) |
| N | 852 | 836 | 836 | 836 | 836 |
| Adj. R2 | 0.94 | 0.93 | 0.93 | 0.93 | 0.93 |
| # of countries | 52 | 51 | 51 | 51 | 51 |
| Years covered | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

**Table 2.3: GBP Share in FX reserves (simple ratios)**

|  | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.850 (0.023)*** | 0.852 (0.024)*** | 0.851 (0.024)*** | 0.852 (0.024)*** | 0.852 (0.024)*** |
| GDP ratio | 0.751 (0.395)* | 0.732 (0.403)* | 0.735 (0.405)* | 0.730 (0.403)* | 0.735 (0.403)* |
| ER volatility | 0.084 (0.467) | 0.050 (0.479) | 0.023 (0.475) | 0.047 (0.483) | 0.031 (0.474) |
| Inflation diff. | 1.260 (0.513)** | 1.322 (0.519)** | 1.331 (0.522)** | 1.320 (0.519)** | 1.327 (0.520)** |
| Share of trade w UK | 0.036 (0.015)** | 0.024 (0.016) | 0.023 (0.016) | 0.024 (0.016) | 0.023 (0.016) |
| FX turnover, location | -0.097 (0.115) | -0.107 (0.117) | -0.104 (0.118) | -0.107 (0.118) | -0.104 (0.119) |
| Political distance UK |  | -0.002 (0.002) | -0.002 (0.002) | -0.002 (0.002) | -0.002 (0.002) |
| UK_sanctions |  |  | -0.003 (0.002) |  |  |
| UK_trade |  |  |  | -0.000 (0.003) |  |
| UK_financial |  |  |  |  | -0.002 (0.003) |
| N | 657 | 641 | 641 | 641 | 641 |
| Adj. R2 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| # of countries | 44 | 43 | 43 | 43 | 43 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

## Table 2.4: JPY Share in FX reserves (simple ratios)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share $(t-1)$ | 0.835 (0.033)*** | 0.824 (0.034)*** | 0.823 (0.035)*** | 0.822 (0.035)*** | 0.823 (0.035)*** |
| GDP ratio | 0.237 (0.191) | 0.218 (0.209) | 0.218 (0.210) | 0.221 (0.210) | 0.218 (0.210) |
| ER volatility | 0.337 (0.182)* | 0.371 (0.189)* | 0.359 (0.192)* | 0.353 (0.194)* | 0.367 (0.189)* |
| Inflation diff. | 0.213 (0.264) | 0.223 (0.281) | 0.221 (0.281) | 0.221 (0.281) | 0.225 (0.282) |
| Share of trade w Japan | 0.002 (0.020) | 0.010 (0.020) | 0.010 (0.020) | 0.011 (0.020) | 0.010 (0.020) |
| FX turnover, location | -0.523 (0.289)* | -0.507 (0.309) | -0.504 (0.309) | -0.509 (0.309) | -0.508 (0.309) |
| Political distance Japan | | -0.004 (0.002)** | -0.004 (0.002)* | -0.004 (0.002)** | -0.004 (0.002)* |
| Japan_sanctions | | | -0.004 (0.002) | | |
| Japan_trade | | | | -0.005 (0.003)* | |
| Japan_financial | | | | | -0.005 (0.003) |
| $N$ | 465 | 456 | 456 | 456 | 456 |
| Adj. R2 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 |
| # of countries | 34 | 32 | 32 | 32 | 32 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

*\* $p<0.1$; \*\* $p<0.05$; \*\*\* $p<0.01$*

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

## Table 2.5: RMB Share in FX reserves (simple ratios)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.861 (0.043)*** | 0.860 (0.044)*** | 0.859 (0.043)*** | 0.860 (0.044)*** | 0.857 (0.043)*** |
| GDP ratio | 0.284 (0.247) | 0.285 (0.247) | 0.259 (0.255) | 0.287 (0.248) | 0.262 (0.254) |
| ER volatility | -2.030 (1.866) | -1.984 (1.789) | -1.841 (1.840) | -1.987 (1.793) | -1.785 (1.862) |
| Inflation diff. | -0.066 (0.190) | -0.087 (0.182) | -0.087 (0.180) | -0.090 (0.184) | -0.108 (0.181) |
| Sh of trade w/ China | 0.007 (0.018) | 0.012 (0.022) | 0.018 (0.022) | 0.011 (0.023) | 0.015 (0.021) |
| FX turnover, location | -1.875 (2.265) | -1.874 (2.260) | -1.697 (2.323) | -1.881 (2.266) | -1.653 (2.338) |
| Political distance China | | -0.002 (0.004) | -0.002 (0.004) | -0.002 (0.004) | -0.002 (0.004) |
| China_sanctions | | | 0.013 (0.009) | | |
| China_trade | | | | -0.003 (0.006) | |
| China_financial | | | | | 0.020 (0.007)** |
| N | 231 | 231 | 231 | 231 | 231 |
| Adj. R2 | 0.68 | 0.67 | 0.67 | 0.67 | 0.67 |
| # of countries | 20 | 20 | 20 | 20 | 20 |
| Years covered | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

**Table 3: Pooled Regression: Major Currency Share in FX reserves (simple ratios)**

|  | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share(t-1) | 0.902 | 0.900 | 0.900 | 0.900 | 0.900 |
|  | (0.018)*** | (0.019)*** | (0.019)*** | (0.019)*** | (0.019)*** |
| USD | 0.023 | 0.019 | 0.019 | 0.018 | 0.019 |
|  | (0.012)* | (0.013) | (0.013) | (0.013) | (0.013) |
| EUR | -0.006 | -0.009 | -0.009 | -0.011 | -0.010 |
|  | (0.007) | (0.008) | (0.007) | (0.008) | (0.008) |
| JPY | 0.007 | 0.005 | 0.005 | 0.004 | 0.005 |
|  | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) |
| GBP | -0.011 | -0.013 | -0.014 | -0.012 | -0.013 |
|  | (0.022) | (0.023) | (0.023) | (0.023) | (0.023) |
| RMB | -0.000 | -0.002 | -0.002 | -0.004 | -0.003 |
|  | (0.006) | (0.006) | (0.006) | (0.007) | (0.007) |
| GDP share in world | 0.063 | 0.067 | 0.067 | 0.072 | 0.068 |
|  | (0.035)* | (0.036)* | (0.035)* | (0.040)* | (0.037)* |
| NEER volatility | -0.774 | -0.742 | -0.742 | -0.689 | -0.731 |
|  | (0.335)** | (0.342)** | (0.343)** | (0.348)* | (0.348)** |
| Inflation diff. | -0.064 | -0.049 | -0.051 | -0.048 | -0.049 |
|  | (0.221) | (0.224) | (0.220) | (0.225) | (0.224) |
| Share of trade w Ctry i | 0.053 | 0.057 | 0.057 | 0.056 | 0.057 |
|  | (0.014)*** | (0.015)*** | (0.015)*** | (0.015)*** | (0.015)*** |
| Anchor Currency | 0.036 | 0.035 | 0.035 | 0.035 | 0.035 |
|  | (0.007)*** | (0.007)*** | (0.007)*** | (0.007)*** | (0.007)*** |
| FX turnover, loc | 0.056 | 0.054 | 0.054 | 0.047 | 0.053 |
|  | (0.066) | (0.068) | (0.067) | (0.066) | (0.068) |
| Political distance from Ctry i |  | 0.002 | 0.002 | 0.001 | 0.002 |
|  |  | (0.002) | (0.002) | (0.002) | (0.002) |
| Sanctions by Ctry i |  |  | 0.000 |  |  |
|  |  |  | (0.003) |  |  |
| Trade sanctions by Ctry i |  |  |  | 0.006 |  |
|  |  |  |  | (0.010) |  |
| Financial sanctions by Ctry i |  |  |  |  | 0.001 |
|  |  |  |  |  | (0.004) |
| N | 3,140 | 3,060 | 3,060 | 3,060 | 3,060 |
| Adj. R2 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| # of countries | 56 | 54 | 54 | 54 | 54 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

### Table 4: Pooled Regression: Major Currency Share in FX reserves (logit ratios)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share(t-1) | 0.909 | 0.909 | 0.909 | 0.909 | 0.909 |
| | (0.016)*** | (0.016)*** | (0.016)*** | (0.016)*** | (0.016)*** |
| USD | -0.354 | -0.283 | -0.284 | -0.292 | -0.282 |
| | (0.260) | (0.288) | (0.295) | (0.292) | (0.287) |
| EUR | -0.650 | -0.612 | -0.612 | -0.622 | -0.610 |
| | (0.201)*** | (0.211)*** | (0.215)*** | (0.217)*** | (0.211)*** |
| JPY | -0.562 | -0.536 | -0.536 | -0.545 | -0.535 |
| | (0.167)*** | (0.173)*** | (0.175)*** | (0.179)*** | (0.173)*** |
| GBP | -0.183 | -0.145 | -0.145 | -0.136 | -0.150 |
| | (0.419) | (0.447) | (0.450) | (0.448) | (0.457) |
| RMB | -0.321 | -0.300 | -0.300 | -0.311 | -0.298 |
| | (0.204) | (0.211) | (0.215) | (0.216) | (0.212) |
| GDP share in world | 1.595 | 1.582 | 1.583 | 1.625 | 1.572 |
| | (0.778)** | (0.804)* | (0.824)* | (0.828)* | (0.809)* |
| NEER volatility | -4.661 | -4.204 | -4.203 | -3.829 | -4.312 |
| | (6.375) | (6.547) | (6.542) | (6.718) | (6.570) |
| Inflation diff. | -2.450 | -1.989 | -1.984 | -1.947 | -1.984 |
| | (4.922) | (4.947) | (4.908) | (4.961) | (4.945) |
| Share of trade w Ctry i | 0.601 | 0.544 | 0.545 | 0.540 | 0.547 |
| | (0.126)*** | (0.146)*** | (0.145)*** | (0.145)*** | (0.145)*** |
| Anchor Currency | 0.248 | 0.260 | 0.260 | 0.262 | 0.260 |
| | (0.048)*** | (0.051)*** | (0.050)*** | (0.051)*** | (0.051)*** |
| FX turnover, loc | -0.507 | -0.492 | -0.492 | -0.539 | -0.473 |
| | (1.235) | (1.268) | (1.269) | (1.277) | (1.304) |
| Political distance from Ctry i | | -0.032 | -0.032 | -0.033 | -0.032 |
| | | (0.025) | (0.026) | (0.025) | (0.026) |
| Sanctions by Ctry i | | | -0.001 | | |
| | | | (0.041) | | |
| Trade sanctions by Ctry i | | | | 0.039 | |
| | | | | (0.047) | |
| Financial sanctions by Ctry i | | | | | -0.012 |
| | | | | | (0.055) |
| *N* | 2,729 | 2,654 | 2,654 | 2,654 | 2,654 |
| Adj. R2 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| # of countries | 56 | 54 | 54 | 54 | 54 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

**Table 5: Pooled Regression: Major Currency Share in FX reserves (recursively defined ratios)**

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share(t-1) | 0.781 (0.062)*** | 0.777 (0.064)*** | 0.777 (0.064)*** | 0.775 (0.064)*** | 0.777 (0.064)*** |
| USD | 0.004 (0.034) | -0.017 (0.039) | -0.016 (0.039) | -0.020 (0.039) | -0.016 (0.039) |
| EUR | 0.000 (0.024) | -0.012 (0.026) | -0.012 (0.027) | -0.016 (0.027) | -0.011 (0.026) |
| JPY | 0.032 (0.023) | 0.025 (0.024) | 0.026 (0.025) | 0.022 (0.025) | 0.026 (0.024) |
| GBP | 0.105 (0.076) | 0.095 (0.077) | 0.094 (0.077) | 0.100 (0.078) | 0.093 (0.078) |
| RMB | -0.010 (0.023) | -0.019 (0.026) | -0.018 (0.026) | -0.022 (0.027) | -0.018 (0.026) |
| GDP share in world | 0.521 (0.173)*** | 0.548 (0.180)*** | 0.544 (0.178)*** | 0.567 (0.189)*** | 0.544 (0.182)*** |
| NEER vol | -1.893 (0.940)** | -1.919 (0.968)* | -1.917 (0.968)* | -1.755 (0.999)* | -1.961 (0.975)** |
| Inflation diff. | -0.812 (0.711) | -0.834 (0.727) | -0.858 (0.732) | -0.841 (0.729) | -0.831 (0.728) |
| Share of trade w Ctry i | 0.131 (0.039)*** | 0.148 (0.047)*** | 0.147 (0.046)*** | 0.146 (0.046)*** | 0.149 (0.047)*** |
| Anchor Currency | 0.058 (0.020)*** | 0.054 (0.018)*** | 0.055 (0.019)*** | 0.055 (0.019)*** | 0.054 (0.018)*** |
| FX turnover, loc | -0.069 (0.201) | -0.076 (0.208) | -0.075 (0.208) | -0.098 (0.211) | -0.070 (0.211) |
| Political distance from Ctry i | | 0.007 (0.007) | 0.007 (0.007) | 0.007 (0.007) | 0.008 (0.007) |
| Sanctions by Ctry i | | | 0.004 (0.009) | | |
| Trade sanctions by Ctry i | | | | 0.018 (0.019) | |
| Financial sanctions by Ctry i | | | | | -0.004 (0.009) |
| N | 3,081 | 3,005 | 3,005 | 3,005 | 3,005 |
| Adj. R2 | 0.92 | 0.91 | 0.91 | 0.91 | 0.91 |
| # of countries | 56 | 54 | 54 | 54 | 54 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.
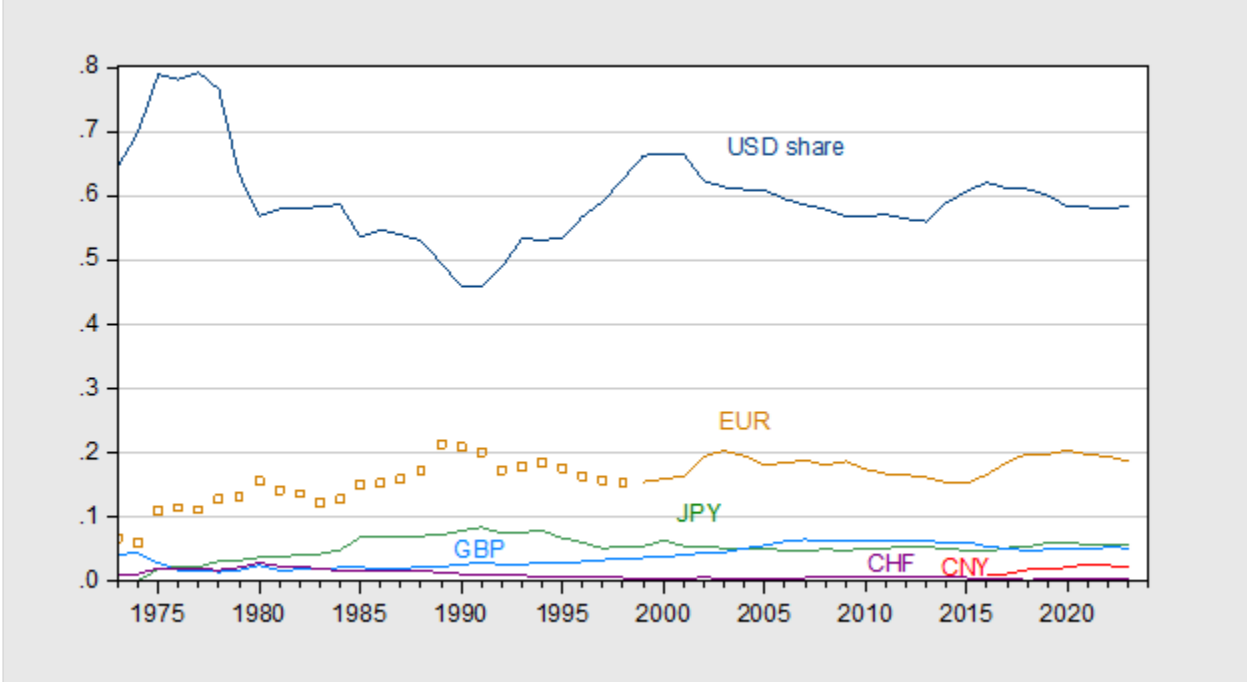
Figure 1: Shares of major currencies in the world's aggregate foreign exchange reserves



Figure 2: FX turnover as a measure of size of financial markets in the home country for each currency

Figure 3: Reserve holdings correlate strongly with size of home financial market (turnover)



Figure 4: International currency metrics for US dollar and euro. Source: ECB (2023).

Figure 5: US dollar share predicted by logit specification



Figure 6: Euro share predicted by logit specification

**Appendix: Estimation Results with Logit Shares or Recursively Defined Shares**

## A1-1: USD Share in FX reserves (Shares in Logit Transformation)

|  | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.927 (0.026)*** | 0.924 (0.027)*** | 0.921 (0.026)*** | 0.925 (0.027)*** | 0.917 (0.023)*** |
| GDP ratio | -0.262 (1.345) | -0.226 (1.432) | 0.330 (1.448) | -0.337 (1.443) | -0.561 (1.470) |
| ER volatility | -14.636 (10.700) | -14.721 (11.134) | -11.026 (11.814) | -16.472 (11.408) | -20.549 (10.520)* |
| Inflation diff. | -8.394 (6.492) | -8.123 (6.704) | -4.296 (7.758) | -8.040 (6.756) | -9.050 (6.551) |
| Share of trade w US | 0.347 (0.154)** | 0.362 (0.161)** | 0.401 (0.163)** | 0.379 (0.161)** | 0.407 (0.165)** |
| USD as Anchor | 0.238 (0.056)*** | 0.208 (0.058)*** | 0.196 (0.059)*** | 0.207 (0.059)*** | 0.196 (0.063)*** |
| FX turnover, location | 2.618 (3.022) | 2.334 (3.110) | 3.019 (3.212) | 2.348 (3.107) | 2.038 (3.046) |
| Political distance us |  | 0.043 (0.035) | 0.058 (0.036) | 0.046 (0.036) | 0.064 (0.037)* |
| US_sanctions |  |  | -0.083 (0.052) |  |  |
| US_trade sanctions |  |  |  | -0.077 (0.075) |  |
| US_financial Sanctions |  |  |  |  | -0.157 (0.080)* |
| N | 903 | 864 | 864 | 864 | 864 |
| Adj. R2 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| # of countries | 56 | 54 | 54 | 54 | 54 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.
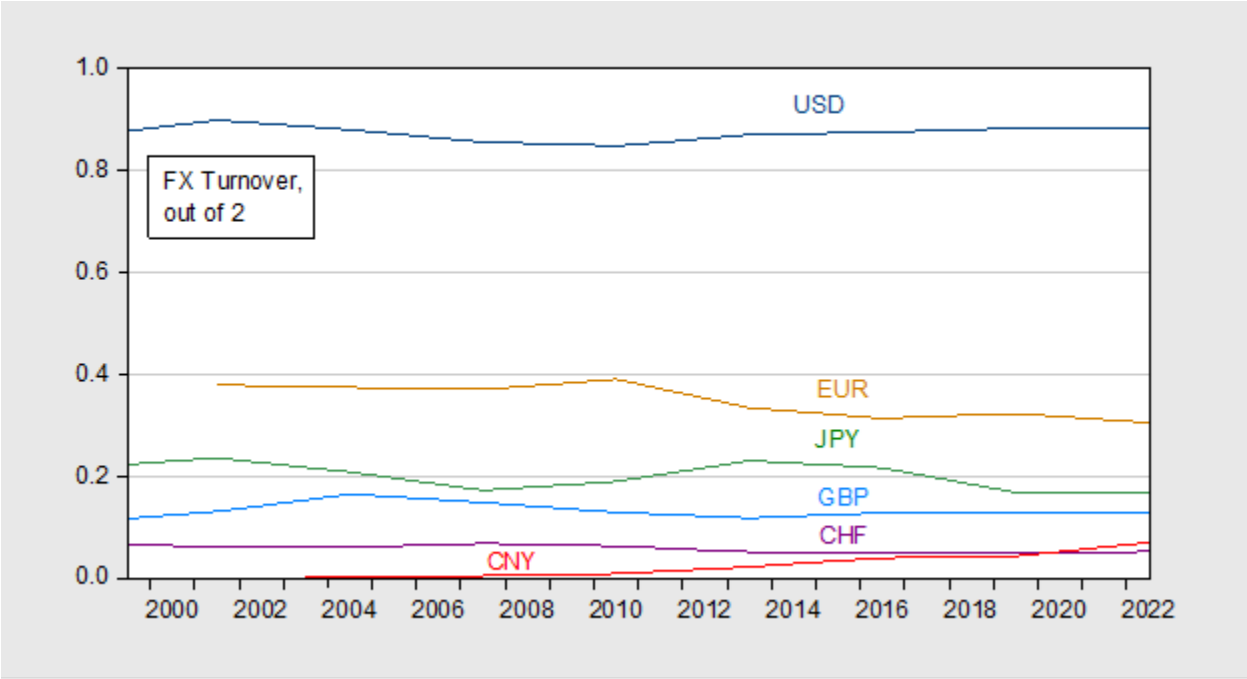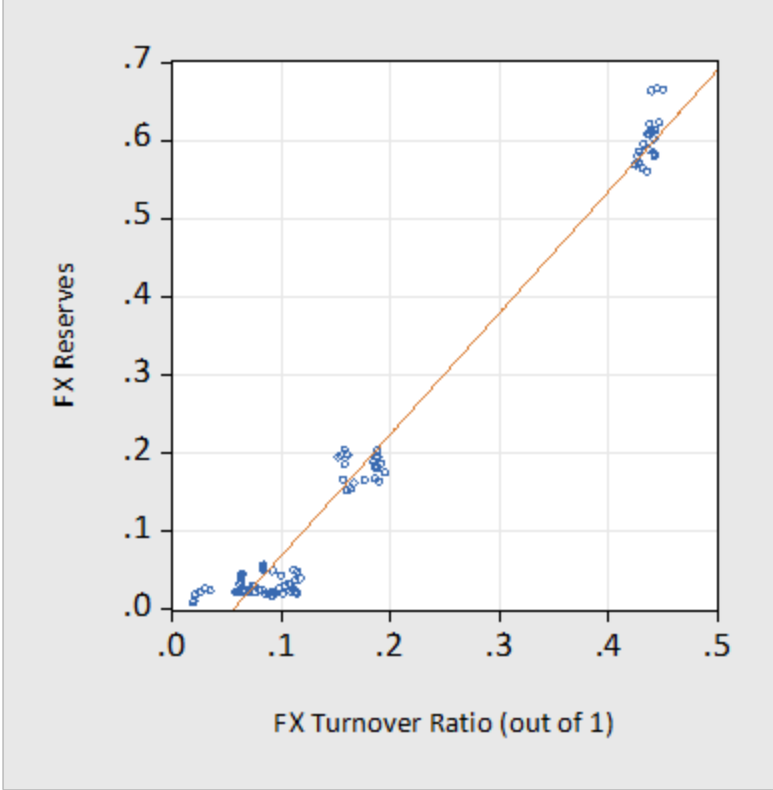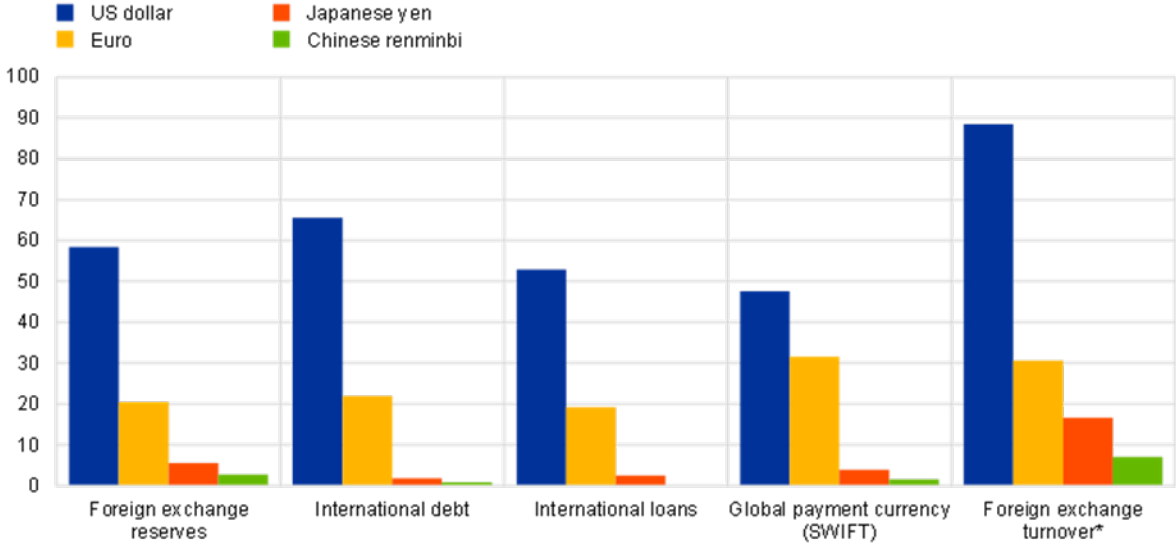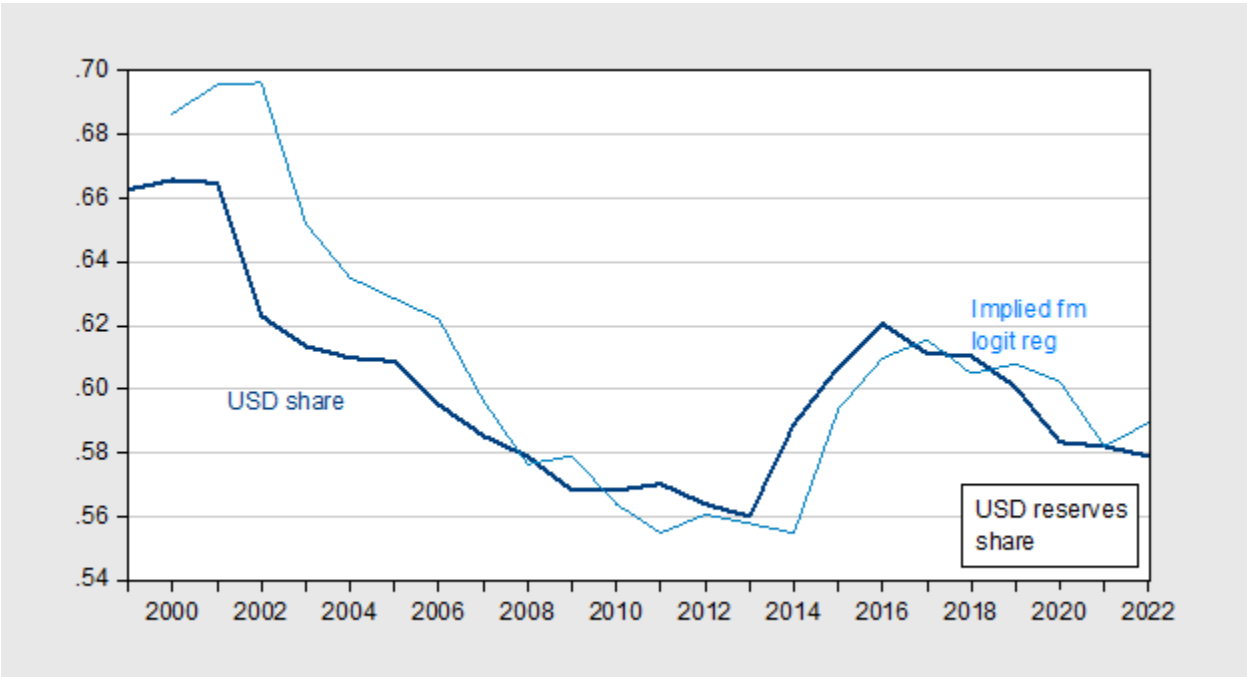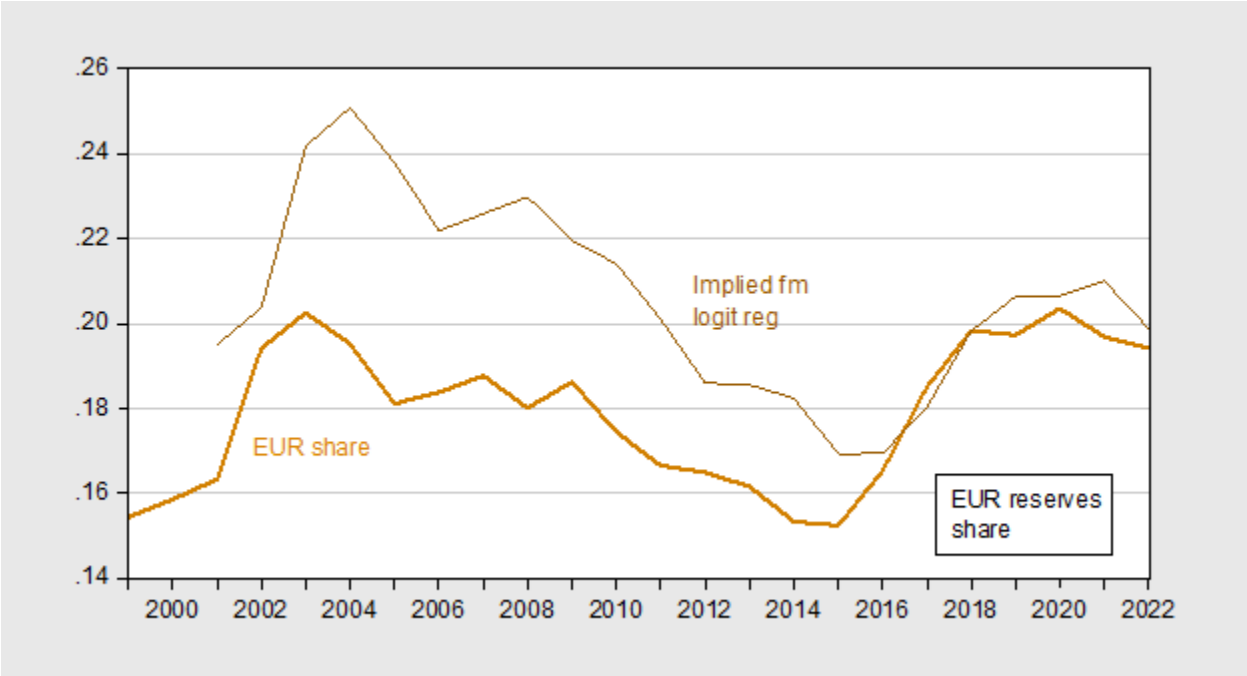
## A1-2: USD Share in FX reserves ( Recirsively Defined Shares)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share $(t-1)$ | 0.890 (0.022)*** | 0.879 (0.022)*** | 0.879 (0.022)*** | 0.878 (0.022)*** | 0.878 (0.022)*** |
| GDP ratio | -0.097 (0.111) | -0.098 (0.115) | -0.104 (0.132) | -0.092 (0.104) | -0.111 (0.115) |
| ER volatility | -3.253 (1.259)** | -3.334 (1.313)** | -3.378 (1.368)** | -3.248 (1.260)** | -3.546 (1.329)** |
| Inflation diff. | -0.635 (1.295) | -0.523 (1.336) | -0.567 (1.343) | -0.530 (1.318) | -0.545 (1.338) |
| Share of trade w US | 0.072 (0.019)*** | 0.078 (0.020)*** | 0.077 (0.020)*** | 0.077 (0.019)*** | 0.079 (0.020)*** |
| USD as Anchor | 0.042 (0.010)*** | 0.036 (0.009)*** | 0.036 (0.009)*** | 0.036 (0.009)*** | 0.035 (0.009)*** |
| FX turnover, location | 0.284 (0.390) | 0.224 (0.397) | 0.216 (0.411) | 0.224 (0.397) | 0.214 (0.393) |
| Political distance us | | 0.010 (0.005)* | 0.010 (0.005)* | 0.010 (0.005)* | 0.011 (0.005)** |
| US_sanctions | | | 0.001 (0.007) | | |
| US_trade sanctions | | | | 0.004 (0.019) | |
| US_financial Sanctions | | | | | -0.006 (0.009) |
| N | 935 | 896 | 896 | 896 | 896 |
| Adj. R2 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| # of countries | 56 | 54 | 54 | 54 | 54 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

## A2-1: EUR Share in FX reserves (Shares in Logit Transformation)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.909 (0.024)*** | 0.901 (0.026)*** | 0.894 (0.024)*** | 0.900 (0.026)*** | 0.895 (0.024)*** |
| GDP ratio | 4.833 (1.771)*** | 4.842 (1.788)*** | 5.058 (1.781)*** | 4.987 (1.868)** | 4.957 (1.768)*** |
| ER volatility | -7.297 (21.606) | -3.640 (22.664) | -3.560 (22.809) | -2.529 (23.084) | -3.771 (22.784) |
| Inflation diff. | -39.730 (26.763) | -37.444 (27.259) | -39.485 (27.180) | -37.071 (27.209) | -38.860 (27.176) |
| Share of trade w EURO area | 0.933 (0.269)*** | 0.868 (0.256)*** | 0.728 (0.266)*** | 0.842 (0.250)*** | 0.823 (0.247)*** |
| EUR as Anchor | 0.081 (0.083) | -0.008 (0.094) | 0.052 (0.107) | 0.008 (0.095) | 0.011 (0.094) |
| FX turnover, location | -5.696 (3.614) | -6.068 (3.704) | -6.056 (3.680) | -6.127 (3.730) | -6.032 (3.682) |
| Political distance euro | | -0.133 (0.057)** | -0.146 (0.061)** | -0.133 (0.058)** | -0.143 (0.060)** |
| Euro_sanctions | | | 0.142 (0.098) | | |
| Euro_trade sanctions | | | | 0.104 (0.102) | |
| Euro_financial Sanctions | | | | | 0.135 (0.122) |
| N | 798 | 782 | 782 | 782 | 782 |
| Adj. R2 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| # of countries | 52 | 51 | 51 | 51 | 51 |
| Years covered | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

### A2-2: EUR Share in FX reserves (Recursively Defined Shares)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.605 (0.190)*** | 0.591 (0.193)*** | 0.587 (0.195)*** | 0.587 (0.196)*** | 0.591 (0.193)*** |
| GDP ratio | 1.401 (0.762)* | 1.410 (0.757)* | 1.461 (0.779)* | 1.476 (0.819)* | 1.410 (0.765)* |
| ER volatility | -4.363 (4.369) | -3.852 (4.507) | -3.748 (4.566) | -3.429 (4.742) | -3.851 (4.514) |
| Inflation diff. | -16.279 (7.480)** | -15.903 (7.410)** | -16.220 (7.700)** | -15.795 (7.381)** | -15.907 (7.505)** |
| Share of trade w EURO area | 0.335 (0.146)** | 0.321 (0.143)** | 0.294 (0.126)** | 0.311 (0.135)** | 0.321 (0.141)** |
| EUR as Anchor | 0.004 (0.037) | -0.035 (0.040) | -0.025 (0.040) | -0.028 (0.041) | -0.035 (0.040) |
| FX turnover, location | 0.232 (0.840) | 0.222 (0.848) | 0.220 (0.839) | 0.203 (0.861) | 0.222 (0.845) |
| Political distance euro | | -0.039 (0.024) | -0.041 (0.025) | -0.039 (0.024) | -0.039 (0.025) |
| Euro_sanctions | | | 0.028 (0.031) | | |
| Euro_trade sanctions | | | | 0.044 (0.059) | |
| Euro_financial Sanctions | | | | | 0.000 (0.027) |
| N | 839 | 823 | 823 | 823 | 823 |
| Adj. R2 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| # of countries | 52 | 51 | 51 | 51 | 51 |
| Years covered | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

**A3-1: GBP Share in FX reserves (Shares in Logit Transformation)**

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t − 1) | 0.896 (0.038)*** | 0.893 (0.037)*** | 0.894 (0.037)*** | 0.893 (0.038)*** | 0.894 (0.037)*** |
| GDP ratio | 20.591 (11.435)* | 20.323 (11.484)* | 20.280 (11.468)* | 20.592 (11.771)* | 20.127 (11.435)* |
| ER volatility | 1.925 (9.741) | 1.022 (9.718) | 1.488 (10.069) | 1.342 (10.263) | 1.319 (10.002) |
| Inflation diff. | 16.483 (21.813) | 19.926 (22.646) | 19.619 (22.728) | 20.102 (22.733) | 19.630 (22.716) |
| Share of trade w UK | 1.028 (0.470)** | 0.397 (0.394) | 0.437 (0.446) | 0.410 (0.404) | 0.415 (0.424) |
| FX turnover, location | 0.161 (2.116) | -0.312 (2.169) | -0.383 (2.183) | -0.318 (2.173) | -0.380 (2.191) |
| Political distance uk | | -0.123 (0.043)*** | -0.121 (0.044)*** | -0.121 (0.044)*** | -0.124 (0.043)*** |
| UK_sanctions | | | 0.050 (0.117) | | |
| UK_trade sanctions | | | | 0.028 (0.096) | |
| UK_financial Sanctions | | | | | 0.044 (0.144) |
| N | 567 | 551 | 551 | 551 | 551 |
| Adj. R2 | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 |
| # of countries | 43 | 42 | 42 | 42 | 42 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

### A3-2: GBP Share in FX reserves (Recursively Defined Shares)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t − 1) | 0.844 (0.023)*** | 0.844 (0.024)*** | 0.843 (0.023)*** | 0.844 (0.024)*** | 0.844 (0.024)*** |
| GDP ratio | 4.320 (1.770)** | 4.210 (1.815)** | 4.239 (1.847)** | 4.272 (1.918)** | 4.207 (1.821)** |
| ER volatility | 1.135 (2.519) | 1.095 (2.626) | 1.306 (2.668) | 1.167 (2.776) | 1.144 (2.608) |
| Inflation diff. | 3.900 (2.083)* | 4.050 (2.103)* | 4.065 (2.119)* | 4.097 (2.112)* | 4.048 (2.106)* |
| Share of trade w UK | 0.147 (0.081)* | 0.118 (0.111) | 0.128 (0.111) | 0.120 (0.112) | 0.120 (0.112) |
| FX turnover, location | -0.298 (0.321) | -0.353 (0.332) | -0.375 (0.334) | -0.357 (0.330) | -0.361 (0.334) |
| Political distance uk | | -0.006 (0.011) | -0.006 (0.011) | -0.006 (0.012) | -0.006 (0.011) |
| UK_sanctions | | | 0.015 (0.017) | | |
| UK_trade sanctions | | | | 0.006 (0.021) | |
| UK_financial Sanctions | | | | | 0.005 (0.018) |
| N | 642 | 626 | 626 | 626 | 626 |
| Adj. R2 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |
| # of countries | 44 | 43 | 43 | 43 | 43 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

**A4-1: JPY Share in FX reserves (Shares in Logit Transformation)**

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.885 (0.038)*** | 0.852 (0.041)*** | 0.851 (0.042)*** | 0.852 (0.041)*** | 0.851 (0.041)*** |
| GDP ratio | 3.817 (6.122) | 1.198 (7.319) | 0.916 (7.286) | 1.119 (7.313) | 1.065 (7.326) |
| ER volatility | 6.229 (12.389) | 9.318 (13.177) | 8.627 (13.646) | 8.320 (13.876) | 9.376 (13.158) |
| Inflation diff. | 3.959 (8.399) | 3.162 (8.960) | 2.905 (8.884) | 2.855 (8.880) | 3.153 (8.969) |
| Share of trade w Japan | 2.781 (1.089)** | 3.079 (1.131)** | 3.125 (1.138)** | 3.134 (1.144)** | 3.080 (1.131)** |
| FX turnover, location | -6.316 (9.765) | -3.082 (10.120) | -2.330 (10.451) | -2.624 (10.289) | -2.844 (10.274) |
| Political distance Japan | | -0.325 (0.107)*** | -0.324 (0.107)*** | -0.327 (0.107)*** | -0.323 (0.107)*** |
| Japan_sanctions | | | -0.246 (0.198) | | |
| Japan_trade sanctions | | | | -0.313 (0.240) | |
| Japan_financial Sanctions | | | | | -0.150 (0.148) |
| N | 369 | 365 | 365 | 365 | 365 |
| Adj. R2 | 0.78 | 0.79 | 0.79 | 0.79 | 0.78 |
| # of countries | 31 | 30 | 30 | 30 | 30 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

### A4-2: JPY Share in FX reserves (Recursively Defined Shares)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t – 1) | 0.741 | 0.740 | 0.739 | 0.739 | 0.739 |
| | (0.057)*** | (0.057)*** | (0.057)*** | (0.056)*** | (0.057)*** |
| GDP ratio | 0.927 | 0.962 | 0.970 | 0.941 | 0.961 |
| | (1.269) | (1.266) | (1.274) | (1.267) | (1.267) |
| ER volatility | -1.555 | -1.712 | -1.620 | -1.539 | -1.764 |
| | (1.435) | (1.483) | (1.523) | (1.540) | (1.489) |
| Inflation diff. | -0.019 | -0.046 | -0.038 | -0.038 | -0.038 |
| | (1.324) | (1.335) | (1.336) | (1.336) | (1.338) |
| Share of trade w Japan | 0.474 | 0.465 | 0.463 | 0.460 | 0.464 |
| | (0.190)** | (0.189)** | (0.189)** | (0.188)** | (0.191)** |
| FX turnover, location | -0.504 | -0.551 | -0.576 | -0.529 | -0.563 |
| | (2.095) | (2.113) | (2.148) | (2.135) | (2.114) |
| Political distance japan | | 0.001 | 0.001 | 0.002 | 0.002 |
| | | (0.014) | (0.014) | (0.014) | (0.014) |
| Japan_sanctions | | | 0.026 | | |
| | | | (0.054) | | |
| Japan_trade Sanctions | | | | 0.047 | |
| | | | | (0.069) | |
| Japan_financial Sanctions | | | | | -0.045 |
| | | | | | (0.014)*** |
| N | 442 | 437 | 437 | 437 | 437 |
| Adj. R2 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| # of countries | 32 | 31 | 31 | 31 | 31 |
| Years covered | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 | 1999 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

## A5-1: RMB Share in FX reserves (Shares in Logit Transformation)

| | Baseline | Baseline | Baseline | Baseline | Baseline |
|---|---|---|---|---|---|
| Share (t – 1) | 0.907 | 0.909 | 0.908 | 0.916 | 0.905 |
| | (0.021)*** | (0.021)*** | (0.019)*** | (0.020)*** | (0.021)*** |
| GDP ratio | 43.190 | 43.132 | 38.953 | 39.365 | 41.936 |
| | (27.397) | (27.757) | (28.893) | (29.782) | (27.976) |
| ER volatility | 599.661 | 601.948 | 607.767 | 605.428 | 604.504 |
| | (322.712)* | (324.441)* | (325.631)* | (324.934)* | (326.607)* |
| Inflation diff. | 92.760 | 91.021 | 86.007 | 89.057 | 88.298 |
| | (63.714) | (65.545) | (66.944) | (66.894) | (65.913) |
| Sh of trade w/ China | -0.238 | 0.041 | 0.853 | 0.855 | 0.232 |
| | (1.415) | (2.152) | (2.512) | (2.599) | (2.254) |
| FX turnover, location | 6.781 | 5.685 | 25.484 | 15.633 | 15.336 |
| | (66.276) | (66.849) | (71.178) | (65.276) | (71.955) |
| Political distance china | | -0.064 | -0.131 | -0.154 | -0.068 |
| | | (0.238) | (0.267) | (0.282) | (0.246) |
| China_sanctions | | | 0.730 | | |
| | | | (0.446) | | |
| China_trade sanctions | | | | 1.072 | |
| | | | | (0.761) | |
| China_financial Sanctions | | | | | 0.541 |
| | | | | | (0.384) |
| N | 92 | 92 | 92 | 92 | 92 |
| Adj. R2 | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 |
| # of countries | 18 | 18 | 18 | 18 | 18 |
| Years covered | 2010 - 2022 | 2010 - 2022 | 2010 - 2022 | 2010 - 2022 | 2010 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.

## A5-2: RMB Share in FX reserves (Recursively Defined Shares)

| | Baseline (1) | Baseline (2) | Baseline (3) | Baseline (4) | Baseline (5) |
|---|---|---|---|---|---|
| Share (t − 1) | 0.823 (0.085)*** | 0.821 (0.082)*** | 0.808 (0.080)*** | 0.820 (0.083)*** | 0.797 (0.085)*** |
| GDP ratio | 1.103 (0.953) | 1.102 (0.957) | 0.864 (0.966) | 1.115 (0.965) | 0.900 (0.957) |
| ER volatility | -8.177 (6.951) | -7.941 (6.833) | -6.720 (7.549) | -7.968 (6.852) | -6.404 (7.682) |
| Inflation diff. | 0.607 (0.591) | 0.502 (0.551) | 0.481 (0.512) | 0.489 (0.540) | 0.295 (0.546) |
| Sh of trade w/ China | -0.047 (0.146) | -0.020 (0.169) | 0.040 (0.163) | -0.025 (0.180) | 0.013 (0.162) |
| FX turnover, location | -6.369 (9.231) | -6.313 (9.212) | -4.526 (9.485) | -6.358 (9.234) | -4.139 (9.634) |
| Political distance china | | -0.008 (0.019) | -0.013 (0.020) | -0.008 (0.020) | -0.010 (0.020) |
| China_sanctions | | | 0.117 (0.064)* | | |
| China_trade sanctions | | | | -0.014 (0.041) | |
| China_financial Sanctions | | | | | 0.182 (0.063)*** |
| N | 223 | 223 | 223 | 223 | 223 |
| Adj. R2 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 |
| # of countries | 20 | 20 | 20 | 20 | 20 |
| Years covered | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 | 2001 - 2022 |

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

Note: The major currency issuers, the US, the euro member countries, the UK, Japan, and China, are not included in the estimations. Political distance reflects how distant a country is from a major currency issuer based on voting behavior at the UN. A smaller value means closer geopolitical distance.